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February 11, 2004

VIA HAND DELIVERY

Laurence K. Lau, Esq.
Deputy Director
Environmental Health Administration
State of Hawaii, Department of Health
1250 Punchbowl Street
Honolulu, Hawaii 96813

Re: EMF Issues

Dear Larry:

On behalf of Bill Bonnet and Sherri Loo, let me thank you once again for meeting with us to discuss issues related to electric and magnetic fields (EMF). As Bill Bonnet stated, we want to continue to provide the Department with updated information on EMF issues. This letter follows up on that commitment.

First, I enclose for your review and return "A Formula for Effective Risk Communication." Please let me know when you are ready to return these videotapes and I will have a messenger pick them up at your offices.

Second, I enclose a copy of testimony recently submitted by Hawaiian Electric Company to the Public Utilities Commission in connection with the East Oahu Transmission Project. The testimony of J. Michael Silva addresses engineering evaluation of electric and magnetic fields; the testimony of William A. Bonnet addresses EMF Policy. Please let me know if you would like to have a complete set of all the testimony submitted to the Public Utilities Commission.

We look forward to working with you on these issues.

Very truly yours,

Lisa Woods Munger

Enclosures

cc (with testimony of Mr. Silva and Mr. Bonnet):
Mr. Au
Mr. Haruno
Mr. Takata

cc (without enclosures):
Mr. Bonnet
Ms. Loo

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840-000

(SAME LETTER SENT TO REP. SCOTT SAIKI
AND COUNCILMEMBER ANN KOBAYASHI)

Robert A. Alm
Senior Vice President
Public Affairs

December 15, 2003

Honorable Carol Fukunaga
The Senate
State Capitol, Room 216
415 South Beretania Street
Honolulu, Hawaii 96813

Dear Senator Fukunaga:

We received your letter concerning the current proposal to run a 46kV transmission line along Fern Street as part of our East Oahu Transmission Project (EOTP) and appreciate your sharing your concerns with us. We are filing the project application with the Public Utilities Commission as we discussed at the McCully/Moiliili Neighborhood Board Meeting on November 6, 2003. In that filing, we do note that we have examined a Kapiolani Boulevard route and had identified some disadvantages of that route when compared to the proposed alignment along Fern Street. This initial examination led to our selection of the proposed route.

However, this project is in the early stages of the regulatory review and approval process and evaluation of the proposed route and alternative alignments will continue. Given the concerns voiced regarding the Fern Street route, we will continue to specifically look at the Kapiolani routing of this line as was suggested in your letter.

We do appreciate the concerns about such lines and their construction. We would, in that context, note that there are already underground 46kV lines in place along the entire proposed route including Fern Street. In fact, the proposed new 46kV lines are essentially an upgrade of and will replace the existing 46kV lines along the proposed route. There may be some changes in

the use of the lines but in no case are we planning to install the new lines where there are no existing lines. We may even be able to do most of the project by pulling cables through the existing ducts along the proposed route with little digging of new trenches. However, we will not be able to determine this until we get into the ducts. We have, therefore, assumed full trenching along the entire route in our project application. However, this can be adjusted based on the conditions we find in the existing ducts. Thus, the availability of existing duct lines under roadways along the entire proposed route is a significant consideration in its favor.

In a further step to address community concerns, we have also decided to conduct an Environmental Assessment on a voluntary basis. We believe that this will provide the public with greater understanding of the potential impacts of this project.

Regarding the issue of electric and magnetic fields, we again would like to cite the Department of Health policy which states that "research data on possible adverse health effects, including cancer, are inconclusive" and recommends a "prudent avoidance" approach, stating "reasonable, practical, simple and relatively inexpensive actions should be considered to reduce exposure (to EMF)." We will continue to monitor developments in this area.

Again, we deeply appreciate your concerns for your communities and we look forward to continuing our discussions with you and the communities you serve.

Sincerely,

Robert A. Alm
Senior Vice President

RAA:kh

xc: Chuck Freedman, Bill Bonnet, Lori Hoo, Tom Joaquin, Kerstan Wong, Ken Morikami, Patsy Nanbu, Tom Williams, Leon Roose, Susan Char, Lynne Unemori, Peter Rosegg

City and County of Honolulu • State of Hawaii

December 1, 2003

Mr. Robert Alm
Senior Vice President, Public Affairs
Hawaiian Electric Company
P.O. Box 2750
Honolulu, Hawaii 96840

Dear Mr. Alm:

RE: Installation of 46kV Underground Power Transmission Lines in the McCully/Moiliili Neighborhoods

We are writing on behalf of Fern Street residents who submitted their petition opposing HECO's use of Fern Street in its proposed Phase 1 East Oahu Transmission Project, based on HECO's presentation at the November 6, 2003 McCully/Mo`ili`ili Neighborhood Board meeting.

Residents along Fern Street have expressed concerns about electric and magnetic fields (EMFs) emissions that may cause some degree of increased risk of childhood leukemia, adult brain cancer, Lou Gehrig's Disease and miscarriages.

We request that HECO consider using a larger, non-residential thoroughfare such as Kapiolani Boulevard for routing its Phase 1 East Oahu Transmission Project. We also request that HECO provide us with factual information that addresses the potential health consequences relating to the resultant EMFs, so that we can respond to our constituents.

We'd appreciate your attention to these requests; and request a written response by December 15, 2003. If you have any questions, please contact Representative Scott Saiki at 586-8485.

Sincerely,

Senator Carol Fukunaga
District 11 (Makiki-Ala Moana, McCully)

Representative Scott Saiki
District 22 (McCully-Moiliili-Kaheka)

Councilmember Ann Kobayashi
District 5 (Manoa/McCully-Moiliili

-----Original Message-----
From: Leslie Au - HEER [mailto:lau@eha.health.state.hi.us]
Sent: Tuesday, July 17, 2001 12:59 PM
To: Miyahara, Lance
Subject: Re: Cal DHS EMF Evaluation

Got it, Lance! I bookmarked that site, too. Thank you. --Leslie
From: "Miyahara, Lance" <LMiyahar@hei.com>
To: "Leslie Au (E-mail 2)" <lau@eha.health.state.hi.us>
Subject: Cal DHS EMF Evaluation
Date sent: Tue, 17 Jul 2001 12:43:47 -1000

Leslie,

It was really nice talking to you. Per our phone conversation I am attaching the hot link to the Draft Cal DHS EMF Risk Evaluation report.
Please let me know what you think of it and if it may have any impact on us locally.

Thanks ... Lance

www.dnai.com/~emf/RiskEvaluation/riskeval.html
<http://www.dnai.com/~emf/RiskEvaluation/riskeval.html>

TESTIMONY BEFORE THE SENATE COMMITTEE ON COMMERCE AND CONSUMER PROTECTION

By Chris M. Shirai
Manager of Engineering
Hawaiian Electric Company, Inc.

April 1, 1999

Senate Concurrent Resolution 61 Requesting the Public Utilities Commission to Establish Standards Regarding Electric and Magnetic Fields Emissions

Chair Taniguchi, Chair Kanno and Members of the Committee:

My name is Chris Shirai. I am testifying on behalf of the Hawaiian Electric Company and its subsidiaries, Hawaii Electric and Light Company and Maui Electric Company.

We recognize that there are concerns about potential adverse health effects related to electric and magnetic fields (EMF). We also acknowledge the intent of Senate Concurrent Resolution 61(SCR 61) to establish EMF standards to address these concerns. However, we must oppose SCR 61, because of the lack of scientific data identifying EMF as a human health hazard and the negative economic impact such unsubstantiated standards would have on consumers throughout the State.

The current Hawaii State Department of Health (DoH) policy relating to EMF states, "the existing research data on possible adverse health effects, including cancer, are inconclusive and not adequate to establish or quantify a health risk." Establishing standards with no scientific basis is poor public policy.

Establishing EMF standards based upon inconclusive and inadequate scientific data would ultimately result in higher costs to all Hawaii residents without any proven benefits. The current DoH "prudent avoidance" policy, which states, "that reasonable,

practical, simple, and relatively inexpensive actions should be considered to reduce exposure," appropriately addresses both health concerns and cost.

Requiring the Public Utilities Commission (PUC) to establish EMF standards is not necessary since the current DoH policy on EMF already states, "the Department of Health will continue to collect and evaluate information on possible health hazards associated with electric and magnetic fields. If adequate data ever becomes available to establish what levels may be harmful, appropriate standards will be established."

SCR 61 refers to the National Institute of Environmental Health Sciences (NIEHS) Working Group Report, which concluded that EMF is "possibly" carcinogenic to humans. However, this statement alone can be misleading. In their August 20, 1998 letter, which accompanied the Working Group Report, Drs. Christopher Portier and Mary Wolfe of the NIEHS stated,

> "No members of the Working Group concluded that EMF could be classified as a 'known human carcinogen' or as a 'probable human carcinogen.'"

The Working Group report did not identify EMF as a health hazard and did not address the question of whether exposure to EMF poses a risk to human health.

The NIEHS Working Group Report is but one of several inputs to the NIEHS Director's Report which is still undergoing internal NIEHS review and is far from being the final word on EMF. The conclusion of the Working Group has been controversial, in comparison to the 1997 National Academy of Science report that concluded,

> "... the current body of evidence does not show that exposure to these fields presents a human-health hazard. Specifically, no conclusive and consistent evidence shows that exposures to residential electric and magnetic fields produce cancer, adverse

neurobehavioral effects, or reproductive and developmental effects."

SCR 61 asserts that other states have established standards for the strength of electric and magnetic fields. In fact, only Florida and New York have established magnetic field standards. These two states developed standards based on the maximum fields produced by existing transmission lines under the maximum load-carrying conditions. In other words, their purpose was to ensure that future power lines do not exceed current EMF levels. Their standards were not health-based standards. It is also important to note that there are no federal health standards for EMF.

The PUC considers EMF exposure in its review of all new transmission line applications and bases its decisions on the most current scientific data available. Establishing unsubstantiated standards would prevent the PUC from determining what is best for consumers throughout the state.

In summary, we recommend that SCR 61 be held without further action because:

1. Scientific research to date has not established EMF to be a human health hazard or established what levels might be harmful,
2. Establishing standards with no scientific basis would imply there is a health risk,
3. The Department of Health presently monitors the latest EMF research and has stated that if EMF is determined to be harmful, the DoH will establish appropriate standards, and
4. Establishing EMF standards based on inconclusive and inadequate scientific data will result in higher costs to all consumers with unsubstantiated benefits.

Thank you for the opportunity to testify on this resolution.

SENATE COMMITTEE ON HEALTH AND HUMAN SERVICES

SCR 67

S.R. 31, REQUESTING THE DEPARTMENT OF HEALTH TO STUDY THE EFFECTS OF ELECTRIC AND MAGNETIC FIELDS ON THE INCIDENCE OF CANCER IN HAWAII'S POPULATION

Testimony of Bruce S. Anderson, Ph.D., M.P.H.
Director of Health

March 29, 1999

Purpose: Senate Resolution 31 requests the Department of Health to study the effects of electric and magnetic fields on the incidence of cancer in Hawaii's population.

Department's Position: The Department is opposed to S.C.R. 67 and to S.R. 31, for two principal reasons.

First, the Resolutions are based on incomplete knowledge. The Resolutions correctly state that, in June, 1998, the National Institute of Environmental Health Sciences (NIEHS) concluded that power-line electric and magnetic fields (EMF) may pose a possible cancer risk to humans. However, in July, 1997, the National Cancer Institute reported its own study that showed that EMF did not cause leukemia in the children of Illinois, Indiana, Iowa, Michigan, Minnesota, New Jersey, Ohio, Pennsylvania, and Wisconsin. Furthermore, in January, 1997, the National Academy of Sciences stated, "No conclusive and consistent evidence shows that

S.R. 31, REQUESTING THE DOH TO STUDY THE EFFECTS OF EMF ON THE INCIDENCE OF CANCER IN HAWAII'S POPULATION

exposures to residential electric and magnetic fields produce cancer, adverse neurobehavioral effects, or reproductive and developmental effects." Because these two other Federal health agencies have found no cancer risk from EMF, there are no Federal standards for the strength of power-line EMF. Consequently, there are no State standards.

