Maine Public Utilities Commission

Report
Related to LD 950, An Act to Establish the Electromagnetic Field Safety Act
on
Setback Requirements Associated with Transmission Lines

Notice of Inquiry

Maine Public Utilities Commission

Docket No. 2013-00402

November 30, 2013

STATE OF MAINE
PUBLIC UTILITIES COMMISSION

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CHA RMAN

DAVID P. LITTELL
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COMMISSIONERS

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ADMINISTRATIVE DIRECTOR

November 27, 2013

Honorable John J. Cleveland, Senate Chair
Honorable Barry J. Hobbins, House Chair
Energy, Utilities and Technology Committee
100 State House Station
Augusta, Maine 04333

Re: Report Related to LDD 950, An Act to Establish the Electromagnetic Field Safety Act

Dear Senator Cleveland and Representative Hobbins:

During its 2013 session, the Legislature voted to carry over LD 950, An Act to Establish the Electromagnetic Field Safety Act until the 2014 session. The Committee requested by letter dated June 19, 2013 that the Commission provide information regarding the potential health impacts of electromagnetic fields associated with transmission lines and additional information regarding the mitigation techniques proposed in the bill by November 30, 2013. Attached is the Commission's Report for the Committee's consideration.

If you have any questions, please do not hesitate to contact us.

Sincerely,

Thomas L. Welch, Chairman

On behalf of the Chairman and

David P. Littell, Commissioner
Mark A. Vannoy, Commissioner
Maine Public Utilities Commission

Attachment
cc: Energy, Utilities and Technology Committee Members
Jean Guzzetti, Legislative Analyst

I. INTRODUCTION

In this Report, we provide the information requested by the Joint Standing Committee on Energy, Utilities and Technology (Committee) regarding setback requirements associated with transmission lines.

II. BACKGROUND

A. LD 950

During the 2013 legislative session, the Committee voted to carry over a bill entitled An Act to Establish the Electromagnetic Field Safety Act (LD 950). The bill proposed that:

1. Beginning October 1, 2013, all new transmission line and electrical installations capable of carrying 5,000 volts[1] or more of electricity must be set back at least 300 feet from residential homes, residential care facilities, hospitals, schools, licensed daycare facilities, playgrounds, youth centers, religious facilities and youth camps.

2. The Commission shall adopt routine technical rules to adopt the setback requirement.

Transmission lines in Maine range in voltage level from 34.5 kV to 345 kV. Distribution lines range from 4 kV to 34.5 kV. Accordingly, the proposed setback requirement would affect new transmission and distribution lines.

The Legislature will consider the bill when it returns in January 2014. In the meantime, the Committee has requested by letter dated June 19, 2013 that the Commission provide information regarding the potential health impacts of electric and magnetic fields (collectively EMF) associated with transmission lines and additional information regarding the mitigation techniques proposed in the bill by November 30, 2013. More specifically, the letter requests the following information:

- Any information the Commission can provide regarding setback requirements for electric transmission lines in other states from residential homes, residential care facilities, hospitals, schools, licensed daycare facilities, playgrounds, youth centers, religious facilities and youth camps;

- A description of the implications of establishing a 300 foot setback requirement for these types of locations on the utilization of existing rights of ways for transmission lines in this State; and

[1] 5000 volts is equal to 5 kV.

- A description of the current standards used by the Commission when considering the health impacts of EMF associated with transmission lines as well as specific references to support the use of those standards.

A copy of the Committee letter is attached as Attachment 4.

B. Inquiry

To obtain information from interested persons on the issues identified in the Committee letter, on August 7, 2013, the Commission issued a Notice of Inquiry (NOI) requesting that Maine's investor owned Transmission and Distribution (T & D) utilities provide answers to the questions outlined below. The NOI also invited any interested person to respond as well:

1. Please provide information regarding other jurisdictions' (other states and other countries) setback requirements for electric transmission lines from residential homes, residential care facilities, hospitals, schools, licensed daycare facilities, playgrounds, youth centers, religious facilities and youth camps for the purpose of mitigating possible EMF effects. Please specify what level of voltage the setback mitigation applies to (for example 115 kV, 345 kV or different measurement).

2. Please discuss the feasibility and the practical and cost implications of establishing a 300-foot setback for new and possibly rebuilt construction of electric transmission or distribution facilities of 5 kV or higher if they are located near the locations listed in question 1. Would utilities be able to locate distribution lines along roadways and, if not, how would service be provided? How would the cost of providing distribution service be affected? Would utilities be able to use existing rights of ways for transmission lines and, if not, how would this affect the siting and cost of new transmission lines? What percentage of existing transmission and distribution lines within the utility's territory are closer than 300 feet to the types of locations listed in question 1?

3. The Committee letter asks for information regarding potential health impacts of EMF associated with transmission lines and for a description of the current standards used by the Commission when considering the health impacts of EMF associated with transmission lines. In considering mitigation measures, the Commission may take into consideration the World Health Organization (WHO)[2] recommendations. During

[2] The WHO Report discusses the studies and guidelines issued by the International Commission on Non Ionizing Radiation Protection (ICNIRP).

consideration of LD 950, there was discussion of the 2007 WHO Report referenced above and its recommendations. To the extent there are more recent reports regarding potential health impacts from EMF associated with transmission lines, please provide that information.

The NOI was sent to interested persons including the Office of the Public Advocate (OPA), all electric T&D utilities and individuals who testified or commented on LD 950. The following companies and individuals filed comments in response to the NOI in September:

Central Maine Power Company (CMP)
Bangor Hydro-Electric Company (BHE)
Maine Public Service Company (MPS)
Diane Wilkins
Mary and David Fournier
Wanda Curtis

The comments are appended In Attachment 2.

The Commission issued a draft report for comment on October 11, 2013. CMP, the OPA, Diane Wilkins, and Wanda Curtis filed comments on the draft report. These comments are also appended in Attachment 2.

III. EMF: DEFINITION AND MEASUREMNT

Electric fields (EF) are produced when a voltage is applied to a conductor. The level of electric fields at a given location near a power line depends on the magnitude of the voltage applied, the arrangement and spacing of the line conductors and the distance from the conductors to the location.

Magnetic Fields (MF) are produced when electric current flows on a conductor. The level of a magnetic field at a given location near to a power line depends on the magnitude of the current, the arrangement and spacing of the line conductors, and the distance from the conductors to the location. EF and MF collectively are referred to as EMF. MF levels are commonly measured in Gauss (G) or milligauss (mG).

IV. SUMMARY

The purpose of this report is to provide information to the Committee that is further summarized below. The Committee did not request, and the Commission does not here make, any recommendation.

No state requires a 300 foot set-back for transmission lines.

Iowa has a set-back requirement of 100 feet from the transmission line to a residence or other building for new transmission lines.[3]

Connecticut has an undergrounding requirement for new transmission lines adjacent to certain types of uses such as residential areas, schools, and playgrounds.

Florida, Minnesota, Montana, New York, New Jersey, and Oregon have new transmission line siting limits based on EMF levels at the edge of the transmission line right of way (ROW): e.*g.*, Florida (150 mG for 230kV lines and 200 mG for 500 kV lines); New York (200 mG).

Connecticut and California have EMF mitigation requirements that consider the cost of possible EMF mitigation in relation to the cost of the entire project.

A 300-foot setback requirement on new or rebuilt distribution lines would not be feasible because numerous residences are located well within 300 feet of the public rights of way (roads). There is also a requirement to maintain voltage in secondary lines which would make a 300-foot setback difficult even in rural areas.

Very broad estimates of the cost of imposing a 300-foot setback requirement for transmission range from approximately $950 million for CMP's existing transmission to $889 million for BHE and $353 million for MPS (assuming that all of BHE's and MPS's lines were rebuilt or that new transmission was constructed along the transmission ROW).

V. CURRENT COMMISSION STANDARD FOR DETERMINING HEALTH IMPACTS OF ELECTRIC AND MAGNETIC FIELDS ASSOCIATED WITH MAINE POWER RELIABILITY PROGRAM TRANSMISSION LINES

The Commission currently considers health impacts of transmission line siting as part of Certificate of Public Convenience and Necessity (CPCN) proceedings. Section 3132 of Title 35-A requires the Commission to consider public health and safety in determining public need for a proposed transmission line that is subject to a CPCN requirement.[4] This section also requires the Commission to consider the proximity of the proposed transmission line to inhabited dwellings, as well as alternatives to construction of the transmission line, including energy conservation, distributed generation or load management. The Commission's rules implementing section 3132

[3] 100 feet appears to be based on the minimum horizontal clearance in the National Electric Safety Code (NESC).

[4] Section 3132 of Title 35-A applies to transmission lines of 69 kV or more and does not apply to generator interconnections.

require a utility in its petition for a CPCN to provide "a description of the effect of the proposed transmission line on public health and safety and scenic, historic, recreational and environmental values and of the proximity of the proposed transmission line to inhabited dwellings." Chapter 330 § 6(E).

The effect on public health and safety is determined on a case-by-case basis. In 2010, in granting a CPCN for the Maine Power Reliability Program (MPRP), the Commission approved a stipulation that among other things set forth the following requirement:

> CMP will take all reasonable steps to mitigate EMF consistent with World Health Organization recommendations, including "reverse phasing" wherever practical.

MPRP Stipulation at § V(E)(9), appended to *Central Maine Power Co. and Public Service of New Hampshire, Request for Certificate of Public Convenience and Necessity for the Maine Power Reliability Program Consisting of the Construction of Approximately 350 Miles of 345 kV and 115 kV Transmission Lines* (MPRP) Docket No. 2008-255, Order Approving Stipulation (June 10, 2010) (MPRP Order). In cases involving landowner disputes regarding possible increased EMF exposure from the MPRP, the Commission required measurements of the EMF fields under different transmission configurations and examined whether the proposed EMF mitigation was low cost or no cost and whether it would materially reduce EMF levels.

The WHO issued a report in 2007 comprising its extensive review of research on the health effects of Extremely Low Frequency (ELF) EMF. [5] This report also contained recommendations for policy makers. The WHO Report concluded that:

> Consistent epidemiological evidence suggests that chronic low-intensity ELF magnetic field exposure is associated with an increased risk of childhood leukaemia. However, the evidence for a causal relationship is limited, therefore exposure limits based upon epidemiological evidence are not recommended, but some precautionary measures are warranted.

WHO Report at 355.

With regard to chronic effects of EMF, the WHO report concludes:

> Scientific evidence suggesting that everyday, chronic, low-intensity ELF magnetic field exposure poses a possible health risk is based on epidemiological studies demonstrating a consistent pattern of an increased risk of childhood leukaemia. Uncertainties in the hazard assessment include

[5] *Extremely Low Frequency Fields Environmental Health Criteria Monograph no. 238 (the WHO Report).*

> the role of control selection bias and exposure misclassification. In addition, virtually all of the laboratory evidence and the mechanistic evidence fails to support a relationship between low-level ELF magnetic field exposure and changes in biological function or disease status. Thus, on balance, the evidence is not strong enough to be considered causal and therefore ELF magnetic fields remain classified as possibly carcinogenic. A number of other diseases have been investigated for possible association with ELF magnetic field exposure. These include other types of cancers in both children and adults, depression, suicide, reproductive dysfunction, developmental disorders, immunological modifications, neurological disease and cardiovascular disease. The scientific evidence supporting a linkage between exposure to ELF magnetic fields and any of these diseases is weaker than for childhood leukaemia and in some cases (for example, for cardiovascular disease or breast cancer) the evidence is sufficient to give confidence that magnetic fields do not cause the disease.

Id. at 350-51.

The WHO Report recommends the use of precautionary approaches but cautioned that "it is not recommended that the limit values in exposure guidelines be reduced to some arbitrary level in the name of precaution. Such practice undermines the scientific foundation on which the limits are based and is likely to be an expensive and not necessarily effective way of providing protection." *WHO Report* at 7. The Report further states:

> It is essential that exposure limits be implemented in order to protect against the established adverse effects of exposure to ELF electric and magnetic fields. These exposure limits should be based on a thorough examination of all the relevant scientific evidence.
>
> Only the acute effects have been established and there are two international exposure limit guidelines (ICNIRP, 1998a; IEEE, 2002) designed to protect against these effects. As well as these established acute effects, there are uncertainties about the existence of chronic effects, because of the limited evidence for a link between exposure to ELF magnetic fields and childhood leukaemia. Therefore the use of precautionary approaches is warranted. However, it is not recommended that the limit values in exposure guidelines be reduced to some arbitrary level in the name of precaution. Such practice undermines the scientific foundation on which the limits are based and is likely to be an expensive and not necessarily effective way of providing protection. Implementing other suitable precautionary procedures to reduce exposure is reasonable and warranted. However, electric power brings obvious health, social and economic benefits, and precautionary approaches should not compromise these benefits. Furthermore, given both the weakness of the evidence for a link between exposure to ELF magnetic fields and childhood leukemia, and the

> limited impact on public health if there is a link, the benefits of exposure reduction on health are unclear. Thus the costs of precautionary measures should be very low.

Id. at 12. The WHO recommendations include the following:

> Policy-makers should establish guidelines for ELF field exposure for both general public and workers. The best source of guidance for both exposure levels and the principles of scientific review are the international guidelines.
>
> Policy-makers should establish an ELF EMF protection program that includes measurements of fields from all sources to ensure that the exposure limits are not exceeded either for the general public or workers.
>
> Provided that the health, social and economic benefits of electric power are not compromised, implementing very low-cost precautionary procedures to reduce exposure is reasonable and warranted.
>
> Changes to engineering practice to reduce EMF exposure from equipment and devices should be considered, provided that they yield additional benefits, such as greater safety, or involve little or no cost.
>
> Policy-makers and community planners should implement very low-cost measures when constructing new facilities and designing new equipment including appliances.
>
> When changes to existing ELF sources are contemplated, ELF field reduction should be considered alongside safety, reliability and economic aspects.

Id. at 372-3.

Regarding whether exposure to magnetic fields is carcinogenic, the WHO Report states:

> Regarding possible long-term effects, epidemiological studies suggest that everyday, low-intensity ELF magnetic field exposure poses a possible increased risk of childhood leukaemia, but the evidence is not strong enough to be considered causal and therefore ELF magnetic fields remain classified as possibly carcinogenic.

Id. at 357. Also in 2007, WHO issued a Research Agenda for Extremely Low Frequency Fields (WHO Research Agenda). The WHO explained the need for additional research

on the association between ELF exposure above approximately 3-4 mg and an increased risk of childhood leukaemia:

> In general, acute effects are known to result from exposure to ELF magnetic field which induces electric fields and currents in the body. These can, at high experimentally induced riled strengths (well above 100 μT),cause nerve and muscle stimulation and changes in nerve cell excitability in the central nervous system. Various research recommendations are made which address uncertainty in the threshold levels of these acute effects. With regard to long term effects, epidemiological studies have presented data indicating an association between ELF exposure above approximately 0.3-0.4 μT and an increased risk of childhood leukaemia. Despite several decades of work, however, compelling evidence from experimental studies to support a causal relationship is lacking. In addition, there is no widely accepted mechanism by which ELF fields at normal environmental and occupational exposure levels might affect the incidence of cancer or any other disease in the human population. Therefore, there is a need to support the epidemiological evidence by establishing an in vitro cell response or animal model response to ELF fields that is widely transferable between laboratories, if indeed such responses occur.

Id. at 1. While the WHO recommends that pooled analyses should be updated with the results from several new epidemiological studies, it has not published any update of its 2007 recommendations based on any new pooled analysis.

A more recent study (2012) by the European Health Risk Assessment Network on Electro Magnetic Fields Exposure (EHFRAN)[6] states:

> Although numerous studies have been completed in this field, the evidence remains ambiguous. The major reasons for this are that study results are inconsistent and many studies have suffered from methodological shortcomings. It is therefore important to continuously review the body of evidence.

EHFRAN at 6-7. This report cites the WHO study, the EMF-NE project of the European Union (EMF-NE, 2009) and Scientific Committee on Emerging and Newly Identified

[6] EHFRAN is funded by the European Commission. EHFRAN "has the specific aim of establishing a wide-ranging network of recognized experts in relevant disciplines that interact and cooperate to perform a health risk assessment of exposure to EMF across the frequency spectrum. The network consists of a co-ordinator and a number of associated participants from universities and research centres in seven European countries, as well as 17 collaborating partners from further ten countries, which include the World Health Organization (WHO) and three stakeholder associations." EHFRAN at 3.

Health Risks (SCENIR, 2009a)[7] and notes that the risk assessment in all three reports "demonstrates few disparities." *Id.* at 7. EFHRAN concludes:

> There is limited evidence for an association between magnetic fields and the risk of leukaemia in children. This evaluation reflects the current state of knowledge that epidemiological studies have shown an association between residential exposures to power frequency magnetic fields at above approximately 0.3/0.4 μT and a two-fold risk of childhood leukaemia with some degree of consistency, but the observed association alone is not sufficient to conclude a causal relationship due to the following three reasons:
>
> i) there is no known mechanistic explanation for the observed association and none of the hypotheses put forward are convincingly supported by the data;
>
> ii) overall, experimental studies do not provide evidence that low frequency magnetic fields are carcinogenic;
>
> iii) a combination of chance, bias and confounding may well have produced a spurious association in the epidemiological studies. It is unlikely that further epidemiological studies of the same design as that used previously will provide any new insights. New concepts to identify cohorts of children with higher exposures may turn out to be promising. If the hypothesis of a poorer survival of children with leukaemia is confirmed by other studies, this will increase the biological plausibility of a causal association. Conversely, further methodological work investigating the impact of possible biases in the childhood leukaemia studies may shift the evidence in the opposite direction.

Id. at 11-12. This document is available at the following link: http://efhran.polimi.it/docs/D2_Finalversion_oct2012.pdf.

The National Institute of Environmental Health Sciences (NIEHS), a department of the National Institutes of Health, issued a document in 2002 entitled, EMF, Electric and Magnetic Fields Associated with the Use of Electric Power, Questions and Answers (NIEHS Report). This source explains the basic principles of EMF, discusses the various ways that people may be exposed to EMF and provides various average levels of home and work exposure. The NIEHS Report also summarizes some of the health

[7] The EHFRAN report also contains as a reference, SCENIHR, (2009b), Research Needs and Methodology to Address the Remaining Knowledge Gaps on the Potential Effects of EMF, Scientific Committee on Emerging and Newly Identified Health Risks, available at the following link: http://ec.europa.eu/health.

studies. With regard to EMF exposure and childhood leukemia, it states that there is an association between exposure to magnetic fields and childhood leukemia "but the association is weak, and it is not clear whether it represents a cause-and-effect relationship." *Id.* at 16 The NIEHS report is available at the following link: http://www.cdc.gov/niosh/topics/emf/.

VI. SETBACK REQUIREMENTS IN OTHER JURISDICTIONS

The NOI asked the following question:

> **Please provide information regarding other jurisdictions' (other states and other countries) setback requirements for electric transmission lines from residential homes, residential care facilities, hospitals, schools, licensed daycare facilities, playgrounds, youth centers, religious facilities and youth camps for the purpose of mitigating possible EMF effects. Please specify what level of voltage the setback mitigation applies to (for example 115 kV, 345 kV or different measurement).**

CMP and BHS/MPS provided information on this question through a report by Exponent (Exponent Report) which is appended to this report as Attachment 1. Table 1 below provides a summary (based on information in the Exponent Report) of setback requirements provided by other states and localities.[8]

[8] Mrs. Curtis asserts that Tennessee has a 300-foot setback requirement; however, we were unable to find any Tennessee statute requiring a 300-foot transmission setback for new or existing transmission.

Table 1. SETBACK REQUIREMENTS FOR STATE AND LOCAL JURISDICTIONS

State	Transmission Line Rating	Setback Distance	Additional Information
	Overhead		
California	50-133kV	100' edge Trans. R/W to property line	Siting setback required for new schools
	ZZ0-230 kV	150' edge Trans. R/W to Property Line	Siting setback required for new schools
	500-550 kV	350' edge Trans. R/W to Property Line	Siting setback required for new schools
	Underground		
	50-133kV	25' edge R/W to Property Line	Siting setback required for new schools
	ZZO-Z30kV	37.5' edge R/W to Property Line	Siting setback required for new schools
	500-SOkV	87.5' edge R/W to Property Line	Siting setback required for new schools
Iowa	NewT Line	100 feet from homes	Adheres to NESC Standards
Local Jurisdiction			
Camas, Washington	50-133kV	100' edge R/W to child intensive locations	Ordinance- new buildings
	ZZ0-230 kV	150' edge R/W to child intensive locations	Ordinance- new buildings
	500-550 kV	350' edge R/W to child intensive locations	Ordinance- new buildings
Torrington, Connecticut	50 kV or greater	150' T Line to dwelling	pertains to new line and new building
Fauquier County, Virginia	500 kV or greater	ZOO' edge R/W to all buildings	Ordinance for new buildings

As shown above, while California has a setback requirement for siting new schools near transmission lines, it has no such setback requirement for siting new transmission lines.[9] Iowa restricts the location of any new transmission line to no closer than 100 feet of any building (except by agreement), except where the line crosses or passes along a public highway or is located alongside or parallel with the ROW of any railway company. This minimum distance appears to be based on the minimum clearance requirements set forth in the National Electric Safety Code (NESC), which the Iowa Safety Code references.

Among foreign countries that have setback requirements, Israel has set back requirements based on voltage:

11-36kV and 110 kV	3 meters (9.8 feet)
161kV	20 meters (65.6 feet)
400 kV	35 meters (114 feet)

In addition, Connecticut and California have a no cost/low cost mitigation requirement that requires utilities proposing new transmission lines to provide a base design that incorporates no cost magnetic field mitigation design features.[10] The utility is required to add in low cost magnetic field mitigation design features at about 4 percent of the total base design cost that are intended to produce a magnetic field reduction of 15 percent or more at the edge of the utility's ROW. See *Electric and Magnetic Field Best Management Practices for the Construction of Electric Transmission Lines in Connecticut, Connecticut Siting Council*, December 14, 2007 at 6.

[9] The Town of Camas in the state of Washington requires setbacks from existing transmission lines for siting facilities where children assemble, such as schools, churches day cares and playgrounds. This locality also requires that transmission lines be installed underground in all zones except the manufacturing and light industrial zones unless the city council finds that exposure to EMF and adverse impact to land values can be reasonably mitigated by prudent avoidance. Under the ordinance, new transmission lines should not be sited within any sensitive use areas (parks, developed recreational areas and other places designed for prolonged human presence) unless there are no practical alternatives.

[10] See, California Public Utilities Commission Opinion on Commission Policies Addressing Electromagnetic Fields Emanating from Regulated Utility Facilities, decision 06-01-042, January 26, 2006; Connecticut Siting Council, Electric and Magnetic Field Best Management Practices for the Construction of Electric Transmission Lines in Connecticut, December 17, 2007. Both of these documents are included in the attached Exponent Report appended as Attachment 1.

Connecticut also has an undergrounding requirement for 345 kV transmission lines adjacent to residential areas, private or public schools, licensed child day care facilities, licensed youth camps or public playgrounds. Such transmission lines can be built overhead only if there is a showing that it is technologically infeasible to bury the facilities.[11] The undergrounding requirement in Connecticut has resulted in substantial additional costs, which were allocated to Connecticut's ratepayers as localized costs rather than all New England's electric ratepayers.[12]

Some states, localities, and foreign countries have restrictions on the mG level at the edge of the ROW of a new transmission line. The following table shows state restrictions based on field levels.

Table 2 - State Restrictions Based on Field Levels

		Property Boundary at Substation		At Edge of Transmission Line ROW		On Transmission Line ROW	
State	Transmission Line Rating	Electric Field (kV/m)	Magnetic Field (mG)	Electric Field (kV/m)	Magnetic Field (mG)	Electric Field (kV/m)	Magnetic Field (mG)
New York	All	-	-	1.6	200	-	-
	<230 kV	2	150	2	150	8	-
Florida	>230kV-<500	2	200	2	200	10	-
	>500	5.5	250	5.5	250	15	
Minnesota	All					8	
Montana	All			1		7	
New	All					3	

[11] Connecticut General Statutes, Chapter 277a-Public Utilities Environmental Standards Act, Section 16-50p(H)(c)(4)(i).

[12] In Docket No. 2009-269, the Commission noted that ISO-NE has determined over $217 million in costs of projects in other states should be excluded from the regional rate. Order, Docket 2009-269. Inquiry into Continued Reform in ISO-NE, September 27, 2012. Most of the localized costs were due to undergrounding where overhead lines would have met the reliability need at a lower cost.

Jersey		
Oregon	All	9

Among foreign countries that have restrictions or recommendations based on field levels, the Finnish Radiation Safety Agency recommends that new houses and day care facilities should not be built on either side of overhead transmission lines where the level of 4mG is continuously exceeded. The Netherlands has a similar policy. Italy imposes regulations regarding new power lines near playgrounds, residences, schools and other areas in which people stay for 4 hours or more per day. Italy's regulations also apply to new building construction with uses such as those described above which are to be built near existing transmission lines. However, Italy's 30 mG level is identified as a "quality goal," and thus does not appear to be a hard cap. Norway applies a voluntary measure to site buildings and electrical installations if it can be done at reasonable expense and with reasonable consequences to limit magnetic field exposure to 1 mG. Switzerland sets a limit of 10 mG for new transmission lines and electrical transmission in sensitive areas, but exemptions are possible for technical and cost reasons.

BHE/MPS provided a sample of magnetic fields measurements taken around company-owned lines. This sample is reflected in Table 3.

Table 3

Sample Magnetic Field Measurements Taken 9-5-13

Distance	L388 (345kV/600MVA)	L246 (115kV/33MVA)	L70 (46kV/14MVA)
Under Line	98mG (9.8uT)	23mG (2.3uT)	16mG (1.6uT)
75 feet	40mG (4uT)	4mG (0.4 uT)	3 mG (0.3 uT)
150 feet	11mG (1.1uT)	2mG (0.2uT)	1mG (0.1 uT)

VII. FEASIBILITY AND PRACTICALITY OF 300-FOOT SETBACK REQUIREMENT

The NOI asked the following question:

Please discuss the feasibility and the practical and cost implications of establishing a 300-foot setback for new and possibly rebuilt construction of electric transmission or distribution facilities of 5 kV or higher if they are located near the locations listed in question 1. Would utilities be able to locate distribution lines along roadways and, if not, how would service be provided? How would the cost of providing distribution service be affected? Would utilities be able to use existing rights of ways for transmission lines and, if not, how would this affect the siting and cost of new transmission lines? What percentage of existing transmission and distribution lines within the utility's territory are closer than 300 feet to the types of locations listed in question 1?

CMP and BHE/MPS filed responses to the question. CMP reports that nearly 100% of its distribution facilities of 5kV or more are *within* 300 feet of residential homes, residential care facilities, hospitals, schools, licensed daycare facilities, playgrounds, youth centers, religious facilities and youth camps. CMP states that a 300-foot setback requirement for distribution is not feasible because the length of overhead services needs to be less than 300 feet in order to meet the voltage requirements of Chapter 320 of the Commission's rules.[13] The typical length of secondary lines is 150 feet or less. In addition, CMP reports that distribution facilities are most often in the public way and that many buildings are set back less than 300 feet from the public way. Further, CMP states that locating distribution facilities "off of the public way is not feasible, practicable or cost effective in almost all situations and may be impossible in some situations, such as in urban areas." CMP concludes with regard to moving distribution lines off of the public ways that "[e]ven if this could be done, it would dramatically increase operational costs and adversely impact customer service particularly storm restoration and other repairs if CMP is required to move facilities out of public way, which could result in more climbing and off road equipment usage." CMP Comments at 5.

With regard to the effect of a 300-foot setback requirement on transmission facilities, CMP states that CMP's transmission facilities are often located in off-road rights of ways, though many 34.5 kV transmission lines run roadside above distribution. CMP points out that roadside transmission lines are predominately within 300 feet of residential homes, but indicates that it does not have delivery point geographical data for its off-road rights of ways for transmission. Accordingly, CMP is unable to specifically determine what portion of the existing transmission lines are within 300 feet of residential homes or other facilities as required in question 2. CMP has determined there were 2,450 residential homes within 300 feet of the edge of the ROW of the MPRP facilities. Given that MPRP facilities span 679 circuit miles, CMP estimates that it would have cost approximately $200 million to acquire the property rights in order to

[13]Section 2.03 of Chapter 320 of the Commission's rules requires a T & D utility to maintain safe voltage levels at the utility's service terminal (meter).

eliminate any residences within 300 feet of the rights of way for the MPRP. CMP extrapolated the MPRP estimated costs to the 2,949 of total CMP transmission circuit miles after MPRP to arrive at an estimated $950 million cost to purchase all residences within 300 feet of all CMP transmission rights of way.[14] This additional cost would likely not be funded regionally under the ISO-NE localized cost rules.

BHE/MPS, like CMP, responded that a 300-foot setback requirement for new or rebuilt distribution lines would not be feasible for the same reasons discussed above in CMP's comments. In determining the impacts on both new and existing transmission lines, BHE/MPS provided information about the potential efforts that would have to be undertaken in order to adhere to a 300-foot setback requirement.

Regarding existing transmission lines within a ROW, BHE/MPS state that significant additional corridor width would be needed along 100% of all existing and future transmission lines in the ROW to provide a required 300-foot setback for any future homes and other facilities. Tables 4 (BHE) and 5 (MPS) show the typical right-of-way widths by voltage and the approximate corridor width that would be required in order to meet a 300-foot setback, as well as estimated cost to provide a 300-foot setback increase on a per mile basis. If the total miles of transmission are multiplied by the per mile cost in Tables 4 and 6, the total cost of the 300-foot setback requirement for BHE would be in the range of $889 million[15] (assuming that all of BHE's lines were rebuilt or that new transmission was constructed along the transmission ROW and roadside). Cost for MPS (based on the same assumptions as for BHE) would be in the range of $353 million.[16]

[14] See CMP's corrected response, filed on October 10, 2013.

[15] This figure is arrived at by adding the sum of the product of the number of miles multiplied by the cost per mile of each kV category of transmission listed in Table 4 and the sum of the product of the number of miles multiplied by the cost per mile in Table 6.

[16] This figure is arrived at by adding the sum of the product of the number of miles multiplied by the cost per mile of each kV category of transmission listed in Table 5 and the sum of the product of the number of miles multiplied by the cost per mile in Table 7.

Table 4 - BHE Transmission ROW[17]

Voltage	Line Miles	Average Existing Width (Ft)	Approx Existing ROW Area Per Mile (Ac)	Width with 300' Setback from outside phase (Ft)	Additional ROW Area Per Mile (Ac)	Estimated Incremental Cost Per Mile @$10K/Ac
35KV	67.5	60	7.3	610	66.7	$666,667
46KV	195.2	80	9.7	610	64.2	$642,424
115kv	237.5	140	17.0	650	61.8	$618,182
345kv	84.6	170	20.6	675	61.2	$612,121

Table 5 - Maine Public - Transmission ROW[18]

Voltage	Line Miles	Average Existing Width (Ft)	Approx Existing ROW Area Per Mile (Ac)	Width with 300' Setback from outside phase (Ft)	Additional ROW Area Per Mile (Ac)	Estimated Incremental Cost Per Mile @$10K/Ac
35KV	4.37	50	6.1	610	67.9	$678,788
46KV	46.43	100	12.1	620	63.0	$630,303
69kv	310.48	100	12.1	620	63.0	$630,303

[17] A small portion of existing Bangor Hydro ROW has multiple lines which would reduce the total widening to some extent. The figure of $10k/acre is a rough estimate of the cost in rural areas. The actual costs could vary greatly as actual land values vary widely across the Bangor Hydro system. Removal of existing homes and businesses along existing ROW would create significant complications and cost above and beyond these estimates.

[18] A small portion of existing Maine Public ROW has multiple lines which would reduce the total widening to some extent. The figure of $10k/acre is a rough estimate of the cost in rural areas. The actual costs could vary greatly as actual land values vary widely across the Maine Public system. Removal of existing homes and businesses along existing ROW would create significant complications and cost above and beyond these estimates.

138kv	11.89	100	12.1	630	64.2	$642,424

For roadside transmission lines a 300-foot setback would require that no new transmission lines could be built along roadsides due to the proximity of existing and potential buildings. BHE/MPS state that a 300-foot setback requirement imposed on roadside transmission rebuilds would require relocating existing roadside transmission lines into a minimum of 610-foot wide ROW due to the proximity of buildings to ROW. BHE/MPS has estimated in the following Tables 6 and 7 the impact on new ROW requirements and preliminary costs associated with work necessary to adhere to a 300-foot setback requirement for roadside transmission lines.

Table 6 - BHE Transmission Roadside[19]

Voltage	Line Miles	Average Existing width	Approx Existing ROW Area	Width with 300' Setback	Additional ROW Area	Estimated Incremental Cost Per Mile @$25K/Ac
35KV	195.5	N/A	N/A	610	73.9	1,848,485
46Kv	88.6	N/A	N/A	610	73.9	1,848,485

Table 7 - MPS Transmission Roadside[20]

Voltage	Line Miles	Average Existing width	Approx Existing ROW Area	Width with 300' Setback	Additional ROW Area	Estimated Incremental Cost Per Mile @$25K/Ac
35KV	7.97	N/A	N/A	610	73.9	1,848,485

[19] All roadside lines would need to be relocated into ROW to provide a 300' setback. This new routing would be very difficult to achieve, especially in developed areas. Additional length associated with finding a suitable location is not factored into this table. The $25k/acre would be much higher if houses/businesses would need to be relocated.

[20] All roadside lines would need to be relocated into ROW to provide a 300' setback. This new routing would be very difficult to achieve, especially in developed areas. Additional length associated with finding a suitable location is not factored into this table. The $25k/acre would be much higher if houses/businesses would need to be relocated.

46Kv	18.86	N/A	N/A	620	75.2	1,878,788
69Kv	34.88	N/A	N/A	620	75.2	1,878,788

BHE/MPS also indicate that, in some cases, achieving a 300-foot setback would not be possible when there is development on both sides of any existing lines. In order to achieve these setbacks, acquisition of private property and the removal of homes and business where lines intersect developed areas, including most road crossings, would likely be needed in order to establish the required 300-foot setback when rebuilding existing lines. BHE concludes that a 300-foot setback requirement would reduce the utilities' ability to meet other stakeholder requirements when routing and permitting transmission lines, thereby limiting the feasibility of construction alternatives and adding costs.

VIII. RESPONSES TO QUESTIONS REGARDING POTENTIAL HEALTH IMPACTS OF EMF

The NOI asked the following question:

The Committee letter asks for information regarding potential health impacts of EMF associated with transmission lines and for a description of the current standards used by the Commission when considering the health impacts of EMF associated with transmission lines. In considering mitigation measures, the Commission may take into consideration the WHO recommendations. During consideration of LD 950, there was discussion of the 2007 WHO report referenced above and its recommendations. To the extent there are more recent reports regarding potential health impacts from EMF associated with transmission lines, please provide that information.

The utilities submitted the Exponent Report to answer this question which is appended as Attachment 1. The Exponent report discusses the WHO Report (discussed above in Section V) and lists national health and scientific agency reviews of research or statements on ELF and magnetic fields that have been issued since the 2007 WHO report. The Exponent Report states that "[n]one of these agencies have recommend [sic] setbacks from transmission or distribution lines, exposure guidelines below those recommended by ICNRIP and ICES, or other actions by public health agencies or electric utilities." Exponent Report at 25.

Diane Wilkins, Mary and David Fournier and Wanda Curtis also submitted comments on this issue and supplied materials relating to the possible health risks of EMF exposure. The studies provided indicate a range of estimated health risks associated with exposure to EMF and many of them suggest additional study and recommend reductions in ELF/EMF exposure. Ms. Wilkins filed and/or referenced 41 studies, reviews and pooled analyses regarding the possible health effects of exposure

to EMF. Other materials include briefs from various proceedings here and in front of the Connecticut Siting Division, but not the final decision in those cases.[21] Mrs. Curtis's comments also discuss the MPRP and the possible effect of the MPRP lines on homes in Chelsea.

Reference materials submitted by commenters are listed in Attachment 3, appended to this report. The Commission would be happy to supply to the Committee, upon request by the Committee, all of the materials provided by commenters, as well as the WHO documents and other studies, discussed in the body of this report. We do not attach all of these materials to this report initially as it would create a voluminous attachment of several hundred pages. We do note however that many of the materials listed in Attachment 3 are available through the Internet and the URLs for these documents are provided in Attachment 3.

IX. PROPOSALS TO MODIFY LD 950

Ms. Wilkins requests that the language in LD 950 to increase the setback requirement from 300 feet be modified to require 1,969 feet from the non-utility property line, stating that "eleven (11) out of the fifteen (15) studies, that concluded increased risk of childhood cancers from exposures measured by distance had significantly increased risk at distances greater than 300 ft (991.44 m) and up to 1,960 ft (600 m)." Wilkins [Corrected] Comments. Ms. Wilkins also requests that LD 950 be modified to impose a 3 mG limit at the property line as a siting requirement for new transmission. She states that many scientists agree "there is a substantial amount of recent evidentiary support for an upgrade from a positive association to a causal relationship between exposures to power line extremely low frequency electromagnetic fields (ELF EVF) and increased rates of childhood cancers indicating a need for precautionary protective measures with minor, if any consideration of costs." Wilkins Comment at 1. Mrs. Curtis suggests that LD 950 "could be amended to state that utilities must use mitigations (like tall steel monopoles, a Delta configuration or split phasing or reverse phasing) on all new electrical installations to reduce EMF levels below 3 mG at the edge

[21] The Fourniers provided the Comments of Richard Blumenthal, Attorney General for the State of Connecticut, regarding Best Management Practices for Electric and Magnetic Fields and the brief of the Office of Public Advocate (OPA) in Docket No. 2011-504, Appeal of LDRT Decision Regarding Mark and Wanda Curtis. We note that the Connecticut Siting Board decision is discussed in the Exponent Report and that the Order in the LDRT appeal (Docket No. 2011-504) rejected the OPA request (as modified at oral argument) to identify a 3 mG level as a level at which CMP would have increased mitigation obligations. The Commission rejected this request finding that an increased mitigation requirement for those homes where the EMF level is above 3 mG "goes beyond the WHO recommendations" and that "there is insufficient information in this record to adopt such a recommendation." Order at 7. The Commission's decision was upheld on appeal to the Law Court. *Curtis v Public Utilities Commission,* Mem-13-24 (Feb. 26, 2013).

of right of ways, which is the level at which the childhood leukemia studies become statistically significant according to Dr. David O. Carpenter MD." Curtis Comments on Draft Report at 2. Mrs. Curtis included the testimony of David O. Carpenter, M.D. before the Connecticut Siting Council and a paper he coauthored. The Fourniers recommend that LD 950 be amended to limit the 300-foot setback requirement to transmission lines of 34.5 kV or greater.

X. CONCLUDING COMMENTS

The OPA commented that the Draft Report "provides a thorough response to the Committee's questions." OPA Comments on Draft Report at 1. The OPA stated that it had nothing to add to the facts presented in the draft report. With regard to the discussion of the WHO's findings and recommendations the OPA stated that the Draft Report goes beyond the research the OPA conducted in Docket No. 2011-504 "and further illuminates the subject." *Id*. The OPA asked that the final report reflect that the OPA's argument on brief in Docket No. 2011-504 was modified on the record during oral argument. We have made the requested change to this report.

Ms. Wilkins commented that the Commission's Chapter 330, which requires a utility in its CPCN petition to provide "a description of the effect of the proposed transmission line on public health and safety; scenic historic, recreational and environmental values…," MPUC Rules Ch. 330 § 6(E), should be amended to require the utility seeking a CPCN "to provide an independent in-depth analysis, meta analysis or scientific review performed by qualified scientist who have specialized in research on the health effects from exposures to EMF ELF's (sic) or requiring qualified independent, third party measurements of exposure levels." Wilkins Comments on Draft Report at 7. She requested that the Commission's report define exactly what the "description of effects" consists of "including the degree of detail expected and the qualifications of persons providing said description." *Id*. We view this request as outside of the scope of the information requested by the Committee. However, we note that each CPCN is determined on a case-by-case basis and any expert testimony may be challenged through the hearing process, including testimony on the health effects of EMF.

Ms. Wilkins also commented that the Commission's report should include a cost-benefit analysis "to allow the EUT to conduct a due diligence cost benefit analysis." Wilkins Comments on Draft Report at 11. Ms. Wilkins appears to want the Commission to do a cost benefit analysis similar to one performed for the California EMF Program. The type of cost-benefit analysis requested by Ms. Wilkins is beyond the scope of this report.

Finally, CMP requests that the Commission make a recommendation to the Legislature "based on the information that has been provided and on the Commission's expertise in this area." CMP comments at 1. CMP further states,

> While the Legislature has not specifically asked for such a recommendation, it is advisable that the PUC do so in order to foster sound public policy on this

> important issue. CMP urges the Commission to recommend its current practice of addressing the safety impact of electromagnetic fields (EMF) on a case by case basis during the certificate of public convenience and necessity process. This practice has been successful in ensuring adequate protections. On the contrary, LD 950 would (1) impose unwarranted, proscriptive measures that are not consistent with sound science, (ii) not be technically feasible and would pose service quality issues particularly in rural areas where it would be difficult to maintain voltages in secondary lines with such a setback, and (iii) would be extremely costly to customers. It is therefore critical that the Commission's Report to the Legislature address the problems that the Bill would pose if adopted.

Id.

We decline to make a recommendation where one was not sought by the Legislature; however, the Commission will be available to respond to any questions the Committee has when it considers this report and LD 950 during the 2014 session.

Exponent®

Inquiry on Setback Requirements

Research to Support Comments

Inquiry on Setback Requirements

Research to Support Comments

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Contents

Limitations

At the request of Central Maine Power and Bangor Hydro Electric Company, Exponent prepared this summary report on setback requirements and other regulations in various jurisdictions related to siting of transmission lines; potential effects of exposure to extremely low-frequency electric and magnetic fields (ELF EMF); and standards and guidelines related to ELF EMF. The findings presented herein are made to a reasonable degree of scientific certainty. Exponent reserves the right to supplement this report and to expand or modify opinions based on review of additional material as it becomes available, through any additional work, or review of additional work performed by others.

The scope of services performed during this investigation may not adequately address the needs of other users of this report, and any re-use of this report or its findings, conclusions, or recommendations presented herein are at the sole risk of the user. The opinions and comments formulated during this assessment are based on observations and information available at the time of the investigation. No guarantee or warranty as to future life or performance of any reviewed condition is expressed or implied.

Setback Requirements in the United States

Although the United States has not implemented statutory regulations, guidelines, or nationwide precautionary measures, a number of states and local jurisdictions have statutory limitations on the distance transmission lines can be built from various structures or the distance buildings can be sited near transmission lines. Some other states have implemented maximum levels of electric fields or magnetic fields, or both, either on or at the edges of the transmission line right of way. While some limitations have been implemented as a government response based on perceived uncertainty in scientific research, other limitations were initiated simply to maintain the *status quo*. Still other regulations have codified National Electric Safety Code (NESC) guidelines that relate to general electrical safety or were established to prevent short-term acute effects near transmission lines.

State Regulations

California

The section of Title 5 of the California Code of Regulations related to school facilities construction stipulates standards for school site selection for new schools in relation to overhead transmission lines.[1] Specifically, the code states:

> The property line of the site even if it is a joint use agreement as described in subsection (o) of this section shall be at least the following distance from the edge of respective power line easements:
>
> 1. 100 feet for 50-133 kV line.
> 2. 150 feet for 220-230 kV line.
> 3. 350 feet for 500-550 kV line.

Title 5 also stipulates standards for school site selection related to other facilities such as railroad track easements, roads and freeways, earthquake faults or fault trace, above-ground

[1] California Code of Regulations, Title 5, Division 1, Chapter 13, Subchapter 1 – School Facilities Construction, Article 2 - School Sites, Paragraph 14010 - Standards for School Site Selection, Item c.

water or fuel storage tanks; certain underground pipeline easements; locations where there is moderate to high liquefaction or landslides; and hazardous waste disposal sites. Local Education Agencies must also consider environmental factors such as light, wind, noise, aesthetics, and air pollution during site selection (Paragraph 14010, d-i, q, t).

Paragraph 14010, Item (u), however, indicates that exemptions may be granted upon request of the governing board of a school district if that school district has limited site choices. For electric transmission lines, strict adherence to the above distances may be waived on a case by case basis if by adhering to these parameters the school district would have to consider other sites closer to the hazards listed in Paragraph 14010, or would need to institute long distance busing.[2]

While Title 5 does not specifically state distance requirements for schools proposed to be sited near underground transmission lines, the California Department of Education's (CDE) Power Line Setback Exception Guidance, dated May 2006, indicates that the CDE shall interpret the Title 5 Setback Regulations to include setback distances from underground transmission lines at distances of at least 25% of the overhead transmission line setbacks. These restrictions apply to usable unrestricted portions of the school site.

1. 25 feet for 50-133 kV underground lines.
2. 37.5 feet for 220-230 kV underground lines.
3. 87.5 feet for 500-550 kV underground lines.

In some cases, an exemption may be granted that allows a school district to measure the distance from the school to the centerline rather than the edge of the easement. Other exemptions may be granted if transmission lines are closer than the prescribed limits, but are in an areas that are considered limited use, such as parking lots, drop-off/loading areas, landscaped areas (excluding play and activity fields), and areas that are unusable for school purposes (steep slopes, wetlands).

[2] California Department of Education, Power Line Setback Exemption Guidance, May 2006.

While the CDE regulates specific distances for new school siting from existing overhead transmission lines, the California Public Utilities Commission (CPUC) does not mandate specific siting distances for new or upgraded transmission lines from any specific facilities, including schools.[3] The CPUC's no cost/low cost mitigation policy states, however, that schools, licensed day care facilities, and hospitals (i.e., locations where there may be many children), take the highest priority for the 4% of funds (determined on the basis of total project costs) that utilities must spend to mitigate magnetic fields from new or upgraded transmission lines. Priority is ordered as follows:

1. Schools, licensed day care facilities, and hospitals;
2. Residential;[4]
3. Commercial/industrial
4. Recreational
5. Agricultural – only if occupied residences, schools, or hospitals are located on this land
6. Undeveloped land – only if occupied residences, schools, or hospitals are located on this land.

There does not seem to be any regulation or guidance that requires mitigation of existing overhead transmission lines that are adjacent to existing facilities where children spend time.

Connecticut

The Connecticut General Assembly enacted "Public Act 04-246 – An Act Concerning Electric Transmission Line Siting Criteria" in 2004 that updated previous statutes. In this updated legislation, specific data that a utility company must provide for a transmission line application now includes "a map of suitable scale of the proposed routing or site, showing details of the rights-of-way or site in the **vicinity of settled areas, parks, recreational areas and scenic areas, residential areas, private or public schools, licensed child day care facilities, licensed**

[3] California Public Utilities Commission (CPUC). Opinion on Commission Policies Addressing Electromagnetic Fields Emanating from Regulated Utility Facilities. Decision 06-01-042, January 26, 2006.