Second, unlike the unproven EMF, there are many proven causes of childhood cancers, adult leukemia, brain cancer, and breast cancer. The most widespread of these other confounding causes are cigarette smoke and benzene vapors in the air. Benzene is a Class A, proven leukemia and cancer agent in humans and is a natural ingredient of gasoline, so that motor vehicles emit benzene into the air above roads and highways. Animal fat in the diet and heredity are proven causes of breast cancer.

Neither the Department of Health nor any other agency could find and study cancer patients in Hawaii who have been exposed to EMF but have never lived or worked downwind of a road or highway. Newborn babies with cancers would fit that requirement, but those cases are very rare. Thus preparing a conclusive study on the impacts of EMF on human health is almost impossible.

Thank you for the opportunity to testify on this matter.

P. O. BOX 3378
HONOLULU, HAWAII 96801

SENATE COMMITTEE ON COMMERCE AND CONSUMER PROTECTION

S.C.R. 61, REQUESTING THE PUBLIC UTILITIES COMMISSION TO ESTABLISH STANDARDS REGARDING ELECTRIC AND MAGNETIC FIELDS EMISSIONS

Testimony of Bruce S. Anderson, Ph.D., M.P.H.
Director of Health

April 1, 1999

Purpose: Senate Concurrent Resolution 61 requests the Public Utilities Commission (PUC) to establish standards regarding electric and magnetic fields (EMF) emissions.

Department's Position: The Department of Health commends the intent of S.C.R. 61, which is to protect health, but would like to explain why this Resolution will not succeed in meeting its purpose.

S.C.R. 61 is based on incomplete information. It states that one Federal health agency, the National Institute of Environmental Health (NIEHS), convened an international committee that concluded the power line frequency EMF can possibly cause cancer in humans.

However, it neglects to mention that two other U.S. Federal health agencies do not believe that EMF are a health risk. In July, 1997, the National Cancer Institute reported its own study which found that EMF did not cause leukemia in the children of Illinois, Indiana, Iowa,

S.C.R. 61, Requesting the PUC to Establish Standards Regarding EMF Emissions

Michigan, Minnesota, New Jersey, Ohio, Pennsylvania, and Wisconsin. In January, 1997, the National Academy of Sciences reported, "Specifically, no conclusive and consistent evidence shows that exposures to residential electric and magnetic fields produce cancer, adverse neurobehavioral effects, or reproductive and developmental effects."

Because of this, there can be no Federal or Hawaii standards for EMF which are based on health. No one, including the PUC, can establish a health-based standard for something which is not a proven health hazard.

The electric or magnetic field standards in other States such as Florida and New York are not based on health, but on preserving the status quo. They were based on the maximum fields that existing lines in those States produced when the standards were established. The standards simply ensured that future power lines did not exceed the strength of the lines already installed. In Florida, the power lines' voltages can be as high as 765,000 volts, which is five and one-half times the maximum of 138,000 volts found here in Hawaii. Florida's standards merely prevented new power lines from being higher than 765,000 volts. New power lines were allowed to be just as powerful, and to be installed just as close to residences and schools, as the old ones were. Those States' standards were not based on protecting public health or decreasing or minimizing any community's exposure to EMF. As a result, they may have given a false impression to many members of the general public in those States and across the country.

Thank you for the opportunity to testify on this matter.

Hawaiian Electric Co., Inc. An HEI Company

FAX COVER SHEET

To: Leslie Au
Company: **Hawaii State Department of Health**
Phone: (808) 586-7539
Fax: (808) 586-7537

From: Lance H. Miyahara
Company: Hawaiian Electric Company, Inc.
Phone: (808) 543-5608
Fax: (808) 543-7099

Date: March 18, 1999
Pages including this cover page: 4

Comments:

Leslie,

Attached is a draft copy of our proposed testimony for Hawaii State Senate Resolution No. 61, requesting the PUC establish EMF standards. If there are any questions regarding this information please feel free to call me.

Lance

bc: Chris Shirai

If there are any problems with the transmission of this document please call (808) 543-5608.

TESTIMONY BEFORE THE SENATE COMMITTEE ON COMMERCE AND CONSUMER PROTECTION

By Chris M. Shirai
Manager of Engineering
Hawaiian Electric Company, Inc.

March 16, 1999

Senate Concurrent Resolution 61 Requesting the Public Utilities Commission to Establish Standards Regarding Electric and Magnetic Fields Emissions

Chair Taniguchi, Chair Kanno and Members of the Committee:

My name is Chris Shirai. I am testifying on behalf of the Hawaiian Electric Company and its subsidiaries, Hawaii Electric and Light Company and Maui Electric Company.

We recognize that there are concerns about potential adverse health effects related to electric and magnetic fields (EMF). We also acknowledge the intent of Senate Concurrent Resolution 61(SCR 61) to establish EMF standards to address these concerns. However, we must oppose SCR 61, because of the lack of scientific data identifying EMF as a human health hazard and the negative economic impact such unsubstantiated standards would have on consumers throughout the State.

The current Hawaii State Department of Health (DoH) policy relating to EMF states, "the existing research data on possible adverse health effects, including cancer, are inconclusive and not adequate to establish or quantify a health risk." Establishing standards with no scientific basis is poor public policy.

Establishing EMF standards based upon inconclusive and inadequate scientific data would ultimately result in higher costs to all Hawaii residents without any proven benefits. The current DoH "prudent avoidance" policy, which states, "that reasonable,

practical, simple, and relatively inexpensive actions should be considered to reduce exposure," appropriately addresses both health concerns and cost.

Requiring the Public Utilities Commission (PUC) to establish EMF standards is not necessary since the current DoH policy on EMF already states, "the Department of Health will continue to collect and evaluate information on possible health hazards associated with electric and magnetic fields. If adequate data ever becomes available to establish what levels may be harmful, appropriate standards will be established."

SCR 61 refers to the National Institute of Environmental Health Sciences (NIEHS) Working Group Report, which concluded that EMF is "possibly" carcinogenic to humans. However, this statement alone can be misleading. In their August 20, 1998 letter, which accompanied the Working Group Report, Drs. Christopher Portier and Mary Wolfe of the NIEHS stated,

> "No members of the Working Group concluded that EMF could be classified as a 'known human carcinogen' or as a 'probable human carcinogen.'"

The Working Group report did not identify EMF as a health hazard and did not address the question of whether exposure to EMF poses a risk to human health.

The NIEHS Working Group Report is but one of several inputs to the NIEHS Director's Report which is still undergoing internal NIEHS review and is far from being the final word on EMF. The conclusion of the Working Group has been controversial, in comparison to the 1997 National Academy of Science report that concluded,

> "... the current body of evidence does not show that exposure to these fields presents a human-health hazard. Specifically, no conclusive and consistent evidence shows that exposures to residential electric and magnetic fields produce cancer, adverse

neurobehavioral effects, or reproductive and developmental effects."

SCR 61 asserts that other states have established standards for the strength of electric and magnetic fields. In fact, only Florida and New York have established magnetic field standards. These two states developed standards based on the maximum fields produced by existing transmission lines under the maximum load-carrying conditions. In other words, their purpose was to ensure that future power lines do not exceed current EMF levels. Their standards were not health-based standards. It is also important to note that there are no federal health standards for EMF.

The PUC considers EMF exposure in its review of all new transmission line applications and bases its decisions on the most current scientific data available. Establishing unsubstantiated standards would prevent the PUC from determining what is best for consumers throughout the state.

In summary, we recommend that SCR 61 be held without further action because:

1. Scientific research to date has not established EMF to be a human health hazard or established what levels might be harmful,
2. Establishing standards with no scientific basis would imply there is a health risk,
3. The Department of Health presently monitors the latest EMF research and has stated that if EMF is determined to be harmful, the DoH will establish appropriate standards, and
4. Establishing EMF standards based on inconclusive and inadequate scientific data will result in higher costs to all consumers with unsubstantiated benefits.

Thank you for the opportunity to testify on this resolution.

Hawaiian Electric Co., Inc. An HEI Company

FAX COVER SHEET

To: Leslie Au
Company: Hawaii State Department of Health
Phone: (808) 586-7539
Fax: (808) 586-7537

From: Lance H. Miyahara
Company: Hawaiian Electric Company, Inc.
Phone: (808) 543-5608
Fax: (808) 543-7099

Date: March 5, 1999
Pages including this cover page: 7

Comments:

Rick/Gayle,

Attached are the Hawaii State Senate Resolution No. 61 and Senate Bill No. 143 which I referenced in my earlier e-mail note. If there are any questions regarding this information please feel free to call me.

Thanks ... Lance

cc: Gayle Novak

If there are any problems with the transmission of this document please call (808) 543-5608.

S.C.R. NO. 61

THE SENATE
TWENTIETH LEGISLATURE, 1999
STATE OF HAWAII

MAR 0 4 1999

SENATE CONCURRENT RESOLUTION

REQUESTING THE PUBLIC UTILITIES COMMISSION TO ESTABLISH STANDARDS REGARDING ELECTRIC AND MAGNETIC FIELDS EMISSIONS.

WHEREAS, the generation, transmission, and use of electric energy are associated with the production of electric and magnetic fields (EMF); and

WHEREAS, there are growing concerns about the potential adverse health effects of exposure to EMF; and

WHEREAS, in June 1998, a majority of the members of an international committee convened by the National Institute of Environmental Health Sciences concluded that power line frequency EMF are possibly carcinogenic to humans; and

WHEREAS, various studies of EMF effects have found that EMF exposure can alter heart rhythms and may lead to elevated cardiac risks, may increase the risk of immunological and hematological disorders, and can block the protective action of melatonin against the growth of cancer cells; and

WHEREAS, several states, including Montana, Minnesota, New Jersey, New York, North Dakota, Oregon, and Florida have established standards for the strength of electric fields from high voltage transmission lines, and Florida has also established magnetic field standards; and

WHEREAS, Hawaii lacks standards for the strength of electric and magnetic fields emissions from high voltage transmission lines; and

WHEREAS, the establishment of standards are necessary to ensure that electric utilities construct high voltage transmission systems within limits intended to lessen or minimize the community's exposure to EMF; and

WHEREAS, under section 269-27.6, Hawaii Revised Statutes, the Public Utilities Commission (PUC) is already required to

S.C.R. NO. 61

consider the factor of EMF emission exposure in reviewing an application for construction of new 138 kilovolt or greater high voltage transmission systems, and the development and application of specific EMF emission standards would assist the PUC in its review; now, therefore,

BE IT RESOLVED by the Senate of the Twentieth Legislature of the State of Hawaii, Regular Session of 1999, the House of Representatives concurring, that the PUC is requested to establish standards for the strength of electric and magnetic fields from high voltage transmission lines; and

BE IT FURTHER RESOLVED that the PUC is requested to report on its efforts to establish EMF standards to the Legislature twenty days before the convening of the Regular Session of 2000; and

BE IT FURTHER RESOLVED that certified copies of this Concurrent Resolution be transmitted to the Chairperson of the PUC and the Consumer Advocate.

OFFERED BY: Suzanne Chun Oakland

THE SENATE
TWENTIETH LEGISLATURE, 1999
STATE OF HAWAII

S.B. NO. 143 S.D. 1

A BILL FOR AN ACT

RELATING TO UTILITY TRANSMISSION LINES.

BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF HAWAII:

SECTION 1. Section 269-27.6, Hawaii Revised Statutes, is amended by amending subsection (a) to read as follows:

"(a) Notwithstanding any law to the contrary, whenever a public utility applies to the public utilities commission for approval to place, construct, erect, or otherwise build a new forty-six kilovolt or greater high-voltage electric transmission system, either above or below the surface of the ground, the public utilities commission shall determine whether the electric transmission system shall be placed, constructed, erected, or built above or below the surface of the ground; provided that in its determination[, the]:

(1) The public utilities commission shall consider:

[(1)] (A) Whether a benefit exists that outweighs the costs of placing the electric transmission system underground;

[(2)] (B) Whether there is a governmental public policy requiring the electric transmission system to be placed, constructed, erected, or built underground, and the governmental agency

establishing the policy commits funds for the additional costs of undergrounding;

[(3)] (C) Whether any governmental agency or other parties are willing to pay for the additional costs of undergrounding;

[(4)] (D) The recommendation of the division of consumer advocacy of the department of commerce and consumer affairs, which shall be based on an evaluation of the factors set forth under this subsection; and

[(5)] (E) Any other relevant factors[.]; and

(2) The public utilities shall not authorize the placement, construction, erection, or building of any forty-six kilovolt or greater high-voltage electric transmission system in a residentially-zoned area or within three hundred feet of any public or private school grounds or any licensed child care facility, unless the electric transmission system is placed underground and insulated against electro-magnetic field emissions."

SECTION 2. This Act shall apply to all applications for approval to place, construct, erect, or otherwise build a new forty-six kilovolt or greater high-voltage electric transmission system, including all applications that were approved by the

public utilities commission prior to the effective date of this Act, but shall not apply to any high-voltage electric transmission system that has been completed with the approval of the public utilities commission, in accordance with law.

SECTION 3. Statutory material to be repealed is bracketed. New statutory material is underscored.

SECTION 4. This Act shall take effect upon its approval.

REPORT TITLE:
Utility Transmission Lines

DESCRIPTION:
Prohibits PUC approval of new 46 kilovolt or greater high voltage electric transmission systems in residential areas, or near schools or licensed child care facilities, unless placed underground and insulated against electro-magnetic field emissions; requires PUC to re-review prior applications. (SD1)

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840-0001

February 22, 1999

The Honorable Senator Brian Taniguchi
The Honorable Senator Brian Kanno
Co-Chairs
Committee on Commerce and Consumer Protection
State Capitol
Honolulu, HI 96813

Dear Senators Taniguchi and Kanno:

Subject: SB 143 Relating to Utility Transmission Lines

At your Committee hearing on February 16, 1999 on Senate Bill 143, Senator Kanno and Senator Hanabusa requested some additional information. Here are responses to your questions:

What future 46KV and above projects do you have planned?

HECO: Kamoku-Pukele 138KV
AES-CEIP 138KV
Waialua-Kuilima 46KV (already under construction)
Kunia-Makai 46KV (design completed, material received)
Waiawa-Mauka 46KV
HELCO: Encogen 69KV Interconnection (to intertie HELCO with purchase power producer)
MECO: none

Does HECO have any historical records on health effects of EMF on its electrical workers?

According to our Director of Corporate Safety & Employee Health Services, who has been with the company for 33 years, HECO has not experienced any unique or unusual number of health related problems that is different from the general Hawaii population.
HECO is one of those rare companies that employ several generations of families, including sons, daughters, nephews and nieces. Many have held the same types of jobs dealing with electricity and all are in good health.

Are you aware that HECO has a written disclaimer about the health effects of EMF in your monthly bills?

Neither HECO, HELCO nor MECO prints a disclaimer on its monthly bill statements. We do have a monthly publication called Consumer Lines that accompanies our bills that has printed articles regarding EMF (See attachments). These articles also do not contain disclaimers.

Aside from these points, I must note that Senate Bill 143 is not a good public policy approach to this issue of overhead vs. underground electric lines. It unilaterally precludes the PUC from considering all of the factors and all of the impacts surrounding the installation of needed transmission lines. SB 143 will result in higher electric rates and therefore will have a significant negative effect on customers, many of whom may be unable to afford the increase. The impacts would be even greater for customers on the neighbor islands where costs are spread among fewer customers.

SB 143 is also fundamentally misleading in its concern about EMF for three reasons. First, there is no basis for the selected areas or facilities and the 300 feet distance cited in SB 143. While there are "non-health-related" standards enacted in certain states based on miligauss limits at line right-of-ways, there are no Federal or State "health-related" standards regarding EMFs and no standards for "buffer" zones which SB 143 is trying to establish. Secondly, the amount of EMF that can emanate from a line is a function of the line's current flow and not a function of the voltage. Often lower voltage lines or household appliances will have higher EMF levels than power lines of higher voltages. Lastly, the amount of EMF exposure is also a function of distance between the source of EMF and a particular reference point. Thus, simply "insulating" an underground line may not necessarily limit the amount of EMF emissions. For example, a person standing directly over an "insulated" underground line could be exposed to a higher level of EMF than an overhead line a 100 feet away.

The State Department of Health's policy on EMF states that the existing research data on possible adverse health effects, including cancer, are inconclusive and not adequate to establish or quantify a health risk. DOH recommends "prudent avoidance" which means that reasonable, practical, simple, and relatively inexpensive actions should be considered to reduce exposure. Insulating an underground line would be expensive and unreasonable.

Hawaiian Electric is <u>not</u> opposed to undergrounding utility lines. In fact, more than half of our lines are now located underground. The major issue involves the cost to undertake undergrounding and who will pay for it. In the case of newer subdivisions, the cost of undergrounding is paid by the developer, and passed on to the individual homeowner in the cost of their homes.

Over the past few years, the legislature has taken steps to provide a balanced approach to considering the underground issue. There is no question that overhead lines have a visual impact. There is also no question that underground lines have significant cost impacts for customers and the Hawaii economy. SB 143 would upset the very proper balance that the legislature has previously adopted in considering this issue.

In the alternative, we again would urge the Senate to consider SCR 30, which calls for the Legislative Reference Bureau to conduct a study on this complex issue and make recommendations to resolve it.

Should you have any further questions on this issue, please call me at 543-7819.

Sincerely,

Ken T. Morikami
Director
Project Management Division

cc: The Honorable Senator Colleen Hanabusa
The Honorable Senator Lorraine Inouye
The Honorable Senator Sam Slom
The Honorable Senator David Matsuura
The Honorable Senator Robert Bunda
The Honorable Senator Les Ihara, Jr.
Mr. Dennis Yamada, Chairman, Hawaii Public Utilities Commission
Mr. Michael Wilson, Executive Director, Division of Consumer Advocacy

TESTIMONY BEFORE
SENATE COMMITTEE ON COMMERCE AND CONSUMER PROTECTION

By Ken T. Morikami
Director, Project Management Division
Hawaiian Electric Company, Inc.

February 16, 1999

Senate Bill 143
Relating to Public Utilities

Chair Taniguchi, Chair Kanno, and Members of the Committee:

My name is Ken Morikami and I am testifying on behalf of the Hawaiian Electric Company and its subsidiaries, Hawaii Electric Light Company and Maui Electric Company.

This Bill would establish a state policy of **REQUIRING** new electric transmission lines (46,000 volts and greater) to be undergrounded and insulated against electro-magnetic field (EMF) emissions in residentially-zoned areas, or within three hundred feet of any public or private school grounds or any licensed child care facility. In theory, this could mean undergrounding new 46KV lines or greater everywhere, not only on Oahu, but also Kauai, Maui and the Big Island. We oppose SB 143 because it does not balance costs vs. benefits.

The present law, HRS Section 269-27.6, takes a balanced approach in the determination of whether a transmission line should be overhead or underground. That law directs the State Public Utilities Commission (PUC) as the expert agency to balance benefits, costs and all other relevant factors in rendering its decision on each transmission line project. We support such a balanced approach. SB 143 would remove this balance, and prevent the PUC from performing its important evaluative process. We do not believe this to be prudent or responsible.

The additional customer cost of undergrounding lines would have a significant and negative impact on the residents, businesses and the economic recovery of our State. Residential rate payers would be required to shoulder this added burden when paying their own electric bills and, in addition, will be further affected by the increasing costs of products or services they buy.

In spite of the high cost of underground transmission lines, there may be situations where underground lines are warranted. The present law properly directs the PUC to weigh the merits of underground transmission lines on a project-by-project basis and approve the installation of underground lines when justified. Accordingly, the present law should not be amended.

With regards to EMF, the Hawaii State Department of Health (DOH), in its current policy relating to EMF, states that "the existing research data on possible adverse health effects, including cancer, <u>are inconclusive and not adequate</u> to establish or quantify a health risk." DOH recommends a prudent avoidance policy which means that reasonable, practical, simple and <u>relatively inexpensive</u> actions should be considered to reduce exposure. HECO has adopted this cautious approach

by constructing new transmission facilities in a manner that minimize EMF exposure to the public by using technically feasible and economically reasonable designs. What is being proposed here in SB 143 with respect to EMF, is not in accordance with DOH's prudent avoidance policy.

We at Hawaiian Electric Company hear the community concerns regarding overhead utility lines. We also hear the concerns about high utility rates. We are constantly striving to strike a balance and weigh all the various factors (environmental, costs, reliability, construction, etc.) in planning our projects accordingly. If the committee desires to move forward on this issue, we suggest that you consider the study proposed in Senate Concurrent Resolution 30 which requests the Legislative Reference Bureau, in consultation with appropriate government and private entities, investigate and conduct a study of the feasibility of undergrounding overhead utility facilities. We believe this to be a balanced approach in examining this difficult issue.

Based on the above, we strongly recommend that SB 143 be held without further action. Thank you for the opportunity to comment on this matter.

TESTIMONY BEFORE
SENATE COMMITTEE ON COMMERCE AND CONSUMER PROTECTION

By Ken T. Morikami
Director, Project Management Division
Hawaiian Electric Company, Inc.

February 16, 1999

Senate Bill 384
Relating to Public Utilities

Chair Taniguchi, Chair Kanno, and Members of the Committee:

My name is Ken Morikami and I am testifying on behalf of the Hawaiian Electric Company and its subsidiaries, Hawaii Electric Light Company and Maui Electric Company.

This Bill would establish a state policy of **REQUIRING** new electric transmission lines (46,000 volts and greater) to be undergrounded and insulated against electro-magnetic field (EMF) emissions in residentially-zoned areas, areas viewed by visitors, or areas important to the film industry. In theory, this would mean undergrounding new 46KV lines or greater everywhere, not only on Oahu, but also Kauai, Maui and the Big Island. We oppose SB 384 because it does not balance costs vs. benefits.

The present law, HRS Section 269-27.6, takes a balanced approach in the determination of whether a transmission line should be overhead or underground. That law directs the State Public Utilities Commission (PUC) as the expert agency to

balance benefits, costs and all other relevant factors in rendering its decision on each transmission line project. We support such a balanced approach. SB 384 would remove this balance, and prevent the PUC from performing its important evaluative process. We do not believe this to be prudent or responsible.

The additional customer cost of undergrounding lines would have a significant and negative impact on the residents, businesses and the economic recovery of our State. Residential rate payers would be required to shoulder this added burden when paying their own electric bills and, in addition, will be further affected by the increasing costs of products or services they buy.

In spite of the high cost of underground transmission lines, there may be situations where underground lines are warranted. The present law properly directs the PUC to weigh the merits of underground transmission lines on a project-by-project basis and approve the installation of underground lines when justified. Accordingly, the present law should not be amended.

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being proposed here in SB 384 with respect to EMF, is not in accordance with DOH's prudent avoidance policy.

We at Hawaiian Electric Company hear the community concerns regarding overhead utility lines. We also hear the concerns about high utility rates. We are constantly striving to strike a balance and weigh all the various factors (environmental, costs, reliability, construction, etc.) in planning our projects accordingly. If the committee desires to move forward on this issue, we suggest that you consider the study proposed in Senate Concurrent Resolution 30 which requests the Legislative Reference Bureau, in consultation with appropriate government and private entities, investigate and conduct a study of the feasibility of undergrounding overhead utility facilities. We believe this to be a balanced approach in examining this difficult issue.

Based on the above, we strongly recommend that SB 384 be held without further action. Thank you for the opportunity to comment on this matter.