[4] When deciding on the priority listing for mitigation, there was some public input that residences should be a first priority along with schools, day care facilities, and hospitals. But since it is not possible to determine if a residence or group of residences will ever have children present, this option was not consistent with the no cost / low cost rationale.

youth camps, and public playground" and "an assessment of the impact of any electromagnetic fields to be produced by the proposed transmission line."[5] In addition, electric transmission lines are to be "contained within an area that provides a buffer zone that protects the public health and safety as determined by the [CSC]. In establishing such buffer zone, the [CSC] shall take into consideration, among other things, residential areas, private or public schools, licenses child day care facilities, licensed youth camps or public playgrounds adjacent to the proposed route of the overhead portions and the level of the voltage of the overhead portions and any existing transmission lines on the proposed route. **At a minimum, the existing right-of-way shall serve as a buffer zone**" (emphasis added).

In accordance with Public Act 04-246, the Connecticut Siting Council (CSC) issued an updated Best Management Practices policy document for electric and magnetic fields from transmission lines.[6] All transmission lines must conform to the precautionary requirements of the CSC's Best Management Practices. The CSC determined that since the "weight of scientific evidence indicates that exposure to electric fields, beyond levels traditionally established for safety, does not cause adverse health effect," electric-field levels from transmission lines are sufficiently addressed by adherence to the National Electrical Safety Code. So the primary focus of the CSC's Best Management Practices is on magnetic fields.

The CSC cites the conclusion of the National Institute of Environmental Health Sciences that since "there is weak evidence for possible health effects of ELF-EMF exposures, until stronger evidence changes this opinion, inexpensive and safe reductions in exposure should be encouraged" (NIEHS, 1999, p. 38).[7] The CSC also supports the recommendation of the NIEHS that utilities continue to site power lines to reduce exposure (NIEHS, 1999, p. 38; CSC, 2007, p. 3), which is reflected in their no cost / low cost policy. Their policy was also developed to incorporate the section of the Connecticut General Statutes related to environmental standards

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5 State of Connecticut, Substitute House Bill No. 5418, Public Act No. 04-246. An Act Concerning Electric Transmission Siting Criteria, Approved June 3, 2004.

6 Connecticut Siting Council. Electric and Magnetic Field Best Management Practices for the Construction of Electric Transmission Lines in Connecticut, dated December 17, 2007. The 2007 document updates the CSC's Best Management Practices document issued in 1993.

7 National Institute of Environmental Health Sciences (NIEHS). NIEHS Report on Health Effects from Exposure to Power-Line Frequency Electric and Magnetic Fields. Prepared in Response to the 1992 Energy Policy Act (PL 102-486, Section 2118). NIEHS Publication 99-4493. Research Triangle Park, NC: NIEHS, 1999.

that restricts the siting of overhead transmission lines ≥345 kV adjacent to "residential areas, private or public schools, licensed child day care facilities, licensed youth camps or public playgrounds," unless the applicant can demonstrate that "burying the facility will be technologically infeasible" or "may result in an unreasonable economic burden on the ratepayers of the state."[8]

To implement no cost / low cost policy, the CSC established a 4 percent requirement, similar to California, in which utilities are required to provide a base design that incorporates no cost magnetic field mitigation design features. The utility then adds in low cost magnetic field mitigation design features at about 4 percent of the base design cost (the 4 percent cost is neither a binding cap, nor a binding floor) that "should aim at a magnetic field reduction of 15 percent or more at the edge of the utility's ROW" (CSC 2007, p. 6).

The buffer zone requirements established by the CSC are at a minimum the distance of an existing right of way (as codified in Public Act 04-246), however, the CSC does not set a specific buffer zone distance requirement for transmission lines on new rights-of-way, nor do they require that existing rights-of-way be expanded. Their criteria include standards set by the NESC that provide safe clearance from "vegetation, buildings, and other natural and man-made objects," but point out that these standards do not include magnetic field limits. Therefore, they look to guidelines from other states that recommend or set maximum magnetic field levels at edges of rights of way (CSC 2007, p. 9), such as New York, and Florida, but the CSC has not set a maximum allowable limit at the edges of rights of way in Connecticut.

Iowa

The state of Iowa's Code, Chapter 478 – Electric Transmission Lines places restriction on the distance of new transmission lines from any home or other building.[9] Chapter 478 states:

[8] Connecticut General Statutes, Chapter 277a – Public Utilities Environmental Standards Act. Section 16-50p (H) (c) (4) (i).

[9] Iowa Code, Title XI, Subtitle 5, Chapter 478 – Electric transmission lines, Paragraph 478.20 – Distance from buildings (current as of 2009).

> No transmission line shall be constructed, except by agreement, within one hundred feet of any dwelling house or other building, except where said line crosses or passes along a public highway or is located alongside or parallel with the right-of-way of any railway company. In addition to the foregoing, each person, company, or corporation shall conform to any other rules, regulations, or specifications established by the utilities board, in the construction, operation, or maintenance of such lines.

This minimum distance seems to be based on the minimum horizontal clearance in the NESC, which the Iowa Electrical Safety Code references.

Regulations in Local Jurisdictions

Camas, Washington

The city council of Camas, Washington established prudent avoidance regulations for electrical transmission and distribution facilities in Chapter 8.52 of the city municipal code.[10] The code includes a preference for undergrounding, a requirement to identify the location where magnetic-field levels drops below 4 mG, and specific setback distances from child intensive locations. They also require that new subdivisions be planned in order to provide setback for sensitive-use structures and sensitive-use areas from existing transmission lines and facilities. Sensitive use structures are defined as "structures in which regular, frequent and prolonged human presence would be expected, and shall include but not be limited to residential dwellings, schools, day care centers, hospitals and homes for the aged" (Section 8.52.010). Sensitive use areas are defined as "parks, developed recreational areas and other places designed for prolonged human presence" (Section 8.52.010). The specific provisions are as follows:

> 8.52.50 Electrical transmission facilities—Conditional use permit.
>
> C. Overhead Transmission Usage. All electrical transmission lines shall be installed underground in all zones except the manufacturing district

[10] Camas, Washington, Code of Ordinances. Title 8 – Health and Safety, Chapter 8.52 Electrical Transmission and Distribution Facilities, Sections 8.52.010 – 8.52.100, enacted 1995. The Camas Code of Ordinances are reviewed every 6 months.

and light industrial/country tech district, unless the city council finds that exposure to electrical magnetic fields and adverse impact to land value and aesthetics can be reasonably mitigated by prudent avoidance measures. Use of overhead power should consider, among other factors, facility size, location, setback, topography, scheduling, cost, sensitive lands, land value and proximity to children and schools.

8.52.060 Provisions applicable to all electrical transmission facilities.

A. Prudent Avoidance Measures. All electrical transmission facilities shall be designed, constructed, and operating using prudent avoidance measures to minimize exposure to electromagnetic fields, to preserve land values, and to satisfy the other requirements in this chapter. Further, the applicants shall identify the four mG magnetic field line associated with the proposed installation. The mG contour line shall be identified as the line coinciding with normal winter loading which shall be further defined as being eighty percent of the line's rated peak capacity.

8.52.070 Setbacks for child intensive locations.

Special consideration shall be given to facilities where children assemble. Such areas shall include but not be limited to schools, churches, day cares and playgrounds. Such areas shall be set back in accordance with the following:

A. One hundred feet from edge of easement for fifty to one hundred thirty-three kilovolt line;
B. One hundred fifty feet from edge of easement for two hundred twenty to two hundred thirty kilovolt line;
C. Three hundred fifty feet from edge of easement for five hundred to five hundred fifty kilovolt line.

8.52.80 Sensitive-use structures.

Sensitive-use structures should be setback from the facility to minimize exposure. All proposed subdivision shall identify the location of any electrical transmission facilities on or adjacent to the property being subdivided, and if applicable, shall identify on the plat map the setback from any such electrical transmission facility.

8.52.090 Sensitive-use areas.

Electrical transmission facilities should not, where practical alternatives exist, be located within any sensitive use area.

The City of Torrington, Connecticut

The City of Torrington's Planning & Zoning Commission established environmental regulations for "electromagnetic radiation" in their Zoning Regulations using setback requirements. Section 4.0 defines area and setback requirements for different zoning categories; Section 4.1 General Area and Setback Requirements, Paragraph 4.1.3 states "Regulations governing distances from electric transmission lines are in Section 7.1." Section 7.1 delineates environmental performance standards.[11] Specifically, the regulation on "electromagnetic radiation" states:

7.1.2 Standards

C. Electromagnetic Radiation -

2. No dwelling unit shall be placed within 150 feet of any electric transmission line carrying a voltage greater than 50,000 volts.

3. No electric transmission line carrying a voltage greater than 50,000 volts shall be placed within 150 feet of any dwelling unit.

[11] City of Torrington, Connecticut – Zoning Regulations. Torrington Planning & Zoning Commission. Revised to June 14, 2011

The County of Baltimore, Maryland

In a specially created Metropolitan Zone in the Metropolitan District of the County, the Commissioner of the County Board of Appeals under Paragraph 411.3, has the power to require that distribution and transmission lines carrying 35,000 volts or greater be located underground. The criteria that guides such a decision includes the "proximity of the line to any school, church, theater, club, museum, fairground, racetrack or other place where persons may congregate,"[12] although the ordinance does not define the distance that is considered "proximate."

Fauquier County, Virginia

Fauquier County amended their zoning ordinance in 2005 to establish setback requirements for new buildings to be built on lots adjacent to 500-kV transmission lines, based on "public convenience, general welfare, and good zoning practices, consistent with the adopted Comprehensive Plan."[13]

> 2-411 Yard Regulations for Lots Abutting Interstate Highways, Railroad Tracks, and the Right of Way for Transmission Lines of 500 kV or greater.
>
> 3. Notwithstanding any other provisions of this Ordinance, there shall be a minimum distance of 200 feet between all buildings and the right-of-way for transmission lines of 500 kV or greater.
>
> 4. The provisions of [paragraph 3] shall not apply to those instances where a lot has been recorded prior to the enactment of this Ordinance where the enforcement of this regulation would negate the use of the lot in accordance with the provisions of the zoning district in which located.

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[12] Baltimore County Zoning Regulations, Article 4 – Special Regulations, Section 411: Public Utility Uses. http://ecode360.com/12148906.

[13] Fauquier County, Virginia – Zoning Ordinances. Article 2 – General Regulations, Part 4 – Qualifying Lot and Yard Requirements, Section 2-411 – Yard Regulations for Lots Abutting Interstate Highways, Railroad Tracks, and the Right-of-Way for Transmission Lines of 500 kV or Greater.

These setback requirements were implemented to prevent short-term acute effects, i.e., to prevent "induced electrostatic voltage on objects." The ordinance was proposed after an event occurred in the Lee's Glen subdivision after power line upgrades near the subdivision induced voltage on the gutters and downspouts of homes about 400 feet from the line.[14]

Brentwood, Tennessee

The city of Brentwood, Tennessee, passed a health and safety ordinance in 1991 that limits the magnetic-field level from transmission lines at the edge of rights-of-way to less than 4 mG and if the level is greater, it needs to be mitigated, although they did not indicate how this should be achieved.[15] Unlike the other ordinances and acts, this requires that existing transmission lines be brought into compliance, rather than just new or upgraded transmission lines. Specifically:

> Sec. 30-9 – Electrical Power Transmission Lines
>
> (a) Design specifications for transmission lines in the city which carry 120 or more kilovolts shall not allow spillage of the electromagnetic fields (EMFs) associated with such transmission lines in excess of four milligauss beyond the legal right-of-way boundaries in which such transmission lines are located. Where design specifications for transmission lines are not executed in compliance with this article, each day in which spillage of EMFs occurs shall be considered a separate violation, except that spillage of EMFs due to emergency conditions shall not be considered a violation of this section. Emergency conditions shall mean those conditions created by unexpected, unforeseen or unanticipated events such as, but not limited to, failure of generating or electrical facilities due to natural or manmade causes beyond the control of the facility owner. Whenever it is determined that spillage of

[14] Fauquier County Board of Supervisors Public Agenda Request. http://www fauquiercounty.gov/government/departments/BOS/pastagendas/12-08-05/500kv_agrq htm

[15] Code of Ordinances, City of Brentwood, Tennessee. Part II – Code of Ordinances, Chapter 30 – Health and Sanitation, Section 20-9 – Electrical Power Transmission Lines, 1995.

EMFs has occurred, notification shall be provided to the city manager within 30 days thereof.

(b) Existing transmission lines which were in place as of January 31, 1991, shall be brought into compliance with the terms of this section within five years of April 8, 1991.

(c) Employees and agents of the city shall be expressly authorized to enter onto any property, whether public or private, within the city limits to test for spillage of EMFs.

Restrictions Based on Field Levels in the United States

Several states in the United States limit field levels at the edges of transmission line rights-of-way and substations for electric fields or magnetic fields, or both. The restrictions these states are not based on health or environmental impacts, but were set as maximum values to maintain the status quo. These limits are listed in Table 1.

Table 1. State standards and guidelines for transmission lines and substations

		Property Boundary at Substation		At Edge of Transmission Line ROW		On Transmission Line ROW	
State	Transmission Line Rating	Electric Field (kV/m)	Magnetic Field (mG)	Electric Field (kV/m)	Magnetic Field (mG)	Electric Field (kV/m)	Magnetic Field (mG)
New York	All	--	--	1.6	200	--	--
Florida	≤230 kV	2	150	2	150	8	--
	>230 kV - ≤ 500	2	200	2	200	10	--
	>500	5.5	250	5.5	250	15	
Minnesota	All					8	
Montana	All			1[a]		7[b]	
New Jersey	All					3	
Oregon	All					9	

[a]Can be waived by landowner; [b]Maximum for highway crossings.

Source: NIEHS, 2002, p. 46

Setback Requirements in Other Countries

The World Health Organization recommends that countries adopt the guidelines established by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) or the International Committee on Electromagnetic Safety (ICES), although there are quite a number of countries without a formal policy, including the United States. Other countries have informally applied ICNIRP guidelines, while others have incorporated international guidelines (either ICNIRP's standards or the European Union's (EU) 1999/518/EC recommendation)[16] and have adopted the precautionary principle by implementing no cost/low cost policies. Still other countries, or localities within countries that follow ICNIRP or EU guidelines, have adopted stricter policies based either on distance or by setting maximum EMF levels at the edge of the transmission line rights of way.

National Grid, U.K. maintains a website regarding information on electric and magnetic fields that includes a frequently updated matrix of statutes, regulations, and policies on a country-by-country basis (Power-frequency EMF Exposure Standards Applicable in Europe and Elsewhere). This reference manual was consulted for the data in this section and the section on restrictions based on field levels in other countries, unless noted otherwise. This data were cross-referenced to the greatest extent possible with the actual statutes and regulations available from the World Health Organization's database of EMF World Wide Standards (http://www.who.int/docstore/peh-emf/EMFStandards/who-0102/Worldmap5.htm); however, much of that information has not been translated into English.

Austria

While the national government of Austria follows the 1999 EU Recommendations, the district of Salzburg introduced additional restrictions that would require undergrounding. For systems with voltage greater than 110 kV that in the future will be installed in sensitive areas, they

[16] European Union. Council recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz). Official Journal of the European Communities L199/59-L199/70, 1999.

should be buried where technically and economically efficient to do so. Sensitive areas are defined by distance, as follows:

1. 400m between an overhead line and land in the zoning code that falls under categories in the Regional Planning Act of 2009 (specifics not indicated and translation not available).
2. 200 m between an overhead line and individual use building in permanent residential use in categories in the Regional Planning Act of 2009 (specifics not indicated and translation not available).

Bulgaria

In 1991 the Bulgarian government issued a national ordinance establishing maximum permissible exposures for electromagnetic radiation in residential areas and determined safety zones around electromagnetic sources. The ordinance is available through the WHO's EMF standards database; however, the document uploaded is in Bulgarian. Another source indicates that the Bulgarian government established minimal distances between residences and power lines or substations. Although they indicate the minimal distances are based on voltage, they do not specify what those distances are. [17]

Denmark

The Danish National Board of Health recommended in 1993, and reaffirmed in 2007, that homes or places where children spend time should not be constructed near to transmission lines and vice versa. The Board, however, did not specify minimum distances and left it to "pragmatic considerations."

Israel

Israel follows ICNIRP's guidelines and between 2001 and 2004, Israel has an environmental guideline value of 1 μT for 24-hour time-weighted average exposure. In 2005, this was revised to eliminate a numeric guideline, and implement precautionary measures to "… significantly

[17] http://www.who.int/docstore/peh-emf/EMFStandards/who-0102/Europe/Bulgaria_files/table_bu htm

reduce the number of residents, in general, and children, in particular, that are continuously or even temporarily exposed to magnetic fields from the electricity network that exceed the values cited in the professional literature as possibly causing increased health risks."[18]

New distribution or transmission lines are not granted a building permit unless they are at least a specified distance from buildings:

11-36 kV and 110 kV	3 meters
161 kV	20 meters
400 kV	35 meters

In addition, indoor transformers must be at least 3 meters from a wall shared by a residential room.

Luxembourg

In 1994, Luxembourg issued a recommendation to local authorities that land in the immediate proximity of transmission lines should no longer be approved for buildings (Circular no. 1644 - ref. 26/94). The recommendation used distance rather than EMF levels because they concluded distance is "more easily measurable and are in direct relation with the fields." These recommendations are non-binding however, and localities have the option to ignore them or put more stringent restrictions in place. From the available literature, it is not clear what distances were recommended.

[18] Kandel S. ELF policies worldwide – protection of the general public. Developing and implementing protective measures for ELF EMF. Presented at WHO Workshop, 20-21 June, 2007, Geneva.

Restrictions Based on Field Levels in Other Countries

Finland

The Finish Radiation Safety Agency recommends that new houses and day care facilities should not be built in a zone on either side of overhead transmission lines where 0.4 μT (4 mG) is continuously exceeded. This is a recommendation only and is not legally binding, although it has been indicated that this zone may actually be in effect in practice.

France

A 2013 circular from the Minister of Ecology, Sustainable Development and Energy (MEDDE) to their local ministers asks them to recommend to local municipalities that they establish a zone of prudence when granting permits for new sensitive use buildings (e.g. hospitals, primary schools, kindergartens) near high-voltage infrastructure where exposure may be 1 μT or greater. The Minister did not define the zone of prudence.

Italy

A Degree of the President of the Council of Ministers established country-wide exposure limits in July 2003.[19] These regulations set limitations for magnetic-field levels from new transmission lines, as follows:

> In designing new power lines in the neighborhood of children's playgrounds, residential dwellings, school premises, and in areas where people are staying for 4 hours or more per day, as well as planning developments in the proximity of existing electric power lines and installations, including the categories mentioned above, a quality goal of 3 μT is adopted for the purpose of the progressively minimizing exposures to electric and magnetic fields generated by

[19] The President of the Council of Ministers. Establishment of exposure limits, attention values, and quality goals to protect the population against power frequency (50 Hz) electric and magnetic fields generated by power lines. 8 July 2003.

50-Hz power lines. The quality goal is the median of values recorded over 24 hours, under normal operating conditions.

Netherlands

A 2005 policy, which seems not to be binding, recommends that local authorities restrict the building of new homes within a "0.4 μT" zone near power lines. This recommendation was reaffirmed in 2008 and extended to areas of long stay (14-18 hrs per day) and all "sensitive objects" including dwellings, schools, crèches, and house garden paths.

Norway

Norway applies a voluntary precautionary principle if measures to reduce exposure can be taken at reasonable expense and with reasonable consequences to achieve median magnetic field value. Where new electrical installations and buildings are concerned, efforts should be made at the planning stage to design and position new electrical installations and buildings so that exposure is limited. The median magnetic field value for homes and day nurseries in major towns or cities is defined as approximately 0.1 μT (1 mG).

Spain

Spain adopted EU's 1999/519/EC recommendation into Spanish law and added a vague provision for sensitive areas. The Spanish government requires that "levels of emissions into sensitive areas such as schools, health care centres, hospitals or public parks shall be kept as low as possible" (Article 8.7 d). In addition, wherever possible, there should be no emission footprints impinging on buildings, terraces or attics." But, since it simply states emissions should be kept as low as possible, it is not clear if this is a recommendation or a mandatory requirement.[20]

[20] European Commission. Implementation Report on the Council Recommendation Limiting the Public Exposure to Electromagnetic Fields (0 Hz to 300 GHz). http://ec.europa.eu/health/archive/ph_determinants/environment/emf/implement_rep_en.pdf

Switzerland

Since 1999, Switzerland has set a precautionary limit called installation limit values for electric transmission lines, transformer stations, and substations for installations in sensitive areas of 1 uT. Exemptions are possible for new installations on technical or cost grounds. In addition, this limit is not applicable to existing installations if they utilize optimal phasing.[21]

[21] Swiss Federal Council. Ordinance relating to protection from non-ionising radiation (ONIR) of 23 December 1999 (as of 1 February 2000) 814.710.

Standards and Guidelines for ELF EMF Exposure

The two primary international agencies that published guidelines to limit public and occupational exposure to ELF EMF, which have been adopted by a number of countries, are ICNIRP and ICES. ICNIRP is an independent group of approximately 40 experts assembled from around the world and is formally recognized as the non-governmental organization charged with developing safety guidance for non-ionizing radiation for the World Health Organization, the International Labour Organization, and the European Union. The ICES is a committee of the Institute of Electrical and Electronics Engineers, charged with developing standards for the safe use of electromagnetic energy (0 Hz to 300 GHz) relative to the hazards of exposure to humans. The ICES encourages a consensus process with balanced international participation of the public, the scientific and engineering community, government agencies, electricity producers, and electricity users. They operate under the rules and oversight of the IEEE Standards Association Standards Board; membership of the central governing and technical committees is made up of about 150 professionals from 26 countries.[22]

Both these organizations reviewed the scientific literature and determined that the only established effects of exposure to ELF EMF involved the stimulation of nerves and tissues. These guidelines set limits to protect against the short-term direct, acute health effects (i.e., perception, annoyance, and the stimulation of nerves and muscles) that can occur at these high levels of exposure.

[22] http://www.ices-emfsafety.org/about_purpose.php

Neither organization found that the scientific evidence relating to lower exposures over longer periods of time, which is the focus of epidemiology studies, provided a basis for setting human exposure limits. As ICES states:

> Established human mechanisms fall within the category of short-term effects. Such effects are understood in terms of recognized interaction mechanisms. Exposure limits defined in this standard are not based on the potential effects of long-term exposure because:
>
> a) There is not sufficient, reliable evidence to conclude that long-term exposures to electric and magnetic fields at levels found in communities or occupational environments are adverse to human health or cause a disease, including cancer.
>
> b) There is no confirmed mechanism that would provide a firm basis to predict adverse effects from low-level, long-term exposure (ICES, 2002, p. 1).

Although ICNIRP and ICES have the same objectives and used similar methods, the recommended limits for exposure of the general public to EMF at the frequencies used to transmit electricity differ, as listed in Table 2.

Table 2. Reference levels for whole body exposure to 50/60-Hz fields: general public

	General Public	
Organization	**Magnetic fields**	**Electric fields**
ICNIRP (Restriction Level)	2,000 mG	4.2 kV/m
ICES (Maximum permissible exposure)	9,040 mG	5 kV/m 10 kV/m[a]

[a] ICES provides an exception within transmission line rights of way since the general public does not spend a substantial amount of time in ROWs and very specific conditions must be present before a response is likely to occur; a person must be well insulated from ground and must contact a grounded conductor.

ICNIRP recommends screening values for magnetic fields of 2,000 mG for the general public and 4,200 mG for workers (ICNIRP, 2010). The ICES recommends a screening value of 9,040 mG for magnetic-field exposure (ICES, 2002). The ICNIRP screening value for general public exposure to electric fields is 4.2 kV/m, and the ICES screening value for general public exposure to electric fields is 5 kV/m. Both organizations allow higher exposure levels if it can be demonstrated that exposure does not produce current densities or electric fields within tissues that exceed basic restrictions on internal current densities or electric fields.

The ICNIRP and ICES basic restrictions are set well below the value at which an adverse effect was observed in experiments; as a result, these exposure limits are conservative since they incorporate dose reduction factors, also known as safety factors, to account for potential sources of uncertainty. For example, both groups account for vulnerable groups with a potentially higher sensitivity in using a safety factor.

The ICNIRP and ICES guidelines provide direction to national agencies in establishing national guidelines, but only become legally binding if a country adopts them into legislation. While the United States has not codified any regulations or issued any guidelines at the federal level related to exposure standards for ELF EMF from transmission lines or any other source, the World Health Organization strongly recommends that countries adopt the ICNIRP guidelines or use a scientifically sound framework for formulating any new guidance (WHO, 2006). The 28 members of the European Union apply the ICNIRP guidelines[23] as do several other countries. Several countries have adopted the ICNIRP guidelines and recommended lower exposures be applied when siting transmission lines. In addition, a number of state and local jurisdictions in the United States also have instituted various restrictions on ELF EMF exposure, as discussed above.

[23] The EU countries apply the ICNIRP guidelines for the public for locations where people spend significant time. European Union. Council recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz). Official Journal of the European Communities L199/59-L199/70, 1999.

Potential Effects of Exposure to Electric and Magnetic Fields from Transmission Lines

Short-term effects

Virtually any environmental or other exposure to a substance or agent can lead to adverse effects at very high levels. Similarly, adverse effects can be expected from exposure to very high levels of extremely low frequency (ELF) electric and magnetic fields (EMF). Acute effects, defined as perception, annoyance, and the stimulation of nerves and muscles, are known to occur. If the current density or electric field induced by a very, very strong magnetic field exceeds a certain threshold, excitation of muscles and nerves is possible. Strong electric fields can induce charges on the surface of the body that can lead to small microshocks. The effects caused by strong magnetic and electric fields below the recommended limits are acute but cause no long-term damage or health consequences. Limits for the general public and occupational limits have been set to prevent these effects, but there are no real-life situations where these levels are exceeded on a regular basis.

Long-term effects

After nearly years 40 of research that includes hundreds of studies, none of the scientific organizations that conducted weight-of-evidence reviews concluded that exposure to ELF-EMF is a demonstrated cause of any long-term adverse health effect.

The evidence in support of a causal relationship is weak because it is founded largely, if not entirely, on *some* epidemiology studies that reported statistical associations between magnetic-field exposure and a disease. Scientists have placed less weight on these associations because they are weak, often inconsistent across studies, possibly due to errors in the way the study was designed or conducted, and use methods to measure magnetic-field exposure that are unreliable (e.g., calculated historical fields; spot measurements; wire code categories; distance; and job-exposure matrices). Overall, laboratory studies have not reported an increase in cancer among animals exposed to high levels of electric or magnetic fields, and no mechanism has been discovered in cellular studies that explains how electric or magnetic fields might initiate disease.

In some epidemiology studies, a weak but statistically significant association has been reported between childhood leukemia and estimates of long-term exposure to high, average magnetic field levels. The reported associations are weak, however, and there is no evidence of a consistent exposure-response relationship. Furthermore, the strongest individual epidemiology studies of childhood leukemia and magnetic fields, which were conducted in the United States, Canada, and the United Kingdom, do not indicate a statistical association. Given the lack of convincing evidence from epidemiology studies and the lack of consistent findings from animal and cellular studies, the overall body of research does not indicate that this association, or any other, is causal.

The absence of clear adverse effects after continued testing increases the certainty that there is no adverse effect from long-term exposure. This absence also increases the certainty that any possible unknown risk associated with long-term exposure is small. No scientific review panel can ever completely rule out the possibility that ELF EMF in our communities and workplaces might have some adverse effect, due to the inherent limitations of scientific investigations. But, given the amount and quality of research that has been conducted thus far, a strong conclusion can be drawn that there is no cause-and-effect relationship between ELF EMF exposure and long-term, adverse health effects.

The only studies that can be said to confirm a relationship between electric or magnetic fields and an adverse biological or health effect are those in which very high levels of exposure to ELF EMF produce currents and fields in the body, a short-term, shock-like effect, as discussed above.

The World Health Organization, which completed the most comprehensive review of the relevant research on ELF EMF, came to the following conclusion regarding short-term and long-term effects:

> Acute [short-term] biological effects have been established for exposure to ELF electric and magnetic fields in the frequency range up to 100 kHz that may have adverse consequences on health. Therefore, exposure limits are needed. International guidelines exist that have addressed this issue. Compliance with these guidelines provides adequate protection.

> Consistent epidemiological evidence suggests that chronic low-intensity ELF magnetic field exposure is associated with an increased risk of childhood leukaemia. However, the evidence for a causal relationship is limited, therefore exposure limits based upon epidemiological evidence are not recommended, but some precautionary measures are warranted (WHO 2007, p. 355).

Subsequently, other national health and scientific agencies have released reviews of research or statements on extremely-low-frequency electric and magnetic fields. The following list indicates the scientific organization and a link to the online reviews or statements:

- **The European Health Risk Assessment Network on Electromagnetic Fields Exposure**
    - http://efhran.polimi.it/docs/D2_Finalversion_oct2012.pdf (EFHRAN, 2012 [human exposure])
    - http://efhran.polimi.it/docs/IMS-EFHRAN_09072010.pdf (EFHRAN, 2010 [*in vitro* and *in vivo* [animal] studies)
- **The Health Council of Netherlands**
    - http://www.gezondheidsraad.nl/sites/default/files/200902.pdf (HCN, 2009a)
    - http://www.gezondheidsraad.nl/en/publications/advisory-letter-power-lines-and-alzheimer-s-disease (HCN, 2009b)
    - http://www.gezondheidsraad.nl/en/publications/bioinitiative-report-0 (HCN, 2008a)
    - http://www.gezondheidsraad.nl/en/publications/high-voltage-power-lines-0 (HCN, 2008b)
- **The Health Protection Agency (United Kingdom)**
    - http://www.hpa.org.uk/Publications/Radiation/DocumentsOfTheHPA/RCE01PowerFrequencyElectromagneticFieldsRCE1/ (HPA, 2006)
- **The International Commission on Non-Ionizing Radiation Protection**
    - http://www.icnirp.de/documents/LFgdl.pdf (ICNIRP, 2010)

- **The Scientific Committee on Emerging and Newly Identified Health Risks (European Union)**
    - http://ec.europa.eu/health/ph_risk/committees/04_scenihr/docs/scenihr_o_007.pdf (SCENIHR, 2007)
    - http://ec.europa.eu/health/ph_risk/committees/04_scenihr/docs/scenihr_o_022.pdf (SCENIHR, 2009)

The Swedish Radiation Protection Authority

- http://www.who.int/peh-emf/publications/reports/SWEDENssi_rapp_2006.pdf (SSI, 2007)
- http://www.who.int/peh-emf/publications/reports/SWEDENssi_rapp_2007.pdf (SSI, 2008)

- **The Swedish Radiation Safety Authority**
    - http://www.stralsakerhetsmyndigheten.se/Global/Publikationer/Rapport/Stralskydd/2009/SSM-Rapport-2009-36.pdf (SSM, 2009)
    - http://www.stralsakerhetsmyndigheten.se/Global/Publikationer/Rapport/Stralskydd/2010/SSM-Rapport-2010-44.pdf (SSM, 2010)
    - http://www.stralsakerhetsmyndigheten.se/Publikationer/Rapport/Stralskydd/2013/201319/ (SSM, 2013)

The assessments of the scientific evidence by these agencies have reached conclusions similar to the World Health Organization. None of these agencies have recommend setbacks from transmission or distribution lines, exposure guidelines below those recommended by ICNRIP and ICES, or other actions by public health agencies or electric utilities.

Appendix A

Setback Requirements in the United States

Regulations

California Department of Education (http://www.cde.ca.gov/ls/fa/sf/title5regs.asp)
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Title 5, California Code of Regulations

This is an excerpt of California Code of Regulations, Title 5 that relate to school facilities construction. The complete text of the California Code of Regulations, Title 5 may be downloaded from the Office of Administrative Law.

Division 1, Chapter 13, Subchapter 1

School Facilities Construction

Article 1. General Standards

§14001. Minimum Standards.

Educational facilities planned by school districts shall be:

a. Evolved from a statement of educational program requirements which reflects the school district's educational goals and objectives.
b. Master-planned to provide for maximum site enrollment.
c. Located on a site which meets California Department of Education standards as specified in Section 14010.
d. Designed for the environmental comfort and work efficiency of the occupants.
e. Designed to require a practical minimum of maintenance.
f. Designed to meet federal, state, and local statutory requirements for structure, fire, and public safety.
g. Designed and engineered with flexibility to accommodate future needs.

Note: Authority cited: sections 17251(b) and 33031, Education Code. Reference: Section 17017.5 and 17251(b), Education Code.

Article 2. School Sites

§ 14010. Standards for School Site Selection.

All districts shall select a school site that provides safety and that supports learning. The following standards shall apply:

a. The net usable acreage and enrollment for a new school site shall be consistent with the numbers of acres and enrollment established in Tables 1-6 of the 2000 Edition, "School Site Analysis and Development" published by the California Department of Education and incorporated into this section by reference, in toto, unless sufficient land is not available or circumstances exist due to any of the following:
    1. Urban or suburban development results in insufficient available land even after considering the option of eminent domain.
    2. Sufficient acreage is available but it would not be economically feasible to mitigate geological or environmental hazards or other site complications which pose a threat to the health and/or safety of students and staff.
    3. Sufficient acreage is available but not within the attendance area of the unhoused students or there is an extreme density of population within a given attendance area requiring a school to serve more students on a single site. Choosing an alternate site would result in extensive long-term bussing of students that would cause extreme financial hardship to the district to transport students to the proposed school site.
    4. Geographic barriers, traffic congestion, or other constraints would cause extreme financial hardship for the district to transport students to the proposed school site.
b. If a school site is less than the recommended acreage required in subsection (a) of this section, the district shall demonstrate how the students will be provided an adequate educational program including physical education as described in the district's adopted course of study.
c. The property line of the site even if it is a joint use agreement as described in subsection (o) of this section shall

be at least the following distance from the edge of respective power line easements:

1. 100 feet for 50-133 kV line.
2. 150 feet for 220-230 kV line.
3. 350 feet for 500-550 kV line.

d. If the proposed site is within 1,500 feet of a railroad track easement, a safety study shall be done by a competent professional trained in assessing cargo manifests, frequency, speed, and schedule of railroad traffic, grade, curves, type and condition of track need for sound or safety barriers, need for pedestrian and vehicle safeguards at railroad crossings, presence of high pressure gas lines near the tracks that could rupture in the event of a derailment, preparation of an evacuation plan. In addition to the analysis, possible and reasonable mitigation measures must be identified.

e. The site shall not be adjacent to a road or freeway that any site-related traffic and sound level studies have determined will have safety problems or sound levels which adversely affect the educational program.

f. Pursuant to Education Code sections 17212 and 17212.5, the site shall not contain an active earthquake fault or fault trace.

g. Pursuant to Education Code sections 17212 and 17212.5, the site is not within an area of flood or dam flood inundation unless the cost of mitigating the flood or inundation impact is reasonable.

h. The site shall not be located near an above-ground water or fuel storage tank or within 1500 feet of the easement of an above ground or underground pipeline that can pose a safety hazard as determined by a risk analysis study, conducted by a competent professional, which may include certification from a local public utility commission.

i. The site is not subject to moderate to high liquefaction or landslides.

j. The shape of the site shall have a proportionate length to width ratio to accommodate the building layout, parking and playfields that can be safely supervised and does not exceed the allowed passing time to classes for the district.

k. The site shall be easily accessible from arterial roads and shall allow minimum peripheral visibility from the planned driveways in accordance with the Sight Distance Standards established in the "Highway Design Manual," Table 201.1, published by the Department of Transportation, July 1, 1990 edition, and incorporated into this section by reference, in toto.

l. The site shall not be on major arterial streets with a heavy traffic pattern as determined by site-related traffic studies including those that require student crossings unless mitigation of traffic hazards and a plan for the safe arrival and departure of students appropriate to the grade level has been provided by city, county or other public agency in accordance with the "School Area Pedestrian Safety" manual published by the California Department of Transportation, 1987 edition, incorporated into this section by reference, in toto.

m. Existing or proposed zoning of the surrounding properties shall be compatible with schools in that it would not pose a potential health or safety risk to students or staff in accordance with Education Code Section 17213 and Government Code Section 65402 and available studies of traffic surrounding the site.

n. The site shall be located within the proposed attendance area to encourage student walking and avoid extensive bussing unless bussing is used to promote ethnic diversity.

o. The site shall be selected to promote joint use of parks, libraries, museums and other public services, the acreage of which may be included as part of the recommended acreage as stated in subsection (a) of this section.

p. The site shall be conveniently located for public services including but not limited to fire protection, police protection, public transit and trash disposal whenever feasible.

q. The district shall consider environmental factors of light, wind, noise, aesthetics, and air pollution in its site selection process.

r. Easements on or adjacent to the site shall not restrict access or building placement.

s. The cost and complications of the following shall be considered in the site selection process and should not result in undue delays or unreasonable costs consistent with State Allocation Board standards:

1. Distance of utilities to the site, availability and affordability of bringing utilities to the site.
2. Site preparation including grading, drainage, demolition, hazardous cleanup, including cleanup of indigenous material such as serpentine rock, and off-site development of streets, curbs, gutters and lights.
3. Eminent domain, relocation costs, severance damage, title clearance and legal fees.
4. Long-term high landscaping or maintenance costs.
5. Existence of any wildlife habitat that is on a protected or endangered species list maintained by any state or federal agency, existence of any wetlands, natural waterways, or areas that may support migratory species, or evidence of any environmentally sensitive vegetation.

t. If the proposed site is on or within 2,000 feet of a significant disposal of hazardous waste, the school district shall contact the Department of Toxic Substance Control for a determination of whether the property should be considered a Hazardous Waste Property or Border Zone Property.

u. At the request of the governing board of a school district, the State Superintendent of Public Instruction may grant exemptions to any of the standards in this section if the district can demonstrate that mitigation of specific circumstances overrides a standard without compromising a safe and supportive school environment.

Note: Authority cited: sections 17251(b) and 33031, Education Code. Reference: sections 17212, 17212.5, 17213, 17251(b), 17251(f), and 25220, Education Code; Section 65402, Government Code; Section 25220, Health and Safety Code; sections 21372, 22350, 22352, 22358.4, and 22358.5, Vehicle Code; and sections 1859.74 and 1859.75(b), Title 2, California Code of Regulations.

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§ 14011. Procedures for Site Acquisition State-Funded School Districts.

A state-funded school district is defined as a school district having a project funded under Chapter 12.5 (commencing with Section 17070.10) of the Education Code. A state-funded school district, before acquiring title to real property for school use, shall obtain written approval from the California Department of Education using the following procedures:

a. Request a preliminary conference with a consultant from the School Facilities Planning Division and in consultation review and evaluate sites under final consideration.
b. Contact the School Facilities Planning Division of the California Department of Education to obtain a "School Facilities Planning Division Field Site Review," form SFPD 4.0, published by the California Department of Education, as last amended in December 1999 and incorporated into this section by reference, in toto, which lists the site options in order of merit according to the site selection standards delineated in Section 14010.
c. Prepare a statement of policies as delineated on the "School Facilities Planning Division School Site Report," form SFPD 4.02, as last amended in December 1999 and incorporated into this section by reference, in toto, covering the range and organization of grades to be served, the transportation of pupils, and the ultimate maximum pupil enrollment to be housed on the site. Prepare a statement showing how the site is appropriate in size as justified by the school district's Facilities Master Plan, including acreage increases above the California Department of Education recommendation made to compensate for off-site mitigation. A school district may choose, in place of a master plan, a developer fee justification document or a five-year plan if it addresses enrollment projections, needed schools, and site sizes.
d. Prepare maps showing present and proposed school sites, significant roads or highways, unsanitary or hazardous installations, such as airports or industries and the indicated boundary of the pupil attendance area to be served as delineated on form SFPD 4.02.
e. Meet with appropriate local government, recreation, and park authorities to consider possible joint use of the grounds and buildings and to coordinate the design to benefit the intended users as required by Education Code Section 35275.
f. Give written notice to the local planning agency having jurisdiction, to review the proposed school site or addition to an existing school site and request a written report form the local planning agency of the investigations and recommendations for each proposed site with respect to conformity with the adopted general plan as required by Public Resource Code Section 21151.2 and Government Code Section 65402.
g. Comply with Education Code sections 17212 and 17212.5, with particular emphasis upon an engineering investigation made of the site to preclude locating the school on terrain that may be potentially hazardous:
    1. The geological and soils engineering study shall address all of the following:
        A. Nature of the site including a discussion of liquefaction, subsidence or expansive soils, slope, stability, dam or flood inundation and street flooding.
        B. Whether the site is located within a special study zone as defined in Education Code Section 17212.
        C. Potential for earthquake or other geological hazard damage.
        D. Whether the site is situated on or near a pressure ridge, geological fault or fault trace that may rupture during the life of the school building and the student risk factor.
        E. Economic feasibility of the construction effort to make the school building safe for occupancy.
    2. Other studies shall include the following:
        A. Population trends
        B. Transportation
        C. Water supply
        D. Waste disposal facilities
        E. Utilities
        F. Traffic hazards
        G. Surface drainage conditions
        H. Other factors affecting initial and operating costs.

Mailed 1/27/2006

Decision 06-01-042 January 26, 2006

BEFORE THE PUBLIC UTILITIES COMMISSION OF THE STATE OF CALIFORNIA

Order Instituting Rulemaking to update the Commission's policies and procedures related to electromagnetic fields emanating from regulated utility facilities.	Rulemaking 04-08-020 (Filed August 19, 2004)

OPINION ON COMMISSION POLICIES ADDRESSING ELECTROMAGNETIC FIELDS EMANATING FROM REGULATED UTILITY FACILITIES

I. Summary

Today's decision affirms our "low-cost/no-cost," policy[1] to mitigate EMF exposure for new utility transmission and substation projects. As a measure of low-cost mitigation, we continue to use the benchmark of 4% of transmission and substation project costs for EMF mitigation, and combine linked transmission and substation projects in the calculation of this 4% benchmark. In addition, this decision adopts rules and policies to improve utility design guidelines for reducing EMF, and provides for a utility workshop to implement these policies and standardize design guidelines.

In order that utilities may proceed with a workshop, we define and adopt EMF mitigation polices and rules which address underground transmission lines, application of the 4% mitigation benchmark to EMF priority classes, EMF

[1] This terminology is used rather than "prudent avoidance" as it more clearly defines our purpose in addressing electromagnetic fields (EMF).

mitigation modeling techniques, and the locations for measuring EMF mitigation. We also direct utilities to initiate standardized field reduction techniques and develop a table to reflect EMF reduction measures taken or rejected.

As stated in the rulemaking initiating this proceeding,[2] at this time we are unable to determine whether there is a significant scientifically verifiable relationship between EMF exposure and negative health consequences. However, this decision directs the Commission's Energy Division to pursue and review all available studies regarding EMF, and to review scientific information and report on new findings. Should such studies indicate negative EMF health impacts, we will reconsider our EMF policies, and open a new rulemaking if necessary.

II. Procedural Background

The Commission opened R.04-08-020, on August 26, 2004, to address public concern regarding exposure to EMF,[3] an issue that has consistently generated strong public opinion in recent transmission and substation projects.[4] The rulemaking identified three issues to explore:

1. The results of the Commission's current "low-cost/no-cost" mitigation policy and the need for modifications.

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[2] Order Instituting Rulemaking, (R.) 04-08-020, *mimeo.,* p. 7.

[3] R.04-08-020 (pp. 6-7) explains why the Commission has exclusive jurisdiction over issues related to EMF exposure from regulated utility facilities.

[4] *Id.*, p. 1.

2. Improvement in the implementation of the existing "low-cost/no-cost" mitigation policy.

3. As new EMF-related scientific data becomes available, new or revised Commission EMF mitigation policies.

On October 28, 2004, a prehearing conference (PHC) was held to identify parties and establish a service list, to consider whether hearings or workshops should be held, and to establish a schedule. At the PHC, parties requested an opportunity to provide comments on the scope of the issues to be considered in the proceeding, whether hearings were necessary, and a proposed schedule.

On December 31, 2004, comments were received from Leeka Kheifets (Kheifets), Sierra Pacific Power Company (Sierra), Citizens Concerned About EMFs (CCAE) and Fund for the Environment (FUND),[5] 280 Corridor Concerned Citizens Group (280 Citizens), The Concerned Residents of Burlingame (CRB), Pacific Gas and Electric Company (PG&E), Southern California Edison Company (Edison), The California Municipal Utilities Association (CMUA), San Diego Gas & Electric Company (SDG&E), and PacifiCorp.[6] Reply comments were received on January 28, 2005, from Edison, PG&E, SDG&E, CCAE and FUND, Sierra, and PacifiCorp.

CRB, CCAE and FUND, and 280 Citizens requested that the scope include utility information regarding EMF design guidelines, consideration of whether the 4% benchmark is sufficient for EMF mitigation, and inclusion of electric distribution lines in the proceeding. CRB, CCAE and FUND and 280 Citizens

[5] CCAE and FUND submitted joint comments.

[6] PacifiCorp requested authorization to file late-filed comments on January 4, 2005; its motion is unopposed and is granted.

recommended formal consideration of the Department of Health Services (DHS) Final Report issued June 2002,[7] consideration of EMF impacts on property values including appropriate compensation, inclusion of EMF measures adopted in D.04-08-046, and the appearance of Dr. Raymond Neutra, the lead author for the DHS Report.

Utility parties, including PG&E, Edison, SDG&E, PacifiCorp, and CMUA recommended against expanding the scope of the proceeding, inclusion of distribution lines as an issue, reexamination of the DHS Report, establishment of numeric EMF standards, and any consideration of EMFs as an element in the Commission's California Environmental Qualify Act (CEQA) reviews. Utility parties generally requested that the scope of the proceeding include Commission guidance on engineering options for EMF mitigation, the 4% benchmark, and use of a 15% EMF mitigation target at the utility right of way (ROW).

After consideration of the parties' comments, the Assigned Commissioner issued a Scoping Memo and Ruling on March 1, 2005 (Scoping Memo). The Scoping Memo focused the proceeding on the issues identified in R.04-08-020, and denied requests to consider extraneous issues. The Scoping Memo also provided parties an opportunity to review and comment on respondent utilities' design guidelines,[8] and consider new scientific information such as an anticipated World Health Organization (WHO) study.

On April 4, 2005, a PHC was held to discuss the process for resolving Scoping Memo issues. At the PHC, the utilities were directed to provide their

[7] The DHS report was ordered by Decision (D.) 93-11-013.