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Honolulu, HI 96813

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The Honorable Kenneth Hiraki
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The Honorable Lei Ahu Isa
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The Honorable John DeSoto
Honolulu City Council
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530 South King Street
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The Honorable Jon Yoshimura
Honolulu City Council
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The Honorable John Henry Felix
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The Honorable Andy Mirikitani
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The Honorable Duke Bainum
Honolulu City Council
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The Honorable Jeremy Harris
Mayor
City and County of Honolulu
Honolulu Hale
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The Honorable Mufi Hannemann
Honolulu City Council
Honolulu Hale
530 South King Street
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The Honorable Benjamin J. Cayetano
Governor, State of Hawaii
Executive Chambers
Hawaii State Capitol
Honolulu, HI 96813

The Honorable Steve Holmes
Honolulu City Council
Honolulu Hale
530 South King Street
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The Honorable Mazie K. Hirono
Lt. Governor, State of Hawaii
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Hawaii State Capitol
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The Honorable Rene Mansho
Honolulu City Council
Honolulu Hale
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The Honorable Donna Mercado Kim
Honolulu City Council
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Aloha!

Hawaiian Electric has completed its Environmental Impact Statement on the Kamoku-Pukele transmission line and will be issuing the attached news release this afternoon.

Distribution of the EIS is pending certification of completeness by the Office of Environmental Quality Control. If you would like a copy, please fax your request to Mark Willey (CH_2M Hill) at 941-8225.

If I can answer any questions, please call me at 532-5865.

Kevin Doyle
Hawaiian Electric Government Relations

Hawaiian Electric Company

N E W S • R E L E A S E

December 18, 1998
Contact: Chuck Freedman, 543-4440

HECO submits EIS for transmission line project

Hawaiian Electric Company (HECO) has submitted to the State Department of Land and Natural Resources (DLNR) the final environmental impact statement (EIS) for its proposed Kamoku-Pukele 138 kV transmission project. The project proposes a route that will be partially underground and partially overhead to connect the island's northern and southern transmission line corridors, closing the gap in the "ring of reliability" for Oahu's electric customers.

The proposed project will have 1.5 miles of underground lines which will travel from Kamoku Substation on the corner of Date and Kamoku Streets, through the UH Lower Campus, and under Dole Street, where it will transition to an overhead alignment on Waahila Ridge. Higher steel poles will replace 20 existing wood poles already on the ridge. The overhead portion of the line will run 2.3 miles along the ridge to the Pukele substation located in the back of Palolo Valley.

"We reviewed and responded to approximately 190 letters from individuals, public agencies and organizations, as well as to 3,300 postcards we received during the public comment period," said Chuck Freedman, HECO vice president of Corporate Relations. "We're doing our best to address the concerns of the community, while balancing cost, environmental, technical and engineering requirements. We know we cannot please everyone. But the Kamoku-Pukele line is crucial to giving our customers the service they need and to help prevent the enormous negative effects of a major electrical outage to the economy."

Freedman said the EIS also contains additional studies and analysis made in response to public input.

Need for the line. The EIS includes statements recognizing the reliability benefits of the Kamoku-Pukele line by the Public Utilities Commission, the Consumer Advocate, and the State Department of Business Economic Development and Tourism (DBEDT).

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The Kamoku-Pukele line closes the gap between HECO's northern and southern transmission line corridors, which bring electricity from power plants on the Leeward side to the rest of the island. By closing the gap, if one corridor is out of service for any reason, homes and businesses can receive electricity through the other corridor. The Kamoku-Pukele line will improve electric service reliability for 54% of customers on Oahu, from downtown Honolulu to Hawaii Kai to Kahuku.

Visual impacts and cost. Many of the comments received pertained to visual impacts of the overhead portion of the line on Waahila Ridge. In response, HECO has identified three possible mitigation actions.

These actions include painting the poles to help blend with the background, landscaping where possible to partially screen the poles, and possibly relocating some poles to lessen their visual impact.

While these measures will not eliminate visual impacts, costs for an all-underground alignment are 28% to 51% more than the proposed action (costs vary depending on location and technology used). HECO also received other public comments which cited support for HECO's proposed alignment to avoid additional costs to customers.

Electric and magnetic fields (EMF). Through a cancellation effect of magnetic fields that occurs when the new lines are placed near existing power lines, the proposed project would reduce EMF levels at Waahila Ridge Park and the Pukele substation in Palolo.

Regarding EMF, HECO follows the State Department of Health policy, which states that "existing research data...are inconclusive and not adequate to establish or quantify a health risk (from EMF)...Reasonable, practical, simple and relatively inexpensive actions should be considered to reduce EMF exposure." Locating the overhead portion of the line on the ridge away from populated areas is an example of an action to reduce EMF exposure.

Construction. The cost of the planned alignment is estimated at $31 million. Construction will take about 18 months, upon receipt of all permits and approvals. Impacts on recreational resources like hiking and biking will be limited to a few weeks during the construction period.

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Temporary disturbances to the soil and vegetation would be confined directly around each pole. Plants that are removed will be replaced, preferably with native species.

Other impacts. The EIS offers additional information in supplemental studies on flora, fauna, geotechnical (soils) resources, and cultural practices on the ridge. The EIS has found no significant impacts to the environment, tourism, property values, and historic sites resulting from the planned project.

Public process. Upon acceptance of the EIS, the Board of Land and Natural Resources will review HECO's Conservation District Use Application. Copies of the EIS will be available at public libraries, the UH Hamilton Library, the UH Environmental Center, the DLNR, DBEDT Library, Legislative Reference Bureau, and the Honolulu Municipal Reference and Records Center after the Office of Environmental Quality Control has reviewed the EIS distribution list.

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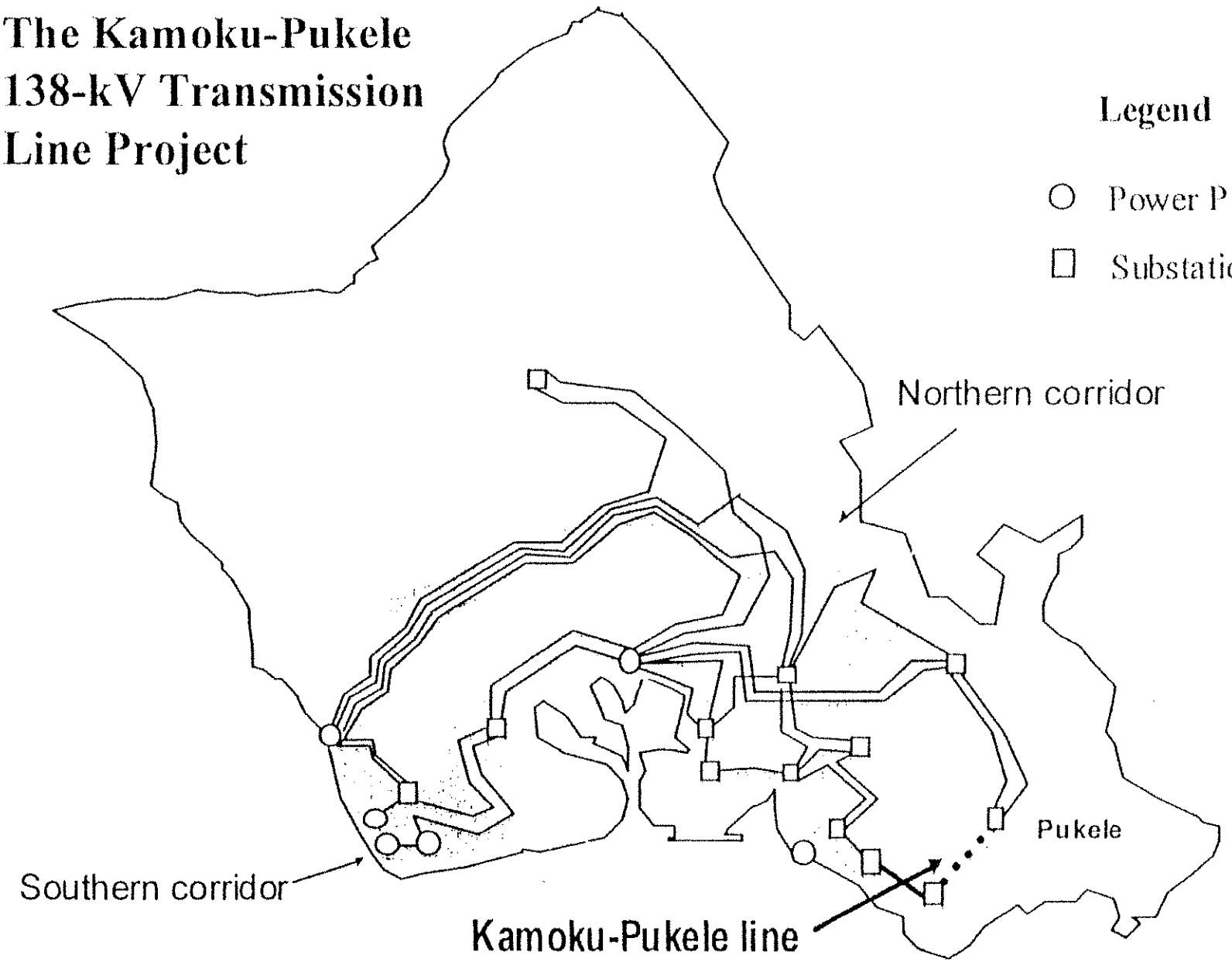
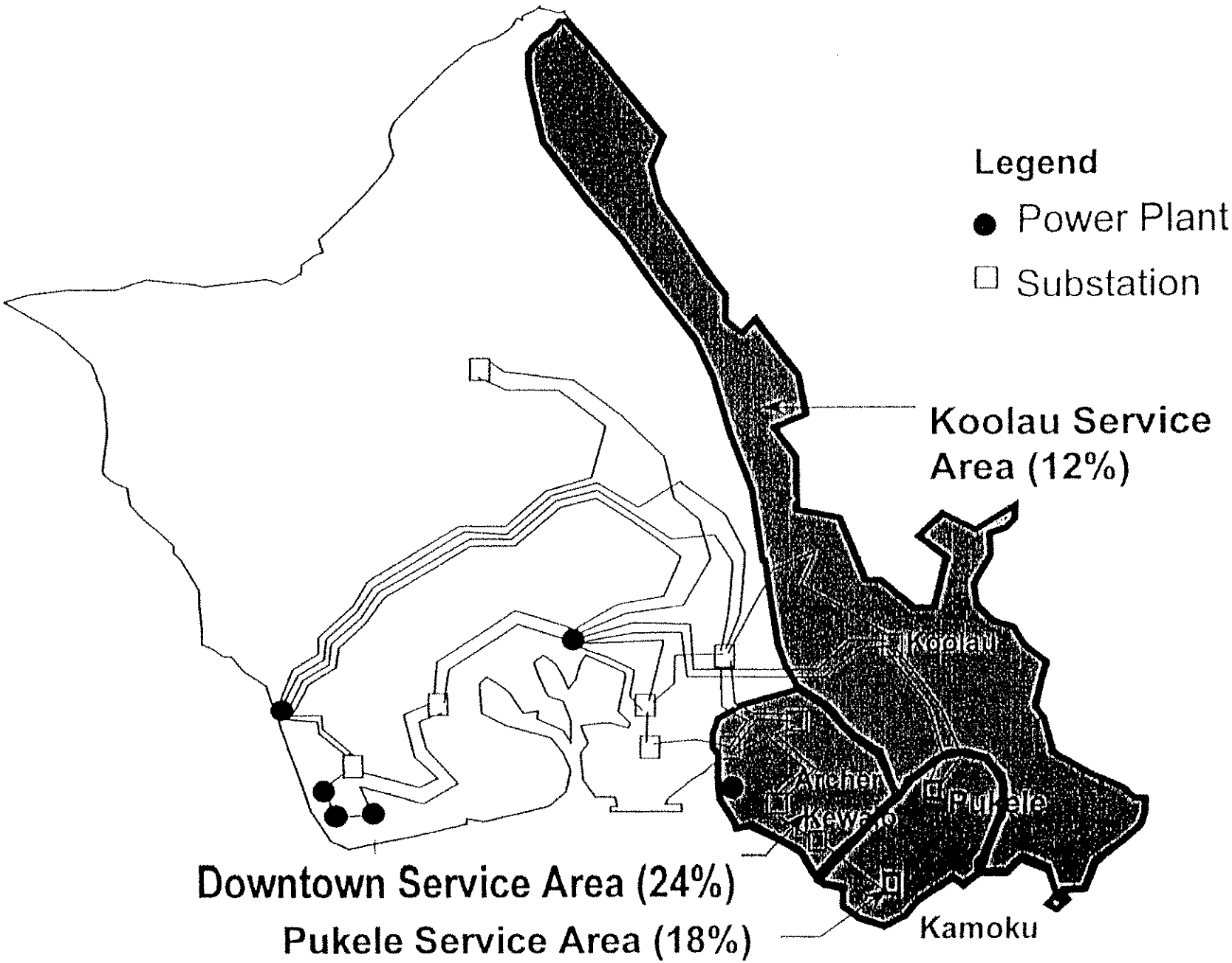
The Kamoku-Pukele 138-kV Transmission Line Project




Legend
Power Plant
Substation
Koolau Service Area (12%)
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Downtown Service Area (24%)
Pukele Service Area (18%)
Kamoku

United States Environmental Protection Agency
Air and Radiation (NAREL)
July 1992

EPA

Measurements of Electric and Magnetic Fields in the Waianae, Hawaii Area

too many pages, but I can mail it over

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Journal of Environmental Pathology, Toxicology and Oncology, 13(1):33–37 (1994)

Investigation of Increased Incidence in Childhood Leukemia near Radio Towers in Hawaii: Preliminary Observations

Gertraud Maskarinec,[1] James Cooper,[1] and Leslie Swygert[2]

Twelve children from the Waianae Coast, Hawaii, were diagnosed with acute leukemia from 1979 to 1990. The standardized incidence ratio (SIR) of 2.09 (95% confidence interval (CI) 1.08 to 3.65) indicates a significant increase. Seven cases occurred between 1982 and 1984 and were unusual in terms of sex, age, and type of leukemia. A case-control study (12 cases, 48 matched controls) explored risk factors, including parents' occupation, X-ray exposure, domestic smoking, family and medical histories, and distance of children's residence locations to low frequency radio towers. The odds ratio (OR) for having lived within 2.6 miles of the radio towers before diagnosis was 2.0 (95% CI 0.06 to 8.3). The clustering may have been a chance event, but because of its peculiar characteristics, we feel it should be noted.

Introduction

Several years ago, a pediatric oncologist noticed an unusual number of children with leukemia from the Waianae Coast, located on Oahu, Hawaii. Data from the Hawaii Tumor Registry confirmed his impression. Supported by several studies associating childhood leukemia with exposure to 60 Hz electromagnetic radiation (EMR)[1–3] and an ecologic study in Honolulu reporting elevated cancer rates in census tracts with broadcasting towers,[4] the population of Waianae had expressed particular concerns about EMR from a military installation with low-frequency radio towers transmitting waves at 23.4 kHz, an order of magnitude higher than EMR from powerlines. The radio towers have been operating since the 1940s without major changes. The primary objectives of this investigation were to describe the incidence pattern of childhood leukemia in Waianae and to explore possible causes, including EMR, in a case-control study.

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Materials and Methods

A case was defined as a child under 15 yr of age who was diagnosed with acute leukemia between 1979 and 1990 and had resided in census tracts 96, 97, or 98 before diagnosis. Incidence data were obtained from the Hawaii Tumor Registry, part of the SEER program, which was founded in 1960, covers all the Hawaiian islands, and ascertains close to 100% of incident cases. Standardized incidence ratios (SIR) and confidence intervals using Byar's approximation[5] were calculated to evaluate the excess of childhood leukemia.

All 12 cases meeting the case definition (Table 1) appeared at least once among the records of the local health center, providing primary care to >90% of the population in the area. From the patient files of the local health center, four sex- and age (±6 months)-matched controls, who had lived in Waianae at the time of diagnosis, were selected for each case. Unblinded telephone interviews were conducted with the parents. Questions included pregnancy, address and type of residency during infancy and childhood, the child's medical history and exposure to X-rays, smoking in the home, and proximity to oil drums. An occupational history for both parents was recorded, and any exposure to metals, chemicals, or

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TABLE 1. Cases of childhood leukemia, Waianae leukemia study, 1979 to 1990.

ID	Sex	Year of diagnosis	Age at diagnosis	Type of leukemia*
1	M	1979	3	ALL
2	M	1980	1	ALL
3	F	1982	9	ALL
4	F	1982	<1	ANLL
5	F	1983	9	ANLL
6	F	1983	12	ANLL
7	F	1983	3	ANLL
8	F	1984	12	ANLL
9	M	1984	5	ALL
10	F	1985	7	ALL
11	M	1986	7	ALL
12	M	1990	2	ALL

* ALL = acute lymphocytic leukemia; ANLL = acute nonlymphocytic leukemia.

X-rays at the workplace was classified as hazardous occupational exposure.

All addresses prior to the age of diagnosis (including pregnancy) were located on a map, and distances from the low-frequency radio towers were estimated both manually and with the help of ARC/INFO®, a geographical software package, with results within two-tenths of a mile. Exposure was defined as having lived within 2.6 miles of the radio towers. This distance is the median of the distribution for all distances and also roughly delineates the valley where the radio towers are located. For addresses containing only the street name or the block number, the midpoint of the street or block was assigned as residence location. Residences outside Waianae were classified as unexposed. Matched odds ratios were calculated using the SAS® software package.[6]

Results

The SIR for the 12 cases reported between 1979 and 1990 is 2.09 (95% CI 1.08 to 3.65). For acute lymphocytic leukemia (ALL), the SIR is 1.58 (95% CI 0.63 to 3.26) and 3.73 (95% CI 1.20 to 8.71) for acute nonlymphocytic leukemia (ANLL). Looking at the time pattern (Figure 1), it can be seen that seven cases occurred during 3 yr, 1982 to 1984. The SIR for that period is 5.34 (95% CI 2.14 to 11.0). After 1984, the incidence returned to the expected pattern. These seven cases are unusual in several respects: Five out of seven had ANLL, whereas only one of four childhood leukemias statewide are of this type. The age of onset is unusually high, and six of these seven cases were girls, whereas childhood leukemia is usually more common in boys than in girls.[7]

Table 2 compares demographic information for the participants in the case-control study. No major differences were noted except for the larger number of younger siblings in the control group. The odds ratio for hazardous parental occupation (Table 3) is slightly elevated, and the families of cases reported more cancer cases in their families. The matched odds ratios for closeness to the

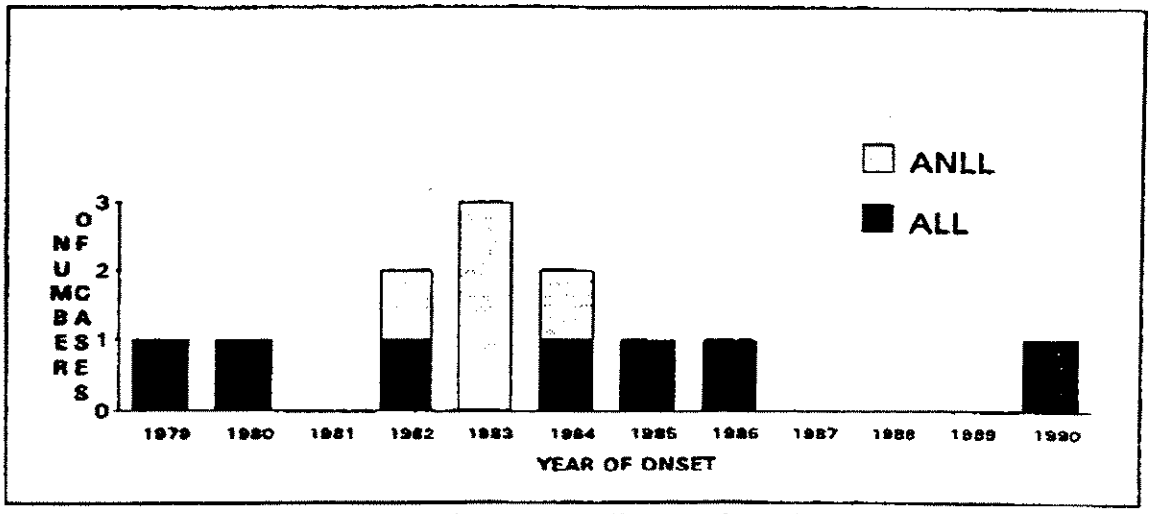

FIGURE 1. Occurence of childhood leukemia on the Waianae Coast, Hawaii, 1979 to 1990.

TABLE 2. Demographic information for 12 cases and 48 controls, Waianae leukemia study, 1979 to 1990.

Item	Cases		Controls	
	No.	%	No.	%
Sex				
male	5	42	20	42
female	7	58	28	58
Ethnicity				
Hawaiian/part Hawaiian	8	67	38	79
other	4	33	10	21
Education of head of household				
elementary	1	8	3	6
high school	8	67	38	79
college, etc.	3	25	7	15
Residencies before critical age				
one	6	50	20	42
two	2	17	16	33
three	3	25	9	19
four	1	8	3	6
	Mean ± SD		Mean ± SD	
Mother's age at child's birth (yr)	24.5 ± 6.0		24.6 ± 5.6	
Father's age at child's birth (yr)	29.8 ± 10.0		29.3 ± 8.3	
No. of siblings				
older	1.7 ± 1.4		1.6 ± 1.8	
younger	0.8 ± 1.4		1.5 ± 1.5	

radio towers were around two, but none of them reached statistical significance.

Discussion

Incidence of childhood leukemia on the Waianae Coast was significantly increased from 1979 to 1990, but in particular from 1982 to 1984. Due to the small number of cases, the power of the case-control study is low (~50% to detect an OR of five). It appears that closeness to the low-frequency radio towers has a weak association with leukemia, even though it was not statistically significant. Closeness to the station may be confounded by other factors, such as socioeconomic status, exposure to petroleum products, or ionizing radiation. The U.S. Environmental Protection Agency (EPA) performed measurements of electric and magnetic fields around Lualualei Naval Station in 1990, and EMR levels did not exceed existing guidelines.[8] These data cannot serve as an exposure variable, since measurements are not available for all the locations of residences for either cases or controls and not for the time before 1982.

Assuming that this cluster of leukemia was limited to the 3 yr from 1982 to 1984, the most likely time for an adverse event would have been the year of 1981, when eight children to be later diagnosed with leukemia were alive, and one was in utero. In spite of some effort, this investigation did not discover a definite incident that may have caused these cases.

Some misclassification of exposure cannot be excluded, since several parents had difficulties remembering exact addresses and times when they had moved. This should not influence the odds ratio very much, since for most of the uncertain addresses there is no doubt as to their locations within or outside the 2.6 miles radius.

TABLE 3. Leukemia risk for selected factors, Waianae leukemia study, 1979 to 1990.

Risk factor	Exposed/ unexposed cases controls	Matched odds ratio	95% CI
Parental occupation with hazardous exposure	4/8 12/36	1.3	0.4–4.6
X-ray exposure during pregnancy or early childhood	3/9 21/27	0.4	0.1–1.8
Serious medical condition before age at diagnosis	8/4 41/7	0.4	0.1–1.3
Any other cases of cancer in family	10/2 31/17	2.8	0.6–14
Smoking in home during pregnancy and early childhood	9/3 39/9	0.6	0.1–3.9
Last residence before diagnosis within 2.6 miles of radio towers	8/4 25/23	2.0	0.6–8.3
Residence at birth within 2.6 miles of radio towers	8/4 26/22	2.2	0.3–15
Residence with the maximum number of years within 2.6 miles of radio towers	8/4 25/28	1.8	0.5–6.3

Selection of the controls may have caused some bias in that controls had to be chosen from a current list of active patients at the health center. On the positive side, the participation rate among cases was 100% and among controls ~80%.