[8] PG&E, SDG&E and Edison are named as respondent utilities.

design guidelines for EMF mitigation and following receipt of the guidelines, to provide representative field management plans (FMP) for transmission line projects. Parties would review the FMP and consider how the utilities applied their respective design guidelines. Parties could then recommend improvements or changes in the design guidelines.

Design guidelines and FMP[9] were provided by PG&E, Edison and SDG&E on April 11, 2005 and May 26, 2005, respectively. Comments were received from 280 Citizens, CCAE and FUND, ORA, and Kheifets on July 26, 2005; reply comments were received from SDG&E, PG&E, Edison, CCAE and FUND, and Kheifets on August 26, 2005.

No party has proposed evidentiary hearings, although 280 Citizens proposed a workshop to discuss standardizing utility design guidelines. As we are ordering the utilities to hold a workshop to standardize design guidelines, no other workshops or evidentiary hearings are necessary. Therefore, this proceeding is deemed submitted on August 26, 2005.

III. Discussion

Two of the three issues identified in this rulemaking (results of current policy, and improvements in mitigation policy) are evident in the utility design guidelines employed for EMF mitigation and the application of these guidelines to transmission line and substation projects. The comments and reply comments of parties form the basis for our decisionmaking. We thank those parties that

[9] PG&E and Edison provided five plans each. SDG&E provided three plans.

contributed useful comments on the utility design guidelines and proposals to improve current mitigation practices.[10] We address each of these matters below.

IV. The 4% Benchmark

D.93-11-013 in Order Instituting Investigation (OII) 91-01-012[11] adopted a benchmark of 4% of total budgeted project costs for low-cost EMF mitigation in new and upgraded projects unless exempted by a utility's design guidelines exemption criteria.[12] ORA contends that the Commission should remain flexible in applying the 4% benchmark as minor increases in EMF mitigation costs may result in significant EMF reductions. ORA recommends that the Commission not consider 4% as an absolute cap, but does not propose a specific alternate percentage benchmark.

While we are not convinced a change in the 4% benchmark is warranted, we believe ORA's argument is consistent with our current policy that provides for potential mitigation measures that might exceed the 4% benchmark. In D.04-08-046 (Application (A.) 02-09-043 addressing construction of the Jefferson-Martin transmission line) we provided additional EMF mitigation which exceeded the 4% benchmark. Although this was a special condition applied to construction of the Jefferson-Martin transmission line, we recognize

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[10] Some comments seek to recommend or address numeric EMF exposure standards, apply EMF mitigation to electric distribution lines, and argue for EMF mitigation policies expressly rejected by R.04-08-020, and the Scoping Memo. We do not further address these matters.

[11] OII 91-01-012 was an investigation to develop policies and procedures for addressing the potential health effects of electric and magnetic fields of utility facilities.

[12] Ordering Paragraphs (OP) 1 and 6, pp. 55-56.

there may be a future unique instance in which the 4% benchmark might be exceeded. Therefore, while we continue our current policy of low-cost/no cost EMF mitigation, as defined by a 4% benchmark of total project cost, we would consider minor increases above the 4% benchmark if justified under unique circumstances, but not as a routine application in utility design guidelines. We add the additional distinction that any EMF mitigation cost increases above the 4% benchmark should result in significant EMF mitigation to be justified, and the total costs should be relatively low.

Parties ask whether the 4% benchmark calculation should apply to the total costs of electric projects which include transmission lines and substation components, or whether the transmission lines and substations should be evaluated separately. In D.04-08-046,[13] we stated that the low cost EMF measures would be based on the total project cost, including both the transmission line and substations. No party has recommended applying the 4% separately. Therefore, we will apply the 4% benchmark calculation to the total project cost.

V. Prioritizing Land Use

Parties generally agree on the following group prioritization for land use categories in determining how mitigation costs will be applied:

1. Schools and licensed day care[14]

2. Residential

[13] *Mimeo.*, p. 101.

[14] As an additional fixed location of young children, we will add hospitals to this category.

3. Commercial/industrial

4. Recreational

5. Agricultural

6. Undeveloped land

However, parties request guidance on aspects affecting these priority groups including: (a) when to consider an area as residential;[15] (b) whether residential land should be in the same category as schools, (c)whether utilities should investigate potential future uses of undeveloped land, (d) whether mitigation measures should be limited or not applied if it is not possible to provide equal treatment to all members within a priority group, and (e) whether to address separately within priority (1) public schools under California Department of Education (CDE) EMF reduction policies.

We begin by noting that determining the future use of undeveloped land is both speculative and difficult. While 280 Citizens argues that EMF mitigation should be undertaken where development "is reasonably foreseeable,"[16] it is apparent that such a task requires many assumptions and is likely to lead to substantial disputes. Planning agencies frequently change land use designations, and it is unlikely that parties to future designs of transmission lines could agree on the location and boundaries of schools, residences, or commercial properties many years in the future. In addition, if the anticipated change in land use does

[15] Edison asks whether an area should be considered residential when the FMP is prepared or at the time of construction.

[16] 280 Citizens Comments, July 26, 2005, p. 14.

not occur, utility ratepayers could end up paying for unnecessary mitigation costs. Accordingly, we will not require utility design guidelines to include low-cost EMF mitigation for undeveloped land. Utility design guidelines should consider EMF mitigation at the time the FMP is prepared, although mitigation may be justified for those portions of undeveloped land on which people reside and permanently occupy structures.

We are sensitive to CCAE and FUND's argument that children may spend more time at home than in schools,[17] and therefore, residences should have the same priority as schools. However, schools, licensed day-care centers, and hospitals (which we have added to the first priority) can be specifically identified in FMP at fixed locations, while identifying those residences in which children might spend significant time is uncertain given the changing uses within houses and as a result of home sales. Furthermore, the application of low-cost options to entire residential areas in order to accommodate the potential that some homes house children may disfavor spending EMF mitigation funds for schools, day-care centers and hospitals where children are known to be present. Therefore, we will maintain our priority of schools, day-care centers, and hospitals over residences.

We agree with Edison that the CDE and our EMF reduction policies should be consistent,[18] although we are concerned that applying low-cost options to the portions of transmission lines near existing schools will consume a disproportionate share of low-cost funds. It is unclear how this alignment of

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[17] Joint Comments of CCAE and FUND, July 26, 2005, p. 4.

[18] CDE requires minimum distances between new schools and transmission lines.

policies can occur, although utilities should meet with CDE and develop additional design guideline criteria. Any proposed changes in guidelines should be provided through an advice letter process and should be consistent with the EMF policy established in this decision and in D.93-11-013.[19]

In A.02-09-043, PG&E proposed not to adopt mitigation measures in residential areas unless equal mitigation could be provided for the entire priority group, and the cost of the mitigation was within the 4% benchmark. Although equal mitigation for an entire class is a desirable goal, we will not limit the spending of EMF mitigation to zero on the basis that not all class members can benefit. We expect that utilities will modify their design guidelines so that those residences most impacted by EMF will receive some mitigation within the 4% benchmark. As a guideline for accomplishing this task we expect that EMF reductions will be 15% or greater at the utility ROW as further discussed below.

VI. Modeling EMF Mitigation

CCAE and FUND and 280 Citizens recommend that Commission EMF policies measure actual EMF on constructed transmission lines and thus validate whether persons living, working or attending schools near power lines are exposed to particular levels of EMF. CCAE and FUND argue that it is irrelevant whether particular EMF reductions have resulted; instead, persons need to know absolute EMF exposure values. As an additional criticism of utility modeling, CCAE and FUND recommend that EMF modeling assume maximum peak power flow rather than projected peak loads in the year of construction.

[19] This advice letter may be separate from the advice letter requested as a result of the utility workshop ordered later in this decision.

Our review of the modeling methodology provided in the utility design guidelines indicates that it accomplishes its purpose, which is to measure the relative differences between alternative mitigation measures. Thus, the modeling indicates relative differences in magnetic field reductions between different transmission line construction methods, but does not measure actual environmental magnetic fields. In the same way, these relative differences in mitigation measures will be evident regardless of whether a maximum peak or a projected peak is used for the comparisons.

It is also true that post construction measurement of EMF in the field cannot indicate the effectiveness of mitigation measures used as it would be extremely difficult to eliminate all other EMF sources. We note that ordering EMF field measurements would lead to arguments regarding the risks associated with absolute EMF values and an attempt to determine health based standards, an issue excluded from this proceeding.

VII. Should Underground Lines be Considered for Additional Mitigation?

In some instances, a new transmission line may be constructed underground rather than overhead. 280 Citizens recommends that although a transmission line may be placed underground, this should not prohibit consideration of additional mitigation measures for an underground line. Sierra and PacifiCorp argue that the cost of underground construction and the resulting reduction in EMF are sufficient to meet the Commission's Prudent Avoidance Policy. Thus, Sierra and PacifiCorp recommend against any additional EMF mitigation spending for underground lines. PG&E, quoting D.04-08-046, recommends that underground lines not receive any low-cost mitigation funds except for "typical trenching and duct bank construction costs that may be

incurred because the route may not be as direct as otherwise possible if strategic placement were not undertaken"[20]

As noted in the utility design guidelines,[21] underground transmission lines typically reduce magnetic fields in comparison to overhead line construction. We also note that underground lines are usually more costly than overhead line construction. Nevertheless, there may be instances in which additional mitigation may be appropriate for an underground transmission line. In D.04-08-046 we noted the intense public concern regarding the particular circumstances in locating a portion of the Jefferson-Martin transmission line in a residential area, and thus we required PG&E to lower the trench depth of this underground transmission line by an additional five feet in all residential areas where this would lower magnetic fields by at least 15%.[22] This additional depth was required as well as strategic line placement that already mitigated EMF exposure.

Although we expect that placing a transmission line underground should normally provide sufficient mitigation, we will not adopt a policy that totally excludes additional mitigation for underground lines should special circumstances warrant some additional cost in order to achieve significant further EMF mitigation.

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[20] D.04-08-046, *mimeo.,* pp. 105-106.

[21] See, for example, SDG&E EMF Design Guidelines For Transmission, Distribution and Substation Facilities, May 23, 1994 , p. 28.

[22] D.04-08-046, *mimeo.*, p. 107.

VIII. Standard Table of Reduction Measures

ORA proposes that utilities clearly state the mitigation alternatives they are considering for transmission and substation projects. ORA's proposal for transmission line and substation projects would include a standardized table summarizing the estimated costs and reasons for adoption or rejection of the EMF mitigation alternatives, thus providing a simpler and more transparent evaluation. Utilities also support this proposal.

We agree such a table is useful in evaluating new transmission and substation projects. Although no party provided an outline of the format for a standardized table, we direct the utilities to provide this table as part of the utility workshop ordered below, and submit this as part of the revised utility design guidelines.

IX. Choosing the Location for Measuring EMF Mitigation

280 Citizens proposes that the Commission state that the proper location for measuring EMF mitigation is at the edge of the utility ROW,[23] if the public is barred from the ROW. Otherwise, 280 Citizens would measure EMF mitigation from the nearest point to a point that is "routinely" used by people. Although PG&E, SDG&E and Edison's current design guidelines generally use the ROW as the location of measurement, PG&E proposes that measurement occur at the edge of occupied buildings.

For determining the appropriate location for measuring EMF mitigation, we point out that our EMF policy seeks to reduce public EMF exposure at those

[23] SDG&E points out that the EMF measurement location was as a result of workshops that followed the adoption of D.93-11-013.

locations where people tend to live, work, or go to school, and not in every area that may be used by people for short periods of time. Second, as explained above with regard to undeveloped land, it is not in the interest of ratepayers who must bear utility construction costs to speculate about future land uses and pay additional costs that cannot be justified by what is unknown at the time a FMP is developed. As PG&E points out, people contemplating changes in land use will have a choice regarding whether to construct buildings, including homes, next to existing or planned transmission lines or substations.

Generally we favor measurement of EMF mitigation at the ROW as this is the location where the utilities maintain access control; however exceptions may occur. For example, D.04-08-046 directed PG&E to strategically locate portions of the Jefferson-Martin transmission line at least 34 feet from occupied buildings where feasible, even if the EMF reduction was less than 15%.[24] In ordering this line location, we noted that the strategic line placement generally would entail minimal costs,[25] and in this way we balanced slightly greater construction costs against unique circumstances.

Consistent with our policy stated above that FMP should not include low-cost mitigation for undeveloped land, measuring EMF mitigation at the ROW should not apply to agricultural, rural and undeveloped land where

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[24] Parties disagree whether the use of a 15% reduction factor is a significant measure of EMF mitigation. CCAE and FUND argue that absolute measures of EMF are necessary to determine meaningful mitigation. However, this proposal is based on numeric measures of EMF, an issue not considered in this proceeding. As no party has proposed changes in use of the 15% factor, we find no reason to change our use of 15% as a factor for measuring significant EMF mitigation.

[25] D.04-08-046, *mimeo*., p. 107.

people can make choices about future construction and decide whether they choose to permanently live and work in these areas. For land uses in which rural housing or schools exist, we expect utilities to treat these locations as if the area was an urban school or residential location. As we have stated elsewhere, this policy applies only to consideration of low-cost mitigation measures. No cost mitigation measures that currently exist, or which may result from the recommendations of the utility workshop ordered in this decision should always be applied in all locations, including undeveloped land.

X. Consideration of New Scientific Data and Studies

The third issue identified in R.04-08-020 and in the Scoping Memo for exploration in this proceeding is consideration and receipt of new EMF-related scientific data that in turn may lead to new or revised EMF policies. At the April 4, 2005 PHC, the assigned Administrative Law Judge (ALJ) provided an opportunity for parties to address this issue and comment on the process of gathering scientific data.[26] Also, at the PHC, Kheifets, a professor in Epidemiology, provided some background on an anticipated scientific EMF study due from the WHO. Kheifets suggests the WHO study is likely to recommend no and low cost exposure reduction measures, similar to those adopted in this decision.[27]

280 Citizens recommends that the proceeding should be closed so that improvements in policy and implementation can be applied, and that

[26] Tr. 124.

[27] Comments of Leeka Kheifets, July 26, 2005, p. 2.

Commission staff should be assigned to gather information and data on new scientific EMF research. 280 Citizens recommends opening a new rulemaking after new scientific research is available. Edison also supports the assignment of Commission staff to monitor EMF health and engineering research.

We agree with the recommendation of 280 Citizens and Edison. Accordingly, rather than leaving this proceeding open for new EMF related scientific data, we direct the Commission's Energy Division to monitor and report on new EMF related scientific data as it becomes available. When new scientific research becomes available, we will then consider opening a new rulemaking. As a result, prospective policy changes regarding EMF health effects should not be litigated in future utility Certificate of Public Convenience and Necessity (CPCN) or Permit to Construct (PTC) proceedings.

XI. Utility Workshop Standardizing Design Guidelines

280 Citizens recommends that the Commission require utilities to amend their design guidelines to include measures which may be listed in the guidelines of one utility but not another. 280 Citizens also recommends expansion of design guidelines to include less typical mitigation measures such as those applied or ordered in A.02-09-043. While Edison supports standardization of field reduction techniques,[28] Edison notes that new mitigation techniques must not

[28] PG&E believes that its design guidelines include the same options available under Edison and SDG&E's guidelines.

compromise safety and other standards and regulations as required in the Commission's General Orders (GO) 95 and 128.[29]

We agree with 280 Citizens and Edison that some standardization of design guidelines would be a useful tool in evaluating EMF mitigation measures, provide common approaches and procedures, and lead to improvements in implementing our low-cost/no-cost policy. Accordingly, we will order the utilities to convene a workshop to consider changes, modifications and additions to current utility design guidelines. As other parties have already submitted comments on the design guidelines for PG&E, Edison and SDG&E, we will direct the utilities to meet and consider design guideline changes without further input. We have stated our EMF mitigation policies in this decision and we expect the utilities to implement these policies in revised design guidelines including engaging CDE to develop consistent mitigation measures. We will require that the proposed design guidelines be submitted within six months as an advice letter, subject to review and approval by our Energy Division.[30]

In ordering a utility workshop, we are mindful that changes in design guidelines should not compromise safety, reliability, or the requirements of GOs 95 and 128. Furthermore, we do not request that utilities include non-routine mitigation measures, or other mitigation measures that are based on numeric values of EMF exposure, in revised design guidelines or apply mitigation measures to reconfigurations or relocations of less than 2,000 feet, the

[29] GO 95 addresses overhead electric line construction requirements. GO 128 addresses underground electric and communication systems construction requirements.

[30] We note that this process is similar to the development of design guidelines ordered in D.93-11-013. (OP 10.)

distance under which exemptions apply under GO 131-D. Non-routine mitigation measures should only be considered under unique circumstances.

XII. Conclusion

A number of improvements in mitigating EMF exposure have been developed since we last addressed EMF policies in D.93-11-013. Although recent proceedings such as A.02-09-043 have ordered various EMF mitigation measures, today's decision provides policies allowing regulated utilities to modify and improve existing design guidelines. We remain vigilant regarding new scientific research on EMF, and are prepared to open a new rulemaking if warranted. Until that time we emphasize that our continuing EMF policy is one of prudent avoidance, and application of low-cost/no-cost principles to mitigating EMF exposure.

XIII. Comments on Draft Decision

The draft decision of ALJ Bruce DeBerry in this matter was mailed to the parties in accordance with Section 311(g)(1) of the Public Utilities Code and Rule 77.7 of the Commission's Rules of Practice and Procedure. Comments were filed by Edison, Leeka Kheifets, SDG&E, Sage Associates,[31] ORA, and PG&E.

We have carefully considered the comments on the issues addressed in today's decision. In response to comments, we have modified the draft decision to clarify the relationship between CDE and Commission EMF policies.

[31] Neither Sage Associates nor Cindy Sage is an active party to this proceeding, although Cindy Sage, Sage Associates is listed as an "Information Only" party. Although Sage Associates does not have the standing of a party in the proceeding, we have considered these comments along with the comments of other parties.

XIV. Assignment of Proceeding

Michael R. Peevey is the Assigned Commissioner and Bruce DeBerry is the assigned ALJ in this proceeding.

XV. Categorization and Need for Hearings

The Commission preliminarily categorized this proceeding as quasi-legislative, and preliminarily determined that hearings were necessary. No party has requested hearings. Given this status public hearing is not necessary and the preliminary determination made with regard to hearings should be altered, but the categorization remains the same.

Findings of Fact

1. The purpose of this rulemaking was to determine if improvements should be made to existing Commission rules and regulations concerning EMF associated with transmission lines and other electric facilities.

2. Current Commission policy requires utilities to implement low-cost/no cost EMF mitigation measures to minimize public EMF exposure.

3. Low-cost measures have been defined as mitigation measures that cost 4% or less of the total project cost, which is also referred to as the 4% benchmark.

4. Although some parties have proposed that EMF mitigation costs may exceed the 4% benchmark, no party has recommended a specific alternate benchmark percentage.

5. As discussed in the rulemaking, a direct link between exposure to EMF and human health effects has yet to be proven despite numerous studies including a study ordered by this Commission and conducted by DHS.

6. EMF results from many electric sources outside of the control of the utilities.

7. PG&E, Edison and SDG&E each employ their own set of design guidelines for applying EMF mitigation measures to electric transmission, distribution and substation facilities.

8. No party has proposed evidentiary hearings.

9. Determining the future use of undeveloped land is speculative and difficult.

10. If an anticipated change in future land use does not occur, ratepayers could pay for unnecessary EMF mitigation costs.

11. Schools, day-care centers and hospitals can be identified in FMP at fixed locations.

12. Any proposed changes in guidelines should be consistent with the EMF policy established in this decision and in D.93-11-013.

13. Identifying residences in which children spend significant time is difficult and uncertain due to changing uses within houses and home sales.

14. Utility modeling methodology is intended to compare differences between alternative EMF mitigation measures and not determine actual EMF amounts.

15. EMF from underground transmission lines is usually less than overhead transmission line EMF.

16. A table listing the various EMF mitigation alternatives and costs is a useful tool for evaluating FMP.

17. The appropriate location for measuring EMF mitigation is the utility ROW as this is the location at which utilities may maintain access control.

18. Low-cost EMF mitigation is not necessary in agricultural and undeveloped land except for permanently occupied residences, schools or hospitals located on these lands.

19. People can make choices regarding new construction on undeveloped and agricultural land knowing that transmission lines either exist or are planned for those lands.

20. A 15% reduction in EMF is the current measure of significant EMF mitigation. No party has proposed a different measure of significant EMF mitigation.

21. No party provided new EMF scientific data or scientific research.

22. The Energy Division should monitor and report on new EMF related scientific data or research.

Conclusions of Law

1. The Commission has exclusive jurisdiction over issues related to EMF exposure from regulated utility facilities.

2. EMF concerns in future CPCN and PTC proceedings for electric transmission and substation facilities should be limited to the utility's compliance with the Commission's low-cost/no-cost policies.

3. A utility EMF workshop should be held for the purpose of developing standard approaches for design guidelines including the development of a standard table showing EMF mitigation measures and costs.

4. Low-cost EMF mitigation should use four percent of total project cost as a benchmark.

5. Revisions to utility design guidelines should not compromise safety, reliability or the requirements of GOs 95 and 128, or apply to reconfigurations or relocations exempted under GO 131-D.

6. This proceeding should be closed.

O R D E R

IT IS ORDERED that:

1. Respondent electric utilities shall convene a utility workshop to develop standard approaches for design guidelines including the development of a standard table showing electromagnetic field (EMF) mitigation measures and costs as discussed in this order.

2. Respondent electric utilities shall implement low-cost/no-cost EMF mitigation measures in new and upgraded transmission line and substation projects as discussed in this order.

3. Respondent electric utilities shall file revised design guidelines as an advice letter within six months of the effective date of this order.

4. No hearings were necessary for this proceeding.

5. Respondent electric utilities shall file an advice letter showing any proposed changes in design guidelines after meeting with the California Department of Education as discussed in this order.

6. Rulemaking 04-08-020 is closed.

This order is effective today.

Dated January 26, 2006, at San Francisco, California.

MICHAEL R. PEEVEY
President
GEOFFREY F. BROWN
DIAN M. GRUENEICH
JOHN A. BOHN
RACHELLE B. CHONG
Commissioners

Substitute House Bill No. 5418

Public Act No. 04-246

AN ACT CONCERNING ELECTRIC TRANSMISSION LINE SITING CRITERIA.

Be it enacted by the Senate and House of Representatives in General Assembly convened:

Section 1. Subsection (a) of section 16-50l of the general statutes, as amended by section 4 of public act 03-140, is repealed and the following is substituted in lieu thereof (*Effective from passage and applicable to applications for a certificate of environmental compatibility and public need that was originally filed on or after October 1, 2003, for which the Connecticut Siting Council has not rendered a decision upon the record prior to the effective date of this section*):

(a) To initiate a certification proceeding, an applicant for a certificate shall file with the council an application, in such form as the council may prescribe, accompanied by a filing fee of not more than twenty-five thousand dollars, which fee shall be established in accordance with section 16-50t, and a municipal participation fee of twenty-five thousand dollars to be deposited in the account established pursuant to section 16-50bb, except that an application for a facility described in subdivision (5) or (6) of subsection (a) of section 16-50i, as amended, shall not pay such municipal participation fee. An application shall contain such information as the applicant may consider relevant and the council or any department or agency of the state exercising environmental controls may by regulation require, including the following information:

(1) In the case of facilities described in subdivisions (1), (2) and (4) of subsection (a) of section 16-50i, as amended: (A) A description, including estimated costs, of the proposed transmission line, substation or switchyard, covering, where applicable underground cable sizes and specifications, overhead tower design and appearance and heights, if any, conductor sizes, and initial and ultimate voltages and capacities; (B) a statement and full explanation of why the proposed transmission line, substation or switchyard is necessary and how the facility conforms to a long-range plan for expansion of the electric power grid serving the state and interconnected utility systems, that will serve the public need for adequate, reliable and economic service; (C) a map of suitable scale of the proposed routing or site, showing details of the rights-of-way or site in the vicinity of settled areas, parks, recreational areas and scenic areas, residential areas, private or public schools, licensed child day care facilities, licensed youth camps, and public playgrounds and showing existing transmission lines within one mile of the proposed route or site; (D) justification for adoption of the route or site selected, including comparison with alternative routes or sites which are environmentally, technically and economically practical; (E) a description of the effect of the proposed transmission line, substation or switchyard on the environment, ecology, and scenic, historic and recreational values; (F) a justification for overhead portions, if any, including life-cycle cost studies comparing overhead alternatives with underground alternatives, and effects described in subparagraph (E)

of this subdivision of undergrounding; (G) a schedule of dates showing the proposed program of right-of-way or property acquisition, construction, completion and operation; **[**and**]** (H) identification of each federal, state, regional, district and municipal agency with which proposed route or site reviews have been undertaken, including a copy of each written agency position on such route or site; and (I) an assessment of the impact of any electromagnetic fields to be produced by the proposed transmission line; and

(2) In the case of facilities described in subdivision (3) of subsection (a) of section 16-50i, as amended: (A) A description of the proposed electric generating or storage facility; (B) a statement and full explanation of why the proposed facility is necessary; (C) a statement of loads and resources as described in section 16-50r; (D) safety and reliability information, including planned provisions for emergency operations and shutdowns; (E) estimated cost information, including plant costs, fuel costs, plant service life and capacity factor, and total generating cost per kilowatt-hour, both at the plant and related transmission, and comparative costs of alternatives considered; (F) a schedule showing the program for design, material acquisition, construction and testing, and operating dates; (G) available site information, including maps and description and present and proposed development, and geological, scenic, ecological, seismic, biological, water supply, population and load center data; (H) justification for adoption of the site selected, including comparison with alternative sites; (I) design information, including description of facilities, plant efficiencies, electrical connections to system, and control systems; (J) description of provisions, including devices and operations, for mitigation of the effect of the operation of the facility on air and water quality, for waste disposal, and for noise abatement, and information on other environmental aspects; and (K) a listing of federal, state, regional, district and municipal agencies from which approvals either have been obtained or will be sought covering the proposed facility, copies of approvals received and the planned schedule for obtaining those approvals not yet received.

Sec. 2. Subsection (a) of section 16-50l of the general statutes, as amended by section 5 of public act 03-140 and sections 1 and 11 of this act, is repealed and the following is substituted in lieu thereof (*Effective October 1, 2004, and applicable to applications for a certificate of environmental compatibility and public need that was originally filed on or after October 1, 2003, for which the Connecticut Siting Council has not rendered a decision upon the record prior to the effective date of this section*):

(a) (1) To initiate a certification proceeding, an applicant for a certificate shall file with the council an application, in such form as the council may prescribe, accompanied by a filing fee of not more than twenty-five thousand dollars, which fee shall be established in accordance with section 16-50t, and a municipal participation fee of twenty-five thousand dollars to be deposited in the account established pursuant to section 16-50bb, except that an application for a facility described in subdivision (5) or (6) of subsection (a) of section 16-50i, as amended, shall not pay such municipal participation fee. An application shall contain such information as the applicant may consider relevant and the council or any department or agency of the state exercising environmental controls may by regulation require, including the following information:

(A) In the case of facilities described in subdivisions (1), (2) and (4) of subsection (a) of section 16-50i, as amended: (i) A description, including estimated costs, of the proposed transmission line, substation or switchyard, covering, where applicable underground cable sizes and specifications, overhead tower design and appearance and heights, if any, conductor sizes, and initial and ultimate voltages and capacities; (ii) a statement and full explanation of why the proposed transmission line, substation or switchyard is necessary and how the facility conforms to a long-range plan for expansion of the electric power grid serving the state and interconnected utility systems, that will serve the public need for adequate, reliable and economic service; (iii) a map of suitable scale of the proposed routing or site, showing details of the

rights-of-way or site in the vicinity of settled areas, parks, recreational areas and scenic areas, residential areas, private or public schools, licensed child day care facilities, licensed youth camps, and public playgrounds and showing existing transmission lines within one mile of the proposed route or site; (iv) justification for adoption of the route or site selected, including comparison with alternative routes or sites which are environmentally, technically and economically practical; (v) a description of the effect of the proposed transmission line, substation or switchyard on the environment, ecology, and scenic, historic and recreational values; (vi) a justification for overhead portions, if any, including life-cycle cost studies comparing overhead alternatives with underground alternatives, and effects described in (v) of this subparagraph of undergrounding; (vii) a schedule of dates showing the proposed program of right-of-way or property acquisition, construction, completion and operation; and (viii) identification of each federal, state, regional, district and municipal agency with which proposed route or site reviews have been undertaken, including a copy of each written agency position on such route or site; and **[**I**]** (ix) an assessment of the impact of any electromagnetic fields to be produced by the proposed transmission line; and

(B) In the case of facilities described in subdivision (3) of subsection (a) of section 16-50i, as amended: (i) A description of the proposed electric generating or storage facility; (ii) a statement and full explanation of why the proposed facility is necessary; (iii) a statement of loads and resources as described in section 16-50r; (iv) safety and reliability information, including planned provisions for emergency operations and shutdowns; (v) estimated cost information, including plant costs, fuel costs, plant service life and capacity factor, and total generating cost per kilowatt-hour, both at the plant and related transmission, and comparative costs of alternatives considered; (vi) a schedule showing the program for design, material acquisition, construction and testing, and operating dates; (vii) available site information, including maps and description and present and proposed development, and geological, scenic, ecological, seismic, biological, water supply, population and load center data; (viii) justification for adoption of the site selected, including comparison with alternative sites; (ix) design information, including description of facilities, plant efficiencies, electrical connections to system, and control systems; (x) description of provisions, including devices and operations, for mitigation of the effect of the operation of the facility on air and water quality, for waste disposal, and for noise abatement, and information on other environmental aspects; and (xi) a listing of federal, state, regional, district and municipal agencies from which approvals either have been obtained or will be sought covering the proposed facility, copies of approvals received and the planned schedule for obtaining those approvals not yet received.

(2) On or after December 1, 2004, the filing of an application pursuant to subdivision (1) of this subsection shall initiate the request-for-proposal process, except for an application for a facility described in subdivision (5) or (6) of subsection (a) of section 16-50i.

(3) Notwithstanding the provisions of this subsection, an entity that has submitted a proposal pursuant to the request-for-proposal process may initiate a certification proceeding by filing with the council an application containing the information required pursuant to this section, accompanied by a filing fee of not more than twenty-five thousand dollars, which fee shall be established in accordance with section 16-50t, and a municipal participation fee of twenty-five thousand dollars to be deposited in the account established pursuant to section 16-50bb, not later than thirty days after the Connecticut Energy Advisory Board performs the evaluation process pursuant to subsection (f) of section 16a-7c.

Sec. 3. Subsection (a) of section 16-50p of the general statutes, as amended by section 10 of public act 03-140, section 6 of public act 03-221 and section 120 of public act 03-278, is repealed and the following is

substituted in lieu thereof (*Effective from passage and applicable to applications for a certificate of environmental compatibility and public need that was originally filed on or after October 1, 2003, for which the Connecticut Siting Council has not rendered a decision upon the record prior to the effective date of this section*):

(a) In a certification proceeding, the council shall render a decision upon the record either granting or denying the application as filed, or granting it upon such terms, conditions, limitations or modifications of the construction or operation of the facility as the council may deem appropriate. The council's decision shall be rendered within twelve months of the filing of an application concerning a facility described in subdivision (1) or (2) of subsection (a) of section 16-50i, as amended, or subdivision (4) of said subsection (a) if the application was incorporated in an application concerning a facility described in subdivision (1) of said subsection (a), and within one hundred eighty days of the filing of any other application concerning a facility described in subdivision (4) of said subsection (a), and an application concerning a facility described in subdivision (3), (5) or (6) of said subsection (a), provided such time periods may be extended by the council by not more than one hundred eighty days with the consent of the applicant. The council shall file, with its order, an opinion stating in full its reasons for the decision. **[**Except as provided in subsection (c) of this section, the**]** The council shall not grant a certificate, either as proposed or as modified by the council, unless it shall find and determine: (1) **[**A**]** Except as provided in subsection (c) of this section, a public need for the facility and the basis of the need taking into consideration other feasible and prudent alternatives provided to the council by a party or intervenor that address the same public need; (2) the nature of the probable environmental impact of the facility, or a feasible and prudent alternative provided to the council by a party or intervenor, alone and cumulatively with other existing facilities, including a specification of every significant adverse effect, including, but not limited to, electromagnetic fields that, whether alone or cumulatively with other effects, on, and conflict with the policies of the state concerning, the natural environment, ecological balance, public health and safety, scenic, historic and recreational values, forests and parks, air and water purity and fish, aquaculture and wildlife; (3) why the adverse effects or conflicts referred to in subdivision (2) of this subsection are not sufficient reason to deny the application, including why other feasible and prudent alternatives with less adverse effects or fewer conflicts that are provided to the council by a party or intervenor do not address the same public need; (4) in the case of an electric transmission line, (A) what part, if any, of the facility shall be located overhead, (B) that the facility conforms to a long-range plan for expansion of the electric power grid of the electric systems serving the state and interconnected utility systems and will serve the interests of electric system economy and reliability, and (C) that the overhead portions, if any, of the facility, or a feasible and prudent alternative provided to the council by a party or intervenor, are cost effective and the most appropriate alternative based on a life-cycle cost analysis of the facility and underground alternatives to such facility, **[**and**]** are consistent with the purposes of this chapter, with such regulations or standards as the council may adopt pursuant to **[**subsection (a) of**]** section 16-50t, including, but not limited to, the council's best management practices for electric and magnetic fields for electric transmission lines and with the Federal Power Commission "Guidelines for the Protection of Natural Historic Scenic and Recreational Values in the Design and Location of Rights-of-Way and Transmission Facilities" or any successor guidelines and any other applicable federal guidelines and are to be contained within an area that provides a buffer zone that protects the public health and safety, as determined by the council. In establishing such buffer zone, the council shall take into consideration, among other things, residential areas, private or public schools, licensed child day care facilities, licensed youth camps or public playgrounds adjacent to the proposed route of the overhead portions and the level of the voltage of the overhead portions and any existing overhead transmission lines on the proposed route. At a minimum, the existing right-of-way shall serve as the buffer zone; (5) in the case of an electric or fuel transmission line, that the location of the line will not pose an

undue hazard to persons or property along the area traversed by the line; and (6) in the case of a facility described in subdivision (6) of subsection (a) of section 16-50i, as amended, that is proposed to be installed on land under agricultural restriction, as provided in section 22-26cc, as amended, that the facility will not result in a material decrease of acreage and productivity of the arable land. The terms of any agreement entered into by the applicant and any party to the certification proceeding, or any third party, in connection with the construction or operation of the facility, shall be part of the record of the proceedings and available for public inspection. The full text of any such agreement, and a statement of any consideration therefor, if not contained in the agreement, shall be filed with the council prior to the council's decision. This provision shall not require the public disclosure of proprietary information or trade secrets.

Sec. 4. Subsection (a) of section 16-50p of the general statutes, as amended by section 11 of public act 03-140, section 6 of public act 03-221 and section 120 of public act 03-278, is repealed and the following is substituted in lieu thereof (*Effective October 1, 2004, and applicable to applications for a certificate of environmental compatibility and public need that was originally filed on or after October 1, 2003, for which the Connecticut Siting Council has not rendered a decision upon the record prior to the effective date of this section*):

(a) (1) In a certification proceeding, the council shall render a decision upon the record either granting or denying the application as filed, or granting it upon such terms, conditions, limitations or modifications of the construction or operation of the facility as the council may deem appropriate.

(2) The council's decision shall be rendered in accordance with the following:

(A) Not later than twelve months after the deadline for filing an application following the request-for-proposal process for a facility described in subdivision (1) or (2) of subsection (a) of section 16-50i, as amended, or subdivision (4) of said subsection (a) if the application was incorporated in an application concerning a facility described in subdivision (1) of said subsection (a);

(B) Not later than one hundred eighty days after the deadline for filing an application following the request-for-proposal process for a facility described in subdivision (4) of said subsection (a), and an application concerning a facility described in subdivision (3) of said subsection (a), provided such time periods may be extended by the council by not more than one hundred eighty days with the consent of the applicant; and

(C) Not later than one hundred eighty days after the filing of an application for a facility described in subdivision (5) or (6) of said subsection (a), provided such time period may be extended by the council by not more than one hundred eighty days with the consent of the applicant.

(3) The council shall file, with its order, an opinion stating in full its reasons for the decision. **[**Except as provided in subsection (c) of this section, the**]** The council shall not grant a certificate, either as proposed or as modified by the council, unless it shall find and determine:

(A) **[**A**]** Except as provided in subsection (c) of this section, public need for the facility and the basis of the need;

(B) The nature of the probable environmental impact of the facility alone and cumulatively with other existing facilities, including a specification of every significant adverse effect, including, but not limited to, electromagnetic fields that, whether alone or cumulatively with other effects, on, and conflict with the policies of the state concerning, the natural environment, ecological balance, public health and safety,

scenic, historic and recreational values, forests and parks, air and water purity and fish, aquaculture and wildlife;

(C) Why the adverse effects or conflicts referred to in subparagraph (B) of this subdivision are not sufficient reason to deny the application;

(D) In the case of an electric transmission line, (i) what part, if any, of the facility shall be located overhead, (ii) that the facility conforms to a long-range plan for expansion of the electric power grid of the electric systems serving the state and interconnected utility systems and will serve the interests of electric system economy and reliability, and (iii) that the overhead portions, if any, of the facility are cost effective and the most appropriate alternative based on a life-cycle cost analysis of the facility and underground alternatives to such facility, **[**and**]** are consistent with the purposes of this chapter, with such regulations or standards as the council may adopt pursuant to **[**subsection (a) of**]** section 16-50t, including, but limited to, the council's best management practices for electric and magnet fields for electric transmission lines and with the Federal Power Commission "Guidelines for the Protection of Natural Historic Scenic and Recreational Values in the Design and Location of Rights-of-Way and Transmission Facilities" or any successor guidelines and any other applicable federal guidelines and are to be contained within an area that provides a buffer zone that protects the public health and safety, as determined by the council. In establishing such buffer zone, the council shall take into consideration, among other things, residential areas, private or public schools, licensed child day care facilities, licensed youth camps or public playgrounds adjacent to the proposed route of the overhead portions and the level of the voltage of the overhead portions and any existing overhead transmission lines on the proposed route. At a minimum, the existing right-of-way shall serve as the buffer zone;

(E) In the case of an electric or fuel transmission line, that the location of the line will not pose an undue hazard to persons or property along the area traversed by the line;

(F) In the case of an application that was heard under a consolidated hearing process with other applications that were common to a request-for-proposal, that the facility proposed in the subject application represents the most appropriate alternative among such applications based on the findings and determinations pursuant to this subsection; and

(G) In the case of a facility described in subdivision (6) of subsection (a) of section 16-50i, as amended, that is proposed to be installed on land under agricultural restriction, as provided in section 22-26cc, as amended, that the facility will not result in a material decrease of acreage and productivity of the arable land.

Sec. 5. Subsection (c) of section 16-50p of the general statutes, as amended by section 12 of public act 03-140 and section 1 of public act 03-248, is repealed and the following is substituted in lieu thereof (*Effective from passage and applicable to applications for a certificate of environmental compatibility and public need that was originally filed on or after October 1, 2003, for which the Connecticut Siting Council has not rendered a decision upon the record prior to the effective date of this section*):

(c) (1) The council shall not grant a certificate for a facility described in subdivision (3) of subsection (a) of section 16-50i, as amended, either as proposed or as modified by the council, unless it finds and determines **[**: (A) A**]** a public benefit for the facility. **[**; (B) the nature of the probable environmental impact, including a specification of every significant adverse and beneficial effect that, whether alone or cumulatively with other effects, conflicts with the policies of the state concerning the natural environment, ecological balance,

public health and safety, scenic, historic and recreational values, forests and parks, air and water purity and fish and wildlife; and (C) why the adverse effects or conflicts referred to in subparagraph (B) of this subdivision are not sufficient reason to deny the application. For purposes of subparagraph (A) of this subdivision, a public benefit exists if such a facility is necessary for the reliability of the electric power supply of the state or for a competitive market for electricity. **]**

(2) The council shall not grant a certificate for a facility described in subdivision (1) of subsection (a) of section 16-50i, as amended, which is substantially underground or underwater except where such facilities interconnect with existing overhead facilities, either as proposed or as modified by the council, unless it finds and determines **[**: **]**

[(A) A**]** a public benefit for the facility, in the case of such facility that is substantially underground, and a public need for such facility, in the case of such facility that is substantially underwater, taking into consideration other feasible and prudent alternatives provided to the council by a party or intervenor that address the same public need or public benefit, as applicable. **[**; **]**

[(B) The nature of the probable environmental impact of the facility, or a feasible and prudent alternative provided to the council by a party intervenor, alone and cumulatively with other existing facilities, including a specification of every single adverse and beneficial effect that, whether alone or cumulatively with other effects, conflict with the policies of the state concerning the natural environment, ecological balance, public health and safety, scenic, historic and recreational values, forests and parks, air and purity and fish and wildlife;

(C) Why the adverse effects or conflicts referred to in subparagraph (B) of this subdivision are not sufficient reason to deny the application, including why other feasible and prudent alternatives with less adverse effects and fewer conflicts that were provided to the council by a party or intervenor do not address the same public need or public benefit, as applicable;

(D) In the case of a new electric transmission line, (i) what part, if any, of the facility shall be located overhead, (ii) that the facility conforms to a long-range plan for expansion of the electric power grid of the electric systems serving the state and interconnected utility systems and will serve the interests of electric system economy and reliability, and (iii) that the overhead portions of the facility, if any, are cost-effective and the most appropriate alternative based on a life-cycle cost analysis of the facility and underground alternatives to such facility and are consistent with the purposes of this chapter, with such regulations as the council may adopt pursuant to subsection (a) of section 16-50t, and with the Federal Energy Regulatory Commission "Guidelines For the Protection of Natural Historic Scenic and Recreational Values in the Design and Location of Rights-of-Way and Transmission Facilities" or any other successor guidelines and any other applicable federal guidelines; and

(E) In the case of an electric or fuel transmission line, that the location of the line will not pose an undue hazard to persons or property along the area traversed by the line. **]**

(3) For purposes of **[**subparagraph (A) of**]** this **[**subdivision**]** subsection, a public benefit exists if such a facility is necessary for the reliability of the electric power supply of the state or for the development of a competitive market for electricity.

[(3) Any application for an electric transmission line with a capacity of three hundred forty-five kilovolts or more that is filed on or after May 1, 2003, and that proposes the underground burial of such line in all

residential areas and overhead installation of such line in industrial and open space areas affected by such proposal shall have a rebuttable presumption of meeting a public benefit for such facility if the facility is substantially underground, and meeting a public need for such facility if the facility is substantially above ground. Such presumption may be overcome by evidence submitted by a party or intervenor to the satisfaction of the council. **]**

Sec. 6. Subdivisions (1) and (2) of subsection (c) of section 16-50p of the general statutes, as amended by section 13 of public act 03-140, are repealed and the following is substituted in lieu thereof (*Effective October 1, 2004, and applicable to applications for a certificate of environmental compatibility and public need that was originally filed on or after October 1, 2003, for which the Connecticut Siting Council has not rendered a decision upon the record prior to the effective date of this section*):

(c) (1) The council shall not grant a certificate for a facility described in subdivision (3) of subsection (a) of section 16-50i, as amended, either as proposed or as modified by the council, unless it finds and determines **[**: (A) A**]** a public benefit for the facility. **[**; (B) the nature of the probable environmental impact, including a specification of every significant adverse and beneficial effect that, whether alone or cumulatively with other effects, conflicts with the policies of the state concerning the natural environment, ecological balance, public health and safety, scenic, historic and recreational values, forests and parks, air and water purity and fish and wildlife; (C) why the adverse effects or conflicts referred to in subparagraph (B) of this subdivision are not sufficient reason to deny the application; and (D) in the case of an application that was heard under a consolidated hearing process with other applications that were common to a request-for-proposal, that the facility proposed in the subject application represents the most appropriate alternative among such applications based on the findings and determinations pursuant to this subdivision. For purposes of subparagraph (A) of this subdivision, a public benefit exists if such a facility is necessary for the reliability of the electric power supply of the state or for a competitive market for electricity. **]**

(2) The council shall not grant a certificate for a facility described in subdivision (1) of subsection (a) of section 16-50i, as amended, which is substantially underground or underwater except where such facilities interconnect with existing overhead facilities, either as proposed or as modified by the council, unless it finds and determines **[**: **]**

[(A) A**]** a public benefit for the facility, in the case of such facility that is substantially underground, and a public need for such facility, in the case of such facility that is substantially underwater. **[**; **]**

[(B) The nature of the probable environmental impact of the facility alone and cumulatively with other existing facilities, including a specification of every single adverse and beneficial effect that, whether alone or cumulatively with other effects, conflict with the policies of the state concerning the natural environment, ecological balance, public health and safety, scenic, historic and recreational values, forests and parks, air and purity and fish and wildlife;

(C) Why the adverse effects or conflicts referred to in subparagraph (B) of this subdivision are not sufficient reason to deny the application;

(D) In the case of a new electric transmission line, (i) what part, if any, of the facility shall be located overhead, (ii) that the facility conforms to a long-range plan for expansion of the electric power grid of the electric systems serving the state and interconnected utility systems and will serve the interests of electric system economy and reliability, and (iii) that the overhead portions of the facility, if any, are cost-effective and the most appropriate alternative based on a life-cycle cost analysis of the facility and underground

alternatives to such facility, and are consistent with the purposes of this chapter, with such regulations as the council may adopt pursuant to subsection (a) of section 16-50t, and with the Federal Energy Regulatory Commission "Guidelines For the Protection of Natural Historic Scenic and Recreational Values in the Design and Location of Rights-of-Way and Transmission Facilities" or any other successor guidelines and any other applicable federal guidelines;

(E) In the case of an electric or fuel transmission line, that the location of the line will not pose an undue hazard to persons or property along the area traversed by the line; and

(F) In the case of an application that was heard under a consolidated hearing process with other applications that were common to a request-for-proposal, that the facility proposed in the subject application represents the most appropriate alternative among such applications based on the findings and determinations pursuant to this subdivision. **]**

(3) For purposes of subparagraph (A) of this subdivision, a public benefit exists if such a facility is necessary for the reliability of the electric power supply of the state or for the development of a competitive market for electricity and a public need exists if such facility is necessary for the reliability of the electric power supply of the state.