The excess of ANLL may be related to the ethnic distribution of this predominantly Hawaiian population. Data from international comparisons suggest that Hawaiians and Maoris in New Zealand have a lower rate of ALL and a higher rate of ANLL than other ethnic groups.[9] However, the incidence rate for all types of childhood leukemia in Hawaiians has been similar to rates in other ethnic groups (Hawaii Tumor Registry, unpublished report), signifying that the excess of leukemia cases on the Waianae Coast cannot be explained by the ethnic distribution of the population. Even the ratio ALL/ANLL was extreme in this study (1.4) as compared to the statewide ratio for Hawaiians during the same time period (2.6).

This study concludes that the incidence of childhood leukemia in Waianae was elevated from 1982 to 1984. The number of study participants was too small to identify risk factors with any certainty. Whatever caused this cluster of leukemia cases does not seem to be in effect any longer. Since 1985, the incidence of leukemia along the Waianae Coast has returned to an expected pattern of approximately one case of childhood leukemia every 2 yr. Although the possibility remains that this clustering was a chance event, the unusual age, sex, and type of leukemia pattern of this cluster should be noted.

Acknowledgments

Appreciation is expressed for the assistance of Dr. Robert Wilkinson and his staff in making contact with cases, and for the help provided by the staff of the Waianae Coast Comprehensive Health Center in identifying controls and administering the interviews.

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INVESTIGATION

OF

CHILDHOOD LEUKEMIA

ON THE WAIANAE COAST

1977-1990

PREPARED BY

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OFFICE OF HEALTH STATUS MONITORING

HAWAII STATE DEPARTMENT OF HEALTH

JULY 1992

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SUMMARY

Concern about an unusual number of children from the Waianae Coast with leukemia prompted the Department of Health to conduct a detailed investigation and a case-control study. Between 1977 and 1990, fourteen children from the Waianae Coast were diagnosed with acute leukemia. Twelve children had been Waianae residents at the time of diagnosis and two of them had spent more than 25% of their lifetime in the area. Seven of the cases occurred from 1982 to 1984. In a population of this size approximately one case every two years is expected to occur. These seven cases were unusual in terms of age, sex, and type of leukemia.

The case-control study explored numerous factors, such as occupation of the parents, smoking in the home, X-ray exposure, cancers in the family, and medical history. Only the history of cancer in the family showed an association with leukemia.

Due to public concern about electromagnetic radiation from Lualualei Naval Station, we analyzed the distance of the children's residence locations to the low frequency radio towers. The children with leukemia were approximately twice as likely to have lived within 2.5 miles of the station as the healthy children. However, it is important to note that this result was not statistically significant. Even though closeness to the station may have been a risk factor for leukemia, we do not have enough information to link the two causally. Closeness to the station may be confounded by other factors, such as socioeconomic status or exposure to a hazardous chemical. In that case, distance to Lualualei would be a surrogate for some unknown factor(s) causing leukemia.

The size of the study was too small to identify any factors with any certainty. Whatever caused this cluster of leukemia cases does not seem to be in effect anymore. Since 1985, the incidence of leukemia at the Waianae Coast has returned to an expected pattern of approximately one case of every two years. Retrospectively, it is nearly impossible to identify a cause, because no reliable assessment of a specific exposure can be performed after the event. Although the possibility remains that this clustering was a chance event, the unusual age, sex, and type of leukemia pattern of this cluster reduces, though does not eliminate, that possibility.

INTRODUCTION

In 1985, the Department of Health was notified by Dr. Robert Wilkinson, a pediatric oncologist, that he had seen an unusual number of children with leukemia from the Waianae Coast. This Western part of Oahu includes four communities: Nanakuli, Maili, Waianae, and Makaha. As early as 1986, data from the Hawaii Tumor Registry confirmed his impression of an increased occurrence of childhood leukemia on the Waianae Coast. In 1990 the Department of Health created a chronic disease epidemiology section and assigned to it the task of conducting a detailed investigation and a case-control study. Results of both are presented in this paper.

DESCRIPTION OF THE LEUKEMIA CASES

A case was defined as a child under fifteen years of age who was diagnosed with acute leukemia between 1977 and 1990 and who had spent at least 25% of his/her lifetime before diagnosis in census tracts 96, 97, or 98. Table 1 lists all cases, two of whom never permanently resided in Waianae but had spent 2 or 3 days there every week. All of the fourteen cases meeting this definition appeared at least once among the records of the Waianae Coast Comprehensive Health Center.

The average annual incidence for juvenile leukemia in Hawaii is 0.048 per 1000 juvenile population, which is a little higher than the national rate (0.040 per 1000). Applying Hawaii's rate to the juvenile population count of the Waianae Coast, one would expect roughly one case of juvenile leukemia in two years or seven cases in 14 years. Twelve cases with a permanent residence at the Waianae Coast were reported during the 14 years, plus two cases who spent a major part of their time there. This difference, seven expected vs. fourteen observed, is statistically significant. For adults, leukemia incidence was not increased during the same time period. Of all fourteen childhood cases, twelve are alive. The two girls who expired were twelve years old at diagnosis (table 1, ID 7 and 9) and both had suffered from acute nonlymphocytic leukemia (ANLL).

Looking more closely at the time pattern of cases (figure 1), it can be seen that seven cases occurred during three years, 1982 through 1984. After 1984 the incidence returned to the expected pattern. These seven cases are unusual in several respects: Five of them were acute nonlymphocytic leukemias (ANLL), while three out of four childhood leukemias statewide are of the lymphocytic type (ALL). Six of the cases were girls, while childhood leukemia is usually somewhat more common in boys than in girls. Four of these girls were between nine and twelve years old at diagnosis. The peak age of onset for childhood leukemias is around three years (figure 2).

From international comparisons some evidence for variation in leukemia rates according to ethnicity has been detected. The sparse data suggest that Hawaiians and Maoris in New Zealand have a lower rate of ALL and a higher rate of ANLL than other ethnic groups. However, the overall numbers are too small for definite conclusions.

CASE-CONTROL STUDY

To collect more information on possible risk factors for these cases of childhood leukemia, a case-control study was designed and approved by the Department of Health's Research Assistance and Evaluation Committee. Each case was matched with four controls. From their patient files, the Waianae Coast Comprehensive Health Center listed children who were the same sex and born within six months of the case. The same questionnaire was administered to a parent of all 14 cases and 56 control children randomly selected from the control list. Questions were asked concerning pregnancy, address and type of residency during infancy and childhood, the child's medical history, the child's exposure to X-ray, smoking in the home, and proximity to oil drums. An occupational history for both parents was recorded and any exposure to metals, chemicals, or X-rays at the workplace were classified as hazardous occupational exposure. Because the population of Waianae had expressed concerns about the electromagnetic radiation from Lualualei Naval Station, all addresses prior to the age of diagnosis (including pregnancy) for cases and controls were located on the map and their distances from the low frequency radio towers were estimated (figure 3 and 4). We defined several categorical variables expressing distance from the low frequency radio towers.

Table 2 provides demographic information on the study participants. Both cases and controls are predominantly Hawaiian (64% and 77%), with high school educated head of the household (72% and 77%). Most of the cases had only lived in one home prior to diagnosis. Mother's and father's age at birth of the child were very similar, as were the average number of older siblings. The cases have a mean of only one younger sibling as compared to 1.6 of the controls.

Table 3 and 4 list the hypothetical risk factors for leukemia that were analyzed. If the matched odds ratio equals one, the risk for cases and controls is the same. If it is greater than one, those with this factor are more likely to develop leukemia. If it is less than one, those with this factor are less likely to develop leukemia. Because of the small study size all the confidence intervals are quite wide. For parental occupation with hazardous exposure and for smoking in the home the odds ratio is slightly elevated. Families with leukemia children reported more cancer cases in their families, possibly a result of recall bias. After one case of cancer occurs in a family, everyone tries to remember other cancer cases in the family, whereas the control families never made such an effort. For X-ray exposure, illnesses in early childhood, and residence in Waianae during pregnancy the odds ratio is smaller

than one. The matched odds ratios for closeness to Lualualei Station (table 4) were all above one. This means that the children with leukemia were approximately twice as likely to have lived within 2.5 miles of the station.

We did not analyze many of the other questions from the questionnaire, such as exposure to electric appliances, because of little variation in exposure. As to the type of housing, there was very little variation since most homes were wooden. However, four of the cases lived in a Quonset hut for some time before being diagnosed with leukemia and none of the controls ever lived in such a structure. Quonset huts are made from galvanized corrugated metal sheets, meaning they are coated with zinc.

DISCUSSION

This is an investigation of a very small number of cases and it is always possible that the clustering was a chance event. Because there was no well defined hypothesis undergoing testing, the case-control study must be considered exploratory and no final results can be expected. One should also keep in mind that it is very difficult to get a statistically significant result when the population being studied is so small. Therefore, all results should be regarded as propositions for thought and as suggestions for further research.

From the results it appears that closeness to Lualualei Naval Station may have a weak association with leukemia even though it is not statistically significant. No matter what kind of indicator variable for vicinity to the station is used, the odds ratio remains above one. However, this result cannot be considered proof that anything emanating from the station actually caused the leukemia. Closeness to the station may be confounded by other factors, such as socioeconomic status or exposure to a hazardous chemical. In that case, distance to Lualualei would be a surrogate for the unknown factor that causes leukemia. Looking at the map, it is apparent that the cases lived mostly in Maili and in Waianae, whereas many of the controls lived in Makaha and Nanakuli.

The U.S. Environmental Protection Agency (EPA) came to Hawaii in 1990 and performed measurements of electric and magnetic fields around Lualualei Naval Station. Unfortunately these data cannot serve as an exposure variable for our study since measurements are not available for all the locations of residences for either cases or controls. In addition, most measurements were taken along roadsides. The power lines along the roads appear to have a shielding effect, i.e. electromagnetic fields from the radio transmitters are lower under the powerlines than further away from the roads, such as in homes and yards where the children actually spent their time.

Improper storage and disposal of oil is a major concern on the Waianae Coast. Unfortunately, we could not develop a useful measure to assess exposure for our study subjects. The locations of prior residences were often approximated when the parents could not provide an exact street address.

Assuming that this cluster of leukemia was limited to the three years from 1982 to 1984, we tried to look at it as an outbreak from a point source and we estimated the time period when the adverse event might have happened. The most likely time would have been the year of 1981 when nine children to be diagnosed with leukemia later were alive and one was in utero. Of course, we do not know if there ever was such an event or what it might have been. Nevertheless, we searched the Hawaii Newspaper Index and noticed several articles about problems with Lualualei Naval Station in 1981 (Star-Bulletin January 15, 1981, Advertiser January 17, 1981, Star-Bulletin & Advertiser March 8, 1981). Maintenance problems and disrepair at the station led to termination of the maintenance contract and the selection of a new contractor. One hypothesis about the effects of electromagnetic radiation suggests intermittent or irregular exposures may be more harmful than continuous exposures. However, a real association between the leukemia cluster and the events in 1981 appear unlikely because of the short incubation period. From studies in Japan we know that the minimum period between exposure to radiation and leukemia is about two years and peaks around five years. The latency period appears to be shorter for younger children.

The conclusion from this study is that there was an unexpectedly high incidence of childhood leukemia from 1982 to 1984. The size of the study was too small to identify risk factors with any certainty and none of the analyzed variables reached statistical significance. Even though closeness to Lualualei Naval Station may have been a risk factor, we do not have enough knowledge to link the two causally. Whatever caused this cluster of leukemia cases does not seem to be in effect anymore. Since 1985 the incidence of leukemia at the Waianae Coast has returned to an expected pattern of approximately one case of leukemia every two years. Retrospectively, it is nearly impossible to identify a cause, because no reliable assessment of a specific exposure can be performed after the event. Although the possibility remains that this clustering was a chance event, the unusual age, sex, and type of leukemia pattern of this cluster reduces that possibility.

We recommend further research into the possible health effects from living in Quonset huts. The inhabitants may be exposed to particles of zinc released from the coating of the iron pieces. In the future, clusters of leukemia should be identified in a more timely fashion. No mechanism for detecting clusters existed within the Department of Health during the early eighties. With help from the Hawaii Tumor Registry and by utilizing health insurance claims data, we are developing a surveillance program for cancer clusters. This system will greatly increase our capability of monitoring of disease occurrence in the State of Hawaii.

TABLE 1. Cases of Childhood Leukemia, Waianae Coast, 1977-1990.

ID	Sex	Year of Diagnosis	Age at Diagnosis	Type of Leukemia°
*1	F	1977	3	ALL
2	M	1979	3	ALL
^3	M	1980	1	ALL
4	F	1982	9	ALL
^5	F	1982	0	AML
6	F	1983	9	AML
7	F	1983	12	Mono
8	F	1983	3	AML
9	F	1984	12	AML
10	M	1984	5	ALL
11	F	1985	7	ALL
12	M	1986	7	ALL
^*13	M	1987	1	ALL
^14	M	1990	2	ALL

* This child never had a permanent residence at the Waianae Coast but s/he spent more than 25% of her/his time there.

^ This child once lived in a metal Quonset hut.

° ALL stands for Acute Lymphocytic Leukemia, AML for Acute Myelocytic Leukemia, and Mono for Monocytic Leukemia.

TABLE 2. Demographic information for 14 cases and 56 controls in Walanae leukemia study, 1977-1990.

Item	Cases		Controls	
	No.	%	No.	%
Sex				
male	6	43	23	41
female	8	57	33	59
Ethnicity				
Hawaiian/Part Hawaiian	9	64	43	77
Other	5	36	13	23
Education of head of household				
Elementary	1	7	4	7
Highschool	10	72	43	77
College etc.	3	21	9	16
Residencies before critical age				
one	8	57	25	45
two	2	14	19	34
three	3	22	7	12
four	1	7	5	9
	Mean +/- SD		Mean +/- SD	
Mother's age at child's birth (years)	23.9 +/- 5.7		24.3 +/- 5.7	
Father's age at child's birth (years)	28.5 +/- 9.7		28.4 +/- 8.0	
Number of siblings				
Older	1.5 +/- 1.4		1.5 +/- 1.7	
Younger	1.0 +/- 1.4		1.6 +/- 1.5	

TABLE 3. Leukemia risk for selected factors in Waianae case-control study, 1977-1990

Risk factor	Matched Odds Ratio	95% CI
Parental occupation with hazardous exposure	1.30	0.37-4.58
X-Ray exposure during pregnancy or early childhood	0.67	0.19-2.33
Positive medical history before age at diagnosis	0.59	0.21-1.61
Any other cases of cancer in family	3.40	0.70-16.41
Residence in Waianae during pregnancy	0.13	0.02-0.73
Smoking in home during pregnany and early childhood	1.13	0.26-4.84

TABLE 4. Leukemia risk for different measures of exposure to Lualulei Naval Station in Waianae leukemia, 1977-1990

Risk factor	Matched Odds Ratio	95% CI
1. Closest distance to Lualualei ever lived	2.20	0.65-7.56
2. Last residence before diagnosis	2.11	0.62-7.19
3. Residence at birth	2.12	0.53-8.56
4. Residence with the maximum number of years	1.42	0.44-4.58
5. Residence in 1981 (for 10 cases and 14 controls who were alive and not yet diagnosed with leukemia)	3.25	0.55-19.24
6. Index (YEARS/DISTANCE)	3.53	0.43-28.62

The categorical variables are defined as follows:

1. The closest to Lualualei a child ever lived was within 2.2 miles of the station.
2. The residence where the child lived just before diagnosis was within 2.6 miles of Lualualei.
3. The residence where the child lived at birth was within 2.6 miles of Lualualei.
4. The residence where the child lived for the longest time prior to diagnosis was within 2.6 miles of Lualualei.
5. The residence where the child lived in 1981 was within 2.6 miles of Lualualei.
6. The summary index (sum of ratios of number of years lived in a residence and its distance to Lualualei for each residence) was greater than 1.8.

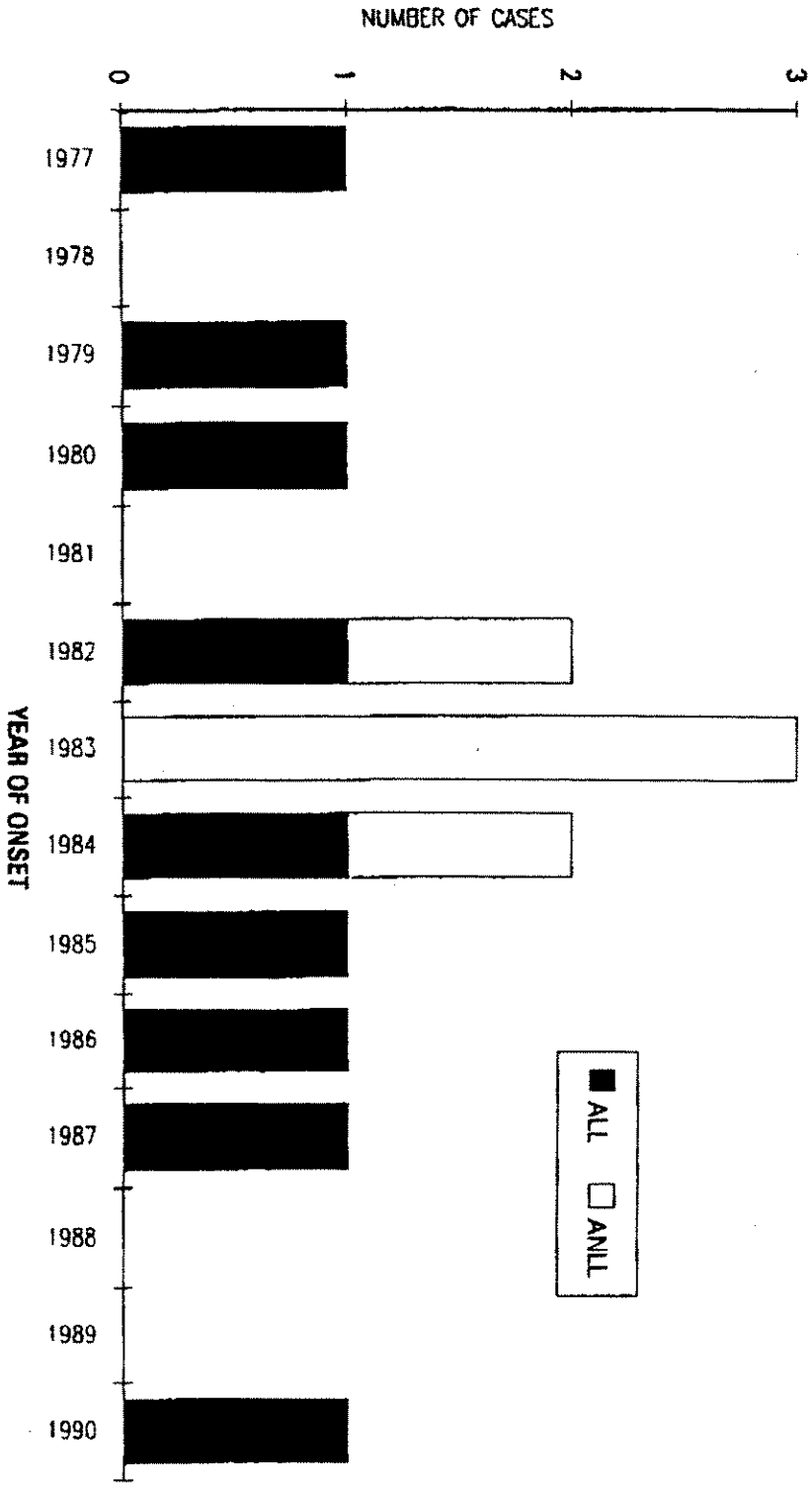


FIGURE 1. Occurrence of Leukemia Cases at Waianae Coast, 1977-1990
(ALL = Acute Lymphocytic Leukemia, ANLL = Acute Non Lymphocytic Leukemia)