Sec. 7. Section 16-50p of the general statutes, as amended by section 10 of public act 03-140, section 6 of public act 03-221 and section 120 of public act 03-278, is amended by adding subsection (h) as follows (*Effective from passage and applicable to applications for a certificate of environmental compatibility and public need that was originally filed on or after October 1, 2003, for which the Connecticut Siting Council has not rendered a decision upon the record prior to the effective date of this section*):

(NEW) (h) For a facility described in subdivision (1) of subsection (a) of section 16-50i, as amended, with a capacity of three hundred forty-five kilovolts or greater, there shall be a presumption that a proposal to place the overhead portions, if any, of such facility adjacent to residential areas, private or public schools, licensed child day care facilities, licensed youth camps or public playgrounds is inconsistent with the purposes of this chapter. An applicant may rebut this presumption by demonstrating to the council that it will be technologically infeasible to bury the facility. In determining such infeasibility, the council shall consider the effect of burying the facility on the reliability of the electric transmission system of the state.

Sec. 8. Section 16-50o of the general statutes is repealed and the following is substituted in lieu thereof (*Effective from passage and applicable to applications for a certificate of environmental compatibility and public need that was originally filed on or after October 1, 2003, for which the Connecticut Siting Council has not rendered a decision upon the record prior to the effective date of this section*):

(a) A record shall be made of the hearing and of all testimony taken and the cross-examinations thereon. Every party or group of parties as provided in section 16-50n shall have the right to present such oral or documentary evidence and to conduct such cross-examination as may be required for a full and true disclosure of the facts.

(b) For an application on a facility described in subdivision (1) of subsection (a) of section 16-50i, as amended, the council shall administratively notice completed and ongoing scientific and medical research on electromagnetic fields.

[(b)**]** (c) A copy of the record shall be available at all reasonable times for examination by the public without

cost at the principal office of the council. A copy of the transcript of testimony at the hearing shall be filed at an appropriate public office, as determined by the council, in each county in which the facility or any part thereof is proposed to be located.

Sec. 9. Section 16-50o of the general statutes, as amended by section 9 of public act 03-140 and section 8 of this act, is repealed and the following is substituted in lieu thereof (*Effective October 1, 2004, and applicable to applications for a certificate of environmental compatibility and public need that was originally filed on or after October 1, 2003, for which the Connecticut Siting Council has not rendered a decision upon the record prior to the effective date of this section*):

(a) A record shall be made of the hearing and of all testimony taken and the cross-examinations thereon. Every party or group of parties as provided in section 16-50n shall have the right to present such oral or documentary evidence and to conduct such cross-examination as may be required for a full and true disclosure of the facts.

(b) For an application on a facility in subdivision (1) of subsection (a) of section 16-50i, as amended, the council shall administratively notice completed and ongoing scientific and medical research on electromagnetic fields.

(c) The applicant shall submit into the record the full text of the terms of any agreement, and a statement of any consideration therefor, if not contained in such agreement, entered into by the applicant and any party to the certification proceeding, or any third party, in connection with the construction or operation of the facility. This provision shall not require the public disclosure of proprietary information or trade secrets.

[(c)**]** (d) The results of the evaluation process pursuant to subsection (f) of section 19 of **[**this act**]** public act 03-140 shall be part of the record, where applicable.

[(d)**]** (e) A copy of the record shall be available at all reasonable times for examination by the public without cost at the principal office of the council. A copy of the transcript of testimony at the hearing shall be filed at an appropriate public office, as determined by the council, in each county in which the facility or any part thereof is proposed to be located.

Sec. 10. Section 16-50t of the general statutes is repealed and the following is substituted in lieu thereof (*Effective from passage and applicable to applications for a certificate of environmental compatibility and public need that was originally filed on or after October 1, 2003, for which the Connecticut Siting Council has not rendered a decision upon the record prior to the effective date of this section*):

(a) The council shall prescribe and establish such reasonable regulations and standards in accordance with the provisions of chapter 54 as it deems necessary and in the public interest with respect to application fees, siting of facilities and environmental standards applicable to facilities, including, but not limited to, regulations or standards relating to: (1) Reliability, effluents, thermal effects, air and water emissions, protection of fish and wildlife and other environmental factors; (2) the methodical upgrading or elimination of facilities over appropriate periods of time to meet the standards established pursuant to this subsection or other applicable laws, standards or regulations; and (3) the elimination of overhead electric transmission and distribution lines over appropriate periods of time in accordance with existing applicable technology and the need to provide electric service at the lowest reasonable cost to consumers.

(b) The council may adopt regulations or standards in accordance with the provisions of chapter 54, with

respect to subdivisions (1) and (2) of subsection (a) of this section. Such regulations or standards shall be in addition to and not in lieu of any regulation or standard adopted by any other state or local agency or instrumentality. No such regulation or standard shall be adopted by the council without one or more public hearings at which members of the public are given adequate opportunity to be heard.

(c) The council shall adopt, and revise as the council deems necessary, standards for best management practices for electric and magnetic fields for electric transmission lines. Such standards shall be based on the latest completed and ongoing scientific and medical research on electromagnetic fields and shall require individual, project-specific assessments of electromagnetic fields, taking into consideration design techniques including, but not limited to, compact spacing, optimum phasing of conductors, and applicable and appropriate new field management technologies. Such standards shall not be regulations for purposes of chapter 54.

[(c)**]** (d) Expenditures by a utility shall not be considered a necessary and proper expense for the purpose of computing fair net return on invested capital, if such expenditures were incurred (1) for fines, forfeitures and other penalties, including legal fees and other expenses incurred in connection therewith, imposed for failure to comply with any state or federal environmental or pollution standard or (2) in connection with any action described in subsection (a) of section **[**16-50k(a)**]** 16-50k prior to issuance of a certificate therefor.

Sec. 11. (NEW) (*Effective from passage and applicable to applications for a certificate of environmental compatibility and public need that was originally filed on or after October 1, 2003, for which the Connecticut Siting Council has not rendered a decision upon the record prior to the effective date of this section*) If legislation adopted on or after January 1, 2004, results in the reconfiguration or burial of a proposed facility described in subdivision (1) of subsection (a) of section 16-50i of the general statutes, all prudent costs incurred by an electric distribution company, as defined in section 16-1 of the general statutes, as amended, associated with the reconfiguration or burial shall be deemed to be reasonable pursuant to sections 16-19 and 16-19e of the general statutes and shall be recovered by the electric distribution company in its rates.

Sec. 12. (*Effective from passage and applicable to applications for a certificate of environmental compatibility and public need that was originally filed on or after October 1, 2003, for which the Connecticut Siting Council has not rendered a decision upon the record prior to the effective date of this section*) Not later than January 1, 2005, the Connecticut Siting Council shall, in accordance with section 11-4a of the general statutes, submit a report to the joint standing committee of the General Assembly having cognizance of matters relating to energy and the environment, which report shall contain the council's most recent version of its standards for best management practices for electric and magnetic fields for electric transmission lines and a description of the methodology used in selecting such standards.

Approved June 3, 2004

Electric and Magnetic Field Best Management Practices
For the Construction of Electric Transmission Lines in Connecticut

December 14, 2007

I. Introduction

To address a range of concerns regarding potential health risks from exposure to transmission line electric and magnetic fields (EMF), whether from electric transmission facilities or other sources, the Connecticut Siting Council (Council) (in accordance with Public Act 04-246) issues this policy document "*Best Management Practices for the Construction of Electric Transmission Lines in Connecticut*." It references the latest information regarding scientific knowledge and consensus on EMF health concerns; it also discusses advances in transmission-facility siting and design that can affect public exposure to EMF.

Electric and magnetic fields (EMF) are two forms of energy that surround an electrical device. The strength of an electric field (EF) is proportional to the amount of electric voltage at the source, and decreases rapidly with distance from the source, diminishing even faster when interrupted by conductive materials, such as buildings and vegetation. The level of a magnetic field (MF) is proportional to the amount of electric current (not voltage) at the source, and it, too, decreases rapidly with distance from the source; but magnetic fields are not easily interrupted, as they pass through most materials. EF is often measured in units of kilovolts per meter (kV/m). MF is often measured in units of milligauss (mG).

Transmission lines are common sources of EMF, as are other substantial components of electric power infrastructure, ranging from transformers at substations to the wiring in a home. However, any piece of machinery run by electricity can be a source of EMF: household objects as familiar as electric tools, hair dryers, televisions, computers, refrigerators, and electric ovens.

In the U.S., EMF associated with electric power have a frequency of 60 cycles per second (or 60 Hz). Estimated average background levels of 60-Hz MF in most homes, away from appliances and electrical panels, range from 0.5 to 5.0 mG (NIEHS, 2002). MF near operating appliances such as an oven, fan, hair dryer, television, etc. can range from 10's to 100's of mG. Many passenger trains, trolleys, and subways run on electricity, producing MF: for instance, MF in a Metro-North Railroad car averages about 40-60 mG, increasing to 90-145 mG with acceleration (Bennett Jr., W.

1994). As a point of comparison to these common examples, the Earth itself has an MF of about 570 mG (USGS 2007). Unlike the MF associated with power lines, appliances, or computers, the Earth's MF is steady; in every other respect, however, the Earth's MF has the same characteristics as MF emanating from man-made sources.

Concerns regarding the health effects of EMF arise in the context of electric transmission lines and distribution lines, which produce time-varying EMF, sometimes called extremely-low frequency electric and magnetic fields, or ELF-EMF. As the weight of scientific evidence indicates that exposure to electric fields, beyond levels traditionally established for safety, does not cause adverse health effects, and as safety concerns for electric fields are sufficiently addressed by adherence to the National Electrical Safety Code, as amended, health concerns regarding EMF focus on MF rather than EF.

MF levels in the vicinity of transmission lines are dependent on the flow of electric current through them and fluctuate throughout the day as electrical demand increases and decreases. They can range from about 5 to 150 mG, depending on current load, height of the conductors, separation of the conductors, and distance from the lines. The level of the MF produced by a transmission line decreases with increasing distance from the conductors, becoming indistinguishable from levels found inside or outside homes (exclusive of MF emanating from sources within the home) at a distance of 100 to 300 feet, depending on the design and current loading of the line (NIEHS, 2002).

In Connecticut, existing and proposed transmission lines are designed to carry electric power at voltages of 69, 115, or 345 kilovolts (kV). Distribution lines, i.e. those lines directly servicing the consumer's building, typically operate at voltages below 69 kV and may produce levels of MF similar to those of transmission lines. The purpose of this document is to address engineering practices for proposed electric transmission lines with a design capacity of 69 kV or more and MF health concerns related to these projects, but not other sources of MF.

II. Health Concerns from Power-Line MF

While more than 40 years of scientific research has addressed many questions about EMF, the continuing question of greatest interest to public health agencies is the possibility of an association between time weighted MF exposure and demonstrated health effects. The World Health Organization (WHO) published its latest findings on this question in an Electromagnetic Fields and Public Health fact sheet, June 2007. (http://www.who.int/mediacentre/factsheets/fs322/en/index.html) The fact sheet is based on a review by a WHO Task Group of scientific experts who assessed risks

associated with ELF-EMF. As part of this review, the group examined studies related to MF exposure and various health effects, including childhood cancers, cancers in adults, developmental disorders, and neurobehavioral effects, among others. Particular attention was paid to leukemia in children. The Task Group concluded "that scientific evidence supporting an association between ELF magnetic field exposure and all of these health effects is much weaker than for childhood leukemia". (WHO, 2007) For childhood leukemia, WHO concluded recent studies do not alter the existing position taken by the International Agency for Research on Cancer (IARC) in 2002, that ELF-MF is "possibly carcinogenic to humans."

Some epidemiology studies have reported an association between MF and childhood leukemia, while others have not. Two broad statistical analyses of these studies as a pool reported an association with estimated average exposures greater than 3 to 4 mG, but at this level of generalization it is difficult to determine whether the association is significant. In 2005, the National Cancer Institute (NCI) stated, "Among more recent studies, findings have been mixed. Some have found an association; others have not . . . . Currently, researchers conclude that there is limited evidence that magnetic fields from power lines cause childhood leukemia, and that there is inadequate evidence that these magnetic fields cause other cancers in children." The NCI stated further: "Animal studies have not found that magnetic field exposure is associated with increased risk of cancer. The absence of animal data supporting carcinogenicity makes it biologically less likely that magnetic field exposures in humans, at home or at work, are linked to increased cancer risk."

The American Medical Association characterizes the EMF health-effect literature as "inconsistent as to whether a risk exists." The National Institute of Environmental Health Sciences (NIEHS) concluded in 1999 that EMF exposure could not be recognized as "*entirely safe*" due to some statistical evidence of a link with childhood leukemia. Thus, although no public health agency has found that scientific research suggests a causal relationship between EMF and cancer, the NIEHS encourages "inexpensive and safe reductions in exposure" and suggests that the power industry continue its current practice of siting power lines to reduce exposures" rather than regulatory guidelines (NIEHS, 1999, pp. 37-38). In 2002 NIEHS restated that while this evidence was "weak" it was "still sufficient to warrant limited concern" and recommended "continued education on ways of reducing exposures" (NIEHS, 2002, p. 14).

Reviews by other study groups, including IARC (2002), the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) (2003), the British National Radiation Protection Board (NRPB) (2004a), and the Health Council of the Netherlands ELF Electromagnetic Fields

Committee (2005), are similar to NIEHS and NCI in their uncertainty about reported associations of MF with childhood leukemia. In 2004, the view of the NRPB was:

> "[T]he epidemiological evidence that time-weighted average exposure to power frequency magnetic fields above 0.4 microtesla [4 mG] is associated with a small absolute raised risk of leukemia in children is, at present, an observation for which there is no sound scientific explanation. There is no clear evidence of a carcinogenic effect of ELF EMFS in adults and no plausible biological explanation of the association can be obtained from experiments with animals or from cellular and molecular studies. Alternative explanations for this epidemiological association are possible…Thus: any judgments developed on the assumption that the association is causal would be subject to a very high level of uncertainty." (NRPB, 2004a, p. 15)

Although IARC classified MF as "possibly carcinogenic to humans" based upon pooling of the results from several epidemiologic studies, IARC further stated that the evidence suggesting an association between childhood leukemia and residential MF levels is "limited," with "inadequate" support for a relation to any other cancers. The WHO Task Group concluded "the evidence related to childhood leukemia is not strong enough to be considered causal" (WHO, 2007).

The Connecticut Department of Public Health (DPH) has produced an EMF Health Concerns Fact Sheet (May 2007) that incorporates the conclusions of national and international health panels. The fact sheet states that while "the current scientific evidence provides no definitive answers as to whether EMF exposure can increase health risks, there is enough uncertainty that some people may want to reduce their exposure to EMF."
[http://www.dph.state.ct.us/Publications/brs/eoha/emf_2004.pdf]

In the U.S., there are no state or federal exposure standards for 60-Hz MF based on demonstrated health effects. Nor are there any such standards world-wide. Among those international agencies that provide guidelines for acceptable MF exposure to the general public, the International Commission on Non-Ionizing Radiation Protection established a level of 833 mG, based on an extrapolation from experiments involving transient neural stimulation by MF at much higher exposures. Using a similar approach, the International Committee on Electromagnetic Safety calculated a guideline of 9,040 mG for exposure to workers and the general public (ICNIRP, 1998; ICES/IEEE, 2002). This situation reflects the lack of credible scientific evidence for a causal relationship between MF exposure and adverse health effects.

III. Policy of the Connecticut Siting Council

The Council recognizes that a causal link between power-line MF exposure and demonstrated health effects has not been established, even after much scientific investigation in the U.S. and abroad. Furthermore, the Council recognizes that timely additional research is unlikely to prove the safety of power-line MF to the satisfaction of all. Therefore, the Council will continue its cautious approach to transmission line siting that has guided its Best Management Practices since 1993. This continuing policy is based on the Council's recognition of and agreement with conclusions shared by a wide range of public health consensus groups, and also, in part, on a review which the Council commissioned as to the weight of scientific evidence regarding possible links between power-line MF and adverse health effects. Under this policy, the Council will continue to advocate the use of effective no-cost and low-cost technologies and management techniques on a project-specific basis to reduce MF exposure to the public while allowing for the development of efficient and cost-effective electrical transmission projects. This approach does not imply that MF exposure will be lowered to any specific threshold or exposure limit, nor does it imply MF mitigation will be achieved with no regard to cost.

The Council will develop its precautionary guidelines in conjunction with Section 16-50p(i) of the Connecticut General Statutes, enacted by the General Assembly to call special attention to their concern for children. The Act restricts the siting of overhead 345kV transmission lines in areas where children congregate, subject to technological feasibility. These restrictions cover transmission lines adjacent to "residential areas, public or private schools, licensed child day-care facilities, licensed youth camps, or public playgrounds."

Developing Policy Guidelines

One important way the Council seeks to update its Best Management Practices is to integrate policy with specific project development guidelines. In this effort, the Council has reviewed the actions of other states. Most states either have no specific guidelines or have established arbitrary MF levels at the edge of a right-of-way that are not based on any demonstrated health effects. California, however, established a no-cost/low-cost precautionary-based EMF policy in 1993 that was re-affirmed by the California Public Utilities Commission in 2006. California's policy aims to provide significant MF reductions at no cost or low cost, a precautionary approach consistent with the one Connecticut has itself taken since 1993, consistent with the conclusions of the major scientific reviews, and consistent with the policy recommendations of the Connecticut Department of Public Health and the WHO. Moreover, California specifies certain benchmarks integral to its

policy. The benchmark for “low-cost/no-cost” is an increase in aggregate project costs of zero to four percent. The benchmark for “significant MF reduction” is an MF reduction of at least 15 percent. With a policy similar to Connecticut’s, and concrete benchmarks as well, California offers the Council a useful model in developing policy guidelines.

No-Cost/Low-Cost MF Mitigation

The Council seeks to continue its precautionary policy, in place since 1993, while establishing a standard method to allocate funds for MF mitigation methods. The Council recognizes California’s cost allotment strategy as an effective method to achieve MF reduction goals; thus, the Council will follow a similar strategy for no-cost/low-cost MF mitigation.

The Council directs the Applicant to initially develop a Field Management Design Plan that depicts the proposed transmission line project designed according to standard good utility practice and incorporating “no-cost” MF mitigation design features. The Applicant shall then modify the base design by adding low-cost MF mitigation design features specifically where portions of the project are adjacent to residential areas, public or private schools, licensed child day-care facilities, licensed youth camps, or public playgrounds.

The overall cost of low-cost design features are to be calculated at four percent of the initial Field Management Design Plan, including related substations. Best estimates of the total project costs during the Council proceedings should be employed, and the amounts proposed to be incurred for MF mitigation should be excluded. It is important to note that the four percent guideline is not an absolute cap, because the Council does not want to eliminate prematurely a potential measure that might be available and effective but would cost more than the four percent, or exclude arbitrarily an area adjacent to the ROW that might be suitable for MF mitigation. Nor is the four percent an absolute threshold, since the Council wants to encourage the utilities to seek effective field reduction measures costing less than four percent. In general, the Council recognizes that projects can vary widely in the extent of their impacts on statutory facilities, necessitating some variance above and below the four percent figure.

The four percent guideline for low-cost mitigation should aim at a magnetic field reduction of 15 percent or more at the edge of the utility’s ROW. This 15 percent reduction should relate specifically to those portions of the project where the expenditures would be made. While experience with transmission projects in Connecticut since 1993 has shown that no-cost/low-cost designs can and do achieve reductions in MF on the order of 15 percent, the 15 percent guideline

is no more absolute than the four percent one, nor must the two guidelines be correlated by rote. The nature of guidelines is to be constructive, rather than absolute.

The Council will consider minor increases above the four percent guideline if justified by unique circumstances, but not as a matter of routine. Any cost increases above the four percent guideline should result in mitigation comparably above 15 percent, and the total costs should still remain relatively low.

Undergrounding transmission lines puts MF issues out of sight, but it should not necessarily put them out of mind. With that said, soils and other fill materials do not shield MF, rather, MF is reduced by the underground cable design (refer to page 9 for further information). However, special circumstances may warrant some additional cost in order to achieve further MF mitigation for underground lines. The utilities are encouraged, prior to submitting their application to the Council, to determine whether a project involves such special circumstances. Note that the extra costs of undergrounding done for purposes other than MF mitigation should be counted in the base project cost and not as part of the four percent mitigation spending.

Additionally, the Council notes two general policies it follows in updating its EMF Best Management Practices and conducting other matters within its jurisdiction. One is a policy to support and monitor ongoing study. Accordingly, the Council, during the public hearing process for new transmission line projects, will consider and review evidence of any new developments in scientific research addressing MF and public health effects or changes in scientific consensus group positions regarding MF. The second is a policy to encourage public participation and education. The Council will continue to conduct public hearings open to all, update its website to contain the latest information regarding MF health effect research, and revise these Best Management Practices to take account of new developments in MF health effect research or in methods for achieving no-cost/low-cost MF mitigation.

The Council will also require that notices of proposed overhead transmission lines provided in utility bill enclosures pursuant to Conn. Gen. Stats. §16-50*l*(b) state the proposed line will meet the Council's Electric and Magnetic Fields Best Management Practices, specifying the design elements planned to reduce magnetic fields. The bill enclosure notice will inform residents how to obtain siting and MF information specific to the proposed line at the Council's website; this information will also be available at each respective town hall. Phone numbers for follow-up information will be made available, including those of DPH, and utility representatives. The project's final post-

construction structure and conductor specifications including calculated MF levels shall also be available at the Council's website and each respective town hall.

Finally, we note that Congress has directed the Department of Energy (DOE) periodically to assess congestion along critical transmission paths or corridors and apply special designation to the most significant ones. Additionally, Congress has given the Federal Regulatory Commission supplemental siting authority in DOE designated areas. This means the Council must complete all matters in an expeditious and timely manner. Accordingly, the cooperation of all parties will be of particular importance in fulfilling the policies set forth above.

IV. MF Best Management Practices: Further Management Considerations

The Council's EMF Best Management Practices will apply to the construction of new electric transmission lines in the State, and to modifications of existing lines that require a certificate of environmental compatibility and public need. These practices are intended for use by public service utilities and the Council when considering the installation of such new or modified electric transmission lines. The practices are based on the established Council policy of reducing MF levels at the edge of a right-of-way (ROW), and in areas of particular interest, with no-cost/low-cost designs that do not compromise system reliability or worker safety, or environmental and aesthetic project goals.

Several practical engineering approaches are currently available for reducing MF, and more may be developed as technology advances. In proposing any particular methods of MF mitigation for a given project, the Applicant shall provide a detailed rationale to the Council that supports the proposed MF mitigation measures. The Council has the option to retain a consultant to confirm that the Field Management Design Plan and the proposed MF reduction strategies are consistent with these EMF Best Management Practices.

A. MF Calculations

When preparing a transmission line project, an applicant shall provide design alternatives and calculations of MF for pre-project and post-project conditions, under 1) peak load conditions at the time of the application filing, and 2) projected seasonal maximum 24-hour average current load on the line anticipated within five years after the line is placed into operation. This will allow for an evaluation of how MF levels differ between alternative power line configurations. The intent of requiring various design options is to achieve reduced MF levels when possible through practical

design changes. The selection of a specific design will also be affected by other practical factors, such as the cost, system reliability, aesthetics, and environmental quality.

MF values shall be calculated from the ROW centerline out to a distance of 300 feet on each side of the centerline, at intervals of 25 feet, including at the edge of the ROW. In accordance with industry practice, the calculation shall be done at the location of maximum line sag (typically mid-span), and shall provide MF values at 1 meter above ground level, with the assumption of flat terrain and balanced currents. The calculations shall assume "all lines in" and projected load growth five years beyond the time the lines are expected to be put into operation, and shall include changes to the electric system approved by the Council and the Independent System Operator – New England.

As part of this determination, the applicant shall provide the locations of, and anticipated MF levels encompassing, residential areas, private or public schools, licensed child day care facilities, licensed youth camps, or public playgrounds within 300 feet of the proposed transmission line. The Council, at its discretion, may order the field measurement of post-construction MF values in select areas, as appropriate.

B. Buffer Zones and Limits on MF

As enacted by the General Assembly in Section 4 of Public Act No. 04-246, a buffer zone in the context of transmission line siting is deemed, at minimum, to be the distance between the proposed transmission line and the edge of the utility ROW. Buffer zone distances may also be guided by the standards presented in the National Electrical Safety Code (NESC), published by the Institute of Electrical and Electronic Engineers (IEEE). These standards provide for the safe installation, operation, and maintenance of electrical utility lines, including clearance requirements from vegetation, buildings, and other natural and man-made objects that may arise in the ROW. The safety of power-line workers and the general public are considered in the NESC standards. None of these standards include MF limits.

Since 1985, in its reviews of proposed transmission-line facilities, the Massachusetts Energy Facilities Siting Board has used an edge-of-ROW level of 85 mG as a benchmark for comparing different design alternatives. Although a ROW-edge level in excess of this value is not prohibited, it may trigger a more extensive review of alternatives.

In assessing whether a right-of-way provides a sufficient “buffer zone,” the Council will emphasize compliance with its own Best Management Practices, but may also take into account approaches of other states, such as those of Florida, Massachusetts, and New York.

A number of states have general MF guidelines that are designed to maintain the ‘status quo’, i.e., that fields from new transmission lines not exceed those of existing transmission lines. In 1991, the New York Public Service Commission established an interim policy based on limits to MF. It required new high-voltage transmission lines to be designed so that the maximum magnetic fields at the edge of the ROW, one meter above ground, would not exceed 200 mG if the line were to operate at its highest continuous current rating. This 200 mG level represents the maximum calculated magnetic field level for 345 kV lines that were then in operation in New York State.

The Florida Environmental Regulation Commission established a maximum magnetic field limit for new transmission lines and substations in 1989. The MF limits established for the edge of 230-kV to 500-kV transmission line ROWs and the property boundaries for substations ranged from 150 mG to 250 mG, depending on the voltage of the new transmission line and whether an existing 500-kV line was already present.

Although scientific evidence to date does not warrant the establishment of MF exposure limits at the edge of a ROW, the Council will continue to monitor the ways in which states and other jurisdictions determine MF limits on new transmission lines.

C. Engineering Controls that Modify MF Levels

When considering an overhead electric transmission-line application, the Council will expect the applicant to examine the following Engineering Controls to limit MF in publicly accessible areas: distance, height, conductor separation, conductor configuration, optimum phasing, increased voltage, and underground installation. Any design change may also affect the line’s impedance, corona discharge, mechanical behavior, system performance, cost, noise levels and visual impact. The Council will consider all of these factors in relation to the MF levels achieved by any particular Engineering Control. Thus, utilities are encouraged to evaluate other possible Engineering Controls that might be applied to the entire line, or just specific segments, depending upon land use, to best minimize MF at a low or no cost.

Consistent with these Best Management Practices and absent line performance and visual impacts, the Council expects that applicants will propose no-cost/low-cost measures to reduce magnetic fields by one or more engineering controls including:

Distance

MF levels from transmission lines (or any electrical source) decrease with distance; thus, increased distance results in lower MF. Horizontal distances can be increased by purchasing wider ROWs, where available. Other distances can be increased in a variety of ways, as described below.

Height of Support Structures

Increasing the vertical distance between the conductors and the edge of the ROW will decrease MF: this can be done by increasing the height of the support structures. The main drawbacks of this approach are an increase in the cost of supporting structures, possible environmental effects from larger foundations, potential detrimental visual effects, and the modest MF reductions achieved (unless the ROW width is unusually narrow).

Conductor Separation

Decreasing the distances between individual phase conductors can reduce MF. Because at any instant in time the sum of the currents in the individual phase conductors is zero, or close to zero, moving the conductors closer together improves their partial cancellation of each other's MF. In other words, the net MF produced by the closer conductors reduces the MF level associated with the line. Placing the conductors closer together has practical limits, however. The distance between the conductors must be sufficient to maintain adequate electric code clearance at all times, and to assure utility employees' safety when working on energized lines. One drawback of a close conductor installation is the need for more support structures per mile (to reduce conductor sway in the wind and sag at mid-span); in turn, costs increase, and so do visual impacts.

Conductor Configuration

The arrangement of conductors influences MF. Conductors arranged in a flat, horizontal pattern at standard clearances generally have greater MF levels than conductors arranged vertically. This is due to the wider spacing between conductors found typically on H-frame structure designs, and to the closer distance between all three conductors and the ground. For single-circuit lines, a

compact triangular configuration, called a “delta configuration”, generally offers the lowest MF levels. A vertical configuration may cost more and may have increased visual impact. Where the design goal is to minimize MF levels at a specific location within or beyond the ROW, conductor configurations other than vertical or delta may produce equivalent or lower fields.

Optimum Phasing

Optimum phasing applies in situations where more than one circuit exists in an overhead ROW or in a duct bank installed underground. Electric transmission circuits utilize a three-phase system with each phase carried by one conductor, or a bundle of conductors. Optimum phasing reduces MF through partial cancellation. For a ROW with more than two circuits, the phasing arrangement of the conductors of each circuit can generally be optimized to reduce MF levels under typical conditions. The amount of MF cancellation will also vary depending upon the relative loading of each circuit. For transmission lines on the same ROW, optimizing the phasing of the new line with respect to that of existing lines is usually a low-cost method of reducing MF.

MF levels can be reduced for a single circuit line by constructing it as a “split-phase” line with twice as many conductors, and arranging the conductors for optimum cancellation. Disadvantages of the split-phase design include higher cost and increased visual impact.

Increased Voltage

MF are proportional to current, so, for example, replacing a 69-kV line with a 138-kV line, which delivers the same power at half the current, will result in lower MF. This could be an expensive mitigation to address MF alone because it would require the replacement of transformers and substation equipment.

Underground Installation

Burying transmission lines in the earth does not, by itself, provide a shield against MF, since magnetic fields, unlike electric fields, can pass through soil. Instead, certain inherent features of an underground design can reduce MF. The closer proximity of the currents in the wires provides some cancellation of MF, but does not eliminate it entirely. Underground transmission lines are typically three to five feet below ground, a near distance to anyone passing above them, and MF can be quite high directly over the line. MF on either side of an underground line, however, decreases more rapidly with increased distance than the MF from an overhead line.

The greatest reduction in MF can be achieved by "pipe-type" cable installation. This type of cable has all of the wires installed inside a steel pipe, with a pressurized dielectric fluid inside for electrical insulation and cooling. Low MF is achieved through close proximity of the wires, as described above, and through partial shielding provided by the surrounding steel pipe. While this method to reduce MF is effective, system reliability and the environment can be put at risk if the cable is breached and fluid is released.

Lengthy high-voltage underground transmission lines can be problematic due to the operational limits posed by the inherent design. They also can have significantly greater environmental impacts, although visual impacts associated with overhead lines are eliminated. The Council recognizes the operational and reliability concerns associated with current underground technologies and further understands that engineering research regarding the efficiency of operating underground transmission lines is ongoing. Thus, in any new application, the Council may require updates on the feasibility and reliability of the latest technological developments in underground transmission line design.

V. References

American Medical Association (AMA). 2003. "Effects of Electric and Magnetic Fields." http://www.ama-assn.org/ama/pub/category/13682.html

Australian Radiation Protection and Nuclear Safety Agency (ARPNSA). 2003. The Controversy Over Electromagnetic Fields and Possible Adverse Health Effects: Fact Sheet. http://www.arpansa.gov.au/is_emf.htm

Bennett, Jr., W., Health and Low Frequency Electromagnetic Fields, Yale University Press, 1994.

British National Radiation Protection Board (NRPB) (now Health Protection Agency or HPA). 2004a. Advice on Limiting Exposure to Electromagnetic Fields (0-300 GHz). Documents of the NRPB. 15(2) http://www.hpa.org.uk/radiation/publications/documents_of_nrpb/abstracts/absd15-2.htm

British National Radiation Protection Board (NRPB) (now Health Protection Agency or HPA). 2004b. Review of the Scientific Evidence for Limiting Exposure to (0 to 300 GHz) Electromagnetic

Fields. Documents of the NRPB. 15(3)
http://www.hpa.org.uk/radiation/publications/documents_of_nrpb/abstracts/absd15-3.htm

California Public Utilities Commission. Order Instituting Investigation on the Commission's Own Motion to Develop Policies and Procedures for Addressing the Potential Health Effects of Electric and Magnetic Fields of Utility Facilities. Decision No.
93-11-013, Investigation No. 91-01-012 (Filed January 15, 1991). November 2, 1993. San Francisco, CA.

California Public Utilities Commission. Order Instituting Rulemaking to update the Commission's policies and procedures related to electromagnetic fields emanating from regulated utility facilities. Decision 06-01-042 (Filed August 19, 2004). January 26, 2006. San Francisco, CA.
http://www.cpuc.ca.gov/PUBLISHED/FINAL_DECISION/53181.htm.

California Public Utilities Commission. EMF Design Guidelines for Electrical Facilities. July 21, 2006.
http://www.cpuc.ca.gov/static/energy/environment/electromagnetic+fields/california+guidelines+for+el

Commonwealth Associates, Inc. and IIT Research Institute, Electric and Magnetic Fields (EMF) RAPID Program Engineering Project 8: FINAL REPORT, Evaluation of Field Reduction Technologies, Volume 1 (Report) and Volume 2 (Appendices), 1997.

Connecticut Department of Public Health (DPH). 2004. EMF Health Concerns Fact Sheet.
http://www.dph.state.ct.us/Publications/brs/eoha/emf_2004.pdf

Health Council of the Netherlands: ELF Electromagnetic Fields Committee. Electromagnetic fields: Annual Update 2001, 2003, 2004, 2005. http://www.gr.nl/pdf.php?ID=1281&p=1

Institute of Electrical and Electronics Engineers (IEEE). 2002. “C95.6-2002 IEEE Standard for Safety Levels with Respect to Human Exposure to Electromagnetic Fields, 0-3 kHz”, Prepared by Subcommittee 3, Safety Levels with Respect to Human Exposure ISBN 0-7381-3389-2, 2002.

Institute of Electrical and Electronics Engineers (IEEE). 2002. “C2-2002 National Electric Safety Code”, American National Standards Institute, 2002.

International Committee on Electromagnetic Safety (ICES) / International Agency for Research on Cancer (IARC). 2002. Static and Extremely Low-Frequency Electric and Magnetic Fields: http://www-cie.iarc.fr/htdocs/monographs/vol80/80.html

International Commission on Non-Ionizing Radiation Protection (ICNIRP). 1998. "Guidelines for Limiting Exposure to Time-Varying Electric, Magnetic, and Electromagnetic Fields (Up to 300 GHz). http://www.icnirp.org/documents/emfgdl.pdf

Johnson, G.B., Power Research Engineering, Field Management Technologies, EMF Engineering Symposium, 1998.

Minnesota State Interagency Working Group on EMF Issues, A White Paper of Electric and Magnetic Field (EMF) Policy and Mitigation Options, 2002.

National Cancer Institute. Magnetic Field Exposures and Cancer: Questions and Answers. April 21, 2005. http://www.cancer.gov/cancertopics/factsheet/Risk/magnetic-fields

National Institute of Environmental Health Sciences. 2002. EMF Questions and Answers. EMF RAPID Program. http://www.niehs.nih.gov/emfrapid/booklet/home.htm

National Institute of Environmental Health Sciences, Report on Health Effects from Exposure to Power-Line Frequency Electric and Magnetic Fields, 1999.
http://www.niehs.nih.gov/emfrapid/html/EMF_DIR_RPT/NIEHS_Report.pdf

National Research Council. 1999. Research on Power Frequency Fields Completed Under the Energy Policy Act of 1992. http://www.nap.edu/catalog/9587.html

Public Service Commission of Wisconsin. 2001. EMF – Electric and Magnetic Fields Brochure. http://psc.wi.gov/consumerinfo/brochures/electric/6002b.pdf

United States Geological Survey (2007). http://geomag.usgs.gov/intro.php

World Health Organization (2007) Fact Sheet N322, Electromagnetic Fields and Public Health, Exposure to extremely low frequency fields.
http://www.who.int/mediacentre/factsheets/fs322/en/index.html

CHAPTER 277a*
PUBLIC UTILITY ENVIRONMENTAL STANDARDS ACT

*Applicability of chapter discussed. 165 C. 687. Cited. 177 C. 623, 624; 180 C. 474, 477. Public utility environmental standards act, Sec. 16-50g et seq. cited. 212 C. 157; 215 C. 474. Cited. 220 C. 516.

Public utility environmental standards act, Sec. 16-50g et seq. cited. 20 CA 474. Cited. 37 CA 653, 662; judgment reversed, see 238 C. 361.

Attempted taking of easement for future facility where procedure prescribed by chapter was not followed was an abuse of plaintiff's powers of eminent domain. 35 CS 303.

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Sec. 16-50o. Record of hearing. Rights of parties. Administrative notice re electromagnetic fields. (a) A record shall be made of the hearing and of all testimony taken and the cross-examinations thereon. Every party or group of parties as provided in section 16-50n shall have the right to present such oral or documentary evidence and to conduct such cross-examination as may be required for a full and true disclosure of the facts.

(b) For an application on a facility described in subdivision (1) of subsection (a) of section 16-50i, the council shall administratively notice completed and ongoing scientific and medical research on electromagnetic fields.

(c) The applicant shall submit into the record the full text of the terms of any agreement, and a statement of any consideration therefor, if not contained in such agreement, entered into by the applicant and any party to the certification proceeding, or any third party, in connection with the construction or operation of the facility. This provision shall not require the public disclosure of proprietary information or trade secrets.

(d) The results of the evaluation process pursuant to subsection (f) of section 16a-7c shall be part of the record, where applicable.

(e) A copy of the record shall be available at all reasonable times for examination by the public without cost at the principal office of the council. A copy of the transcript of testimony at the hearing shall be filed at an appropriate public office, as determined by the council, in each county in which the facility or any part thereof is proposed to be located.

(1971, P.A. 575, S. 9; P.A. 75-375, S. 6, 12; P.A. 03-140, S. 9; P.A. 04-246, S. 8, 9.)

History: P.A. 75-375 included grouped parties in Subsec. (a) and required transcript copy to be filed at designated public office in county rather than municipality where facility to be located; P.A. 03-140 added new Subsec. (b) re submitting into the record terms of agreements, added Subsec. (c) re results of the evaluation process and redesignated existing Subsec. (b) as Subsec. (d), effective October 1, 2004; P.A. 04-246 added new Subsec. (b) re administrative notice of research on electromagnetic fields and redesignated existing Subsecs., effective June 3, 2004, and applicable to applications for a certificate of environmental compatibility and public need that was originally filed on or after October 1, 2003, for which the Connecticut Siting Council has not rendered a decision upon the record prior to June 3, 2004.

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Sec. 16-50p. Certification proceeding decisions: Timing, opinion, factors considered. Telecommunications and community antenna television facilities: Additional factors considered, conditions. Modification of location. Amendment proceeding decisions. Service and notice. "Public need" defined. Civil action by Attorney General. (a)(1) In a certification proceeding, the council shall render a decision upon the record either granting or denying the application as filed, or granting it upon such terms, conditions, limitations or modifications of the construction or operation of the facility as the council may deem appropriate.

(2) The council's decision shall be rendered in accordance with the following:

(A) Not later than twelve months after the deadline for filing an application following the request for proposal process for a facility described in subdivision (1) or (2) of subsection (a) of section 16-50i or subdivision (4) of said subsection (a) if the application was incorporated in an application concerning a facility described in subdivision (1) of said subsection (a);

(B) Not later than one hundred eighty days after the deadline for filing an application following the request for proposal process for a facility described in subdivision (4) of subsection (a) of section 16-50i and an application

concerning a facility described in subdivision (3) of said subsection (a), provided the council may extend such period by not more than one hundred eighty days with the consent of the applicant; and

(C) Not later than one hundred eighty days after the filing of an application for a facility described in subdivision (5) or (6) of subsection (a) of section 16-50i, provided the council may extend such period by not more than one hundred eighty days with the consent of the applicant.

(3) The council shall file, with its order, an opinion stating in full its reasons for the decision. The council shall not grant a certificate, either as proposed or as modified by the council, unless it shall find and determine:

(A) Except as provided in subsection (c) of this section, a public need for the facility and the basis of the need;

(B) The nature of the probable environmental impact of the facility alone and cumulatively with other existing facilities, including a specification of every significant adverse effect, including, but not limited to, electromagnetic fields that, whether alone or cumulatively with other effects, impact on, and conflict with the policies of the state concerning the natural environment, ecological balance, public health and safety, scenic, historic and recreational values, forests and parks, air and water purity and fish, aquaculture and wildlife;

(C) Why the adverse effects or conflicts referred to in subparagraph (B) of this subdivision are not sufficient reason to deny the application;

(D) In the case of an electric transmission line, (i) what part, if any, of the facility shall be located overhead, (ii) that the facility conforms to a long-range plan for expansion of the electric power grid of the electric systems serving the state and interconnected utility systems and will serve the interests of electric system economy and reliability, and (iii) that the overhead portions, if any, of the facility are cost effective and the most appropriate alternative based on a life-cycle cost analysis of the facility and underground alternatives to such facility, are consistent with the purposes of this chapter, with such regulations or standards as the council may adopt pursuant to section 16-50t, including, but not limited to, the council's best management practices for electric and magnetic fields for electric transmission lines and with the Federal Power Commission "Guidelines for the Protection of Natural Historic Scenic and Recreational Values in the Design and Location of Rights-of-Way and Transmission Facilities" or any successor guidelines and any other applicable federal guidelines and are to be contained within an area that provides a buffer zone that protects the public health and safety, as determined by the council. In establishing such buffer zone, the council shall consider, among other things, residential areas, private or public schools, licensed child day care facilities, licensed youth camps or public playgrounds adjacent to the proposed route of the overhead portions and the level of the voltage of the overhead portions and any existing overhead transmission lines on the proposed route. At a minimum, the existing right-of-way shall serve as the buffer zone;

(E) In the case of an electric or fuel transmission line, that the location of the line will not pose an undue hazard to persons or property along the area traversed by the line;

(F) In the case of an application that was heard under a consolidated hearing process with other applications that were common to a request for proposal, that the facility proposed in the subject application represents the most appropriate alternative among such applications based on the findings and determinations pursuant to this subsection;

(G) In the case of a facility described in subdivision (6) of subsection (a) of section 16-50i that is (i) proposed to be installed on land under agricultural restriction, as provided in section 22-26cc, that the facility will not result in a material decrease of acreage and productivity of the arable land, or (ii) proposed to be installed on land near a building containing a school, as defined in section 10-154a, or a commercial child day care center, as described in subdivision (1) of subsection (a) of section 19a-77, that the facility will not be less than two hundred fifty feet from such school or commercial child day care center unless the location is acceptable to the chief elected official of the municipality or the council finds that the facility will not have a substantial adverse effect on the aesthetics or scenic

quality of the neighborhood in which such school or commercial child day care center is located, provided the council shall not render any decision pursuant to this subparagraph that is inconsistent with federal law or regulations; and

(H) That, for a facility described in subdivision (5) or (6) of subsection (a) of section 16-50i, the council has considered the manufacturer's recommended safety standards for any equipment, machinery or technology for the facility.

(b) (1) Prior to granting an applicant's certificate for a facility described in subdivision (5) or (6) of subsection (a) of section 16-50i, the council shall examine, in addition to its consideration of subdivisions (1) to (3), inclusive, of subsection (a) of this section: (A) The feasibility of requiring an applicant to share an existing facility, as defined in subsection (b) of section 16-50aa, within a technically derived search area of the site of the proposed facility, provided such shared use is technically, legally, environmentally and economically feasible and meets public safety concerns, (B) whether such facility, if constructed, may be shared with any public or private entity that provides telecommunications or community antenna television service to the public, provided such shared use is technically, legally, environmentally and economically feasible at fair market rates, meets public safety concerns, and the parties' interests have been considered, (C) whether the proposed facility would be located in an area of the state which the council, in consultation with the Department of Energy and Environmental Protection and any affected municipalities, finds to be a relatively undisturbed area that possesses scenic quality of local, regional or state-wide significance, and (D) the latest facility design options intended to minimize aesthetic and environmental impacts. The council may deny an application for a certificate if it determines that (i) shared use under the provisions of subparagraph (A) of this subdivision is feasible, (ii) the applicant would not cooperate relative to the future shared use of the proposed facility, or (iii) the proposed facility would substantially affect the scenic quality of its location or surrounding neighborhood and no public safety concerns require that the proposed facility be constructed in such a location.

(2) When issuing a certificate for a facility described in subdivision (5) or (6) of subsection (a) of section 16-50i, the council may impose such reasonable conditions as it deems necessary to promote immediate and future shared use of such facilities and avoid the unnecessary proliferation of such facilities in the state. The council shall, prior to issuing a certificate, provide notice of the proposed facility to the municipality in which the facility is to be located. Upon motion of the council, written request by a public or private entity that provides telecommunications or community antenna television service to the public or upon written request by an interested party, the council may conduct a preliminary investigation to determine whether the holder of a certificate for such a facility is in compliance with the certificate. Following its investigation, the council may initiate a certificate review proceeding, which shall include a hearing, to determine whether the holder of a certificate for such a facility is in compliance with the certificate. In such proceeding, the council shall render a decision and may issue orders it deems necessary to compel compliance with the certificate, which may include, but not be limited to, revocation of the certificate. Such orders may be enforced in accordance with the provisions of section 16-50u.

(c) (1) The council shall not grant a certificate for a facility described in subdivision (3) of subsection (a) of section 16-50i, either as proposed or as modified by the council, unless it finds and determines a public benefit for the facility and considers neighborhood concerns with respect to the factors set forth in subdivision (3) of subsection (a) of this section, including public safety.

(2) The council shall not grant a certificate for a facility described in subdivision (1) of subsection (a) of section 16-50i, that is substantially underground or underwater except where such facility interconnects with existing overhead facilities, either as proposed or as modified by the council, unless it finds and determines a public benefit for a facility substantially underground or a public need for a facility substantially underwater.

(3) For purposes of this section, a public benefit exists when a facility is necessary for the reliability of the electric power supply of the state or for the development of a competitive market for electricity and a public need exists when a facility is necessary for the reliability of the electric power supply of the state.

(4) Any application for an electric transmission line with a capacity of three hundred forty-five kilovolts or more that is filed on or after May 1, 2003, and proposes the underground burial of such line in all residential areas and overhead installation of such line in industrial and open space areas shall have a rebuttable presumption of meeting a public benefit for such facility if the facility is substantially underground and meeting a public need for such facility if the facility is substantially above ground. Such presumption may be overcome by evidence submitted by a party or intervenor to the satisfaction of the council.

(d) If the council determines that the location of all or a part of the proposed facility should be modified, it may condition the certificate upon such modification, provided the municipalities affected by the modification and the residents of such municipalities shall have had notice of the application pursuant to subsection (b) of section 16-50*l*.

(e) In an amendment proceeding, the council shall render a decision not later than ninety days after the filing of the application or adoption of the resolution initiating the proceeding. The council shall file an opinion with its order stating its reasons for the decision. The council's decision shall include the findings and determinations enumerated in subsection (a) of this section which are relevant to the proposed amendment.