Source: Hawaii State Department of Health - Office of Health Status Monitoring

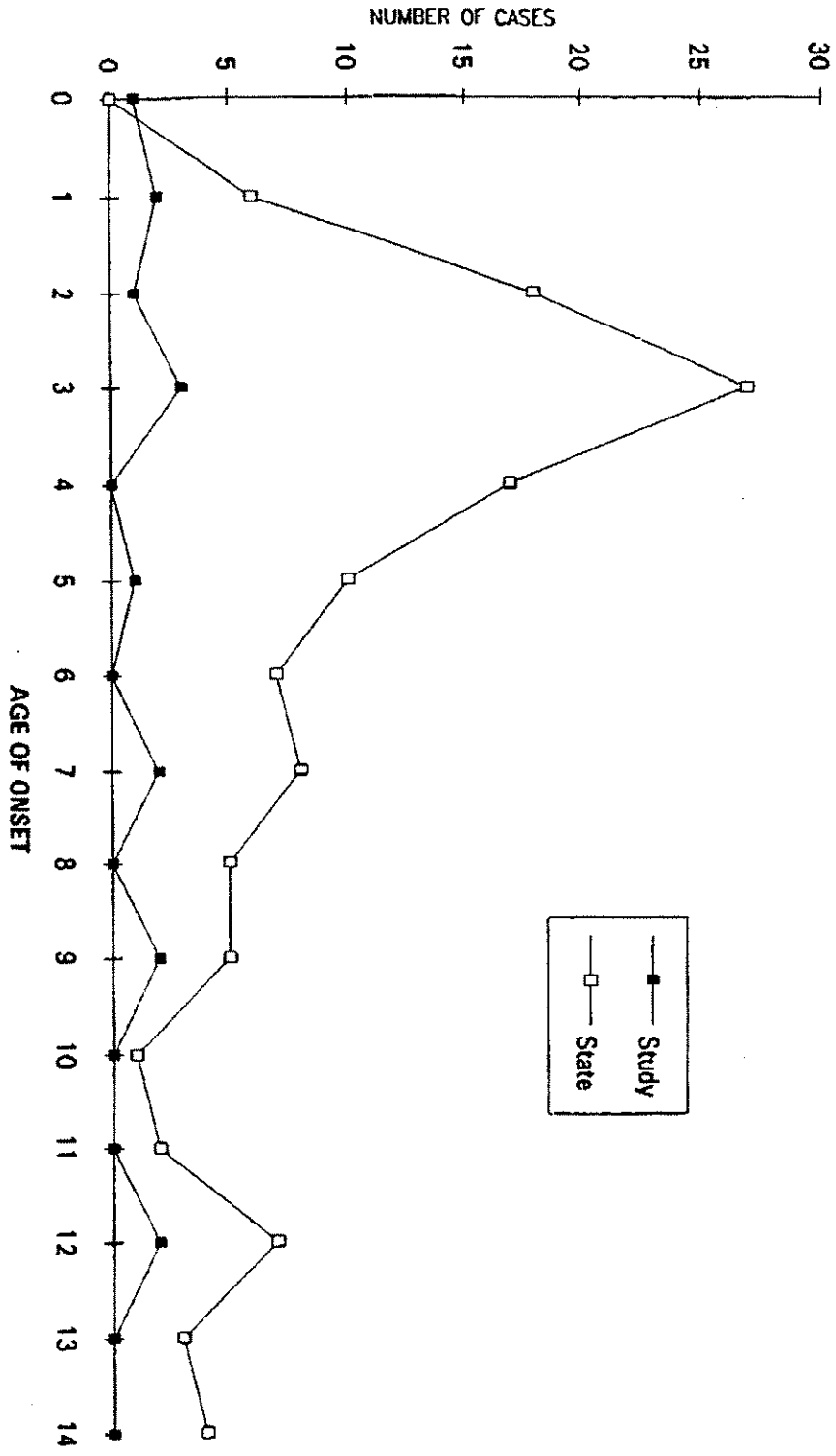


FIGURE 2. Age Distribution of Childhood Leukemia Cases, 1977-1990

Source: Hawaii State Department of Health - Office of Health Status Monitoring

FIGURE 3. Map of all residence locations where cases ever lived

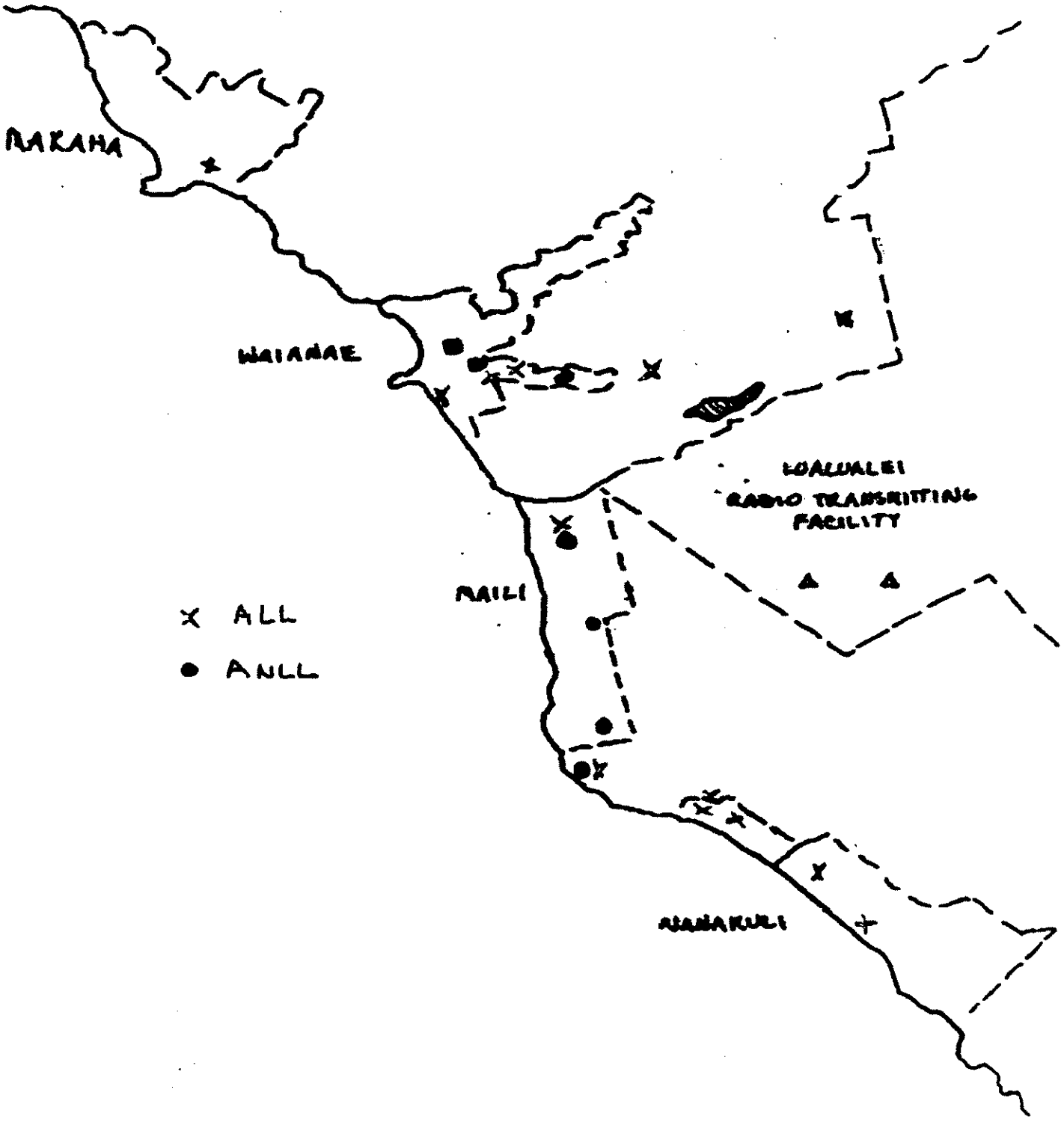
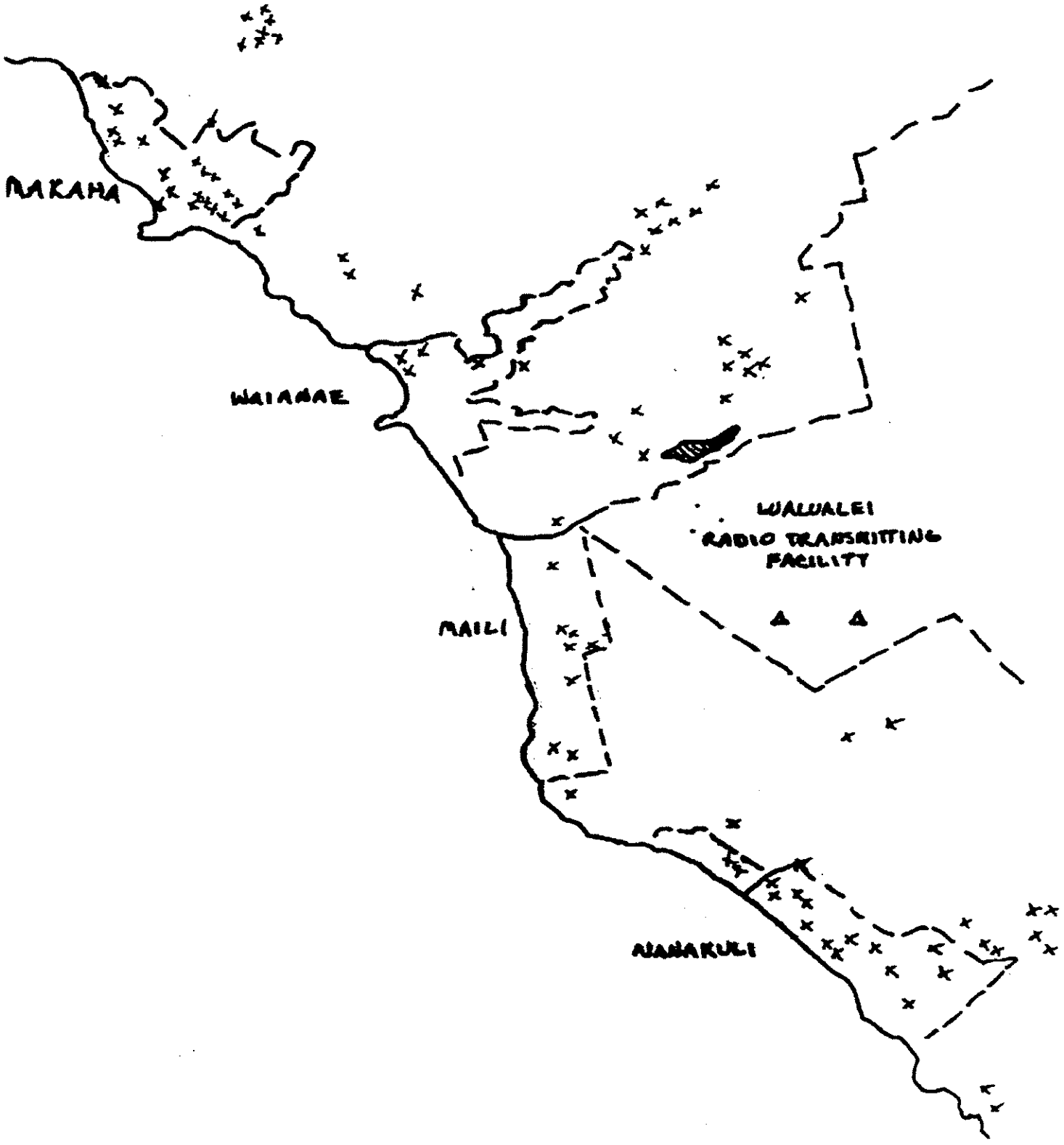


FIGURE 4. Map of all residence locations where controls ever lived



Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840-0001

September 19, 1997

Mr. Brian Baron
Chair, Manoa Neighborhood Board
2716 Woodlawn Drive
Honolulu, HI 96822

Dear Mr. Baron:

Thank you for allowing Hawaiian Electric Company (HECO) to present the Honolulu City Line project to the Manoa Neighborhood Board on September 3, 1997. During the meeting Neighborhood Board members, Mr. Richard Fassler and Dr. Jeremy Lam, commented that electric and magnetic fields (EMFs) are still an issue. We recognize that there are customers who are concerned about EMFs from this and other transmission line projects and that it is our responsibility to address these concerns. For these very reasons we will address EMFs in the Environmental Impact Study (EIS) and will continue to monitor and provide information on the latest EMF research.

The findings of the National Cancer Institute (NCI) Study (July 3, 1997) were included in our Honolulu City Line because the study is the most recent, comprehensive, and credible to date. What makes this study significant?

1. The NCI study was four (4) times larger than the next largest comparable study. The large number of participants makes the results of the study more reliable because it increased the possibility of finding an association between magnetic fields and leukemia. No significant association was found.

2. No overall statistical association was found between leukemia and estimated magnetic field exposure (e.g., wire codes) as had been previously suggested.

3. The study measured magnetic field exposure within two (2) years of diagnosis unlike previous studies that sometimes used data as old as two or three decades after diagnosis.

4. The NCI study was conducted in homes in both rural and urban areas across nine states, making it less likely to be influenced by factors specific to one geographic area.

Dr. Lam commented that there are hundreds of EMF articles on the Internet. But how does one determine which articles are credible? What are the strengths and weaknesses of each study? Have these studies undergone a stringent peer review process? We are not all epidemiologists, oncologists, biostaticians, etc. We must rely upon the collective expertise of reputable organizations such as the National Cancer Institute, National Academy of Sciences, National Institute of Environmental Health Sciences, and American Cancer Society to establish the validity and significance of the research.

The National Academy of Sciences (NAS) on October 1996, released a comprehensive review of the EMF research to date. This private, nonprofit society of distinguished scholars, including experts on cancer, neurobiologic, reproductive and developmental effects concluded that:

> "Based on a comprehensive evaluation of published studies **[500 peer-reviewed reports selected from a reference base of 13,000 articles]** relating to the effects of power frequency electric and magnetic fields on cells, tissues and organisms (including humans), the conclusion of the committee is that the current body of evidence does not show that exposure to these fields presents a human-health hazard. Specifically, no conclusive and consistent evidence shows that exposures to residential electric and magnetic fields produce cancer, adverse neurobehavioral effects, or reproductive and developmental effects."
>
> *"Possible Health Effects of Exposure to Residential Electric and Magnetic Fields," National Academy of Sciences, National Research Council, 1997*

This is not to say that the NCI study and NAS report are the final words on the EMF issue. However, we reference them because they are the latest and most comprehensive information from very reputable organizations.

Mr. Fassler also commented that at a past HECO fair at Ala Moana Center, the company gave out pamphlets which warned people that EMFs were dangerous. We believe this misconstrues the information HECO provided at the July 1995 fair. Enclosed are copies of the handouts, published in 1993, which were passed out. They do not appear to include strong warnings that EMFs are dangerous.

Our policy has always been to acknowledge the inconclusive nature of the collective body of EMF study findings and to provide as much information as possible to our customers to allow them to make educated decisions about what actions, if any, related to EMFs make sense for them.

HECO's comprehensive EMF education program includes:

- Providing customers with written information on EMF;
- Measuring magnetic fields, at no charge, in homes on request;
- Providing speakers on EMF to interested groups;
- Producing an informational EMF video (available for check out at the main public library);
- Preparing a Teachers' Guide for EMF education in our schools;
- Providing the State Departments of Health, Education, and Labor with EMF measuring devices and instructions for use; and
- Presenting the previously mentioned EMF educational exhibit at our "HECO in Your Community" fairs.

The issue of EMFs is far from over. Let me reassure you that HECO has and will continue to monitor and inform the public on the latest research. We take our responsibility to address this issue very seriously and are committed to design and construct all our electrical lines to ensure the safety of the public and our employees.

Thank you again for allowing us to present the Honolulu City Line project to your Board. If you have any further questions, please feel free to call me at 543-7059.

Sincerely,

Kerstan J. Wong
Project Manager

KJW

c: Manoa Neighborhood Board Members