(f) The council shall serve a copy of the order and opinion issued therewith upon each party and publish a notice of the issuance of the order and opinion in such newspapers as will serve substantially to inform the public of the issuance of such order and opinion. The name and address of each party shall be set forth in the order.

(g) In deciding whether to issue a certificate, the council shall in no way be limited by the applicant already having acquired land or an interest therein for the purpose of constructing the facility that is the subject of its application.

(h) For purposes of this section, a public need exists for an energy facility if such facility is necessary for the reliability of the electric power supply of the state.

(i) For a facility described in subdivision (1) of subsection (a) of section 16-50i, with a capacity of not less than three hundred forty-five kilovolts, the presumption shall be that a proposal to place the overhead portions, if any, of such facility adjacent to residential areas, private or public schools, licensed child day care facilities, licensed youth camps or public playgrounds is inconsistent with the purposes of this chapter. An applicant may rebut this presumption by demonstrating to the council that burying the facility will be technologically infeasible. In determining such infeasibility, the council shall consider the effect of burying the facility on the reliability of the electric transmission system of the state and whether the cost of any contemplated technology or design configuration may result in an unreasonable economic burden on the ratepayers of the state.

(j) Upon a motion of a party or intervenor or a council determination that any party or intervenor relating to a facility described in subdivision (5) or (6) of subsection (a) of section 16-50i has intentionally omitted or misrepresented a material fact in the course of a council proceeding, the council may, by majority vote, request the Attorney General to bring a civil action against such party or intervenor. In any such action, the Attorney General may seek any legal or equitable relief the Superior Court deems appropriate, including, but not limited to, injunctive relief or a civil penalty of not more than ten thousand dollars and reasonable attorney fees and related costs.

(1971, P.A. 575, S. 10; P.A. 73-340, S. 1, 2; 73-458, S. 8; P.A. 75-375, S. 7, 12; P.A. 76-320, S. 1, 2; 76-359, S. 3, 7; P.A. 77-218, S. 4; P.A. 79-537, S. 4; P.A. 80-483, S. 66, 186; P.A. 83-569, S. 5, 17; P.A. 88-121, S. 1, 3; P.A. 93-268, S. 1; P.A. 94-176, S. 3; P.A. 98-28, S. 50, 117; P.A. 01-120, S. 2, 3; P.A. 03-140, S. 10–13; 03-221, S. 6; 03-248, S. 1; 03-263, S. 6; 03-278, S. 120; P.A. 04-236, S. 6, 7; 04-246, S. 3–7; P.A. 05-288, S. 219; June Sp. Sess. P.A. 07-4, S. 116; P.A. 11-80, S. 1; P.A. 12-165, S. 1.)

History: P.A. 73-340 added Subsec. (d) re irrelevance of applicant's prior acquisition of land; P.A. 73-458 amended Subsec. (a) to clarify Subdiv. (2) by specifying "significant" adverse effects "whether alone or cumulatively ...", to add "that will provide, in accordance with the need for adequate and reliable electric service" in

Subdiv. (4)(B) and to delete Subdiv. (6) re conformity of facility location to state and local laws; P.A. 75-375 amended Subsec. (a) to require decision within 10 months rather than one year, to delete reference in Subdiv. (4)(B) to elimination of overhead lines in accordance with need for adequate and reliable service and to require consistency with purposes of Ch. 277a and adopted regulations as well as with federal guidelines under Subdiv. (4)(C); P.A. 76-320 made technical change in Subsec. (b) and amended Subsec. (c) to require publication of notice of issuance of order and opinion rather than publication of copy of order and opinion; P.A. 76-359 rephrased Subsec. (d); P.A. 77-218 made 10-month deadline applicable to applications for facilities in Subdivs. (1) to (4), inclusive, of Sec. 16-50i(a), imposed 120-day deadline for those in Subdivs. (5) and (6) and made provision for extensions under Subsec. (a); P.A. 79-537 made clear that provisions apply to certification proceedings, inserted new Subsec. (c) re amendment proceedings and redesignated former Subsecs. (c) and (d) accordingly; P.A. 80-483 made technical changes; P.A. 83-569 amended Subsec. (a) to establish a time limit for council decisions affecting substations and switchyards; P.A. 88-121 amended Subsec. (a) increasing the council's time to render decisions on applications; P.A. 93-268 inserted new Subsec. (b) regarding factors considered in granting and conditions of a certificate for a facility described in Sec. 16-50i(a)(5) or (6), and relettered former Subsecs. (b) to (e) as (c) to (f); P.A. 94-176 amended Subsec. (a)(4)(C) by adding provision re life-cycle cost analysis of the facility and underground alternatives; P.A. 98-28 made technical changes in Subsec. (a), added new Subsec. (c) re siting of electric generating and storage facilities and electric transmission lines which are substantially underground or underwater, and redesignated former Subsecs. (c) to (f) as Subsecs. (d) to (g), effective July 1, 1998; P.A. 01-120 amended Subsec. (a) by adding aquaculture to items in Subdiv. (2) that council must determine the probable environmental impact upon for any facility and adding provisions making the terms of any agreement between the applicant and any party to the proceeding or third party part of the record of the proceeding, effective July 1, 2001; P.A. 03-140 amended Subsec. (a) to add provisions re feasible and prudent alternatives, effective July 1, 2003, and applicable to applications for a certificate of environmental compatibility and public need filed after that date, and further amended said Subsec. to add subdiv. designators, to add "not later than" and "after the deadline for filing an application following the request-for-proposal process for" in Subdivs. (2)(A) and (2)(B), to delete reference to community antenna television and telecommunication towers in Subdiv. (2)(B), to add Subdiv. (2)(C) re deadline for issuing a decision on an application for community antenna television and telecommunication towers, to delete provisions re feasible and prudent alternatives, to add Subdiv. (3)(F) re applications heard under a consolidated hearing process, to delete provisions re terms of agreements as part of the record of the proceedings, and to make conforming changes, effective October 1, 2004, and amended Subsec. (c) to add provisions re public need for a facility that is substantially underwater in Subdiv. (2)(A), to add provisions re feasible and prudent alternatives, and to make technical changes, effective July 1, 2003, and applicable to applications for a certificate of environmental compatibility and public need filed after that date, and further amended said subsec. to add Subdiv. (1)(D) re applications heard under a consolidated hearing process, to delete provisions re feasible and prudent alternatives, and to add Subdiv. (2)(F) re applications heard under a consolidated hearing process, effective October 1, 2004; P.A. 03-221 added Subsec. (a)(6) re telecommunication towers proposed on land under agricultural restriction; P.A. 03-248 added Subsec. (c)(3) re rebuttable resumption for an application for certain electric transmission lines, effective July 9, 2003; P.A. 03-263 added new Subsec. (h) re definition of public need for an energy facility, effective July 9, 2003; P.A. 03-278 amended Subsec. (a) by adding Subdiv. (6) re facility proposed to be installed on land under agricultural restriction; P.A. 04-236 made a technical change in former version of Subsecs. (a)(4)(C) and (c)(2)(B), effective June 8, 2004; P.A. 04-246 amended Subsec. (a) to make technical changes, to add "including, but not limited to, electromagnetic fields that," to include references to standards and best management practices for electric and magnetic fields for electric transmission lines, and to add buffer zone requirement, amended Subsec. (c) to make technical changes and to eliminate provisions re rebuttable presumption for certain electric transmission line applications, and added Subsec. (i) re presumption re proposal for an overhead electric transmission facility with a capacity of three hundred forty-five kilovolts or greater, effective June 3, 2004, and applicable to applications for a certificate of environmental compatibility and public need that was originally filed on or after October 1, 2003, for which the Connecticut Siting Council has not rendered a decision upon the record prior to June 3, 2004 (Revisor's note: In 2005, the Revisors editorially redesignated Subsec. (c)(3) as Subsec. (c)(4) to conform with technical changes made by P.A. 04-246); P.A. 05-288 made technical changes in Subsec. (a)(3)(A) and (D), effective July 13, 2005; June Sp. Sess. P.A. 07-4 amended Subsec. (i) to add to factors for determining infeasibility whether cost of

any contemplated technology or design configuration may result in unreasonable economic burden for ratepayers, effective July 1, 2007; pursuant to P.A. 11-80, "Department of Environmental Protection" was changed editorially by the Revisors to "Department of Energy and Environmental Protection" in Subsec. (b)(1), effective July 1, 2011; P.A. 12-165 amended Subsec. (a)(3) to add provisions re certification decisions for proposed facilities located not less than 250 feet from a school or commercial child day care center in Subpara. (C) and add Subpara. (H) re consideration of manufacturer's recommended safety standards for equipment, machinery or technology, amended Subsec. (b)(1) to add Subpara. (D) re examination of the latest facility design options intended to minimize aesthetic and environmental impacts and add provision re surrounding neighborhood, amended Subsec. (c)(1) to add provision re consideration of neighborhood concerns for proposed facilities, added Subsec. (j) re civil action brought by Attorney General, and made technical changes, effective July 1, 2012.

See Sec. 16a-7c re the request-for-proposal process.

Cited. 177 C. 623; 212 C. 157; 215 C. 474. In determining environmental impact, council's jurisdiction is limited to nonnuclear environmental effects. 286 C. 57.

Cited. 20 CA 474.

Subsec. (g):

The phrase "in no way be limited" implies that legislature did not want council to be bound by applicant's alleged acquisition of an interest in land, but council was not prohibited from considering such an interest in determining whether certificate should be issued; the language is an enlargement of council's discretion, not a limitation, permitting but not obligating council to consider likelihood of applicant securing the proposed site. 50 CS 443.

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Sec. 16-50q. Judicial review. Any party may obtain judicial review of an order issued on an application for a certificate or an amendment of a certificate in accordance with the provisions of section 4-183. Any judicial review sought pursuant to this chapter shall be privileged in respect to assignment for trial in the Superior Court.

(1971, P.A. 575, S. 11; 1972, P.A. 108, S. 3; P.A. 73-458, S. 9; P.A. 76-436, S. 360, 681; P.A. 77-603, S. 14, 125.)

History: 1972 act replaced superior court with court of common pleas, effective September 1, 1972, exceptthat courts with cases pending retain jurisdiction; P.A. 73-458 deleted provisions re rehearing on applications as intermediate step to judicial review and deleted provision re finding of facts de novo; P.A. 76-436 replaced court of common pleas with superior court and added reference to judicial districts, effective July 1, 1978; P.A. 77-603 replaced previous provision detailing procedure for judicial review with statement that review to be obtained in accordance with Sec. 4-183.

Since appellate review for both issuance of original certificates and for amendments thereto is provided for, it is not intended that application for amendment opens, for all purposes including appellate review, the previously issued granting of certification. 177 C. 623. Cited. 212 C. 157; 220 C. 516.

Cited. 37 CA 653; judgment reversed, see 238 C. 361. Section does not confer automatic statutory aggrievement on parties to appeal adverse decision of siting council. 133 CA 851.

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Iowa Code Chapter 478 - Electric transmission lines

Iowa Code > *Title XI* > *Subtitle 5* > ***Chapter 478 - Electric transmission lines***

Current as of: 2009

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Iowa Code 478.20 - Distance from buildings

Iowa Code > *Title XI* > *Subtitle 5* > *Chapter 478* > ***§ 478.20. Distance from buildings***

Current as of: 2009

Check for updates

No transmission line shall be constructed, except by agreement, within one hundred feet of any dwelling house or other building, except where said line crosses or passes along a public highway or is located alongside or parallel with the right-of-way of any railway company. In addition to the foregoing, each person, company, or corporation shall conform to any other rules, regulations, or specifications established by the utilities board, in the construction, operation, or maintenance of such lines.

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Iowa Laws: Electricity

- Iowa Code Chapter 390 - Joint electrical utilities
- Iowa Code Chapter 469A - Hydroelectric plants
- Iowa Code Chapter 476A - Electric power generation and transmission
- Iowa Code Chapter 478 - Electric transmission lines

U.S. Code Provisions: Electricity

- U.S. Code Title 7 > Chapter 31 > Subchapter I - Rural Electrification
- U.S. Code > Title 16 > Chapter 12 - Federal Regulation And Development Of Power
- U.S. Code > Title 16 > Chapter 12A - Tennessee Valley Authority
- U.S. Code > Title 16 > Chapter 12E - Niagara Power Project
- U.S. Code > Title 16 > Chapter 12G - Pacific Northwest Federal Transmission System
- U.S. Code > Title 16 > Chapter 12H - Pacific Northwest Electric Power Planning And Conservation
- U.S. Code > Title 16 > Chapter 47 - Small Hydroelectric Power Projects
- U.S. Code Title 42 > Chapter 149 > Subchapter XII - Electricity

Federal Regulations: Electricity

- U.S. Code Title 7 > Chapter 31 > Subchapter I - Rural Electrification
- U.S. Code > Title 16 > Chapter 12 - Federal Regulation And Development Of Power
- U.S. Code > Title 16 > Chapter 12A - Tennessee Valley Authority
- U.S. Code > Title 16 > Chapter 12E - Niagara Power Project

Chapter 8.52 ELECTRICAL TRANSMISSION AND DISTRIBUTION FACILITIES

Sections:

8.52.010 Findings.

The city council makes the following findings:

A. There is a need for adequate electric power facilities to serve existing uses and to supply anticipated growth.

B. Electrical facilities generate electric and magnetic fields.

C. While there is scientific evidence that suggests exposure to electric and/or magnetic fields may have adverse health effects, including increased risk of cancer and leukemia, the scientific community has not reached a definitive conclusion. Existing studies have not been able to categorically establish or eliminate any connection between electromagnetic fields and such health risk.

D. Overhead electric transmission lines may negatively impact real property values due to both undesirable aesthetic effects and to public concerns over health-related risk associated with electrical transmission lines.

E. The potential negative impact on property values and the exposure to electromagnetic fields may be eliminated or greatly reduced by utilization of prudent avoidance measures.

F. Spillage of electromagnetic fields from electrical transmission facilities on abutting property may constitute an involuntary imposition of risk on those who reside, work, attend school, or otherwise occupy or use such abutting property.

G. It has been determined that exposure to electrical fields should be a factor considered when developing land, and target levels to minimize exposure should, where reasonable, not exceed four milligauss for magnetic fields and 1.6 kilovolts per meter for electrical fields.

H. It is an appropriate exercise of the police power to adopt regulations designed to eliminate or minimize health and safety risk, to preserve property values, and to promote the general welfare by enhancing the livability of the community.

(Ord. 2030 § 1, 1995)

8.52.020 Definitions.

As used in this chapter:

"Electrical distribution line" means an electrical power line with a rated voltage of less than fifty-five kilovolts.

"Electrical transmission facility" means an electrical power line or power substation with a rated voltage of fifty-five kilovolts or greater.

"Electrical transmission line" means an electrical power line with a rated voltage of fifty-five kilovolts or greater.

"Facility boundaries" means the exterior boundaries of the property upon which an electrical transmission facility is located, and shall include but not be limited to easements, rights-of-way, and fee ownership.

"Gauss" means a unit used to measure magnetic induction or intensity which is equal to one line of magnetic force per square centimeter.

"Kilovolt" means one thousand volts (kV).

"Milligauss" means one thousandth of a gauss (mG).

"Prudent avoidance" means those practices and standards which serve to minimize exposure to electrical and magnetic fields, and include but are not limited to purchasing additional right-of-way, altering line configuration, selection of alternative routes, utilizing capacity in existing transmission facilities, underground, shielding, public education, research and testing, and discouraging siting near sensitive areas and structures.

"Sensitive use area" means those parks, developed recreational areas and other places designed for prolonged human presence.

"Sensitive use structures" means those structures in which regular, frequent and prolonged human presence would be expected, and shall include but not be limited to residential dwellings, schools, day care centers, hospitals and homes for the aged.

"Utility" means any entity proposing to install electrical transmission or distribution facilities.

"Volt" means a unit of electromotor force which will cause a current of one ampere to flow through a resistance of one ohm.

(Ord. 2030 § 2, 1995)

8.52.030 Applicability.

The provisions of this chapter shall apply to all electrical transmission facilities and electric distribution lines installed, constructed, or erected from and after July 24, 1995. This chapter shall not apply to any existing electrical transmission facilities and electrical distribution lines nor to the repair, upgrade, minor relocation and maintenance of any such existing facilities.

(Ord. 2030 § 3, 1995)

8.52.040 Electrical distribution lines.

All electrical distribution lines located within a residential area shall be installed underground, and shall utilize prudent avoidance measures to minimize exposure to electrical magnetic fields. Electrical distribution lines may be installed above-ground on collector and arterial level streets. Overhead installations shall utilize prudent avoidance measures to minimize exposure to electrical magnetic fields.

(Ord. 2030 § 4, 1995)

8.52.050 Electrical transmission facilities—Conditional use permit.

A. Permit Required. No person, firm, corporation, or other entity shall construct, install, erect or cause to be constructed, installed or erected any electrical transmission facility without first obtaining a conditional use permit from the city.

B. Application. An application for a conditional use permit under this chapter shall be on a form provided by the public works director, and shall include the name and address of the applicant, the nature of the proposed electrical transmission facility, the location of the proposed electrical transmission facility, the existing facility's boundary, the proposed method of construction, installation or erection of the electrical transmission facility, and such other information as may be required by the public works director.

C. Overhead Transmission Usage. All electrical transmission lines shall be installed underground in all zones except the manufacturing district and light industrial/country tech district, unless the city council finds that exposure to electrical magnetic fields and adverse impact to land value and aesthetics can be reasonably mitigated by prudent avoidance measures. Use of overhead power should consider, among other factors, facility size, location, setback, topography, scheduling, cost, sensitive lands, land value and proximity to children and schools.

D. SEPA. All applications shall be accompanied with a SEPA checklist and, to the extent required, any impact studies.

E. Fee. All applications shall be accompanied by a fee of four hundred dollars.

(Ord. 2030 § 5, 1995)

8.52.060 Provisions applicable to all electrical transmission facilities.

A. Prudent Avoidance Measures. All electrical transmission facilities shall be designed, constructed, and operated using prudent avoidance measures to minimize exposure to electromagnetic fields, to preserve land values, and to satisfy the other requirements of this chapter. Further, the applicants shall identify the four mG magnetic field line associated with the proposed installation. The mG contour line shall be identified as the line coinciding with normal winter loading which shall be further defined as being eighty percent of the line's rated peak capacity.

B. Noise Levels. Noise levels generated by electric transmission facilities shall comply with Washington State law as set forth in WAC 173-60.

(Ord. 2030 § 6, 1995)

8.52.070 Setbacks for child intensive locations.

Special consideration shall be given to facilities where children assemble. Such areas shall include but not be limited to schools, churches, day cares and playgrounds. Such areas shall be set back in accordance with the following:

A. One hundred feet from edge of easement for fifty to one hundred thirty-three kilovolt line;

B. One hundred fifty feet from edge of easement for two hundred twenty to two hundred thirty kilovolt line;

C. Three hundred fifty feet from edge of easement for five hundred to five hundred fifty kilovolt line.

(Ord. 2030 § 7, 1995)

8.52.080 Sensitive use structures.

Sensitive use structures should be setback from the facility to minimize exposure. All proposed subdivision shall identify the location of any electrical transmission facilities on or adjacent to the property being subdivided, and if applicable, shall identify on the plat map the setback from any such electrical transmission facility.

(Ord. 2030 § 8, 1995)

8.52.090 Sensitive use areas.

Electrical transmission facilities should not, where practical alternatives exist, be located within any sensitive use area.

(Ord. 2030 § 9, 1995)

8.52.100 Violation—Penalty.

Violations of this section shall be considered a nuisance and shall be enforced in accordance with Chapter 18.80 of this code.

(Ord. 2030 § 10, 1995)

CITY OF TORRINGTON
CONNECTICUT

ZONING REGULATIONS

Torrington
Planning & Zoning Commission
Revised to June 14, 2011

Effective date of Zoning Regulations: 12/24/57

Section 4.0 AREA AND SETBACK REQUIREMENTS

4.1 General Area and Setback Requirements

4.1.1 All measurements are minimums unless otherwise noted.

4.1.2 Area and setback regulations for multi-family developments are in Section 6.8.

4.1.3 Regulations governing distances from electric transmission lines are in Section 7.1.

4.1.4 Yards are to be unoccupied by structures except as follows**:** (Rev. 12/19/98)

A. Flag poles, fences, mail boxes, newspaper tubes, basketball poles, children's playsets, and other minor structures which are of a strictly ornamental or recreational nature;
B. Septic systems and wells; and
C. as provided for elsewhere in these regulation

4.1.5 All buildings containing one or more dwelling units shall be on a lot abutting a street.

4.1.6 A corner lot shall comply with the setback requirements for two front yards and two side yards.

4.1.7 For residential buildings, decks, porches, steps, ramps and similar structures may extend to within 5 feet of any property line provided:

A. The deck, porch, step, ramp, or similar structure is not covered by a roof; and
B. The deck, porch, step, ramp, or similar structure is at least 5 feet from an accessory structure.

4.1.8 For one, two and three family residences, the total area in the required front yard setback used for either parking or covered by impervious surface shall not exceed 50% of the required front yard setback area.

4.1.9 Where an existing building is in violation of front, side, or rear yard setbacks or buffer and the applicant has requested an expansion of the building, the Commission may, by special exception, allow a reduction of the setback and/or buffer for such building expansion to the lesser of:

A. twenty percent of the required setback or buffer; or
B. the setback of the existing building.

4.1.10 Where an existing use exceeds the maximum impervious surface ratio and a property owner purchases additional contiguous property to expand the use, the maximum impervious surface area on the expanded parcel shall be the sum of:

A. the impervious surface area of the original parcel; and
B. the maximum impervious surface area allowed on the additional parcel.

Section 7.0 ENVIRONMENTAL REGULATIONS

7.1 Environmental Performance Standards

7.1.1 Purpose

The purpose of this section is to insure:

A. All properties in the City can be used without undue hindrance from activities on adjoining properties; and

B. Activities that may be detrimental to the public health, safety or welfare are restricted.

7.1.2 Standards

A. Vibration - Except for vibration associated with demolition, excavation, or construction, no vibration shall be discernible to human touch outside of the property where the vibration originates.

B. Odor - No odor from any activity, except agricultural activities, shall be discernible to any objectionable degree outside of the property where the odor originates.

C. Electromagnetic Radiation -

1. No activity on a property shall interfere with the radio, television, telephone or other electromagnetic reception on another property.
2. No dwelling unit shall be placed within 150 feet of any electric transmission line carrying a voltage greater than 50,000 volts.
3. No electric transmission line carrying a voltage greater than 50,000 volts shall be placed within 150 feet of any dwelling unit.

D. Heat - Heat shall not be discernible to human touch outside of the property on which the heat originates.

E. Lighting - (See **Section 5.17**)

1. The lighting on a property shall not interfere with vehicle or pedestrian travel on any public right of way.
2. The lighting on a property shall not interfere with, or be a nuisance to, the reasonable use of another property.

F. Hazardous Materials - Materials classified as hazardous by either the State of Connecticut or the U.S. Government shall be used, stored, manufactured, processed or assembled in accordance with all applicable City, State, and Federal regulations.

G. Noise - Noise levels are regulated by the Torrington Area Health District. A violation of the Torrington Area Health District regulations regarding noise shall also be a violation of these regulations.

7.1.3 Regulations of Other Agencies

A. At the time of application for a special exception, site plan, variance, certificate of compliance or certificate of occupancy, an applicant for any non-residential use shall certify that the use is, or will be, in compliance with all applicable regulations of the U.S. Environmental Protection Agency (EPA), the Connecticut Department of Environmental Protection (DEP), the Connecticut State Department of Health (DOH), and the Torrington Area

Baltimore County, MD
Monday, September 16, 2013

ARTICLE 4. SPECIAL REGULATIONS

SECTION 411. Public Utility Uses

[BCZR 1955]

For public utility uses permitted only by special exception in addition to the provisions of Section 502, the following regulations shall apply.

§ 411.1. Conditions for use.

The use must be needed for the proper rendition of the public utility's service, and the location thereof shall not seriously impair the use of neighboring property.

§ 411.2. Exterior appearance.

In any residential zone in the Metropolitan District of Baltimore County, public utility buildings and structures, to the extent practicable, shall have an exterior appearance harmonious with the general character of the neighborhood, including architectural treatment, landscaping, screen planting and/or fencing, and plans therefor shall be approved by the Zoning Commissioner.

§ 411.3. Electric light and power transmission lines.

Electric light and power transmission lines carrying more than 35,000 volts shall be governed by the following principles, standards, rules, conditions and safeguards (in addition to the foregoing):

A. For the purposes of the control of the location and construction of such electric light and power transmission lines, there is hereby created an additional zone which shall conform to the present or future boundaries of the Metropolitan District of Baltimore County and be known as the "Metropolitan Zone." *Editor's Note: Possibly conflicts with Section 100.1.C.* Within the said Metropolitan Zone, but excluding manufacturing zones therein, the Zoning Commissioner or the County Board of Appeals, upon appeal, shall have the power to require that such electric light and power transmission lines or portions thereof be located underground in cables or conduits. In the exercise of such power, the Zoning Commissioner and the County Board of Appeals, upon appeal, shall consider and be guided by the following factors and standards:

1. The crossing of much traveled highways or streets.

2. The proximity of the line to any school, church, theater, club, museum, fairground, racetrack or other place where persons may congregate.

3. The probability of extensive flying over the area and its general nearness to any airport.

4. Any fire hazard or interference with fire-fighting equipment due to the location and construction of the proposed line.

5. The future conditions to be reasonably anticipated in each such area in the normal course of development.

6. The said Commissioner or Board, on appeal, may also consider the comparative costs of underground and overhead construction, including not only reasonable estimates of rights-of-way cost but also estimated damage to neighboring property, whether or not the owners of such property would be legally entitled to compensation for such damage; but the fact that the total cost to the applicant of placing a line or any portion thereof underground would be greater than locating it overhead, in any given case, shall not in itself be deemed sufficient cause to prevent a requirement for underground construction.

7. Any other matter or thing deemed by the Commissioner or Board to be material in connection with the public health, safety or general welfare.

6. An outside stairway, unenclosed above and below its steps, may extend four (4) feet into any required side or rear yard, but not nearer to any side lot line than a distance of six (6) feet.

7. Ramps and/or other means of handicapped accessibility to and from any structure may encroach into any required yard area, assuming such encroachment is the least necessary in order to provide access and that safe site distance is maintained on the subject property.

2-410 **Access to Lots Fronting on More than One Street**

A. Where a lot has frontage on two or more streets, vehicular access shall not be permitted to the higher standard street unless the County approves a waiver to allow the access on the higher standard street as necessary to improve public safety. The waiver shall be granted by the Director in conjunction with site plans; by the Planning Commission in conjunction with Preliminary Plats and other Divisions; and the Board of Supervisors in conjunction with Special Exceptions and Rezonings.

B. Subsection A does not apply to entrance and exit of emergency vehicles garaged on such lots with multiple entrances provided VDOT has approved the access.

2-411 **Yard Regulations for Lots Abutting Interstate Highways, Railroad Tracks, and the Right-of-Way for Transmission Lines of 500 kV or Greater.**

1. Notwithstanding any other provisions of this Ordinance, the following minimum distance shall be maintained between all principal buildings and the right(s)-of-way of interstate highways.

   A. All residential buildings - 200 feet.

   B. All commercial and industrial buildings - 75 feet.

2. Notwithstanding any other provisions of this Ordinance, there shall be a minimum distance of 200 feet between all dwellings and railroad track(s). The requirement shall not apply to the Warrenton Branch Line.

3. Notwithstanding any other provisions of this Ordinance, for buildings erected after December 8, 2005, there shall be a minimum distance of 200 feet between such buildings and the right-of-way for transmission lines of 500 kV or greater; preexisting buildings within 200 feet of the transmission line shall not be deemed nonconforming uses and may be expanded within the 200-foot setback.

4. The provisions of Paragraph 1, 2, and 3 above shall not apply to those instances where a lot has been recorded prior to the enactment of this Ordinance where the enforcement of this regulation would

negate the use of the lot in accordance with the provisions of the zoning district in which located.

2-412 **Yard Regulations for Lots Having Area in Floodplain**

Notwithstanding any other provisions of this Ordinance, no dwelling shall be located closer than twenty-five (25) feet in horizontal distance to the edge of an established floodplain.

2-413 **Reserved.**

2-414 **Yard Regulations for Corner Lots**

Minimum front yard requirements apply to all parts of a lot fronting on a street. Such yards are measured from the centerline of all proximate streets.

2-415 **Limitation on Detached Garages, Etc.**

On any lot of less than two (2) acres, the total floor area of all detached garages, sheds, pool houses and other dependencies exceeding six feet in height shall not exceed the floor area of the principal structure on the same lot. Such structures shall not exceed the height of the principal structure by more than four feet.

2-416 **Reduction in Side and Rear Yard Requirements**

In the interest of encouraging the most imaginative, livable, attractive and appropriate types and arrangements of dwellings on a particular site, in residential developments where the applicable minimum side and rear yard requirement is less than 25 feet, said requirement may be reduced or waived altogether by the Board. Such action will be based on a finding that it would conform to the intent of the proceeding sentence and would not conflict with existing uses in the vicinity. Site Plan approval will be required for developments proposing such reductions. Typical designs of the proposed structure will be submitted and considered in ruling on requests under this section. The provisions of this Section shall not apply to end units in single family attached dwelling structures.

PART 5 2-500 QUALIFYING USE, STRUCTURE REGULATIONS

2-501 **Limitation on the Number of Dwellings on a Lot**

With the exception of multiple family dwelling units as permitted by the provisions of this Ordinance, not more than one (1) dwelling unit shall hereafter be erected on any one (1) lot unless the resultant dwelling density is less than 1 DU/50 acres, nor shall a dwelling unit be located on the same lot with any other principal building, except as an accessory use

CODE OF ORDINANCES
CITY OF
BRENTWOOD, TENNESSEE

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Published by Order of the Board of Commissioners

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M	MUNICIPAL CODE CORPORATION
CC	Tallahassee, Florida 1995

OFFICIALS

of the

CITY OF

BRENTWOOD, TENNESSEE

AT THE TIME OF THIS CODIFICATION

_____

Joe Reagan

Mayor

_____

Joe Reagan, Mayor
Regina R. Smithson, Vice Mayor

Anne Dunn

Robert L. Higgs
Brian J. Sweeney

Board of Commissioners

_____

Michael W. Walker

City Manager

_____

Robert H. Jennings, Jr.

City Attorney

_____

Roger A. Horner

Assistant City Attorney/City Recorder

ARTICLE I. - IN GENERAL

Sec. 30-9. - Electrical power transmission lines.

(a) Design specifications for transmission lines in the city which carry 120 or more kilovolts shall not allow spillage of the electromagnetic fields (EMFs) associated with such transmission lines in excess of four milligauss beyond the legal right-of-way boundaries in which such transmission lines are located. Where design specifications for transmission lines are not executed in compliance with this article, each day in which spillage of EMFs occurs shall be considered a separate violation, except that spillage of EMFs due to emergency conditions shall not be considered a violation of this section. Emergency conditions shall mean those conditions created by unexpected, unforeseen or unanticipated events such as, but not limited to, failure of generating or electrical facilities due to natural or manmade causes beyond the control of the facility owner. Whenever it is determined that spillage of EMFs has occurred, notification shall be provided to the city manager within 30 days thereof.

(b) Existing transmission lines which were in place as of January 31, 1991, shall be brought into compliance with the terms of this section within five years of April 8, 1991.

(c) Employees and agents of the city shall be expressly authorized to enter onto any property, whether public or private, within the city limits to test for spillage of EMFs.

(Code 1978, § 8-113; Ord. No. 91-3, § 1, 4-8-91)

Secs. 30-10—30-30. - Reserved.

Appendix B

Restrictions Based on Field Levels in the United States

Regulations

STATE OF NEW YORK
PUBLIC SERVICE COMMISSION

CASES 26529 and 26559 - Proceeding on Motion of the Commission as to Regulations Regarding Electric and Magnetic Field Standards for Transmission Lines

STATEMENT OF INTERIM POLICY ON MAGNETIC FIELDS OF MAJOR ELECTRIC TRANSMISSION FACILITIES

Issued and Effective: September 11, 1990

STATE OF NEW YORK
PUBLIC SERVICE COMMISSION

COMMISSIONERS PRESENT:
Peter Bradford, Chairman
Harold A. Jerry, Jr.
Gail Garfield Schwartz
James T. McFarland
Edward M. Kresky
Henry G. Williams

STATEMENT OF INTERIM POLICY ON MAGNETIC FIELDS OF MAJOR ELECTRIC TRANSMISSION FACILITIES

(Issued and Effective: September 11, 1990)

Background

In April 1988, the Commission began a process looking toward the adoption of an interim magnetic field standard for future major electric transmission facilities.[1] The interim standard, by analogy to the Commission's 1978 decision on electric fields,[2] is intended to ensure that magnetic fields at the edges of future major electric transmission facility rights-of-way will be no stronger than the fields typical of the many existing 345 kV lines operating throughout the State.

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1. Cases 26529 and 26559, et al., Order Continuing Interim Transmission Line Electric Field Standard, Directing That an Interim Transmission Line Magnetic Field Standard be Developed and Directing Utilities to Undertake Studies, (Issued and Effective April 12, 1988).
2. Cases 26529 and 26559, 18 NY PSC 665, 690.

Pursuant to other provisions of the 1988 Order, the major New York State electric utilities, in consultation with the Department of Public Service staff, developed a protocol for a statewide survey of magnetic fields around operating 345 kV circuits. Following completion of the survey, the utilities presented the data at a public Technical Conference convened by staff in Albany on July 26, 1989. At the Technical Conference, the utilities explained how the data had been collected and provided statistical analyses of the magnetic field strengths observed. Questions and comments on the presentations were received both during and following the Technical Conference.

After reviewing the record of that Conference, staff developed a proposed interim policy, including an interim magnetic field standard, for consideration by the Commission at the session of March 28, 1990. The Commission issued the proposed interim policy for public comment on April 26, 1990. The nine letters of comment received were reviewed and used to revise this Statement of Policy that we now adopt.

Development of the Interim Policy

The utilities, through the Empire State Electric Energy Research Corporation, issued the results of their magnetic field survey in a June 1989 document, Magnetic Field Levels Associated with 345 kV Transmission Circuits in New York State. The 255-page report examined the accuracy of a computer model used to

calculate magnetic fields, determined the variability of measured fields along transmission line rights-of-way, and calculated fields under various operating conditions (because magnetic field varies with load) for all overhead 345 kV transmission circuits in New York State.

The conditions used for the calculations included three New York Power Pool defined loads: the winter-normal circuit rating; the winter-normal conductor rating; and the winter fifteen-minute emergency conductor rating. Although transmission circuits rarely (less than 0.1% of the time) operate at their winter-normal conductor rating, it is a particularly useful reference point for defining an interim field standard because it is the maximum the transmission wires (conductors) can tolerate for an extended time. This rating will produce the maximum magnetic field which can be sustained continuously; it is essentially a design maximum for normal operation.[3]

Results obtained for the 83 circuits studied showed that the average magnetic field at the edges of the rights-of-way, calculated using the winter-normal conductor rating for all circuits, was about 200 milligauss (mG). As noted above,

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3. The winter-normal circuit rating is not useful for the interim standard because it can change if terminal (substation) equipment is modified; the winter fifteen-minute emergency rating is not useful because it is not a normal operating condition. Summer ratings are not appropriate because they are less than winter ratings.

however, the winter-normal conductor rating is a design maximum; transmission circuits normally produce much weaker magnetic field levels. Ninety-nine percent of the time, the magnetic field level at the edge of the right-of-way of the average 345 kV transmission circuit was less than about 55 mG, according to historical load flow data presented in the report. Ninety percent of the time, the field was less than 45 mG; 50% of the time, it was less than 30 mG; 10% of the time, it was less than 15 mG.

The report also showed that the magnetic field directly above underground 345 kV transmission circuits is on the order of 1 mG, measured one meter above ground during maximum normal power flow.

Methods for using the magnetic field survey to develop a transmission line standard were solicited in the announcement for the Technical Conference. Written comments were submitted by Doreen Banks, secretary of the East Williston Civic Association; by Adam J. Becker and Robert O. Becker, M.D. of Becker Biomagnetics; and jointly by New York State's investor-owned electric utilities and the New York Power Authority. Oral comments were presented by Doreen Banks, by Henry Nowak (a consultant and former Niagara Mohawk employee), and jointly by the utilities and the New York Power Authority.

After reviewing the record of the Technical Conference and the state of knowledge with respect to possible biological

effects of electric and magnetic fields, staff recommended the adoption of a proposed interim policy, including an interim magnetic field standard. On April 26, 1990, we issued a notice requesting comments on the proposed interim policy. Nine letters of comment were received.

Several of those commenting revisited the basic premise for the magnetic field standard. Mrs. Mary Jane L. Row stressed the need for reliable and current health effects information so that informed decisions can be made. Mr. Harry P. Bifulco, Jr. questioned the medical and scientific basis for the proposed standard. Ms. Doreen Banks objected to the idea of basing the standard on fields that are typical of existing 345 kV lines. Dr. Robert O. Becker argued that a direct causal link between magnetic field exposure and adverse health effects has been established, and that a more stringent standard is warranted to protect public health.

The Department of Environmental Conservation, W. T. Kaune and J. M. Silva (Enertech Consultants), the New York State utilities and the Power Authority were generally supportive of the proposed Statement of Policy.

Discussion of Policy and the Interim Standard

The staff recommendations in this matter proceeded from the premise that adoption now of a standard based on health effects would be unreasonable given the current state of

research; the research does not provide a basis for choosing a standard. Hasty adoption of unnecessarily strict standards would itself compromise public safety by making it more difficult and costly to provide needed energy supplies.

In these circumstances, the better approach is one of "prudent avoidance," as advocated in the May 1989 Background Paper, Biological Effects of Power Frequency Electric & Magnetic Fields, issued by the U. S. Congress, Office of Technology Assessment. That approach recognizes that while emerging evidence does not provide a basis for asserting that magnetic fields pose a significant risk, neither does it allow one to assert categorically that there are no risks. Prudence therefore suggests a degree of caution in dealing with magnetic fields until further research permits a more conclusive determination.

These considerations support an interim standard that would avoid unnecessary increases in existing levels of exposure to magnetic fields. Such a standard thus would apply only to future transmission line facilities subject to Article VII of the Public Service Law, and would not be intended to imply either "safe" or "unsafe" levels of exposure. Its function would be to restrict the design choices for future transmission facilities; designs which could produce higher magnetic fields than typical 345 kV lines are to be avoided.

The report, Magnetic Field Levels Associated with 345 kV Transmission Circuits in New York State, shows that the

average magnetic field at the edges of the rights-of-way for all 345 kV transmission circuits in the State, calculated using their winter-normal conductor ratings, is about 200 mG.[4] This magnetic field level can therefore be considered typical of those that can be produced by the many existing 345 kV lines throughout the State, and will be the interim standard. Consistent with the use of winter-normal conductor rating for the interim standard, winter-normal conductor sag should be assumed in compliance calculations. Choice of 200 mG for the interim standard restricts the design options for future transmission facilities, thus avoiding unnecessary increases in magnetic field exposure.

When transmission lines are constructed within or across public thoroughfares, the term "right-of-way" is not directly applicable. For the purpose of this interim standard, typical right-of-way widths will be used in those circumstances: 150 feet for 345 kV circuits, 120 feet for 230 kV circuits, and 100 feet for lower voltage circuits, with the transmission line centered.

When multiple transmission circuits will exist within the same corridor, the interim standard is to apply to the combination of circuits and operating conditions which would

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4. Consistent with ANSI/IEEE Standard 644-1987, maximum rms flux density is used, as opposed to the square root of the sum of the squares of three orthogonal components.

reasonably be expected to produce the highest edge of right-of-way field.

Article VII applications are required to contain a statement explaining what consideration, if any, was given to any alternate method that would fulfill the energy requirements with comparable costs. The statement must include the comparative advantages and disadvantages of any alternative considered. The interim standard requires that the levels of electric and magnetic fields produced at the edge of the right-of-way for each alternative be addressed in this context. Thus, the applicant will be required to consider magnetic fields even when the 200 mG standard may not be a limiting constraint (e.g., in applications for 115 kV vertical configuration circuits).

These interim measures are subject to modification upon a showing of significant change in the body of knowledge on this issue.

Conclusion

The Commission concludes that a prudent approach should be taken that will avoid unnecessary increases in existing levels of magnetic field exposure. Therefore, the following interim measures, applicable only to future electric transmission facilities certified under Article VII of the Public Service Law, are adopted:

1. Future Article VII transmission circuits shall be designed, constructed and operated such that magnetic fields at the edges of their rights-of-way (measured one meter above ground level) will not exceed 200 milligauss when the circuit phase currents are equal to the winter-normal conductor rating (as defined by the New York Power Pool).

2. Where there is no edge of right-of-way defined, the field level shall not exceed the value specified in paragraph 1 above at a horizontal distance of (a) 75 feet from the centerline of the structures supporting an Article VII transmission circuit operating at 345 kV, (b) 60 feet from the centerline of the structures supporting an Article VII transmission circuit operating at 230 kV, and (c) 50 feet from the centerline of the structures supporting an Article VII circuit operating at a lower voltage.

3. For overhead Article VII transmission circuit proposals where multiple transmission circuits will exist within the same corridor, the combination of circuits and operating

conditions that can reasonably be expected to produce the maximum edge of right-of-way fields shall be used in determining compliance with the interim standard.

4. In the Exhibit required by 16 NYCRR Part 86.4, which includes an evaluation of the comparative advantages and disadvantages of any alternative considered, Article VII applicants should address the levels of fields to be produced at the edge of the right-of-way for each alternative considered.

5. Opinion 78-13 established an electric field strength interim standard of 1.6 kV/m for Article VII electric transmission facilities (at the edge of the right-of-way, one meter above ground level, with the line at rated voltage). The conditions set forth in items 2-4 above are to be added to that policy.

By the Commission,

John J. Kelliher

Secretary

STATE OF NEW YORK
DEPARTMENT OF PUBLIC SERVICE

August 20, 1990

TO: THE COMMISSION

FROM: THE STAFF EMF COMMITTEE

SUBJECT: Cases 26529 and 26559 - Proceeding on Motion of the Commission as to Regulations Regarding Electric and Magnetic Field Standards for Transmission Lines

RECOMMENDATION: The Commission should adopt a statement of interim policy to limit magnetic fields at the edges of future major electric transmission line rights-of-way to 200 mG.

Summary

After a review of the nine comments received in response to the Commission's proposal to establish an interim magnetic field standard for new Article VII transmission lines, staff recommends that the Commission adopt the attached statement of policy. It incorporates the basic provisions of the proposed statement with several minor revisions necessitated by the submitted comments. The policy statement provides a prudent approach that will avoid unnecessary increases in existing levels of electric and magnetic field exposure from future electric transmission facilities authorized under Article VII of the Public Service Law. The statement of policy:

1. Establishes a 200 mG edge of right-of-way magnetic field standard;

2. Clarifies application of the standard when no right-of-way exists.

3. Clarifies application of the standard to multiple circuit corridors;

4. Requires evaluation of magnetic fields for any alternative considered in an Article VII application; and,

5. Applies conditions 2-4 to the 1.6 kV/m electric field standard.

Introduction

At its session on March 28, 1990, the Commission considered the adoption of a statement of policy (including an interim standard) to limit magnetic fields at the edges of the rights-of-way of future major electric transmission facilities subject to Article VII of the Public Service Law. A notice requesting comments on the Proposed Statement of Interim Policy on Magnetic Fields of Major Electric Transmission Facilities (Statement of Policy) was issued April 26, 1990; comments were due May 28. Nine letters of comment were received.

Analysis of Comments

Several commentors revisited the basic premise for the magnetic field standard. Mrs. Mary Jane L. Row of Clifton Park stressed the need for reliable and current health effects information so that informed decisions can be made. Mr. Harry P. Bifulco, Jr. of Huntington Station questioned the scientific basis for the proposed standard. Ms. Doreen Banks of Williston Park objected to the idea of basing the standard on fields that are typical of existing 345 kV lines, levels which she argued are

"far greater than what is considered a threat to human health." Dr. Robert O. Becker (Becker Biomagnetics) rejected the claim in the Proposed Statement of Policy that "as yet, no studies have established a direct causal link between magnetic field exposure and adverse health effects;" he argued that the link has been established and that a more stringent standard is warranted to protect public health.

As is indicated in the Proposed Statement of Policy, the proposed standard was chosen after a thorough (and ongoing) review of the current state of knowledge with respect to possible biological effects of fields. While the biological effects research gives cause for concern (the raison d'etre for the proposed interim standard), it does not provide a basis for choosing the standard. Instead, the standard is based on the concept of "prudent avoidance"; the 200 mG standard requires the utilities to avoid certain transmission line designs which produce stronger magnetic fields than the typical or average 345 kV line. Since the question of whether or not a link has been established between magnetic field exposure and adverse health effects is a subject of continuing debate, the statement referenced by Dr. Becker has been deleted from the revised Statement of Interim Policy on Magnetic Fields of Major Electric Transmission Facilities attached to this memorandum.

The Department of Environmental Conservation (DEC) commented that, in addition to placing the 200 mG limit on the winter-normal conductor rating (a design standard), a 100 mG limit should be placed on the "average annual magnetic field" (an operational standard). Ms. Banks also recommended that a limit

be placed on the magnetic fields produced during normal operation.

There are several problems with imposing an operational standard. An operational standard, such as that proposed by the DEC, serves a purpose similar to that of the design standard proposed by the Commission, but at much greater cost and complexity. The design standard simply requires that future transmission lines be designed so that their magnetic fields are no greater than those that can be produced by existing lines. An operational standard, on the other hand, would require extensive monitoring of continually varying field levels to assure compliance, and would require potentially costly remedies if the monitoring were to show a violation of the "average" operational standard. The current state of knowledge of magnetic field health effects does not warrant such an effort.

The New York State utilities and the Power Authority submitted joint comments generally supportive of the Statement of Policy. Their recommended changes are primarily editorial in nature; most are incorporated in the revised Statement of Policy.

The Power Authority submitted independent comments in addition to the joint comments. Concerning the proposed requirement that "where multiple transmission circuits will exist within the same corridor, the combination of circuits producing the maximum edge of right-of-way fields shall be used in determining compliance ...," the Authority recommended that periods of maintenance be excluded. The Power Authority's recommendation runs counter to the purpose of this requirement, which was to <u>consider</u> periods when one or more circuits are out-of-service for maintenance or other reasons. Without this

requirement, the magnetic field of the new line could exceed the standard when one or more circuits are taken out of service. Also, this requirement will normally cause the 200 mG standard to be applied to individual circuits, which is appropriate since the standard is based on a survey of individual circuits.

The Power Authority also points out that the "multiple circuit" requirement does not specify the condition of service of the individual circuits. The revised Policy Statement has been modified to indicate that the combination of circuits and operating conditions that will produce the maximum edge of right-of-way fields shall be used in determining compliance. As a practical matter, this condition should rarely require consideration of more than two or three circuits operating at winter-normal conductor rating (or nominal voltage for the electric field interim standard).

The Power Authority also recommended that the Statement of Policy be modified to specify the condition of sag (the ground clearance) to be used in determining compliance. Consistent with use of the winter-normal conductor rating, the revised Statement of Policy specifies that winter-normal sag be used to determine compliance.

In a second letter, Mr. Bifulco submitted a mathematical derivation showing that, contrary to the assertion in the Statement of Policy that "magnetic fields are not expected to be higher at angles than along straight runs [for underground 345 kV transmission pipelines]," the magnetic field at a right angle bend is 70% higher. Mr. Bifulco's derivation is correct, however the predicted 70% increase is applicable only at distances from the pipeline that are large compared to the radius of curvature

of the bend (which, for a 345 kV pipeline, is typically 100 feet). But the magnetic field of such a pipeline is negligible beyond about 10 feet; within 10 feet of a bend, it is more accurate to use the same magnetic field as for a straight pipeline.

W.T. Kaune and J.M. Silva (Enertech Consultants) recommend that the Statement of Policy specify whether the 200 mG is the maximum flux density, or the square root of the sum of the squares of three orthogonal measurements. Kaune and Silva point out that the second method can give varying results depending on the frame-of-reference chosen. Staff is aware of that problem; the measurements and calculations on which the proposed standard is based use the maximum flux density. For clarity, the revised Statement of Policy has been changed to specify that the 200 mG is the maximum flux density; this specification also is consistent with ANSI/IEEE Standard 644-1987, IEEE Standard Procedures for Measurement of Power Frequency Electric and Magnetic Fields from AC Power Lines.

Conclusion

After a review of the comments received in response to the Commission's Notice of Proposed Policy, staff has made several minor revisions to the proposed Statement of Interim Policy on Magnetic Fields of Major Electric Transmission Facilities. The

revised statement, which is attached hereto, carries forward the essential elements of the proposed statement. Staff recommends that it be adopted.

Respectfully submitted,

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CHAPTER 62-814 ELECTRIC AND MAGNETIC FIELDS

62-814.100 Intent, Findings, Basis of Standards, and Research Needs.

(1) Intent. The intent and purpose of this chapter is to establish electric and magnetic field (EMF) standards for 60 hertz electrical transmission lines and substations rated at 69 kV or greater, to prescribe how compliance with those standards shall be determined, and to establish rules for all electrical facilities, pursuant to Sections 403.061(30) and 403.523(1) and (14), Florida Statutes, relating to the protection of public health and welfare from such electrical facilities.

(2) Findings. Based on the information available to the Department, the Department makes the following general findings:

(a) The Department has reviewed the present scientific data on the potential for health effects of electric and magnetic fields. The Department has also reviewed data on the existing or potential electric and magnetic field levels near electrical transmission and distribution lines and substations in Florida. Although there is no conclusive evidence that there is any danger or hazard to public health at the levels of existing 60 hertz electric and magnetic fields found in Florida, there is evidence of biological effects and a potential for adverse health effects on the public. Further research is needed to determine if there are health effects and the exposure levels at which such effects may occur.

(b) With respect to 60 hertz EMF, reasonable measures include urging more applied research on the potential adverse human health effects of EMF and EMF mitigation techniques; performing a comprehensive review of the state of the science and submitting annual reports to the Environmental Regulation Commission commencing in 1993; reviewing the provisions of this rule not later than July of 1994; and requiring all new and modified transmission lines and substations to meet standards which are achievable through the use of available EMF reduction technology and measures, but in no case to allow any new or modified transmission line or substation, under normal conditions, to cause electric or magnetic field strengths greater than the highest operating voltage and the maximum current rating (MCR) values for existing transmission lines and substations.

(3) Basis of EMF Standards.

(a) Electric Field Strength. The electric field strength standards in this rule are based on the avoidance of the perception of an electric field at the edge of the right-of-way (ROW) or within a ROW; and on the reasonable measures and status quo cap criteria stated under paragraph (2), Findings, above. Compliance with the National Electrical Safety Code (NESC), which applies to all electrical transmission lines and substations within Florida through rules administered by the Florida Public Service Commission (PSC), ensures that unsafe conditions will not exist in the vicinity of these facilities, but compliance with that code does not ensure that a person will not experience tingling sensation or mild, though harmless, shock within the ROW.

(b) Magnetic Field Strength. The magnetic field strength standards in this rule are based on the reasonable measures and status quo cap criteria stated under paragraph (2), Findings, above.

(c) Both Field Strengths. For both electric and magnetic fields, the standards apply to the maximum field strength that occurs, or is predicted to occur by the model prescribed in this rule (whichever is greater) under any normal operating mode (all operating conditions except emergency load conditions). Under most normal load conditions, the actual magnetic field strength at the edge of the ROW will be about one-half of the standards, which are to be met at the facilities maximum current rating (MCR).

(4) Additional Research Needed. Continued research is needed on the potential adverse human health and welfare effects of 60 hertz EMF and EMF mitigation techniques because existing knowledge is inadequate to confidently conclude that no further action is needed.

(5) Categories of Electrical Facilities. This chapter sets forth three categories of electrical facilities for regulation in regards to the electric and magnetic fields associated with these facilities.

(a) The first category is for existing electrical facilities on which construction was commenced prior to March 21, 1989, and new distribution lines. These facilities will be allowed to operate in accordance with Section 62-814.400(2), F.A.C.

(b) The second category of electrical facilities is for those which were certified pursuant to Chapter 403, Part Two, Florida Statutes, after April 15, 1988, but before March 21, 1989. These facilities will be subject to specific standards moderated by the individual circumstances of the facility.

(c) The third category is for new transmission lines and substations the construction of which commenced after March 21, 1989.

(6) Effect of Rule. The effect of this chapter is to establish requirements to reasonably protect the public health and welfare from electric and magnetic fields associated with electrical transmission lines, distribution lines and substations.

Specific Authority 403.061(7), 403.523(1) FS. Law Implemented 403.061(30), 403.523(14) FS. History–New 3-21-89, Amended 1-7-93, Formerly 17-274.100, 17-814.100.

62-814.200 Electric and Magnetic Fields; Definitions.

Words, terms and phrases used in this chapter, unless otherwise indicated, shall have the meaning set forth in the Standards Dictionary of Electrical and Electronic Terms (ANSI/IEEE Standards No. 100-1988) adopted by reference in Rule 62-814.300, F.A.C. In addition, the following words or terms, when used in this chapter, shall have the following indicated meanings:

(1) "ANSI" means the American National Standards Institute.

(2) "Balanced Current" means currents in three-phase electrical systems which are equal in amplitude and separated by a phase angle of 120 degrees.

(3) "Balanced Voltage" means voltages in a three-phase system which are equal in amplitude and separated by a phase angle of 120 degrees.

(4) "Commence Construction" means, as applied to the construction of a new transmission line, or new substation supplied by a new transmission line, or new distribution line, that the facility owner has begun a continuous program of actual on-site construction or physical modification of the electrical facility, to be completed within a reasonable period of time.

(5) "Department" means the Florida Department of Environmental Protection.

(6) "Distribution Line" means a system of conductors used to transport electrical energy at voltages of less than 69 kV including service drops from transformers to residences or businesses.

(7) "Electrical Facility" means the components of an electrical transmission line, distribution line or substation that produce or affect electric and magnetic fields.

(8) "Facility Owner" means an owner or operator of an electrical facility.

(9) "Gauss" means the unit of magnetic flux density that will induce an electromotive force of 1 x 10 to the -8 volt in each linear centimeter of a wire moving laterally with a speed of one centimeter per second at right angles to the magnetic flux.

(10) "Hertz" means the unit of frequency of an electrical facility equivalent to a cycle per second.

(11) "Highest Operating Voltage" means the maximum voltage value set forth for a particular transmission line on Table 1, ANSI C 84.1-1982, or ANSI C 92.2-1981, or the maximum operating voltage as established by the facility owner.

(12) "IEEE" means the Institute of Electrical and Electronic Engineers.

(13) "Kilovolts/meter" means a unit of measurement of electric field strength generally measured at a point one meter above the ground and expressed as kV/m.

(14) "Maximum Current Rating" or "MCR" means the maximum quantity of electric current, expressed in amperes, that can be continuously carried on the conductors of an electrical circuit as determined by the facility owner.

(15) "Maximum Electric Field Strength" means the amplitude (Root Mean Square) of the electric field produced by an electrical facility operating at the highest operating voltage expressed in kV/m at a height of one meter above ground level.

(16) "Maximum Magnetic Field" means the amplitude (Root Mean Square) of the magnetic flux density produced by an electrical facility operating at MCR measured in Gauss one meter above the earth's surface.

(17) "Minimum Conductor Height" means the minimum vertical distance from the earth's surface to the geometric center of the conductor or conductor bundle at MCR.

(18) "Modified" as it relates to electrical facilities means a transmission line or substation that is altered or upgraded to operate at a higher nominal voltage or current after March 21, 1989.

(19) "New Distribution Line" means a distribution line that commenced construction after March 21, 1989.

(20) "New Electrical Facility" means an electrical facility which commenced construction after March 21, 1989.

(21) "New Substation" means a substation that commenced construction after March 21, 1989, that is built to connect new transmission lines of 69 kV or larger with other electrical facilities, or a substation into which a new transmission line is built.

(22) "New Transmission Line" means a transmission line upon which construction commenced after March 21, 1989, or an existing transmission line which commences construction for the purpose of reinsulating to operate at a higher nominal voltage or reconductoring to operate at a higher MCR after March 21, 1989. This does not include transmission lines which are relocated or rebuilt unless such lines are modified. This also does not include conductors used to connect existing transmission lines to substations unless a new edge of right-of-way is created on or immediately adjacent to private property.

(23) "NESC" means the National Electrical Safety Code.

(24) "Nominal Voltage" means the voltage classification as defined in Table 1, ANSI C 84.1-1982 or ANSI C 92.2-1981.

(25) "Residential, Commercial or Industrial Building" means a structure that persons use for their residence, for commercial transactions, or for manufacturing a product. It includes structures used by providers of private and governmental services. It does not include buildings visited by people for short periods of time on a non-daily basis.

(26) "Right-of-Way" (ROW), as used herein, is a term intended to be used only for purposes of determining the appropriate points for compliance with this rule, and not for the purpose of determining a legal interest in property. "Right-of-way" means the area between two edges of ROW. Each edge of the ROW shall be identified as the farthermost point located by application of the following methods:

(a) The boundary of land where the facility owner has a property interest, such as, but not limited to, an easement, prescriptive easement, or fee simple title, and which is used or designated for construction, operation and maintenance of transmission lines.

(b) In areas where the facility owner does not have a property interest in the land where the transmission line or distribution line will be located, the ROW will be assumed to extend to the closer of:

1. The edge of the nearest residential, commercial or industrial building in existence prior to the date the electrical facility commenced construction or obtained a permit, whichever is sooner; or

2. Fifty feet from the point beneath the conductor closest to the edge of the ROW being determined.

(c) In areas where the transmission line or distribution line is adjacent to or within the property boundary of a linear easement of a railroad, utility pipeline, communication line, or public utility linear facility, or public road or canal, the ROW will be assumed to extend to the closer of:

1. The farthermost edge of the linear easement, or 50 feet from the point beneath the conductor closest to the edge of the ROW being determined, whichever is farther; or

2. The edge of the nearest residential, commercial or industrial building in existence prior to the date the electrical facility commenced construction or obtained a permit, whichever is sooner. OR

(d) In areas where the transmission line or distribution line is adjacent to or within property owned by federal, state, regional or local governmental agencies, the ROW will be assumed to extend to the closer of:

1. The edge of the nearest residential, commercial or industrial building in existence prior to the date the electrical facility commenced construction or obtained a permit, whichever is sooner; or

2. Fifty feet from the point beneath the conductor closest to the edge of the ROW being determined.

(27) "Secretary" means the Secretary of the Department of Environmental Protection.

(28) "Substation" means the electrical facility and related property used for the connection of transmission lines or distribution lines to other such electrical facilities or electrical generating plants.

(29) "Transmission Line" means a system of conductors used to transport electrical energy at voltages of 69 kV or greater.

Specific Authority 403.061(7), 403.523(1) FS. Law Implemented 403.061(30), 403.523(14) FS. History–New 3-21-89, Amended 1-7-93, Formerly 17-274.200, 17-814.200.

62-814.300 General Technical Requirements.

(1) The technical standards and criteria contained in the standard manuals and technical publications listed in paragraph (2) below are hereby incorporated by reference and shall be applied unless a deviation is approved, in determining whether proposed new or modified electrical facilities comply with the provisions of this chapter.

(2) Standard Manuals and Publications.

(a) Standards Dictionary of Electrical and Electronic Terms (ANSI/IEEE Standards No. 100-1988). Copies are available from the Institute of Electrical and Electronics Engineers, Inc., Service Center, 445 Hoes Lane, Piscataway, NJ, 08854-4150, or (908) 981-1393.

(b) Appendix E, ANSI C 84.1-1989. Copies are available from the American National Standards Institute Service Center, 11 West 42nd Street, New York, NY 10036, or (212) 642-4900.

(c) IEEE Standard No. 644-1987. Copies are available from the Institute of Electrical and Electronics Engineers, Inc., Service Center.

(d) ANSI C 92.2-1987. Copies are available from the American National Standards Institute Service Center, or the Institute of Electrical and Electronics Engineers, Inc., Service Center.

(3) Copies of the publications listed in subsection (2) are available for inspection at the Department's Information Center, 2600 Blair Stone Road, Tallahassee, Florida 32399-2400.

Specific Authority 403.061(7), 403.523(1) FS. Law Implemented 403.061(30), 403.523(14) FS. History–New 3-21-89, Amended 1-7-93, Formerly 17-274.300, 17-814.300.

62-814.310 Deviations from Standards and Criteria.

(1) Deviations from the standards and criteria contained in publications listed in Rule 62-814.300(2), F.A.C., above or equivalent methodology for the computation and measurement methodology referenced in Rule 62-814.460, F.A.C., may be approved by the Department provided the applicant's engineer's report provides reasonable assurance that the proposed design, calculations or measurement methods will result in electrical facilities meeting the requirements of this rule.

(2) The Department may approve deviations from the standards and criteria contained in the publications listed in Rule 62-814.300(2), F.A.C., above or equivalent methodology for the computation or measurement of electric and magnetic fields upon a finding that conformance to them will not result in noncompliance with the remainder of this chapter or other rules of this Department in accordance with the following:

(a) The owner or operator of any electrical facility subject to the provisions of this section may request in writing a determination by the Secretary or the Secretary's designee that any requirement of Rule 62-814.300, or 62-814.460, F.A.C., relating to measurement or calculation of electric or magnetic fields, procedures, test equipment, methodology, or test facilities shall not apply to such electrical facility, and shall request approval of alternate standards or criteria.

(b) The request shall set forth the following information, at a minimum:

1. Specific electrical facility for which an exception is required.

2. The specific provision(s) of Sections 62-814.300 or 62-814.460, F.A.C., from which an exception is sought.

3. The basis for the exception, including but not limited to any hardship which would result from compliance with the provisions of Rule 62-814.300, or 62-814.460, F.A.C.

4. The alternate standard(s) or criteria for which approval is sought and a demonstration that such alternate standard(s) or criteria shall be adequate to demonstrate compliance with the field strength standards contained in this chapter.

(c) The Secretary or the Secretary's designee shall specify by order each alternate standard or criteria approved for an individual electrical facility in accordance with this section or shall issue an order denying the request for approval. The Department's order shall be the final agency action, reviewable in accordance with Section 120.57, Florida Statutes.

Specific Authority 403.061(7), 403.523(1) FS. Law Implemented 403.061(30), 403.523(14) FS. History–New 3-21-89, Amended 1-7-93, Formerly 17-274.301, 17-814.310.

62-814.400 General Standards.

(1) No electrical facility, subject to the provisions of this chapter, shall be operated in such a way that it exceeds the standards set forth in Section 62-814.450, F.A.C., except as provided in Section 62-814.480, F.A.C.

(2) All existing electrical facilities on which construction was commenced on or prior to March 21, 1989, and all new distribution lines shall be allowed to operate at their maximum current ratings, highest operating voltage, and emergency conditions, provided that such facilities comply with the National Electrical Safety Code (NESC) as required by the Florida Public Service Commission.

(3) Except as otherwise provided in Section 62-814.480, F.A.C., no facility owner shall operate a new transmission line with a nominal voltage of 230 kV or greater above the highest operating voltage or MCR such that the standards in Section 62-814.450, F.A.C., are exceeded.

Specific Authority 403.061(7), 403.523(1) FS. Law Implemented 403.061(30), 403.523(14) FS. History–New 3-21-89, Amended 1-7-93, Formerly 17-274.400, 17-814.400.

62-814.450 Electric and Magnetic Field Standards.

(1) Existing electrical facilities for which construction was commenced on or prior to March 21, 1989 (Reserved).

(2) Transmission lines certified pursuant to Chapter 403, Part Two, Florida Statutes, after April 15, 1988, and prior to March 21, 1989.

(a) For the Lake Tarpon-Kathleen transmission line where the ROW width is 100 feet:

1. The maximum electric field at the edge of the ROW shall not exceed 1.56 kV/m and on the ROW shall not exceed 8.94 kV/m.

2. The peak daily magnetic field at the edge of the ROW shall be limited to 35 milliGauss under normal load conditions. Under load conditions in excess of 500 MW, the peak daily magnetic field shall be limited to 229 milliGauss. Load conditions in excess of 500 MW shall occur for no more than 15 hours in any given year, except for non-permanent load conditions caused by malfunction or maintenance outages in the transmission grid or generation facilities within or outside of Florida. Florida Power Corporation shall report annually to the Department the amount of time during which the 500 MW normal load condition was exceeded.

(b) For the Lake Tarpon-Kathleen transmission line where the ROW width is 190 feet:

1. The maximum electric field at the edge of the ROW shall not exceed 1.90 kV/m and on the ROW shall not exceed 8.80 kV/m.

2. The peak daily magnetic field at the edge of the ROW shall be limited to 24 milliGauss under normal load conditions. Under load conditions in excess of 500 MW, the peak daily magnetic field shall be limited to 154 milliGauss. Load conditions in excess of 500 MW shall occur for no more than 15 hours in any given year, except for non-permanent load conditions caused by malfunction or maintenance outages in the transmission grid or generation facilities within or outside of Florida. Florida Power Corporation shall report annually to the Department the amount of time during which the 500 MW normal load condition was exceeded.

(3) New transmission lines and substations.

(a) The maximum electric field at the edge of the transmission line ROW or at the property boundary of a new substation shall not exceed 2.00 kV/m.

(b) The maximum electric field on the ROW of a 230 kV or smaller transmission line shall not exceed 8 kV/m.

(c) The maximum electric field on the ROW of a 500 kV transmission line shall not exceed 10 kV/m.

(d) The maximum magnetic field at the edge of a 230 kV or smaller transmission line ROW or at the property boundary of a new substation serving such lines shall not exceed 150 milliGauss.

(e) The maximum magnetic field at the edge of the transmission line ROW for a 500 kV line or at the property boundary of a new substation serving a 500 kV line shall not exceed 200 milliGauss, except for double circuit 500 kV lines to be constructed on ROWs existing on March 21, 1989, as identified below where the limit will be 250 milliGauss.

(f) For existing ROWs extending from the Andytown substation to the Orange River substation, Andytown substation to the Martin Generating Plant, and the Martin Generating Plant to the Midway substation, where the facility owner has acquired, prior to March 21, 1989, a ROW sufficiently wide for two or more 500 kV transmission lines and has constructed one or more 500 kV transmission lines on this ROW prior to March 21, 1989, the maximum magnetic field at the edge of the ROW or property boundary of a new or modified substation shall not exceed 250 milliGauss.

Specific Authority 403.061(7), 403.523(1) FS. Law Implemented 403.061(30), 403.523(14) FS. History–New 3-21-89, Amended 1-7-93, Formerly 17-274.450, 17-814.450.

62-814.460 Computation and Measurement Methodology.

(1) Computations to establish compliance with the standards set forth in Rule 62-814.450, F.A.C., shall be performed by the use of the Bonneville Power Administration (BPA) Corona and Field Effects Program for calculating electric and magnetic fields set forth in paragraphs 62-814.470(1) and (2), F.A.C., below. When electric and magnetic field calculations are made using the BPA Corona and Field Effects Program, the following input data will be used:

(a) Magnetic field calculations.

1. The MCR currents will be used.

2. The conductor will be at its minimum clearance to the earth.

3. Currents will be assumed to be balanced in phase and in magnitude with no zero-sequence current.

(b) Electric field calculations.

1. The highest operating voltage will be used.

2. The conductor will be at its minimum clearance to the earth or other conductor height, whichever produces the highest electric field along the ROW.

3. Voltages will be assumed to be balanced in phase and in magnitude.

(c) Equivalent methodology. The Department and the facility owner may agree on substituting other equivalent methodology to verify compliance, in accordance with Rule 62-814.310, F.A.C.

(2) On-site measurements of electric and magnetic fields, when made, shall be conducted in accordance with the procedures set forth and with instruments conforming to and calibrated in accordance with the IEEE Standard No. 644-1987.

Specific Authority 403.061(7), 403.523(1) FS. Law Implemented 403.061(30), 403.523(14) FS. History–New 3-21-89, Amended 1-7-93, Formerly 17-274.460, 17-814.460.

62-814.470 Compliance Methodology.

(1) New Transmission Lines for Which Construction Was Commenced After March 21, 1989.

(a) Compliance with the electric field standards set forth in Rule 62-814.450, F.A.C., shall be determined by calculations using the highest operating voltage for a new transmission line, together with parallel transmission lines then existing in the ROW.

(b) Compliance with the magnetic field standard set forth in Rule 62-814.450, F.A.C., shall be determined by calculations at the MCR current for a new transmission line, together with parallel transmission lines then existing in the ROW.

(c) Where calculations under this section indicate that operation of existing electrical facilities on an existing ROW produces electric or magnetic fields at levels higher than the limits specified for new facilities in Rule 62-814.450, F.A.C., a new electrical facility may be constructed and operated on that existing ROW provided that the new facility does not increase the electric or magnetic fields above the maximum field values created by the existing line. Where calculations under this section indicate that the existing electrical facility produces field strengths less than the limits in Rule 62-814.450, F.A.C., then the limits in Rule 62-814.450, F.A.C., shall apply.

(d) Measurements shall be made in conformance with the criteria of Rule 62-814.460, F.A.C., above.

(2) New Substations for Which Construction Was Commenced After March 21, 1989.

(a) Compliance with the electric field standard set forth in Rule 62-814.450, F.A.C., shall be determined by calculations using the highest operating voltages for the entering and exiting new transmission lines together with existing transmission lines associated with the substation and shall be equal to the maximum edge of ROW electric field of any new transmission line entering or exiting the substation property boundary calculated pursuant to (1).

(b) Compliance with the magnetic field standard set forth in Rule 62-814.450, F.A.C., shall be determined by calculations using the MCR current of the entering and exiting new transmission lines together with existing transmission lines associated with the substation and shall be equal to the maximum value of the edge of ROW magnetic field of any new transmission line entering or exiting the substation property calculated pursuant to (1).

(3) Access. Department employees shall have access to all electrical facilities with reasonable notice to the facility owner for the purpose of determining compliance in accordance with Section 403.091, Florida Statutes.

Specific Authority 403.061(7), 403.091, 403.523(1) FS. Law Implemented 403.061(30), 403.091, 403.523(14) FS. History–New 3-21-89, Amended 1-7-93, Formerly 17-274.470, 17-814.470.

62-814.480 Emergency Exemptions.

An electrical facility that exceeds the maximum current rating (MCR) or highest operating voltage due to emergency conditions is exempt from the provisions of Rule 62-814.450, F.A.C., provided the facility owner exercises reasonable practices to minimize the time the facility exceeds the MCR or highest operating voltage, and reports the duration of the exceedance and reasons for the exceedance to the Department pursuant to 62-814.510(2), F.A.C. The Department may consult with the Florida Public Service Commission to verify any emergency conditions. Emergency conditions mean conditions that cause the MCR or highest operating voltage to be exceeded due to unexpected, unforeseen or unanticipated events such as, but not limited to, failure of generating or electrical facilities due to natural or man-made causes beyond the control of the facility owner.

Specific Authority 403.061(7), 403.081, 403.523(1) FS. Law Implemented 403.061(30), 403.523(14) FS. History–New 3-21-89, Amended 1-7-93, Formerly 17-274.480, 17-814.480.

62-814.510 Monitoring and Reporting.

(1) Monitoring for compliance shall be accomplished by including devices for measuring and recording voltage and current flow or their equivalent on all new 230 kV or greater transmission lines in accordance with this chapter.

(2) Reporting of exceedances of highest operating voltage or MCR on new 230 kV and greater transmission lines shall be made when the standards of Rule 62-814.450, F.A.C., are exceeded, as determined pursuant to subsections (a) and (b) below. Notification shall be made to the Department in writing within 30 days of the determination of an exceedance.

(a) An exceedance of any of the standards of Rule 62-814.450, F.A.C., shall be considered a violation if the average field strength exceeds the standard for a one-hour period.

(b) The one-hour average shall be based on no less than six readings per hour with at least one data scan per ten-minute period.

(c) The data that is used to determine compliance with the standards of Rule 62-814.450, F.A.C., shall be stored by the facility owner for a period of not less than one year.

Specific Authority 403.061(7), 403.523(1) FS. Law Implemented 403.061(30), 403.523(14) FS. History–New 3-21-89, Amended 1-7-93, Formerly 17-274.510, 17-814.510.

62-814.520 Compliance.

(1) No certification, as described in paragraph 2 of this section, for a new electrical facility may be issued unless the applicant gives reasonable assurance that the standards of this rule and other rules of the Department will be complied with.

(2) Any electrical facility owner seeking certification of an electrical facility under the provisions of the Florida Electrical Power Plant Siting Act or the Transmission Line Siting Act, Chapter 403, Part II, Florida Statutes, after March 21, 1989, shall include in the application for certification sufficient information to demonstrate compliance with the standards of this rule.

(3) Any facility owner seeking to construct a new transmission line of nominal voltage of 230 kV or larger or a new substation served by transmission lines of 230 kV or larger, which is not subject to Chapter 403, Part II, Florida Statutes, shall submit to the Department a completed DEP Form 62-814.900 at least 90 days prior to the start of construction. The information on that form shall be of sufficient detail to show compliance with the standards of Rule 62-814.450, F.A.C., and shall be certified by an engineer practicing in Florida and regulated by Chapter 471, Florida Statutes. Any facility owner seeking a permit subject to the provisions of Chapter 62-312, F.A.C., for new 230 kV or larger transmission lines shall include a completed DEP Form 62-814.900 from an engineer practicing in Florida and regulated by Chapter 471, Florida Statutes, with the other applicable application forms.

(4) On or before March 31 of each year, any facility owner that placed in operation, during the preceding calendar year, a transmission line of nominal voltage less than 230 kV or a new substation serving new transmission lines of less than 230 kV, shall submit to the Department a statement and a completed DEP Form 62-814.900 from an engineer practicing in Florida and regulated by Chapter 471, Florida Statutes, verifying that the electrical facility complies with the criteria set forth in Rules 62-814.400 and 62-814.450, F.A.C.

Specific Authority 403.061(7), 403.523(1) FS. Law Implemented 403.061(30), 403.0877, 403.523(14) FS. History–New 3-21-89, Amended 1-7-93, Formerly 17-274.520, 17-814.520.

62-814.530 Time of Compliance.

(1) A facility owner shall take immediate action after discovery of an exceedance to bring the facility into compliance with the requirements of Rule 62-814.450, F.A.C., unless a specific provision of this chapter authorizes a longer period of time.

(2) Failure by a facility owner to comply with the requirements of this chapter, or any conditions of certification or variance authorized under Sections 403.511, or 403.531, F.S., shall be a violation of this chapter and shall subject that facility owner to enforcement action under Chapter 403, F.S.

Specific Authority 403.061(7), (30), 403.161, 403.523(1) FS. Law Implemented 403.061(30), 403.523(14) FS. History–New 1-7-93, Formerly 17-274.530, 17-814.530.

62-814.900 Form and Instructions.

The form and instructions used by the Department under Rule Chapter 62-814, F.A.C., are adopted and incorporated by reference in this section. The form is listed by rule number, which is the same as the form number. Its title is "Report on Compliance with Electric and Magnetic Field (EMF) Standards," effective January 7, 1993. Copies of the form may be obtained by writing to the Administrator, Siting Coordination Office, Department of Environmental Protection, 2600 Blair Stone Road, Tallahassee, Florida 32399-2400.

Specific Authority 403.061(7), 403.523(1) FS. Law Implemented 403.061(30), 403.523(14) FS. History–New 1-7-93, Formerly 17-274.901, 17-814.900.

Appendix C

International Regulations

Summary or Regulation

Country:
Austria

last update 23/3/11
original information from Austrian Association of Electricity Companies
updated by Klemens Reich

National Quantitative Limits

Originating Organisation: Austrian Standards Institute and Austrian Electrotechnical Association

Document Reference: Electric, magnetic and electromagnetic fields in the frequency range from 0 Hz to 300 GHz - restrictions on human expose,
Austrian Standard VORNORM ÖVE/ÖNORM E 8850:2006-02-01.

Frequencies Covered: 0 Hz – 300 GHz

Status: pre-standard
Based on 1999/519/EG - council recommendation, ICNIRP 1998 guidelines, 2004/40/EC directive of the European parliament on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (electromagnetic fields);

Applies to:	Type of Restriction	Quantity	Part of Body	Value	Comment
Occupational exposure	Basic Restriction	J	Head and torso	10 mA m^{-2}	Average over 1 cm^2
	Reference Level	E		10 kV m^{-1}	
		B		500 µT	
		Contact current		1 mA	
General public exposure	Basic Restriction	J	Head and torso	2 mA m^{-2}	Average over 1 cm^2
	Reference Level	E		5 kV m^{-1}	
		B		100 µT	
		Contact current		0.5 mA	

Limits based on the Swiss 1 µT limit are under discussion. They have not yet been formally introduced, but for lines requiring Environmental Impact Assessment, the panel of experts appointed by the relevant authority almost always require compliance with the Swiss limits.

Regional or Local measures

Salzburg has presumption of undergrounding for lines within 200 m of residential areas unless this is demonstrated to be unfeasible.

National Non-Quantitative Measures

Industry Voluntary Measures

Country:
Bulgaria

Last update 30/4/10
Source documents obtained but in Bulgarian

National Quantitative Limits

Originating Organisation: Ministries of Health, Environment and Labour

Document References:
Occupational:
Ordinance #41
Ordinance No. 8, Gov. News No.29/1996 - for the Hygienic Requirements for the Work Places with VDU's
Ordinance No. 7, Gov. News No.88/1999 - for the Minimal Requirements for Healthy and Safety Work Conditions
Bulgarian National Standard BNS 12.1.002-78. Electric Fields near High Voltage Substations and Lines with Voltage 400 kV and more.
General population:
Ordinance No. 9 (14 March 1991) - MPEs for Electromagnetic Radiation in Residential Areas and for Determining Safety Zones Around Electromagnetic Sources, Governmental News No. 35/1991.
Ordinance No. 9, Gov. News No.46/1994 - for the Hygienic Requirements on using VDU's at School
Ordinance No. 7, Gov. News No.46/1992 - Hygienic Requirements for Health Protection of the Residential Areas.

Frequencies Covered: 0 – 300 GHz

Status:

Applies to:	Type of Restriction	Quantity	Part of Body	Value	Comment
Occupational		E		25 kV m^{-1}	ceiling limit
				20-25	up to 5 mins
				15-20	up to 10 mins
				10-15	up to 90 mins
				5-10	up to 3 hours
				5	work day (up to 8 hours)
		B		1200 μT	
Public					

EU Second Implementation Report says the ICNIRP basic restrictions have been implemented

Regional or Local measures

National Non-Quantitative Measures

Industry Voluntary Measures

Country:
Denmark

Last update 8/2/10
information from various Eurelectric members especially Rikke Fo kersen

National Quantitative Limits

Status of EU Recommendation: No known plans for legislation
No EMF Standard.

According to EU Implementation Report, "Labour Inspectorate follows the ICNIRP recommendations when evaluating exposure".

Regional or Local measures

National Non-Quantitative Measures

In 1993 the Danish health authorities introduced a precautionary approach which stated that new high voltage installations should not be built close to existing dwellings or childcare institutions/schools. Equally the building of new homes close to existing high voltage installations should be avoided. The term "close to" was not defined by a minimum distance or an exposure limit but left to a pragmatic evaluation. The precautionary approach was updated in 2007.

Industry Voluntary Measures

Autumn 2009: To ensure that the precautionary approach is applied in a uniform manner and to make it more communicable, Danish grid owners and local governments (local planning authorities) have defined an evaluation value of 0.4 µT. This value is not an exposure limit but rather a value that indicates when various measures to reduce magnetic fields near dwellings and childcare institutions should be evaluated and analysed.

The 0.4 microtesla limit should not be considered a limit, which - when reached - dictates that measures must be initiated at any cost. If the magnetic fields are expected to be above than 0.4 microtesla (annual average), it should be examined whether measures to reduce the fields can be implemented at a reasonable cost (cost/benefit, electrical safety, security of supply, human considerations, etc.). Examples of simple measures include e.g. the optimal phasing of new overhead lines. When new dwellings and childcare institutions/schools are being built in the vicinity of power lines, an approach could be to place the rooms/areas in which children spend a considerable amount of time as far away from the power line as reasonably possible to reduce the exposure.

Country:
Luxembourg

Last update 31/7/10
information from Eurelectric and ENTSO(E) members

National Quantitative Limits

Status of EU Recommendation: No plans up to now to give Recommendation any national force.

Originating Organisation: ITM division for Security and Health

Document Reference: "loi du 10 juin 1999 relative aux établissements classes"; ITM-CL 10.2 (12.11.1997)
This national act of 10 June 1999 on classified establishments where the HV lines belong to, does not tackle EMF issues and no limits are in it.
Security prescriptions released by the "Inspection du Travail et des Mines, ITM division for Security and Health" refer to the term of the German 26th BImschV and apply the following limitations: E= 5kV/m; B = 100 µT for permanent exposure and to DIN/VDE 0848 for short term exposure. These limits are applied by ITM in their construction permit for the lines.

Frequencies Covered: This ITM prescription applies to power systems (50Hz) only

Status:

Applies to:	Type of Restriction	Quantity	Part of Body	Value	Comment
Everyone, permanent exposure	Limits	E		5 kV/m	New or modified installations;
		B		100 µT	New or modified installations;

A recently received permitting paper for a new OH line delivered by the Department of Environment of the Government requested a limitation of 1µT for sensitive places I ke

- space where people stay regularly during a certain amount of time (this is very imprecise definition);
- public or private playgrounds
- not yet built places where the activities mentioned before are allowed based on a general approved future development plan

The legal status of this is being challenged.

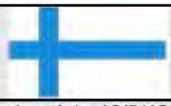
Regional or Local measures

National Non-Quantitative Measures

The government released a circular 1644 (ref 26/94) of 11 March 1994 to local authorities recommending that land in the immediate proximity of high voltage power lines should no longer be approved as building land. This circular is not based on a legal act.

Industry Voluntary Measures

Country:
Finland



Last update 16/2/12
information from Eurelectric and ENTSO(E) members

National Quantitative Limits

Status of EU Recommendation: Regarded as implemented through new law
Originating Organisation: Ministry of Social Affairs and Health
Document Reference: Decree on the limitation of exposure of the public to non-ionizing radiation 294/2002, based on the Law on radiation protection 592/1991, 43
Frequencies Covered: 0-300 GHz; lasers; ultraviolet
Status: Law, April 2002. ELF values are recommended not compulsory.

Applies to:	Type of Restriction	Quantity	Part of Body	Value	Comment
Public	Basic restriction	j		2 mA/m^2	
				10 mA/m^2	Time of exposure not significant
	Recommended limit when people exposed for significant periods of time	E		5 kV/m	
				15 kV/m	Short periods of time
		B		100 µT	
				500 µT	Short periods of time

For occupational exposure, there are no exposure limit values or official action. The intention has been to follow literally the requirements of the EU Directive. Work to write down the Finnish Act was started on the basis of the directive proposal 2004/40/EC but the work was interrupted when EUs Commission postponed the effective date of the Directive.

Finish Radiation Safety Agency recommend that new houses and day care facilities should not be built in the zone round power lines where 0.4 µT is continuously exceeded ("continuously exceeded" is not defined). This has no legal force; it may come to have effect in practice.

Regional or Local measures

National Non-Quantitative Measures

Industry Voluntary Measures

STUK recommends non-costly actions when 0.3-0.4 µT is exceeded.

Country:
France

Last update 2/7/13
Compiled from information in EU Implementation Report plus further detail from EdF/RTE

National Quantitative Limits

Status of EU Recommendation: No plans to give Recommendation any national force
Originating Organisation:
Document Reference: Order of 17 May 2001, Journal Officiel 12 June 2001 ("Technical Order")
Frequencies Covered: Applies to power systems only
Status:

Applies to:	Type of Restriction	Quantity	Part of Body	Value	Comment
Any place accessible to the public	Limits	E		5 kV/m	New or significantly modified installations; permanent service operating conditions*
		B		100 µT	New or significantly modified installations; permanent service operating conditions*

* "*permanent service operating conditions*" are defined as the operating conditions under which the temperature of the overhead line conductors raises up to 40 °C with standard environmental conditions (20 °C, no wind).
No legal definition for buried cables, and so the maximum permanent current is taken as reference condition.

Regional or Local measures

National Non-Quantitative Measures

"Circulaire" 2013 from Minister of Ecology, Sustainable Development and Energy (MEDDE) to Prefets of Departements. Asks them to recommend to local municipalities that they should avoid, as much as possible, giving permission for new sensitive use buildings (e.g. hospitals, primary schools, kindergartens) in a "zone de prudence" of 1 µT exposure from high-voltage infrastructure.

Industry Voluntary Measures

Italian Regulation

DECREE OF THE PRESIDENT OF THE COUNCIL OF MINISTERS 8 JULY 2003

Establishment of exposure limits, attention values, and quality goals to protect the population against power frequency (50 Hz) electric and magnetic fields generated by power lines

THE PRESIDENT OF THE COUNCIL OF MINISTERS

[Omissis]

Decrees:

Art. 1
Scope

1. The present decree sets exposure limits and attention levels to protect the population from exposures to power frequency (50 Hz) electric and magnetic fields due to the operation of power lines. The decree also sets a quality goal for the magnetic field which is aimed at the progressive minimisation of exposures.
2. Exposure limits, attention values and quality goals of the present decree do not apply to workers exposed by reason of their occupation.
3. For protection against exposure to fields in the frequency range 0 Hz – 100 kHz generated by sources unlike power lines and assimilated, the restrictions set out in the EU Recommendation of 12 July 1999 - published in the O.J.E.C. on July 30, 1999 - are applied in their entirety.
4. In pursuance of Art. 1, Paragraph 2 of Law 22 February 2001, No. 36, the special-status regions and the autonomous provinces of Trento and Bolzano are taking measures to achieve the aims of the present decree through the powers assigned to them in accordance with their statutes, their relevant implementing regulations, and the provisions of their respective structures.

Art. 2
Definitions

1. The definitions of the physical quantities mentioned in the present decree are reported in Annex A, in addition to definitions set out in Art. 3 of Law 22 February 2001, No. 36, that are unchanged.

Art. 3
Exposure limits and attention values

1. In case of exposure to electric and magnetic fields generated by power lines, the following exposure limits must not be exceeded: 100 µT for the magnetic flux density and 5 kV/m for the electric field, both expressed as rms values.
2. As a cautionary measure to protect against any possible long-term effects that might be related to power frequency (50 Hz) magnetic fields, an attention value of 10 µT is adopted in children's playgrounds, residential dwellings, school premises, and in areas where people are staying for 4 hours or more per day. The attention value is the median of values recorded over 24 hours, under normal operational conditions.

Art. 4
Quality goals

1. In designing new power lines in the neighbourhood of children's playgrounds, residential dwellings, school premises, and in areas where people are staying for 4 hours or more per day, as well as in planning developments in the proximity of existing electric power lines and installations, including the categories mentioned above, a quality goal of 3 µT is adopted for the purpose of the progressively minimising exposures to electric and magnetic fields generated by 50-Hz power lines. The quality goal is the median of values recorded over 24 hours, under normal operational conditions.

Art. 5
Techniques for measurement and assessment of exposure levels

1. Measurements shall be made in accordance with the Standard CEI 211-6, dated 2001-01 "Guidance for the measurement and assessment of electric and magnetic fields in the frequency range 0 Hz – 100 kHz with reference to human exposure", and its later revisions.
2. The System of Agencies (APAT-ARPA), following approval by the Ministry of the Environment and Protection of Territory, shall determine the procedures to assess the magnetic flux density in order to establish compliance with attention values and quality goals.
3. To establish compliance with the provisions of Art. 3 and 4, APAT-ARPA may use calculation methods based on technical and historical data available from records of the operation of the power line in question, in addition to the measurements and assessment techniques referred to in points 1 and 2 of this Article.
4. For each power line~~s~~ of voltage equal to or greater than 132 kV, the operators, at three month intervals, shall provide the control bodies with electric current data for the period in the form of 12 values per day, each corresponding to the average value~~s~~ of the electric current over succesive 2-hour periods, recorded under normal operating conditions. The modality for the supply of data is provided by the control bodies.

Art. 6

Parameters to determine right-of-way for power lines

1. To determine right-of-way, reference shall be made to the quality goal of Art. 4, and to the electric current load under normal operating conditions of the line, as defined by Standard CEI 11-60. The current load must be declared by the operator to the Minister of the Environment and Protection of Territory where line voltages exceed 150 kV, and to the Regions where voltages are equal to or below 150 kV. The operators shall communicate the data they employed in their calculations, and in the determination of the width of right-of-way, to permit verification by competent authorities.
2. APAT, after consulting ARPAs, shall define the calculation methods to be employed to determine right-of-way; the methods shall be approved by the the Minister of the Environment and Protection of Territory.

Art. 7
Update of knowledge

Within three years from the implementation of the present decree, the interministerial Committee described in Art. 6 of the Framework Law No. 36/2001 shall update the status of the science on possible health risks of electromagnetic fields, based on the findings of scientific reserch at the national and international level.

Art. 8
Withdrawal of norms

The provisions of the Decrees of the President of the Council of Ministers dated 23 April 1992 and 28 September 1995 are incompatible and are no longer applicable after the date of coming into force of the present decree.

ANNEX A - DEFINITIONS

[Omissis]

Translator's Notes

CEI (Comitato Elettrotecnico Italiano) is the Italian Electrotechnical Committee. CEI is member of CENELEC, and CEI Standards are often endorsement of CENELEC Standards, designated by the same number.

APAT (Agenzia per la Protezione dell'Ambiente e per i Servizi Territoriali) is the national agency for environmental protection. ARPA (Agenzia Regionale per la Protezione dell'Ambiente) is the regional agency for environmental protection, for each of the 20 Italian regions. ATAT and ARPAs tightly collaborate in the so-called System of Agencies.

The Decree was published in the Official Gazette of the Italian Republic on August 29, 2003, and came into force on the same day.

Unofficial Translation by Paolo Vecchia

Country:
Netherlands

Last update 1/4/11
Compiled from various informants including Anco Veldhuizen, Tennet TSO, and Tennet workshop 1/4/11

National Quantitative Limits

Status of EU Recommendation: No plans to create legislation
Originating Organisation: Ministry of Housing, Spatial Planning and the Environment
Document Reference: Letter of October 3 2005 of the Ministry of Housing, Spatial Planning and the Environment on overhead powerlines, reiterated in letter of 4 November 2008
Frequencies Covered:
Status: Advice to local and regional authorities and power companies

Applies to:	Type of Restriction	Quantity	Part of Body	Value	Comment
Public	Values as ICNIRP				
Children where exposure from power line of long duration*	Advice	Annual average** field calculated from power line		0.4 µT	Applies to new power lines / new dwellings only, where reasonably possible***

* dwellings, schools and crèches. Letter of 4 November 2008 specified "long stay" is at least 14-18 hours a day during one year and specifies that gardens are included with houses.
** "Calculation Guide" specifies how to calculate this. Use clearance for 15 °C. Use load as 90 °C rating (for aluminium/steel conductors, 70 °C for copper), multiplied by 30% (220/380 kV, derived from average of two years' load data) or 50% (110/150 kV, derived from N-1 criterion) to get estimate of annual average.
*** If value is exceeded, TSO policy is to offer to buy homes or pay compensation if owner prefers to remain, but it is not yet a requirement to remove such homes. Recent court action could force government to clarify this.

Last update 9/7/2
Compiled from source document

Originating Organisation: Health Council of the Netherlands, ELF Electromagnetics Fields Committee
Document Reference: The Hague, Health Council of the Netherlands 2000, Publication Number 2000/6
Frequencies Covered: 0 – 10 MHz
Status: Advisory Report, effectively superseded by more recent advice

Applies to:	Type of Restriction	Quantity	Part of Body	Value	Comment
Occupational exposure	Basic Restriction	j	Body, head included	25 mA m^{-2}	
			Body, head excluded	100 mA m^{-2}	
	Investigation Level	E	Body, head included	62.5 kV m^{-1}	Indirect effects not possible
			Body, head excluded	250 kV m^{-1}	
				40 kV m^{-1}	Indirect effects possible
		B		600 µT	
General population	Basic Restriction	j	Body, head included	5 mA m^{-2}	
			Body, head excluded	20 mA m^{-2}	
	Investigation Level	E		8 kV m^{-1}	
		B		120 µT	

Regional or Local measures

National Non-Quantitative Measures

Industry Voluntary Measures

Country:
Norway

last update 30/7/10
information from various Eurelectric and ENTSO(E) members

National Quantitative Limits

Regional or Local measures

National Non-Quantitative Measures

Status of EU Recommendation:

Originating Organisation: Norwegian Radiation Authority, resulting from Parliamentary debate following High Court decision in 2007

Document Reference: Lov om strålevern og bruk av stråling (strålevernloven) av 12. mai 2000.
Forskrift om strålevern og bruk av stråling (strålevernforskriften).
http://www.regjeringen.no/nb/dep/fin/dok/regpubl/stprp/20052006/stprp-nr-66-2005-2006-.html?id=139085 (s 61-65, in Norwegian only)

Frequencies Covered:

Status:

Applies to:	Type of Restriction	Quantity	Part of Body	Value	Comment
General population	Investigation level. If exceeded, must evaluate possible methods for reducing exposure, but only required to take those measures if they evaluated as "reasonable"	B		0.4 µT (annual average)	Applies to new homes, kindergartens and schools, and new power lines

"to prevent disease, to reduce concern and fear, for better visual aspect, for increased operational reliability"

Industry Voluntary Measures

Implementation report on the Council Recommendation limiting the public exposure to electromagnetic fields (0 Hz to 300 GHz).[*]

[*]In accordance with the terms of Recommendation (1995/519/CE) inviting the Commission: "to draw up a report, giving due consideration to the Member states' reports as well as the most recent opinions and scientific data", please find enclosed for publication in the Official Journal the implementation report on the Council Recommendation limiting the public exposure to electromagnetic fields (0 Hz to 300 GHz).

institute to carry out further research into non-specific health complaints of people claiming to be hypersensitive to electromagnetic fields. The Netherlands Government is also considering the possibility of launching research programmes on the subject of electromagnetic fields.
The Netherlands implements measures to inform the public on the health impact of electromagnetic fields and the measures taken to address them. This is done by various authorities and the National Antenna Bureau. Public information can be found on the internet and in brochures.
The Netherlands is also promoting the development of new technology in the field of electromagnetic fields such as Bluetooth, UMTS pr GPRS licenses, etc. For example, the government sold UMTS licences in 2001

9.12 Portugal

Following the request to the Portuguese government by the Health and Consumer Protection Directorate of the European Commission to fill in a questionnaire on the legislative acts protecting the public against the health effects of exposure to non ionising radiation, adopted by the Member States in application of *Council Recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz)*[28], the ministry of Health reported that Portugal had not implemented measures to protect the public from exposure to electromagnetic fields. The reason for the negative response is because the interdisciplinary nature of the subject makes it advisable that the measures to be implemented should be prepared by a group of technical experts designated for the purpose, which has so far not been done. As a draft joint order has already been drawn up by the Ministry of Social Infrastructure and the Ministry of Health to this end, it is anticipated that a start will be made shortly on implementation in the area in question.

9.13 Spain

a- The protection framework in Member States

The Ministry of Health and Consumer Affairs and the Ministry of Science and Technology have produced a Royal Decree 1066/2001 of 28 September 2001 (Official State Gazette No 324 on Saturday, 29 September 2001) approving the Regulation setting out rules for the protection of installations emitting non-ionising radiation, restrictions on emissions on non-ionising radiation, and health protection measures against emissions of non-ionising radiation. This Royal Decree is designed to guarantee the safety of the public domain from the radioelectricity and ensure health protection against emissions from electromagnetic waves in the spectrum of radiofrequencies. This latter decree supplements the General Law on Telecommunications 11/1998 of 24 April, the Royal Decree 1451/2000 of 28 July, the Royal Decree 1450/2000 of 28 July, the General Law of the Ministry of Health 14/1986 of 25 April, and the Technical Regulation on High Voltage Power Lines, approved by decree 3151/1968 of 28 November. The publication of this Royal Decree answers an enormous public demand for the health authorities to lay down health protection criteria, in particular concerning mobile telephony (antennae and mobile phones).

[28] OJ L199, 30/07/1999, p.0059-0070

The Royal Decree 1066/2001 faithfully transposes the contents of the Recommendation 1999/519/EC into Spanish law. However, it also provides:

- special protection for "*espacios sensibles*" (sensitive areas) by requiring that "levels of emissions into sensitive areas such as schools, health care centres, hospitals or public parks shall be kept as low as possible" (Article 8.7 d). In addition, wherever possible, there should be no emission footprints impinging on buildings, terraces or attics.
- compulsory sign-posting and fencing for installations emitting non-ionising radiation (Article 8.2.).

This decree, including its preventive measures, is based on a report[29] by a working group set up and co-ordinated by the Ministry of Health and Consumer Affairs. This group is composed of experts in various disciplines relating to the evaluation and monitoring of risks caused by electromagnetic fields. Its aim is to prevent problems of sensitisation of people who could be affected by electromagnetic fields from such installations as a result of conditions relating to growth, development, pregnancy, chronic illness or use of implants or prostheses.

There are regional variations in Spain regarding the protection of the public from electromagnetic fields. Indeed, there are Autonomous Communities which have promulgated legislation on this subject, imposing more stringent limits than those established in the Royal Decree. Measures which have been introduced for operators and holders of licences to submit plans for putting up signs and, if need be, fencing to restrict access to unauthorised people to zones in which the limits laid down in Annex II of the Royal Decree could be exceeded.

b- Scope of implemented measures

The Royal Decree makes reference exclusively to radiofrequencies and not the whole spectrum of non-ionising radiation.

Exposure to sources with multiple frequencies is dealt with in the Royal Decree.

Spain has decreed that an inspection and evaluation of radioelectrical installations be undertaken. Spanish legislation provides for three types of checks:

- prior authorisation is required before a new installation emitting non-ionising radiation is set up, so ensuring that emission limits are complied with
- existing installations have been given a deadline (28 June 2002) for sending the authorities certificates, signed by specialists, attesting that the limits set are not exceeded
- inspection measures: there is an annual inspection of the installations commissioned during the previous year. In addition, inspections are made of installations approaching the emission limits and of those near sensitive areas. This is separate from the general programme of scheduled inspections.

Information on emissions supplied by the Ministry of Science and Technology and the Ministry of Health and Consumer Affairs in co-ordination with the Autonomous Communities will be used to carry out a health assessment of the risks in any cases where it is necessary.

c-Additional measures

[29] "Electromagnetic fields and health" (http//:www.msc.es/salud/ambienta/home.htm)

The Spanish Government promotes research into the effects of electromagnetic fields on human health. In the Royal Decree, Article 10 states that, based on the information available, the Ministry of Health and Consumer Affairs shall evaluate the potential health risks of exposure of the public in general to radioelectrical emissions, taking account of the number of persons exposed, their epidemiological characteristics, their age, the parts of the body exposed, the exposure times and the health conditions of the subjects.
The Ministry of Health and Consumer Affairs is putting a great deal of effort into informing the public about the impact on human health of electromagnetic fields. It receives many requests for information from syndicates of property owners, associations, courts and a wide range of public and private authorities, who would like to see the Ministry of Health and Consumer Affairs adopting legislation on the technical and health criteria concerning exposure to electromagnetic fields. The Ministry of Health and Consumer Affairs is currently in the process of drafting an information brochure on the risks to human health of electromagnetic fields.

9.14 Sweden

a. The protection framework in Member States

Sweden has issued a number of binding laws and regulations to protect the public from exposure to electromagnetic fields:

- the Radiation Protection Act (1988:220)
- the Radiation Protection Ordinance (1988:293)
- the Regulations of the Swedish Radiation Protection Authority (SSI) concerning drying with the use of microwaves (SSI FS 1995:3)
- the Environmental Code (1998 :808) which contains among other things a general precautionary principle including both ionising and non-ionising radiation
- the Regulation on Monitoring in accordance with the Environmental Code (1998 :900)
- the Regulation on Activities Dangerous for the Environment and on Health Protection (1998 :899)

Already before the Environmental Code was adopted, Sweden had issued a recommendation involving application of a precautionary principle for low frequency (in the main power frequency) electromagnetic fields (text published by the National Occupational Safety and Health Administration, the National Housing, Building and Planning Board, the National Electrical Safety Board, the National Board of Health and Welfare and the Swedish Radiation Protection Authority). The frequency range is not specified.
The laws and regulations and the Recommendation mentioned are applicable throughout the whole of Sweden.
The Swedish Radiation Protection Authority is about to publish general guidelines based on the limits laid down in the Council Recommendation and in the guidelines of the International Commission on Non-Ionising Radiation Protection (ICNIRP). General guidelines are not legally binding.
Sweden considers that, based on the current state of knowledge, there is no need for other safety criteria or safety levels for the moment.

Ordinance relating to Protection from Non-Ionising Radiation (ONIR)

of 23 December 1999 (as of 1 February 2000)

The Swiss Federal Council,

pursuant to Article 12 para. 2, 13 para. 1, 16 para. 2, 38 para. 3 and 39 para. 1 of the Federal Law relating to the Protection of the Environment of 7 October 1983[1] (Law) and to Article 3 of the Federal Law on Spatial Planning of 22 June 1979[2],

hereby ordains:

Chapter 1: General provisions

Art. 1 Purpose

The purpose of this Ordinance is to protect people against harmful effects or nuisances caused by non-ionising radiation.

Art. 2 Scope

1 This Ordinance regulates:

a. the limitation of electric and magnetic field emissions with frequencies in the range 0 Hz to 300 GHz (radiation) that are generated by stationary installations;

b. the determination and assessment of the radiation exposure;

c. requirements concerning the designation of building zones.

2 It does not regulate the limitation of emissions that are generated:

a. by sources in firms, insofar as the radiation affects staff employed by them;

b. in connection with the application of medical devices in accordance with the Ordinance relating to Medical Products of 24 January 1996[3];

c. by military installations, insofar as the radiation affects members of the army;

d. by electrical appliances such as microwave ovens, cookers, electric tools or mobile telephones.

AS **2000** 213

1 SR **814.01**
2 SR **700**
3 SR **819.124**

3 It also does not regulate the limitation of radiation that affects electrical or electronic medical life-support systems such as cardiac pacemakers.

Art. 3 Terminology

1 Installations shall be deemed to be old if the decision authorising construction or commencement of operations had legal validity when this Ordinance entered into force.

2 Installations shall be deemed to be new if:

a. the decision authorising construction or commencement of operations was not yet legally valid when this Ordinance entered into force;

b. they are moved to another site; or

c. they are replaced at the present site; excepted are railways and trams (Annex 1 Number 5).

3 Places of sensitive use are deemed to be:

a. rooms in buildings that are regularly occupied by persons for prolonged periods;

b. public or private children's playgrounds designated in spatial planning legislation;

c. those areas of undeveloped sites on which uses according to letters a and b are permitted.

4 Measures to limit emissions are deemed technically and operationally possible if:

a. they have been successfully applied in comparable installations in Switzerland or abroad; or

b. they have been successfully applied in tests, and may be applied to other installations using current technology.

5 To assess the economic acceptability of emission limitations, a medium-sized, financially sound, firm shall be taken as representative of the particular branch. If a branch contains widely differing classes of firms, a medium-sized firm in the relevant class shall be used.

6 The installation limit value applies to the radiation emitted by a single installation.

7 The contact current is the electric current that flows when a person touches a conducting object that is charged by an electric or magnetic field but not connected to a voltage supply.

8 The induced limb current is the electric current discharged to earth from a person subjected to an electric field, but not touching a conducting object.

9 The equivalent radiated power (ERP) is the power supplied to a transmission antenna multiplied by the antenna gain for the principal transmission direction and referred to a half-wave dipole.

Chapter 2: Emissions

Section 1: General provisions for new and old installations

Art. 4 Precautionary limitation of emissions

1 Installations shall be built and operated in such a way that they meet the precautionary emission limitations laid down in Annex 1.

2 For installations for which no provisions are laid down in Annex 1, the authorities shall stipulate emission limitations as far as this is technically and operationally possible and economically acceptable.

Art. 5 Supplementary and stricter emission limitations

1 Where it is established or anticipated that one or more of the exposure limit values laid down in Annex 2 are exceeded by a single installation or by several installations taken together, the authorities shall stipulate supplementary or stricter emission limitations.

2 The authorities shall stipulate supplementary or stricter emission limitations to ensure that the exposure limit values are complied with.

3 Where it is established or anticipated that the exposure limit value laid down in Annex 2 Numbers 13 or 225 for the contact current arising on contact with conducting objects is exceeded, the authorities shall first stipulate measures for these objects.

Section 2: Special provisions for new installations

Art. 6

If after being taken into operation a new installation is modified in accordance with Annex 1, the provisions relating to emission limitations for new installations shall apply.

Section 3: Special provisions for old installations

Art. 7 Obligation to retrofit

1 The authorities shall ensure that old installations that do not comply with the requirements of Articles 4 and 5 are retrofitted.

2 They shall issue the necessary orders and lay down the time period for retrofitting in accordance with Article 8. If necessary, they shall order operational restrictions or shut-down of the installation for the duration of retrofitting work.

3 Retrofitting can be waived if the owner undertakes to shut down the installation within the time period set for retrofitting.

Art. 8 Time period for retrofitting

1 The time period for the implementation of precautionary emission limitations shall be as laid down in Annex 1. If Annex 1 contains no relevant provisions, a maximum period of five years shall apply. The authorities may on request extend the time period for retrofitting by half if implementation of the emission limitations within the normal time period is economically unacceptable.

2 Concerning supplementary or stricter emission limitations, the time period for retrofitting shall be a maximum of three years. The authorities shall stipulate shorter time periods if the implementation of the measures does not require significant investments to be made.

Art. 9 Modification of old installations

1 If an old installation is modified in accordance with Annex 1, it shall comply with the following requirements when operated in the reference operating mode:

a. the magnetic flux density or the electric field strength shall not increase at places of sensitive use where the installation limit value was exceeded prior to the modification;

b. the installation limit value laid down in Annex 1 shall not be exceeded at other places of sensitive use.

2 The authorities shall grant exemptions in accordance with Annex 1.

Section 4: Cooperation and control

Art. 10 Obligation to cooperate

The owner of an installation is obliged to provide the authorities with a minimum of information necessary for enforcement as specified in Article 11 Paragraph 2. If necessary, he/she shall carry out or tolerate measurements or inspections.

Art. 11 Obligation to report

1 The owner of an installation for which emission limitations are laid down in Annex 1 shall submit a site data sheet to the authorities in conformity with the authorisation or licensing procedure when the installation is built, moved to another site, replaced at the old site or modified in accordance with Annex 1. Domestic electrical installations (Annex 1 Number 4) are excepted.

2 The site data sheet shall contain:

a. the current and planned technical and operational data of the installation, insofar as these are relevant to the generation of radiation;

b. the reference operating mode according to Annex 1;

c. data on the radiation generated by the installation:
   1. at the points accessible to persons where the radiation is most intense,
   2. at the three places of sensitive use where the radiation is most intense, and
   3. at all places of sensitive use where the installation limit value according to Annex 1 is exceeded;

d. a site map showing the data according to Letter c.

Art. 12 Control

1 The authorities shall ensure compliance with the emission limitations.

2 In order to ensure compliance with the installation limit value laid down in Annex 1, the authorities shall carry out or commission measurements or calculations, or make use of the results of third parties. The Swiss Agency for the Environment, Forests and Landscape (SAEFL) shall recommend suitable measurement and calculation methods.

3 If as a result of exemptions being granted the installation limit value according to Annex 1 is exceeded for new or modified installations, the authorities shall carry out or commission periodic measurements of the radiation generated by these installations. They shall establish within six months after the installation has begun operation whether:

a. the technical and operating data upon which the order was based are correct; and

b. the orders issued have been complied with.

Chapter 3: Exposure

Art. 13 Applicability of the exposure limit values

1 The exposure limit values as laid down in Annex 2 shall be complied with at all places accessible to persons.

2 They apply only to radiation that uniformly impinges on the entire human body.

Art. 14 Determination of exposure

1 The authorities shall determine the exposure if they have reason to believe that the exposure limit values laid down in Annex 2 are exceeded.

2 The authorities shall carry out or commission measurements or calculations, or make use of the results of third parties. SAEFL shall recommend suitable measurement and calculation methods.

3 In determining radiation on a firm's premises, exposure resulting from sources within the firm shall not be considered.

4 Exposure shall be expressed in terms of electric field strength, magnetic field strength, magnetic flux density, induced limb current or contact current, and shall be determined for the operating mode of the installation at the point where it is most intense.

5 If an averaging period is laid down in Annex 2, the exposure shall be expressed as the root mean square value over this period. If not, the maximum rms value shall apply.

Art. 15 Assessment of exposure

The authorities shall assess whether the exposure exceeds one or more of the exposure limit values laid down in Annex 2.

Chapter 4: Requirements for the designation of building zones

Art. 16

For old installations, and for installations planned and authorised in spatial planning legislation, building zones shall only be designated where the installation limit values laid down in Annex 1 are complied with, or can be complied with, by suitable planning or construction measures.

Chapter 5: Final provisions

Section 1: Enforcement

Art. 17 Enforcement by the cantons

Subject to Article 18, the cantons shall be responsible for enforcing this Ordinance.

Art. 18 Enforcement by the Confederation

Where the federal authorities apply other federal laws, international agreements or resolutions relating to the provisions of this Ordinance, they shall also have the responsibility for enforcing this Ordinance. Cooperation by SAEFL and the cantons is laid down in Article 41 Paragraphs 2 and 4 of the Law and is subject to the legal obligation to maintain secrecy.

Art. 19 Coordinating authority

1 Where several installations contribute to exceeding the exposure limit values laid down in Annex 2, and where several authorities are responsible for the enforcement

of this Ordinance for these installations, the authorities concerned shall designate the authority responsible for coordination.

2 The coordinating authority shall act according to the coordination principles of the Federal Law on Spatial Planning of 22 June 1979[4].

Section 2: Transitional provision and entry into force

Art. 20 Transitional provision

The authorities shall issue the retrofitting order as laid down in Article 7 within two years after this Ordinance enters into force. In doing so, they shall consider the urgency of the retrofitting. In non-urgent and exceptional cases, the two-year period may be extended.

Art. 21 Entry into force

This Ordinance enters into force on 1 February 2000.

4 SR **700**

Annex 1
(Art. 4, 6, 8 para. 1, 9, 11, 12 and 16)

Precautionary emission limitations

1 Overhead and cable lines for the transmission of electrical energy

11 Scope

1 The provisions of this Number apply to the following installations with a nominal voltage of at least 1000 V:

a. Alternating current overhead lines;

b. Alternating current cable lines with single conductor cables in separate conduits.

2 For railway catenary systems, Number 5 shall apply.

12 Terminology

1 A phase conductor is a single conductor under tension.

2 A line circuit comprises all phase conductors belonging to the same electrical circuit. For three-phase systems, these are the three phase conductors R, S and T, and for single-phase systems the two phase conductors U and V.

3 A line consists of the collectivity of all phase and earth wires on a support structure or in a cable system laid underground. It can comprise one or several line conductors.

4 The installation contains all the lines located in close proximity within the line section to be considered.

5 The right of way is the space under an overhead line or above an underground cable line. It is bounded at the sides by the outermost phase conductors.

6 Modification of an installation is defined as the modification of the conductor arrangement, the order of the phases or the reference operating mode.

13 Reference operating mode

1 The installation's reference operating mode is defined as the simultaneous operation of all line circuits, where each line circuit is in operation:

a. at its thermal limiting current at 40 °C; and

b. with the power flow in the most frequently occurring direction.

2 Where a maximum current deviating from the thermal limiting current is laid down in the construction permit, this current may be used in defining the reference operating mode.

14 Installation limit value

The installation limit value for the rms magnetic flux density is 1 μT.

15 New installations

1 At places of sensitive use, new installations shall comply in the reference operating mode with the installation limit value.

2 The authorities shall grant exemptions if the owner of the installation can provide evidence that:

a. the order of the phases is optimised such that the magnetic flux density outside the right of way is minimised in the reference operating mode; and

b. all other measures to limit radiation that are technically and operationally possible and economically acceptable have been taken, such as choice of another site, modification of the conductor arrangement, cabling or shielding.

16 Old installations

1 Should the radiation generated by an old installation in the reference operating mode exceed the installation limit value at places of sensitive use, the order of the phases shall be optimised such that the magnetic flux density is minimised at these locations.

2 The period for retrofitting laid down in Article 8 Paragraph 1 shall be a maximum of three years.

17 Modification of old installations

If an old installation is modified, the authorities shall grant exemptions from the requirements laid down in Article 9 Paragraph 1, if the owner of the installation can provide evidence that the conditions specified in Number 15 Paragraph 2 are fulfilled.

2 Transformer stations

21 Scope

The provisions of this Number apply to installations for high to low-voltage transformation.

22 Terminology

1 An installation is defined as the current-carrying parts of a transformer station including the low-voltage connections and the low-voltage distribution board.

2 Modification of an installation is defined as an increase in the nominal power.

23 Reference operating mode

The reference operating mode is defined as operation at nominal power.

24 Installation limit value

The installation limit value for the rms magnetic flux density is 1 μT.

25 New and old installations

1 At places of sensitive use, new and old installations shall comply in the reference operating mode with the installation limit value.

2 The authorities shall grant exemptions if the owner of the installation can show that that all measures have been taken to limit radiation that are technically and operationally possible and economically acceptable, such as choice of another site or shielding.

3 Sub-stations and switchyards

31 Scope

The provisions of this Number apply to installations for the transformation between two different high-voltage levels and for high-voltage switchyards.

32 Terminology

1 An installation is defined as those parts of a sub-station or switchyard that are under high voltage.

2 A modification is defined as an increase in the nominal power or the displacement or extension of parts that are under high voltage.

33 Reference operating mode

The reference operating mode is defined as operation at nominal power.

34 Installation limit value

The installation limit value for the rms magnetic flux density is 1 μT.

35 New and old installations

1 At places of sensitive use, new and old installations shall comply in the reference operating mode with the installation limit value.

2 The authorities shall grant exemptions if the owner of the installation can show that all measures have been taken to limit radiation that are technically and operationally possible and economically acceptable, such as choice of another site or shielding.

36 Modification of old installations

If an old installation is modified, the authorities shall grant exemptions from the requirements laid down in Article 9 Paragraph 1 if the condition specified in Number 35 Paragraph 2 is fulfilled.

4 Domestic electrical installations

41 Scope

The provisions of this Number apply to domestic installations in accordance with Article 16 of the Electricity Law of 24 June 1902[5] excluding electrical products with fixed connection and stationary electrical products with plugged connection.

42 New installations

New domestic installations shall be built in accordance with current technology. In particular, the following measures shall be taken:

5 SR **734.0**

a. Low-voltage wiring from distribution boards shall if possible be arranged in star formation.

b. Loops in low-voltage wiring shall be avoided.

c. Main distribution systems shall not be located in the vicinity of sleeping areas.

5 Railways and trams

51 Scope

The provisions of this Number apply to railways and trams operating with alternating current.

52 Terminology

1 An installation is defined as the catenary system in accordance with Article 3 of the Ordinance relating to Railway Electrical Installations of 5 December 1994[6], together with the traction current return wire.

2 A modification is defined as an increase in the number of tracks.

53 Reference operating mode

The reference operating mode is defined as operation of passenger and goods trains according to the timetable.

54 Installation limit value

The installation limit value for the rms magnetic flux density is 1 μT, expressed as the average over 24 hours.

55 New installations

1 At places of sensitive use, new installations shall comply in the reference operating mode with the installation limit value.

2 The authorities shall grant exemptions if the owner of the installation can show that:

a. the installation is equipped with a return wire placed as near as possible to the contact line; and

6 SR **734.42**

b. all other measures to limit radiation that are technically and operationally possible and economically acceptable have been taken, such as choice of another site or shielding.

56 Old installations

Should the radiation generated by the installation in the reference operating mode exceed the installation limit value at places of sensitive use, the installation shall be fitted with a return wire placed as near as possible to the contact line.

57 Modification of old installations

If an old installation is modified, the authorities shall grant exemptions from the requirements laid down in Article 9 Paragraph 1 if the conditions specified in Number 55 Paragraph 2 are fulfilled.

6 Transmission installations for mobile telecommunication systems and wireless local loops

61 Scope

1 The provisions of this Number apply to transmission installations for cellular mobile telecommunication networks and to transmission installations for wireless local loops with a total equivalent radiated power (ERP) of at least 6 W.

2 They do not apply to point-to-point microwave links.

62 Terminology

1 An installation comprises all transmission antennae for wireless services in accordance with Number 61 that are either attached to the same mast or located in close proximity, e.g. on the roof of the same building.

2 A modification is defined as an increase in the maximum equivalent radiated power (ERP) or change in the transmission directions.

63 Reference operating mode

The reference operating mode is defined as operation at maximum speech and data traffic at maximum transmission power.

64 Installation limit value

The installation limit value for the rms electric field strength is:

a. 4.0 V/m for installations transmitting exclusively in the range of 900 MHz;

b. 6.0 V/m for installations transmitting exclusively in the range of 1800 MHz or higher;

c. 5.0 V/m for installations transmitting simultaneously in both the frequency ranges specified in letters a and b.

65 New and old installations

At places of sensitive use, new and old installations shall comply in the reference operating mode with the installation limit value.

7 Transmission installations for broadcasting and other wireless applications

71 Scope

1 The provisions of this Number apply to transmission installations for broadcasting and other wireless applications with a total equivalent radiated power (ERP) of at least 6 W that transmit at the same location for at least 800 hours per year.

2 They apply neither to wireless services in accordance with Number 6 nor to point-to-point microwave links.

72 Terminology

1 An installation comprises all transmission antennae for wireless services in accordance with Number 71 that are either attached to the same mast or located in close proximity.

2 A modification is defined as an increase in the maximum equivalent radiated power (ERP) or a change in the transmission directions.

73 Reference operating mode

The reference operating mode is defined as operation at maximum transmission power.

74 Installation limit value

The installation limit value for the rms electric field strength is :

a. 8.5 V/m for long-wave and medium-wave broadcasting transmitters;

b. 3.0 V/m for all other transmission installations.

75 New and old installations

1 At places of sensitive use, new and old installations shall comply in the reference operating mode with the installation limit value.

2 The authorities shall grant exemptions if the owner of the installation can show that:

a. the installation is operated at the lowest transmission power necessary to fulfil its intended purpose; and

b. all other measures to limit radiation that are technically and operationally possible and economically acceptable have been taken, such as choice of another site or shielding.

76 Modification of old installations

If an old installation is modified, the authorities shall grant exemptions from the provisions laid down in Article 9 Paragraph 1 if the conditions specified in Number 75 Paragraph 2 are fulfilled.

8 Radar installations

81 Scope

The provisions of this Number apply to radar transmission installations with an average equivalent radiated power (ERP) of at least 6 W that transmit at the same location for at least 800 hours per year.

82 Terminology

1 An installation is defined as all radar transmission antennae located in close proximity.

2 A modification is defined as an increase in the maximum equivalent radiated power (ERP), a change in transmission direction or of scan cycles.

83 Reference operating mode

The reference operating mode is defined as surveillance of the intended air space at maximum transmission power.

84 Installation limit value

The installation limit value for the rms electric field strength is 5.5 V/m expressed as the average over an entire scan cycle.

85 New and old installations

1 At places of sensitive use, new installations shall comply in the reference operating mode with the installation limit value.

2 The authorities shall grant exemptions if the owner of the installation can show that:

a. the installation is operated at the lowest transmission power necessary to fulfil its intended purpose; and

b. all other measures to limit radiation that are technically and operationally possible and economically acceptable have been taken, such as choice of another site or shielding.

86 Modification of old installations

If an old installation is modified, the authorities shall grant exemptions from the provisions laid down in Article 9 Paragraph 1 if the conditions specified in Number 85 Paragraph 2 are fulfilled.

Annex 2
(Art. 5, 13, 14, 15, 19)

Exposure limit values

1 Exposure containing a single frequency

11 Exposure limit values for field quantities

[1] The exposure limit values for the rms electric field strength, the rms magnetic field strength and the rms magnetic flux density are:

Frequency	Exposure limit values for the			Averaging period
	rms electric field strength $E_{G,f}$ (V/m)	rms magnetic field strength $H_{G,f}$ (A/m)	rms magnetic flux density $B_{G,f}$ (μT)	(minutes)
< 1 Hz	–	32 000	40 000	–[7]
1–8 Hz	10 000	32 000 / f^2	40 000 / f^2	–[7]
8–25 Hz	10 000	4000 / f	5000 / f	–[7]
0.025–0.8 kHz	250 / f	4 / f	5 / f	–[7]
0.8–3 kHz	250 / f	5	6.25	–[7]
3–100 kHz	87	5	6.25	–[7]
100–150 kHz	87	5	6.25	6
0.15–1 MHz	87	0.73 / f	0.92 / f	6
1–10 MHz	87 / $\sqrt{f}$	0.73 / f	0.92 / f	6
10–400 MHz	28	0.073	0.092	6
400–2000 MHz	1.375 · $\sqrt{f}$	0.0037 · $\sqrt{f}$	0.0046 · $\sqrt{f}$	6
2–10 GHz	61	0.16	0.20	6
10–300 GHz	61	0.16	0.20	68 / $f^{1.05}$

Where f is the frequency in the units specified in the first column.

7 Based on the highest rms value (Art. 14 Para. 5)

2 For pulsed exposure, in addition to the exposure limit values given in Paragraph 1, the following exposure limit values for the rms electric field strength, the rms magnetic field strength and the rms magnetic flux density apply. The pulsed exposure is averaged over the duration of the pulse:

Frequency	Exposure limit value for the			Averaging period
	rms electric field strength $E_{P,f}$ (V/m)	rms magnetic field strength $H_{P,f}$ (A/m)	rms magnetic flux density $B_{P,f}$ (µT)	
10–400 MHz	900	2.3	2.9	pulse duration
400–2000 MHz	$44 \cdot \sqrt{f}$	$0.12 \cdot \sqrt{f}$	$0.15 \cdot \sqrt{f}$	pulse duration
2–300 GHz	1950	5.1	6.4	pulse duration

Where f is the frequency in MHz.

12 Exposure limit value for the induced limb current

For frequencies between 10 and 110 MHz, the exposure limit value for the rms electric current discharged via any limb is 45 mA. The averaging period is 6 minutes.

13 Exposure limit value for the contact current

The exposure limit value for the rms contact current is:

Frequency	Exposure limit value for the rms contact current $I_{B,G,f}$ (mA):
< 2.5 kHz	0.5
2.5–100 kHz	$0.2 \cdot f$
0.1–110 MHz	20

Where f is the frequency in kHz

2 Exposure containing several frequencies

21 Principles

1 If several frequencies are present concurrently, the exposure shall be determined at each frequency.

2 The exposure values so determined shall be weighted with a frequency-dependent factor and summed as shown in Number 22.

3 The exposure limit value for each of the sums calculated according to Number 22 shall be 1.

22 Summation procedure

Number	Frequency range	Physical quantity	Summation formula	Averaging period
221	1 Hz–10 MHz	electric field strength	$\sum_{1Hz}^{1MHz} \frac{E_f}{E_{G,f}} + \sum_{>1MHz}^{10MHz} \frac{E_f}{87}$	–[8]
		magnetic field strength	$\sum_{1Hz}^{65kHz} \frac{H_f}{H_{G,f}} + \sum_{>65kHz}^{10MHz} \frac{H_f}{5}$	–[8]
		magnetic flux density	$\sum_{1Hz}^{65kHz} \frac{B_f}{B_{G,f}} + \sum_{>65kHz}^{10MHz} \frac{B_f}{6{,}25}$	–[8]
222	100 kHz–300 GHz	electric field strength	$\sqrt{\sum_{100kHz}^{1MHz} \left(\frac{E_f}{87}\right)^2 \cdot f + \sum_{>1MHz}^{300GHz} \left(\frac{E_f}{E_{G,f}}\right)^2}$	6 minutes
		magnetic field strength	$\sqrt{\sum_{100kHz}^{1MHz} \left(\frac{H_f}{0{,}73}\right)^2 \cdot f^2 + \sum_{>1MHz}^{300GHz} \left(\frac{H_f}{H_{G\,f}}\right)^2}$	6 minutes
		magnetic flux density	$\sqrt{\sum_{100kHz}^{1MHz} \left(\frac{B_f}{0{,}92}\right)^2 \cdot f^2 + \sum_{>1MHz}^{300GHz} \left(\frac{B_f}{B_{G\,f}}\right)^2}$	6 minutes
223	additional limit value for pulsed exposure	electric field strength	$\sqrt{\sum_{10MHz}^{300GHz} \left(\frac{E_f}{E_{P,f}}\right)^2}$	pulse duration
	10 MHz–300 GHz	magnetic field strength	$\sqrt{\sum_{10MHz}^{300GHz} \left(\frac{H_f}{H_{P,f}}\right)^2}$	pulse duration
		magnetic flux density	$\sqrt{\sum_{10MHz}^{300GHz} \left(\frac{B_f}{B_{P,f}}\right)^2}$	pulse duration
224	10 MHz–110 MHz	induced limb current	$\sqrt{\sum_{10MHz}^{110MHz} \left(\frac{I_{K,f}}{45}\right)^2}$	6 minutes

8 Based on the highest rms values (Article 14 Paragraph 5)

Number	Frequency range	Physical quantity	Summation formula	Averaging period
225	1 Hz–110 MHz	contact current	$\sum_{1Hz}^{110MHz} \frac{I_{B,f}}{I_{B,G,f}}$	–[9]

The summation shall be carried out for all frequencies f at which exposures are simultaneously present and which fall into the frequency range specified at the summation symbol (Σ).

Definition of symbols:

f frequency in MHz

E_f rms electric field strength in V/m at frequency f

$E_{G,f}$ exposure limit value for the rms electric field strength in V/m at frequency f as laid down in Number 11 Paragraph 1

$E_{P,f}$ exposure limit value for the rms electric field strength in V/m at frequency f as laid down in Number 11 Paragraph 2

H_f rms magnetic field strength in A/m at frequency f

$H_{G,f}$ exposure limit value for the rms magnetic field strength in A/m at frequency f as laid down in Number 11 Paragraph 1

$H_{P,f}$ exposure limit value for the rms magnetic field strength in A/m at frequency f as laid down in Number 11 Paragraph 2

B_f rms magnetic flux density in µT at frequency f

$B_{G,f}$ exposure limit value for the rms magnetic flux density in µT at frequency f as laid down in Number 11 Paragraph 1

$B_{P,f}$ exposure limit value for the rms magnetic flux density in µT at frequency f as laid down in Number 11 Paragraph 2

$I_{K,f}$ rms electric limb current in mA at frequency f

$I_{B,f}$ rms contact current in mA at frequency f

$I_{B,G,f}$ exposure limit value for the rms contact current in mA at frequency f as laid down in Number 13

9 Based on the highest rms values (Article 14 Paragraph 5)

ATTACHMENT 2

CENTRAL MAINE
POWER

September 19, 2013

Mr. Harry Lanphear
Administrative Director
Maine Public Utilities Commission
18 State House Station
Augusta, ME 04333-0018

RE: MAINE PUBLIC UTILITIES COMMISSION,
Inquiry into Setback Requirements as Mitigation for Potential Health Effects
of Electromagnetic Fields Associated with Transmission Lines,
Docket No. 2013-402

Dear Mr.Lanphear:

Enclosed for filing in the above-captioned proceeding please find the Comments of Central Maine Power Company.

Sincerely,

Debra J. Mills

Debra J. Mills
Lead Analyst, Regulatory Administration

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IBERDROLA
USA

STATE OF MAINE
PUBLIC UTILITIES COMMISSION

Docket No. 2013-402

September 19, 2013

MAINE PUBLIC UTILITIES COMMISSION, Inquiry into Setback Requirements as Mitigation for Potential Health Effects of Electromagnetic Fields Associated with Transmission Lines	))))	COMMENTS OF CENTRAL MAINE POWER COMPANY

CMP is providing these comments to the Maine Public Utilities' Commission in response to the Commission's inquiry designed to gather information responsive to a letter from the Joint Standing Committee of Energy and Technology (EUT Committee) requesting the Commission provide information related to setback requirements associated with transmission lines. During the last legislative session, the EUT Committee voted to carry over a bill entitled An Act to Establish the Electromagnetic Field Safety Act, LD 95O. The bill proposed that beginning October 1, 2013, all new transmission line and electrical installations capable of carrying 5,000 volts or more of electricity must be set back at least 300 feet from residential homes, residential care facilities, hospitals, schools, licensed daycare facilities, playgrounds, youth centers, religious facilities and youth camps.

More specifically, the letter requests the following information:

- Any information the Commission can provide regarding setback requirements for electric transmission lines[1] in other states from residential homes, residential care facilities, hospitals, schools, licensed daycare facilities, playgrounds, youth centers, religious facilities and youth camps;

[1] While the proposed NOI notes "transmission" lines, the scope of the legislation is potentially broader in that it includes all electric facilities 5,000 volts or more, and thus having an even greater impact specifically to electric distribution facilities.

- A description of the implications of establishing a 300 foot setback requirement for these types of locations on the utilization of existing rights of ways for transmission lines in this State; and

- A description of the current standards used by the Commission when considering the health impacts of EMF associated with transmission lines as well as specific references to support the use of those standards.

Regarding this bill, on March 26, 2013, CMP offered testimony before the EUT Committee opposing the bill because it is unnecessary, impractical and will adversely impact electric delivery services to large numbers of CMP's customers.

As the Commission mentioned in its August 7, 2013 Inquiry, the Commission currently considers health impacts of transmission line siting as part of Certificate of Public Convenience and Necessity (CPCN) proceedings. Section 3132 of Title 35-A requires the Commission to consider public health and safety in determining public need for a proposed transmission line that is subject to a CPCN requirement. This section also requires the Commission to consider the proximity of the proposed transmission line to inhabited dwellings, as well as alternatives to construction of the transmission line, including energy conservation, distributed generation or load management. The Commission's rules implementing Section 3132 require a utility in its petition for a CPCN to provide "a description of the effect of the proposed transmission line on public health and safety and scenic, historic, recreational and environmental values and of the proximity of the proposed transmission line to inhabited dwellings." Chapter 330 § 6(E). The effect on public health and safety is determined on a case by case basis.

CMP believes that the current method used by the Commission to consider the health impacts of transmission line siting via the CPCN process is preferable to a legislative universal setback requirement that lacks a credible scientific basis and is contrary to sound public policy. Any EMF threshold should be based upon science and not an artificial setback requirement that may or may not mitigate EMP impacts. CMP, the Commission and others found the CPCN approach to be acceptable in addressing health impacts of the Maine Power Reliability Program. In the CPCN proceeding, transmission line specific considerations can be taken into account, relying on current science and engineering best practices with any necessary mitigation measures required as part of the approval.

EMF is a function of voltage, distance and current. Therefore higher voltage does not necessarily mean higher EMF levels. In fact, EMF levels from a home's electrical wiring and some household appliances are higher than from transmission lines.

The following section contains CMP's responses to the specific questions asked by the Commission in its Inquiry.

1. Please provide information regarding other jurisdiction's (other states and other countries) setback requirements for electric transmission lines from residential homes, residential care facilities, hospitals, schools, licensed daycare facilities, playgrounds, youth centers, religious facilities and youth camps for the purpose of mitigating possible EMF effects Please specify what level of voltage the setback mitigation applies to (for example 115 kV, 345 kV or different measurement).

   CMP Response: See Attachment 1.

2. Please discuss the feasibility and the practical and cost implications of establishing a 300-foot setback for new and possibly rebuilt construction of electric transmission or distribution facilities of 5 kV or higher if they are located near the locations listed in question 1. Would utilities be able to locate distribution lines along roadways and, if not, how would service be provided? How would the cost of providing distribution service be affected? Would utilities be able to use existing rights of ways for transmission lines and, if not, how would this affect the siting and cost of new transmission lines? What percentage of existing transmission and distribution lines within the utility's territory are closer than 300 feet to the types of locations listed in question 1?

CMP Response: Nearly 100% of CMP's distribution facilities of 5 kV or more[2] are within 300 feet of residential homes residential homes, residential care facilities, hospitals, schools, licensed daycare facilities, playgrounds, youth centers, religious facilities and youth camps. A 300 feet setback is not feasible as the length of overhead services need to be less than 300 feet in order to meet the voltage requirements of MPUC Chapter 320 and other power quality requirements. Please see Illustration No. 31 of CMP's Handbook of Requirements for Electric Service and Meter Installations for allowable secondary and service lengths with overhead conductors (Attachment 2). Standard utility practice requires distribution primary spans closer than 300 feet to points of service. This is necessary to meet service requirements and avoid excessive secondary wire size and length. The typical length of secondary lines is 150 feet or less. Areas with building setbacks of 300 feet or more require lateral distribution lines that bring the primary to within 150 feet to allow standard secondary size and length at these locations as well.

[2] The majority of CMP's distribution system is 12.5 kV and 34.5 kV, though there is a small amount of 4 kV distribution.

Additionally, distribution facilities are most often in the public way, running along roadways. It is not feasible to maintain this clearance in municipalities where minimum building setbacks are less than 300 feet from the public way. Further, it is impossible to maintain this distance for any lots less than 300 feet deep. Locating such facilities off of the public way is not feasible, practicable or cost effective in almost all situations and may be impossible in some situations, such as in urban areas. Even if this could be done, it would dramatically increase operational costs and adversely impact customer service particularly storm restoration and other repairs if CMP is required to move facilities out of public way, which could result in more climbing and off road equipment usage.

CMP's transmission facilities are often in off road rights of way, though many 34.5 kV transmission lines are roadside above the distribution facilities. The roadside transmission will predominately be within 300 feet of residential homes[3]. As to transmission in off-road rights of way, CMP does not have delivery point geographic data in its GIS at this point, so CMP is unable to determine what portion of existing transmission lines are within 300 feet of a residential home or the other facilities mentioned in Question 1. Using data that was tracked manually for MPRP, there are 2,450 residential homes within 300 feet of the right of way of MPRP facilities. CMP estimates that it would cost over $500 million to acquire the properties in order to eliminate any residential homes from being within 300 feet of the rights of way.

[3] CMP is aware of residential homes that are within 300 feet of transmission lines in rights of way. CMP has no knowledge of whether or not there are any residential care facilities, hospitals, schools, licensed daycare facilities, playgrounds, youth centers, religious facilities and youth camps that are within 300 feet of a transmission line in rights of way.

Due to the nature of the transmission and distribution system, distribution lines are likely to be near buildings so as to provide electric service to customers. However, effort is made to locate transmission lines away from buildings in general.

3. The Committee letter asks for information regarding potential health impacts of EMF associated with transmission lines and for a description of the current standards used by the Commission when considering the health impacts of EMF associated with transmission lines. In considering mitigation measures, the Commission may take into consideration the WHO4 recommendations. During consideration of LD 950, there was discussion of the 2007 WHO report referenced above and its recommendations. To the extent there are more recent reports regarding potential health impacts from EMF associated with transmission lines, please provide that information.

   CMP Response: See Attachment 1.

CMP hopes this information is useful in the Commission responding to the EUT Committee.

Respectfully submitted,

Kenneth W. Farber

Kenneth Farber
Senior Counsel

Bangor Hydro ELECTRIC COMPANY | MAINE PUBLIC SERVICE

Emera Companies

ELECTRONICALLY FILED ON September 19, 2013

Harry A. Lanphear
Administrative Director
Maine Public Utilities Commission
State House Station 18
Augusta, ME 04333-0018

Re: Maine Public Utilities Commission – Inquiry into Setback Requirements as Mitigation for Potential Health Effects of Electromagnetic Fields Associated with Transmission Lines; Docket 2013-00402

Dear Mr. Lanphear:

Enclosed for filing in the above-captioned matter, please find Bangor Hydro Electric and Maine Public Service Company's comments in response to the Notice of Inquiry issued on August 7, 2013.

Please feel free to contact me if you have any questions.

Sincerely,

Nathan Martell
Regulatory Counsel
Bangor Hydro Electric Company
Maine Public Service Company

NM:sm
Enclosures

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STATE OF MAINE
PUBLIC UTILITIES COMMISSION

Docket No. 2013-402

September 19, 2013

MAINE PUBLIC UTILITIES COMMISSION
Inquiry into Setback Requirements as Mitigation for Potential Health Effects of Electromagnetic Fields Associated with Transmission Lines

COMMENTS OF BANGOR HYDRO ELECTRIC COMPANY AND MAINE PUBLIC SERVICE COMPANY

INTRODUCTION

On August 7, 2013, the Maine Public Utilities Commission (the Commission) issued a Notice of Inquiry (NOI) regarding the potential health effects of Electromagnetic Fields (EMF) from transmission lines as well as possible mitigation options for these health effects. In particular, the Commission asked for comments regarding what other jurisdictions require for transmission line setbacks for a number of types of facilities, including residences, playgrounds, and schools, the feasibility of extending the setback to 300-feet for new or rebuilt construction, and any updated EMF health impact information.

As the Commission mentioned in the NOI, the Commission currently considers health impacts of transmission line siting as part of Certificate of Public Convenience and Necessity (CPCN) proceedings. Bangor Hydro Electric Company (Bangor Hydro) has provided EMF measurements and other related data during past CPCN proceedings including Docket No. 2009-26, ODR No. 2 response dated June 12, 2009, related to the Bangor Hydro Downeast Reliability Project. The Utilities believe that the current method used by the Commission to consider the health impacts of transmission line siting as part of the CPCN is a sound process. For example, in a CPCN proceeding, transmission line specific considerations can be taken into account with any necessary mitigation measures required as part of the approval.

Bangor Hydro and Maine Public Service Company (Maine Public) (collectively the Utilities) appreciate the opportunity to comment on this subject and hereby submit the following comments in response to the Commission's NOI.

COMMENTS

1. Please provide information regarding other jurisdiction's (other states and other countries) setback requirements for electric transmission lines from residential homes, residential care facilities, hospitals, schools, licensed daycare facilities, playgrounds, youth centers, religious facilities and youth camps for the purpose of mitigating possible EMF effects. Please specify what level of voltage the setback mitigation applies to (for example 115 kV, 345 kV or different measurement).

To answer the Commission's inquiry regarding what setbacks other jurisdictions require, Bangor Hydro and Maine Public contacted engineering personnel at utilities in other states requesting information on EMF-based setback requirements. The Utilities received responses from utilities serving certain parts of Connecticut, Massachusetts, Rhode Island, New York, and Vermont. Those jurisdictions do not require specific EMF setbacks.

Additionally, the Institute of Electrical and Electronics Engineers (IEEE) Standard C95.6 provides a table that addresses EMF limits rather than setback requirements. This table is provided below.

Last change 21/10/2002

These values are assumed to be specific to power lines and are therefore 60 Hz

Country: USA (State limits, specific to overhead power lines)				
State	Area where limit applies	Quantity	Limit	Comment
Florida	Edge of right-of-way	E	*2 kV/m*	
		B	*15 μT*	230 kV lines
			20 μT	500 kV lines
	Everywhere	E	*8 kV/m*	69-230 kV lines
			10 kV/m	500 kV lines
Minnesota	Everywhere	E	*8 kV/m*	
Montana	Edge of right-of-way	E	*1 kV/m*	May be waived by landowner
	Road crossings	E	*7 kV/m*	
New Jersey	Edge of right-of-way	E	*3 kV/m*	
New York	Edge of right-of-way	E	*1.6 kV/m*	
		B	*20 μT*	
	Public road crossings	E	*7 kV/m*	
	Private road crossings	E	*11 kV/m*	
	Everywhere	E	*11.8 kV/m*	
Oregon	Accessible or inhabited areas	E	*9 kV/m*	

Please note that the Utilities offer this table as an example of EMF requirements and that we have not checked for any updates to these requirements. The Utilities further note that no state requires a specific setback distance to implement EMF thresholds.

Both Bangor Hydro and Maine Public sampled magnetic field measurements around company-owned lines in order to better understand the IEEE setback standards and their relation to the Utilities. These measurements consistently fell below the thresholds listed in the IEEE standard, as show in the following table:

Sample Magnetic Field Measurements Taken 9-5-13

Distance	L388 (345kV/600MVA)	L246 (115kV/33MVA)	L70 (46kV/14MVA)
Under Line	98 mG (9.8 uT)	23 mG (2.3 uT)	16 mG (1.6 uT)
75 feet	40 mG (4 uT)	4 mG (0.4 uT)	3 mG (0.3 uT)
150 feet	11 mG (1.1 uT)	2 mG (0.2 uT)	1 mG (0.1 uT)

Knowing that a magnetic field is a function of current and not voltage, a higher voltage does not necessarily mean higher EMF levels. Further, secondary and service lines are operated at lower voltages resulting in higher current levels than many of the primary lines. Based on this sample table outlined in the table above, EMF measurements taken around service wires both inside and outside customer premises often yield readings higher than measurements around nearby primary lines.

For further information on this topic please see Exponent's Report titled "Inquiry on Setback Requirements" attached hereto and incorporated herein.

2. Please discuss the feasibility and the practical and cost implications of establishing a 300-foot setback for new and possibly rebuilt construction of electric transmission or distribution facilities of 5 kV or higher if they are located near the locations listed in question 1. Would utilities be able to locate distribution lines along roadways and, if not, how would service be provided? How would the cost of providing distribution service be affected? Would utilities be able to use existing rights of ways for transmission lines and, if not, how would this affect the siting and cost of the new transmission lines? What percentage of existing transmission and distribution lines within the utility's territory are closer than 300 feet to the types of locations listed in question 1?

A. Data Limitations

The information provided in the following section and in Bangor Hydro Table 1 of the attached spreadsheet is based on data within the Bangor Hydro geographic information system (GIS) that includes the demand point (generally the meter location) and the plotted location of transmission and distribution spans. Bangor Hydro does not have data that fully identifies the types of demand points and/or meter locations that are listed in Question 1 of the NOI (i.e., residences, businesses, hospitals, schools, etc.). The demand points are categorized as either Residential or Other. Not all demand points are on buildings nor do all demand points represent the closest point of the building to transmission and distribution lines. While the GIS data captures the residential locations fairly well, the non-residential locations listed in Question 1 (business, hospitals, schools, etc.) make up a small unidentified subset of the data in the other category.

Due to certain data limitations, Maine Public was unable to compile similar information for Maine Public Table 1. The Utilities believe, however, that the data characteristics of Maine Public are not dissimilar to the data characteristics of Bangor Hydro regarding the percentage of primary transmission and distribution spans within 300 feet of the types of locations.

B. Setback data for existing lines

Nearly all Bangor Hydro's distribution spans and key transmission spans such as road crossings have demand points (i.e., meter locations at residences, businesses, schools, etc.) within 300 feet. For the Bangor Hydro system, 98.5% of demand points have a distribution span within 300 feet and 4.3% of demand points have a transmission span within 300 feet. Please refer to the Bangor Hydro Table 1 and Maine Public Table 1 of the attached spreadsheet for more detailed information.

Due to the nature of the transmission and distribution system, distribution lines are likely to be near buildings or in a public way so as to provide electric service to customers. It also follows that buildings are located near roads and therefore distribution lines are generally located along roadways. It should be noted that, where appropriate, effort is made to locate transmission lines away from buildings in general.

The small percentage of transmission spans that are within 300 feet of the various types of demand points and/or meter locations are along roadside lines and at key points such as road crossings on lines in a right of way. A 300-foot setback at these locations would typically be extremely difficult or impractical to obtain and will increase costs significantly.

C. Impacts of a 300' setback requirement on new and rebuilt transmission lines

Transmission Lines in the Right of Way

The effort to establish a 300-foot setback to existing locations of all types would involve approximately 40 % of the spans on existing transmission lines when the lines are rebuilt in place, assuming no additional development adjacent to existing lines takes place. This limiting approach would not provide a 300-foot setback for future residential and other types of locations.

Significant additional corridor width would be necessary along 100% of all existing and future transmission lines in the right of way to provide a 300-foot setback for future homes and other facilities. Bangor Hydro Table 2A and Maine Public Table 2A of the attached spreadsheet show typical right of way widths by voltage and the approximate corridor width which would be required to meet a 300-foot setback along with estimated area and cost to provide this increased setback on a per mile basis.

Roadside Transmission Lines

With a 300-foot setback requirement, no new transmission lines could be built along roadsides due to the proximity of existing and potential buildings. Establishing roadside corridors of greater than 600 feet would not be feasible.

All existing roadside transmission lines would need to be relocated into a minimum of 610-foot wide right of ways if they are rebuilt with a 300-foot setback requirement. Estimated new right of way requirements and preliminary cost estimates are shown in Bangor Hydro Table 2B and Maine Public Table 2B of the attached spreadsheet.

Other impacts of this significant widening of transmission lines

In some locations, achieving a 300-foot setback would not be possible since there is development on both sides of existing lines. To achieve these setbacks, condemnation of private property and the removal of homes and businesses where lines intersect developed areas, including most road crossings, would likely be required to establish a 300-foot setback when rebuilding existing lines.

A 300-foot setback requirement would likely reduce the Utilities' ability to meet other stakeholder requirements when routing and permitting transmission lines. This would significantly limit options for siting transmission lines and further increase the costs.

D. Impacts of a 300-foot setback requirement on new and rebuilt distribution lines

Creating a 300-foot setback is not feasible for new or rebuilt distribution lines. By design, nearly 100% of all existing distribution spans are within 300 feet of a demand point. This is true of both overhead and underground distribution lines as shown in Bangor Hydro Table 1 of the attached spreadsheet.

Most distribution lines are along roadways. The setback from buildings is established by the physical space available. Utility line setbacks from road centerlines generally follow state and municipal guidelines. Building setbacks vary depending on local requirements.

Standard utility practice requires distribution primary spans closer than 300 feet to points of service. This is necessary to meet service requirements and avoid excessive secondary wire size and length. The typical length of secondary lines is 150 feet or less. Areas with building setbacks of 300 feet or more require lateral distribution lines that bring the primary to within 150 feet to allow standard secondary size and length at these locations as well.

E. Summary

Establishing 300-foot setbacks transmission lines (from the specified locations and facilities) could be achieved in some remote locations, but would be very difficult in developed areas.

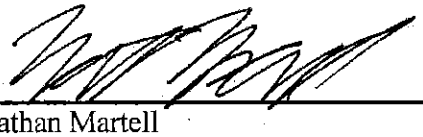
Establishing 300-foot setbacks for distribution lines is simply not feasible. The only way it could occur is with massive condemnation and demolition of urban, suburban and some rural homes, businesses and other facilities. Distribution lines must be located near these facilities and roadside is the most practical location.

In all cases, increased setbacks for lines with 5000 volts and higher would increase cost dramatically.

3. The Committee letter asks for information regarding potential health impacts of EMF associated with transmission lines and for a description of the current standards used by the Commission when considering the health impacts of EMF associated with transmission lines. In considering mitigation measures, the Commission may take into consideration the WHO recommendations. To the extent there are more recent reports regarding potential health impacts from EMF associated with transmission lines, please provide that information.

For further information on this topic please see Exponent's Report titled "Inquiry on Setback Requirements" attached hereto and incorporated herein.

Respectfully submitted this
19th day of September, 2013



Nathan Martell
Regulatory Counsel
Bangor Hydro Electric Company
Maine Public Service Company

FILED ELECTRONICALLY ON SEPTEMBER 18, 2013

Dianne Wilkins
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September 18, 2013

Harry Lanphear
Administrative Director
Maine Public Utilities Commission
State House Station #18
242 State Street
Augusta, Maine 04333-0018

Re: Notice of Inquiry; PUC Docket 2013-00402

Dear Mr. Lanphear:

Enclosed please find my Information and Comment in response to the PUC's Notice of Inquiry of August 7, 2013 regarding LD950.

Thank you.

Sincerely,

Dianne Wilkins

FILED ELECTRONICALLY ON SEPTEMBER 18, 2013

STATE OF MAINE
PUBLIC UTILITIES COMMISSION

September 18, 2013

Notice of Inquiry of August 7, 2013

Docket No. 2013-00402

Information and Comment by Dianne Wilkins for Notice of Inquiry Regarding LD 950

Below is information and comments in response to requests by the Maine Public Utilities Commission (MPUC) in their Notice of Inquiry of August 7, 2013.

1. **In regards to other states and countries setback requirements for electric transmission lines from residential homes, residential care facilities, hospitals, schools, licensed daycare facilities, playgrounds, youth centers, religious facilities and youth camps for the purpose of mitigating possible EMF effects, please consider the following.**

As this document attempts to highlight, many scientist agree there is a substantial amount of recent evidentiary support for an upgrade from a positive association to a causal relationship between exposures to power line extremely low frequency electromagnetic fields (ELF EMF) and increased rates of childhood cancers indicating a need for precautionary protective measures with minor, if any, consideration of costs.

Other states and countries setback requirements for electric transmission lines typically have been based only upon older evidentiary information as found in the WHO, 2007 report and therefore are not protective against the increased rate of childhood cancers recently found, nor are they relevant to this inquiry.

In addition, other state's power line set back reports, policies and/or decisions do not offer a detailed enough account of the scientific studies and evidence regarding the health effects that they relied on to arrive at their power line setback distances; therefore it would not be prudent or in the best interest of Maine's children to just adopt these policies without further justification, determination and agreement with how and why others arrived at those particular setback distances. For the regulating body to simply convey in their report/policy/decision that they "consulted with others" in determining their setback distances without offering any specifics, reasons, analysis or support for choosing these numbers is not adequate justification.

Also, and as pointed out in Repacholi and Ahlbom 1999 study, magnetic field intensity levels and odds risk assessments are likely to be ***lower*** in Europe than exposure levels and odds risk assessments in the United States

due to differences in their assessment protocols and line voltage of 220 V versus 110 V... i.e. double the magnetic field exposure levels in the US.

Another factor which has considerable influence on the different protection and precautionary measures taken by European countries is the lower incidences of Childhood Leukemia in the total population of Europe that is attributable to exposure to power line ELF EMFs at an intensity level of .3 μT than in North America; whose worst case scenario had an overall percentage of children exposed...i.e., population attributable risk percent (PAR %) of 8.3% and as high as 19.6% (Teepen et al., 2012). Taking these numbers into consideration, the US has a higher number of children at risk and at higher exposure intensity levels; therefore low cost should not be the major consideration when determining the power line distances from our vulnerable populations.

2. **During consideration of LD 950, there was discussion of the 2007 WHO report[1] and its recommendations. The following information is provided in regards to the PUC's request for more recent reports regarding potential health impacts from EMF associated with transmission lines.**

As relayed by the MPUC at the top of page three of their Notice of Inquiry:

> The World Health Organization (WHO) issued a report in 2007 resulting from its extensive review of research on the health effects of EMF. This report also contained recommendations for policy makers. The WHO Report found an association but no causal link between long-term exposure to EMF in the 3-4 mill gauss (mG) range and an increased risk of childhood leukemia. It recommended the use of precautionary approaches but cautioned that "it is not recommended that the limit values in exposure guidelines be reduced to some arbitrary level in the name of precaution. Such practice undermines the scientific foundation on which the limits are based and is likely to be an expensive and not necessarily effective way of providing protection." *WHO Report.* at 7.

The report further stated:

> Implementing other suitable precautionary procedures to reduce exposure is reasonable and warranted. However, electric power brings obvious health, social and economic benefits, and precautionary approaches should not compromise these benefits. Furthermore, given both the weakness of the evidence for a link between exposure to ELF magnetic fields and childhood leukemia, and the limited impact on public health if there is a link, the benefits of exposure reduction on health are unclear. Thus the costs of precautionary measures should be very low.

In the above quote, when the WHO said "it is not recommended that the limit values in exposure guidelines be reduced to some arbitrary level in the name of precaution...," the word *arbitrary* is defined as meaning "random" "illogical" or "chance" levels. These definitions do not describe the magnetic field intensity exposure level limit of 0.3 μT (3 mG) being suggested herein since the suggested level is not illogical and was not selected at random, or by chance, but is based on the well recognized scientific threshold level where risk

[1] WHO, 2007, Extremely Low Frequency Fields Environmental Health Criteria Monograph No. 238

estimates for childhood cancers have reached statistical significance as confirmed by the two pooled analyses reviews cited in the WHO, 2007 report (Ahlbom et al., 2000; Greenland et al., 2000); and another more recent pooled analysis along with a meta analysis review (Kheifets et al., 2010; Calvente et al., 2010); extensive reviews of scientific evidence; and recent studies that have not been taken into consideration by the WHO, 2007 report (see Svendsen et al., 2007; Feizi and Arabi, 2007; Mejiz-Arangure e al., 2007; Lowenthal et al., 2007; Yang et al., 2008; Abdul-Rahmann et al., 2008; Malagoli et al., 2010; Calvente et al., 2010; Kroll et al., 2010; Kheifets et al., 2010; Sohrabi et al., 2010; Schuz et al., 2011; Does et al., 2011; Wunsch-Filho et al., 2011; Teepen et al, 2012; BioInitiative, 2012).

Section 12 of the BioInitiative, 2012 review describes this magnetic field intensity exposure level as follows:

> Childhood leukemia is the most frequent childhood malignancy that peaks in the age group of 2 to about 5 years. This peak seems to have been newly evolved in the early quarter of the 20th century and may be due to electrification. This assumption is supported by the absence of this peak or it being much less pronounced in developing countries. An overview of existing evidence from epidemiological studies indicates that there is a continuous increase of risk with increasing levels of average magnetic field exposure. Risk estimates reach statistical significance at levels of 3 to 4 mG. *vide,* page 17

As also claimed by the WHO 2007 report in the quote provided above, a precautionary approach should not compromise the benefits of electric power because of the weakness of the evidence for a link between exposure to extremely low frequency electromagnetic fields (ELF EMF) and Childhood Leukemia, but as will also be pointed out in this paper, the evidence of a positive association has been strengthened by the conclusions of another pooled analyses, a meta analyses along with many other current extensive reviews that not only confirm the positive association, but in many cases, elevates it to a probable causal relationship, giving rise to the necessity to prioritize the use of precautionary measures to eliminate the risk to the children of Maine in lieu of prioritizing monetary cost to customers.

The Maine Office of Public Advocate (OPA) has rendered their opinion regarding the recommendations of the 2007 WHO report in their oral testimony contained in the transcripts of PUC Docket 2011-504:[2]

> MR. BRYANT: -- just acknowledge the association that I've just discussed. We're fully mindful that the WHO has stated that no study has demonstrated a cause and effect relationship. I think that's why -- it's my guess that's why the WHO hasn't come out and made a stronger recommendation than it has. In fact, that's a priority for future study according to the WHO is learning more about the relationship between childhood leukemia and EMF. The -- the monograph number 238 also reveals that laboratory

[2] Transcript of Oral Argument, PUC Docket 2011-504; March 16, 2012, *vide* on page 25 at lines 8-24

> animals do not experience comparable disease, and so it's hard to create a controlled study that would show a causal link.
>
> At any rate -- so I find the WHO recommendations and the document to be, for lack of a better word, schizophrenic. I mean, on the one hand, it references well-conducted studies and it shows a consistent pattern of increased childhood leukemia in reference to power lines. But then the WHO suggests that no agency should draw a bright line.[3]

The OPA has also weighed in on the subject of potential health impacts of exposure to power line ELF EMFs when they were asked why they had intervened in this same power line case before the PUC:

> MR. BRYANT: Very fair question. Well, picking right up on that, the second reason we intervened is because of our concern for Maine children. Many studies, as I just said, link EMF levels between three and four at residences and childhood leukemia. And it's our view that no child should face the risk of developing this devastating disease, and we think the Commission should observe the precautionary principle and take steps to prevent it. [4]

The OPA further emphasized their view point:

> But it really -- it all comes from -- I feel that the risk of Maine children being exposed to these lines is -- is there. I think it's a real risk. *ibid*

Research scientists have noted that studies conducted using small population samples can lead to an underestimation of risk, thus preventing the differentiation between major and slight risk (Calvente et al., 2010; Ahlbom et al., 2000; Greenland et al., 2000). To minimize the effects of small samples when conducting reviews of evidence, data from different studies are combined into pooled analyses. Pooled analyses uses raw data from previous studies, and so can apply identical analyses to all included studies (Kheifets et al., 2010).

Pooled analyses is considered the gold standard for synthesizing results from multiple studies because it allows for comparison across different studies and metrics, free of artefacts introduced by analytical differences, and for derivation of more stable results (Kheifets et al., 2006).

The 2007 WHO report based their recommendations regarding ELF EMF exposure impacts on examination of two pooled analyses, both showed results of statistically significant excess risk of Childhood Leukemia from exposure to power line ELF magnetic fields (Ahlbom et al., 2000; Greenland et al., 2000).

Ahlbom et al. (2000) combined 9 studies from Canada, Denmark, Finland, Germany, New Zealand,

[3] *Id.*, page 22 at 23-25 and 23 at 1-6
[4] *Id.*, page 29 at 9-10

Norway, Sweden, the US, and the UK with overall 3247 cases of Childhood Leukemia and 10,400 control children, showing a pooled calculated a higher risk of 2.00 (95% confidence interval (CI), 1.27e3.13) at magnetic field intensity exposure levels of 0.4 μT and above.

Greenland et al. (2000) analyzed 15 available studies and described a higher overall risk of leukemia with an OR of 1.65 (95% CI 1.15–2.36) in children exposed to magnetic fields above 0.3 μT.

As stated by Repacholi, M. H., & Ahlbom, A. (1999), reviews of epidemiological studies conducted by the US National Research Council[5], and the National Institute of Environmental Health Sciences (1998)[6] have also suggested that there is a weak link between exposure to power-frequency magnetic fields and childhood leukemia, with an odds ratio of about 1.5.

Since the WHO, 2007 report was published, another pooled analyses, a meta analysis, and many more extensive reviews have been conducted by different groups of scientists that were not examined or taken into consideration by the WHO 2007 review of evidence (Svendsen et al., 2007; Feizi and Arabi, 2007; Mejiz-Arangure e al., 2007; Lowenthal et al., 2007; Yang et al., 2008; Abdul-Rahmann et al., 2008; Malagoli et al., 2010; Calvente et al., 2010; Kroll et al., 2010; Kheifets et al., 2010; Sohrabi et al., 2010; Schuz et al., 2011; Does et al., 2011; Wunsch-Filho et al., 2011; Teepen et al, 2012; BioInitiative, 2012). All of these have confirmed a positive association with a higher risk of developing childhood cancers at power line ELF EMF magnetic field intensity exposure levels above .3 or .4 μT (3 or 4 mG) but three of the more recent reports, Sohrabi et al., 2010; Teepen et al., 2012; and BioInitiative, 2012, have elevated the association to a probable causal relationship.

In 2007, Svendsen et al. completed a German cohort study that generally agreed with a prior U.S. study by others that showed poorer survival among children with acute lymphoblastic leukaemia exposed to magnetic fields above .3 μT, however their report concluded an excess risk at fields lower than those in the U.S. study.

---

[5] National Research Council. Possible health effects of exposure to residential electric and magnetic fields. National Research Council, Washington: National Academy Press, 1996.

[6] Portier CJ,Wolfe MS (eds). National Institute of Environmental Health Sciences Working Group Report. Assessment of health effects from exposure to power-line frequency electric and magnetic fields (NIH publication no. 98-3981). Research Triangle Park: NIEHS,
1998.

The Feizi and Arabi (2007) epidemiological case control study published in the *Asian Pacific Journal of Cancer Prevention,* used 60 cases and 59 controls from a residential area of northwest Iran and related the distance from the residence to high-voltage power lines with the relative risk of childhood leukemia comparing between residences less and more than 500 m from high-voltage power lines, finding significant increased risk of Acute Lymphoblastic Leukemia:

> In conclusion, we did find a significantly increased risk of Acute Lymphoblastic Leukemia in children, living In the vicinity of very high voltage (123 & 230 kilo volts) power lines in distances ≤ 500 meters, and in MF intensities > 0.45μT. *vide* pages 71 and 72

Feizi and Arabi also made recommendations for protection from power line exposures:

> The authorities in developing countries should reassess the hazards and re-define the safe zones near the high voltage power lines. The equipments, towers and stations dealing with very high voltage electricity should be installed far enough from the residential areas. If unavoidable, it is rational to underground them in the densely populated areas. It is reasonable to appreciate a minimum of 500 meters as potentially hazardous area, and no building permits should be issued if this safe distance is not respected. *vide* page 71

In their population study in Italy, Malagoli et al. (2010) found:

> When limiting the analysis to leukemia cases and matched controls, the relative risk associated to magnetic field exposure was 3.2 (95% CI 0.4-23.4), which further increased to 6.7 (95% CI 0.6-78.3) after adjusting for socioeconomic status indicators. Corresponding figures for the acute lymphoblastic leukemia were 6.0 (95% CI 0.5-69.5) for crude analysis and 5.3 (95% CI 0.7-43.5) for the multivariate estimate… Limiting the analysis of exposed children to those with highest exposure, i.e. ≥ 0.4 μT, RR, overall risk for the malignancies considered showed a slight increase compared with the previous analysis. *vivid* pages 4 & 5.

Malagoli et al. also noticed an overall increased childhood leukemia risk in the proximity of high voltage power lines which suggested "a homogeneous trend across different populations" and that "It should also be noted that recent laboratory studies have increased the biological plausibility of adverse health effects of extremely low frequency magnetic fields." *vivid* page 7.

In 2010, Calvente et al. published a meta analysis review of the scientific evidence that incorporated all the studies reviewed by the WHO, 2007 report but also reviewed three additional studies including the Feizi and Arabi 2007; Infante-Rivard et al, 2003; and Meja-Arangure et al., 2007 and stated:

> Most of the studies reviewed here found an association between exposure to EMR and the risk of childhood leukemia, although statistical significance was not always reached. Taking into account exposure values of ≥0.3 μT, the risk of cancer is significant and greater than 1 in the majority of datasets

> analyzed in our review (Table 3), despite the wide interval ranges in some of them. In fact, half (n=20) of these datasets show statistically significant increases and none yields a statistically significant decrease. Hence, according to this epidemiological evidence, there is an increased risk of leukemia in children exposed to low electromagnetical fields of ≥ 0.3 μT. *vide* page 3067

In their summary, Calvente et al. argued in favor of using the precautionary principle due to the epidemiological evidence and the severity of potential harm to children:

> In summary, the epidemiological evidence reviewed in this article reveals a consistent pattern of increased leukemia incidence in children exposed to low electromagnetic fields. This increase is pronounced in children exposed to fields greater than 0.3μT but can also be observed in weaker fields. However, all of the studies in this area are affected by various confounding variables that make it difficult to conclusively establish a causal relationship at this juncture.
>
> Nevertheless, epidemiological evidence to date and the severity of the potential harm, especially to children, would argue in favor of application of the precautionary principle. Several reports have recommended use of the precautionary principle for these exposures. *vide* page 3067

Kroll et al. (2010), published in the *British Journal of Cancer*, completed a national case–control study of the UK relating childhood cancer risk to the average magnetic field from high-voltage overhead power lines at the child's home address at birth during the year of birth . From the National Registry of Childhood Tumors, they obtained records of 28,968 children born in England and Wales during 1962–1995 and diagnosed in Britain under age 15. For leukemias, they found a relative risk rate of 2 for exposures ≥ 0.4 μT.

Their prior epidemiological case-control study, Draper et al. (2005), was one of the largest investigations into magnetic fields and childhood cancer conducted where the distance from the residence to high-voltage power lines was related to the relative risk of childhood leukemia, finding a significant risk for distances of 200–600 m (RR 1.22; 95% CI 1.01–1.47) and for distances less than 200 m (RR 1.69; 95% CI 1.13–2.53).

Kroll et al., concluded that their 2010 study slightly strengthened the existing evidence for an association:

> This study slightly strengthens the existing evidence for an association between magnetic fields and childhood leukaemia. However, magnetic fields during the year of birth are extremely unlikely to be the whole cause of the apparent increase in childhood leukaemia risk observed in our previous case–control study of the distance of the birth address from these lines. We emphasize that the fact that *very few homes in Britain are exposed to high magnetic fields* from power lines means that, for the population as a whole, the public-health risk from such exposure would be very small. *vide* page 1126

The Kheifets et al. (2010) pooled analyses selected only population based studies, excluding all hospital based or other institutional based studies. Included in their analysis were seven studies, Wünsch-Filho et al., 2011;

Bianchi et al, 2000; Schuz et al, 2001; Kabuto et al, 2006; Lowenthal et al,2007; Kroll et al, 2010; and Malagoli et al, 2010. It is important to note that even though this analysis used a total of 10,865 cases and 12,853 controls, as emphasized by the authors, the total numbers in the high-exposure categories were small, even for this large data set. This analysis found the odds ratios (95% CI) for Childhood Leukemia to be 1.44 (0.88 –2.36) at magnetic field intensity exposure levels equal to or greater than 0.3 μT (3 mG). Kheifets et al. concluded:

> In conclusion, our results are in line with previous pooled analyses showing an association between residential magnetic field exposure and childhood leukaemia, but the association is weaker in recent studies and imprecise because of small numbers of highly exposed individuals. At the same time, recent studies are small and lack methodological improvements needed to resolve scientific uncertainties regarding the apparent association. In the IARC classification scheme, a key issue is whether 'chance, bias and confounding could be ruled out with reasonable confidence'. Our results, added to the previous pooled analyses, **make chance less likely**, but do not rule out bias or confounding, as whatever bias or confounding was present in previous studies could be present in these studies as well. Therefore, our results support conclusions of the WHO EHC (WHO EHC, 2007) and the European Union Scientific Committee on Emerging and Newly Identified Health Risks (Scientific Committee on Emerging and Newly Identified Health Risks, 2007) that recent studies on magnetic fields and childhood leukaemia do not alter the previous assessment that magnetic fields are possibly carcinogenic to humans. *vide* page 1134. [Emphasis added]

Sohrabi et al. (2010), a case control study published in the *Asian Pacific Journal of Cancer Prevention,* studied 600 children to investigate the association of living near high voltage power lines with the occurrence of Childhood Acute Lymphoblastic Leukemia (ALL). This study found that living near overhead high voltage power lines increases the risk of ALL and this risk is different based on the voltage of the power lines (123 KV, 230 KV or 400 KV):

> Using logistic regression, odds of acute lymphoblastic leukemia for those who were living in less than 400 meters from high voltage power lines was 2.75 (95%CI: 1.59 to 4.76) times to those living in more distance (P< 0.001). It was 2.67 (95%CI: 1.67 to 4.24) for 500 meters and 2.61 (95%CI: 1.73 to 3.94) for 600 meters far from these lines (P< 0.001). Pure risk of living in less than 600 meters far from each type of high voltage power lines after excluding samples that exposed to the other types of lines, estimated as 9.93(95%CI: 3.47 to 28.48) for 123 KV power lines, 10.78 (95%CI: 3.75 to 31) for 230 KV (P< 0.001) and 2.98 (95%CI: 0.93to 9.54) for 400 KV power lines (P< 0.07). *vide* page 423

They concluded:

> It is reasonable to consider a distance of 600 meters as potentially risky area and no building permits should be issued if the defined safe distance is not respected (Feizi and Arabi, 2007; Mousavi et al., 2009). This study emphasizes on risk of ALL following living close to overhead high voltage power lines. Authorities should consider legal limitation for building constructions in at least 600 meters from these power lines. Overhead power lines should be changed to under-ground lines in existing risky neighborhoods. *vide* page 426

Sohrabi et al. also found that the criteria for a **causal** relationship was met as temporality was achieved; the odds ratios of 9.9 and 10.8 for 123 and 230 KV power lines support the strength of association; and an explanation for this relationship is available.

The Schüz, 2011 review published in the *Progress in Biophysics and Molecular Biology,* examined three pooled analyses studies and three cohort studies (Ahlbom et al., 2000, Greenland et al., 2000; Kheifets et al., 2010a; Foliart et al., 2006; Svendsen et al., 2007; Does et al., 2011). Regarding Childhood Leukemia, they stated:

> Recent pooled analysis confirm results from previous studies, namely an approximately two-fold risk increase at ELF-MF exposures of ≥ 0.4 μT., and demonstrate consistency of studies across countries, with different design, different methods of exposure assessment, and different systems of power transmission and distribution. …Overall, the assessment that ELF-MF are a possible carcinogen and may cause childhood leukaemia remains valid. *vide,* page 339.

The Teepen et al. (2012) review, published in the *International Journal of Cancer* also agreed with all three pooled analyses, reviews, and case control studies cited in this document regarding an established association between power line ELF EMF exposures and Childhood Leukemia but also concluded that it is possible that this is a **causal** association:

> Epidemiological studies show a consistent association between ELF-EMF and CL. A 1.4- to 1.7-fold increased risk for exposure levels above 0.3 μT compared to < 0.1 μT was found in pooled analyses. Although some bias may persist, it is possible that this is a causal association. *vide* page 776

Teepen et al. also confirmed the prior positive association between power line ELF EMF exposure and Childhood Leukemia (CL); moreover, this group explored the impact of the increased risk of CL:

> To better understand the impact of an increased risk of CL due to high exposures of ELF-EMF, one must consider the proportion of children exposed to these levels and the increase in risk associated with these levels. The population attributable risk percent (PAR%) is a suitable measure for this. The PAR% is the percentage of the incidence of the disease in the total population that may be attributable to the exposure. *vide,* page 775.

They found that North America had a higher percentage of incidences of Childhood Leukemia in the total population that may be attributable to exposure to power line ELF EMFs than Europe.

> Studies from Northern America (Linet, 1997; London, 1994; McBride, 1999; Savitz, 1988) showed higher PAR% than European studies. In the worst-case scenario, the overall percentage of children exposed to 0.3 μT had a PAR% of 8.3% and ranged from 0.1 to19.6%. *vide* page 776

This group advised that in Northern America, where children are highly exposed, governments should consider precautionary measures:

> However, reducing the exposure of highly exposed children, especially in regions with a large proportion of highly exposed children like Northern America and Brazil, is advised. Governments may consider precautionary measures such as reducing exposure from power lines near densely populated areas or take power lines into consideration in spatial planning of schools and living areas in order to minimize the number of highly exposed children. *vide*, page 776

In addition to Teepen et al. (2012), Section 12 of the BioInitiative 2012 review, entitled *Evidence for Childhood Cancers (Leukemia)* also concluded that the observed association between exposure to power-frequency EMFs and Childhood Leukemia can be causally interpreted. Here they refer to the 2002 WHO IARC committee's classification of exposure to power line ELF EMF as a Class 2-B possible carcinogen and how the evidence of an association is now strengthened:

> Since the evaluation of IARC several other epidemiological studies have been published that corroborate the earlier findings and *strengthen the evidence of an association.* It becomes increasingly less likely that confounding factors exist that operate all over the world and still remained undetected. *vide,* page 3; [emphasis added]

Further in this review, they list the reasons that the more recent evidence would now meet the IARC qualifications to be considered a causal relationship, i.e. a Class 1 carcinogen:

> For all these reasons it can be concluded that there is sufficient evidence from epidemiological studies of an increased risk from exposure to power frequency magnetic frequency that cannot be attributed to chance, bias or confounding. Therefore, according to the rules of IARC such exposures can be classified as a group 1 carcinogen.
>
> It has to be stressed, however, that according to the rules of IARC the working groups may up- or down-grade the classification upon consideration of the overall evidence. The IARC working group considered the lack of supporting evidence from animal experiments and in vitro studies as sufficient to down-grade the classification to 2B. Although it is not possible to discuss this aspect in this context, there are several problems with this view: first, there is no animal model for Acute Lymphoblastic Leukemia, the most frequent childhood leukemia type; second, animal studies are difficult due to the fact that procedures usually applied, i.e. exposure levels just below the acute toxicity level, cannot be followed for magnetic frequencies due to muscle and nerve excitations accompanying such exposures; third, at levels relevant for human long-term exposure in vitro experiments would have to detect extremely rare cellular events to account for the increased risk observed in epidemiological investigations, which is impossible using methods available to date. Therefore, strong and consistent support from such studies can neither be expected nor demanded. Consequently, lack of support from such evidence cannot be used as an argument to down-grade the classification based in epidemiology. *vide,* page 17

The BioInitiative scientists made this determination after having reviewed all the studies presented in the WHO 2007 report along with the more recent evidence found in Svendsen et al., 2007; Feizi and Arabi, 2007; Mejiz-Arangure e al., 2007; Lowenthal et al., 2007; Yang et al., 2008; Abdul-Rahmann et al., 2008; Malagoli et al., 2010; Calvente et al., 2010; Kroll et al., 2010; Kheifets et al., 2010; Sohrabi et al., 2010; Schuz et al., 2011; Does et al., 2011; and Wunsch-Filho et al., 2011.

Section 12 of the BioInitiative also discusses the percentage of the general population (PAR%) that are at risk of Childhood Leukemia from power line ELF EMF exposures (which of course is composed of just children) and the relevant mG level for the increased risk affects:

> Considering only **average** magnetic frequency flux densities the population attributable risk is low to moderate, however, there is a possibility that other exposure metrics are much stronger related to childhood leukemia and may account for a substantial proportion of cases. The population attributable fraction ranges between 1-4% (Kheifets et al., 2007) 2-4% (Greenland & Kheifets 2006) and 3.3% (Greenland 2001) assuming only exposures above 3 to 4 mG are relevant. However, ***if not average*** *magnetic frequency flux density is the metric* causally related to childhood leukemia the attributable fraction can be much higher. Calculating a guideline level based on the unit-risk approach leads to a level close to 1 mG. *vide,* page 17 [emphasis added]

3. **The size and extent of the scientific gaps in knowledge regarding the association of ELF EMFs with childhood cancers should be an important factor taken into consideration when deciding the set back distance causing the least health risk that should be incorporated between power lines and places where children are likely to be located.**

In 2007, the World Health Organization issued an additional report entitled ***Research Agenda for Extremely Low Frequency Fields***[7] to identify gaps in knowledge about possible health effects of ELF EMF exposure. This WHO report listed high priority and other research needs regarding children and pregnant women as:

High priority research needs:

> • **Pooled analyses of existing childhood brain tumour studies**
> *Rationale:* Brain cancer studies have shown inconsistent results. This was also the case for childhood leukaemia studies and here, pooled analyses have been very informative. Therefore a pooled analysis of childhood brain cancer studies is recommended. Such pooled analysis can inexpensively provide greater and improved insight into existing data, including the possibility of a selection bias, and, if studies are sufficiently homogeneous, provide the best estimate of risk.

[7] World Health Organization (2007). ***Research Agenda for Extremely Low Frequency Fields*** Geneva, World Health Organization (see: www.who.int/emf). *Vide* pages 2-8.

• **Update of existing pooled analyses of childhood leukaemia with new information**
Rationale: Since the pooled analyses have been performed, several new epidemiological studies have been published. The pooled analyses should be updated with the results from these recent studies.

• **Development of transgenic mouse models of childhood leukaemia for use in EMF studies**
Rationale: Resolving the conflict between epidemiological results and experimental and mechanistic results for childhood leukaemia is the highest priority. It is recommended that epidemiologists and experimental scientists collaborate on this. To this end, the development of transgenic mouse models for childhood leukaemia should be undertaken in order to provide appropriate experimental animal models relevant to the epidemiological data showing an association of EMF exposure with childhood leukaemia.

Other research needs:

• **Further study of the possible link between miscarriage and ELF magnetic field Exposure**
Rationale: There is some evidence that the risk of miscarriage may be affected by ELF magnetic fields exposure. Taking into account the potentially high public health impact of such an association, further epidemiological research into this hypothesis is recommended.

• **Cognitive, sleep and EEG studies in volunteers, including children and occupationally exposed subjects, using a wide range of ELF frequencies at high field strengths**
Rationale: Studies of adult volunteers and animals suggest that acute cognitive effects may occur with short-term exposures to intense fields. The characterization of such effects is very important for the development of exposure guidance, but there is a lack of specific data concerning field-dependent effects, particularly in children. It is recommended that laboratory-based studies of cognition and changes in electroencephalograms (EEG) in people exposed to ELF magnetic fields be performed, including children and occupationally exposed adults.

• **Studies of pre- and post-natal EMF exposure up to 100 kHz on subsequent cognitive function in animals**
Rationale: Behavioural studies with immature animals provide a useful indicator of possible cognitive effects in children. Possible effects of pre- and post-natal exposure on the development of the nervous system and cognitive function should be studied. These studies could be usefully supplemented by investigations on the effects of exposure to ELF magnetic fields and induced electric fields on nerve cell growth using brain slices or cultured neurons.

• **Studies of ELF magnetic field exposure on immune and haemopoietic systems development in juvenile animals**
Rationale: While changes observed in immune and haematological parameters observed in adults exposed to ELF showed inconsistency, there are essentially no research data available for children. Therefore, the recommendation is to conduct studies on the effects of ELF magnetic exposure on the development of the immune and haemopoietic systems in juvenile animals.

> **• Calculation of induced electric fields and currents in pregnant women and in the foetus**
> *Rationale:* Very little computation has been carried out on advanced models of the pregnant human and the foetus with appropriate anatomical modelling. It is important to assess possible enhanced induction of electric fields during fetal life in relation to the childhood leukaemia issue. Both maternal occupational and residential exposures are relevant here.

It is clear from this WHO knowledge gaps report that the following substantial and crucial information is missing regarding how a power line ELF EMF exposure affects children:

a. the data on childhood brain tumors from various studies has not been pooled to determine the risk rate from power line ELF EMF exposures to children;
b. the existing determination of an association between exposure and childhood leukemia is outdated, hence there is the possibility of a WHO upgrade to a causal relationship;
c. some evidence shows increased risk of miscarriage from ELF EMF exposures but more research is needed to determine risk rate;
d. little is known about how power line ELF EMF exposures affects children's learning abilities or development of their nervous system;
e. little is known about how power line ELF EMF exposures affects children's immune or blood systems;
f. very few exposure calculations have been done using a realistic model of a pregnant human w/ fetus to assess any changes in induction of electric fields during fetal life in relation to childhood leukemia.

In 2009, two years after the WHO's knowledge gaps report, the European Union's Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR) was asked to provide a report to the EU on the high priority knowledge gaps in research for the long term effects ELF EMF. The resulting report, *Research Needs and Methodology to Address the Remaining Knowledge Gaps on the Potential Health Effects of EMF*, describes their recommendations in response to the knowledge gaps as:

> All the studies that are suggested in this opinion are considered very important and given high priority based on their relevance for fundamental understanding of the issue and/or their relevance for public health. *vivd* page 8

Section 4.1.3.1, *Experimental studies relevant to possible carcinogenicity of ELF fields*, describes a study that is needed to close a knowledge gap:

> **Study type**
> Laboratory studies using *in vitro* and/or animal models.
> **Rationale/justification**
> The fact that the epidemiological findings of childhood leukaemia have little support from known mechanisms or experimental studies is intriguing and it is of high priority to reconcile these data. A recent study on rats has provided additional evidence of cocarcinogenic effects from exposure to ELF magnetic fields at 100 μT. Both some earlier

and more recent in vitro studies have indicated that ELF magnetic fields alone and in combination with carcinogens induce both genotoxic and other biological effects in vitro at flux densities of 100 μT and higher. It is unlikely that exposure to ELF fields induces direct damage to DNA, therefore alternative mechanisms must be hypothesised.

Minimum technical requirements

Hypothesis-driven experiments should be based on experimental models that have shown responses to ELF magnetic fields.

Threshold levels and dose-response relationship below 100 μT should be addressed.

Expected impact of results (use for Risk Assessment)

The proposed studies will potentially help to resolve the current uncertainty concerning existence of adverse health effects from weak (below 1 μT) environmental ELF magnetic fields. The results may have important consequences for risk assessment and management and may have impact on understanding the interaction mechanisms between cells and ELF fields.

It is obvious from the needed research recommended by SCENIHR, that they do not know the mechanism, i.e., why evidence is positive for increased rates of Childhood Leukemia and for cocarcinogenic effects from ELF EMF exposures at 100 μT. Not knowing the exact mechanism which causes the effect does not stop the effect from happening, so this lack of knowledge should not prevent legislators from taking precautionary steps to avoid this risk to our children.

Current evidence shows a probable causal relationship that may elevate the risk to a WHO Class 1 carcinogen, therefore the upmost precaution and avoidance should be the primary goal of LD 950 and not just the least expensive solution.

4. <u>Please consider this request to modify LD 950 to increase the setback requirements from 300 ft. (91.44 meters) to 1,969 ft (600 meters) from the non-utility property line.</u>

Below, I have compiled supportive findings of only the scientific research studies through 2012 that have used **distance from power lines** to determine increased risk for the development of child hood cancers, taken from the actual studies and/or from Table 11-4 & 11-5, *Synopsis of main results of childhood cancer studies* (1970-2012) of Section 12 of the BioInitiative (2012) review, attached to this document as Exhibit A:

Name & Year of Study	Distance from power line; kV; mG level	Increased Risk of CL and/or other cancers
1. Fulton et al., 1980	< 46 m; very high kV	OR 1.2
2. Tomenius, 1986	150m; 200 kV	OR 2.15
3. Coleman et al., 1989	50 to 99 m 25-49m 0-24 m	OR. 0.75 OR 1.49 OR 1.63
4. Myers et al., 1990	100-500m; ≥ .3 mG	OR 1.73
5. Feychting & Ahlbom, 1993	< 300 m; 220/400 kV; 1-2 mG	OR 2.1

6. Li et al., 1998	< 100 m; 69-345kV	SIR 2.69
7. Mizoue et al., 2004	< 300 m; 66-220V	IRR 2.2
8. Draper et al., 2005	200-600 m; 132kV,275kV;400kv < 200 m; 132kV,275kV;400kv	RR 1.22 RR 1.68
9. Feizi and Arabi, 2007	≤ 500 m; > 4.5 mG	OR 3.6
10. Lowenthal et al., 2007	0-300 m	OR 3.23
11. Yang et al., 2008	>500 m 0-100 m 0-50 m	OR 2.37 OR 4.31 OR 4.39
12. Abdul-Rahman et al., 2008	0-200 m	OR 2.3
13. Kroll et al.,	200-600 m; ≥ 4 mG	OR 2.0
14. Sohrabi et al., 2010	400m 400m; 123 kV 400m; 230 kV 400m; 400 kV	2.75 (95%CI: 1.59 to 4.76) 9.93 (95%CI: 3.47 to 28.5) 10.78 (95%CI: 3.75 to 31) 2.98 (95%CI: 0.93 to 9.54)
15. Wunsch-Filho et al., 2011	100-200m < 500 m	OR 1.67 OR 1.54

As you can see from my summary, nine (9) out of the fifteen (15) studies, that concluded increased risk of childhood cancers from exposures as measured by distance, had significantly increased risk at distances greater than 300 ft (91.44 m) and up to 1,969 ft. (600 m).

As also can be surmised from this chart and the BioInitiative table, the ORs of contracting childhood cancer have significantly increased in the majority of the newer studies in comparison to the older National Research Council (1996), National Institute of Environmental Health Sciences (1998) and WHO (2007) reports showing an odds ratios of about 1.5.

These results support the modification of LD 950 to increase the setback requirements from 300 ft. (91.44 meters) to 1,969 ft (600 meters).

5. **Please consider this request to modify LD 950 to include a site provision that requires exposure testing levels at the LD 950 non-utility property setback lot line to be at or below 3 mG (0.3 µT). In order to meet this siting requirement the utility should have the option to use reverse phasing, split phasing, tall steel monopoles with a delta configurations, rerouting lines, or other mitigation measures to reduce exposure levels.**

As previously demonstrated, to date, every pooled analyses, meta analyses, review of the evidence, and the majority of scientific studies on this subject have found a statistical positive association and/or causal relationship between exposures to power lines and childhood cancers at or above a magnetic field intensity level

of 3 mG (0.3 μT) which supports this request to modify LD 950 to include a site set back requirement that requires a magnetic field intensity exposure level of 3mG (0.3 μT) or less at the non-utility lot line.

In support of this siting requirement request, below are a compilation of the findings for the pooled analyses, meta analyses, and the reviews of evidence previously discussed in this document:

Ahlbom et al. (2000): pooled data from 9 studies (3247 cases of CL0 showed a pooled risk of 2.00 (95% confidence interval (CI), 1.27e3.13) at magnetic field intensity exposure levels ≥ 0.4 μT (4 mG)

Greenland et al. (2000): pooled data from 15 available studies (3,457 cases) showed a pooled risk of OR 1.65 (95% CI 1.15–2.36) at exposure to magnetic fields > 0.3 μT (3mG).

Calvente et al. (2010): pooled Meta analyses cases from 1970 to 2008; statistically significant increased risk of CL in majority of datasets at magnetic fields ≥ 0.3 μT (3mG)

Kheifets et al. (2010): pooled analyses examined 2 pooled analyses & 6 studies; (9,830 cases & 10,337 controls): found diminished possibility that the positive association is due to chance; odds ratios (95% CI) of 1.44 for increased risk to CL at exposure levels ≥ 0.3 μT (3 mG)

Schuz et al. (2011): review examined 3 pooled analyses & 3 cohort studies (over 19,287 cases); found consistency of studies across different countries; confirms 2-fold increase in risk of CL from exposures ≥ 0.4 μT (4 mG)

Teepen et al. (2012): review examined 3 pooled analysis , 2 reviews and 4 case control studies (over 20,000 cases); found higher percentage of North American children effective by increased risk; elevated the positive association to a probable causal relationship; confirmed prior studies increased risk and association with CL at magnetic field exposure ≥ 0.3 μT (3 mG)

BioInitiative; Section 12 (2012): review examined 3 pooled analyses, 1 meta analyses, and 42 case/cohort studies (estimated over 25,000 cases); found justification for a causal relationship and WHO IARC Class 1 carcinogen at magnetic field exposure ≥ 0.3 μT (3 mG)

Respectfully submitted,

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REFERENCES
(Full copies for most references filed in PUC Docket No. 2013-00402)

1. Ahlbom A, Day N, Feychting M, Roman E, Skinner J, Dockerty J, Linet M, McBride M, Michaelis J, Olsen JH, Tynes T, Verkasalo PK.***A pooled analysis of magnetic fields and childhood leukaemia.*** British Journal of Cancer (2000) **83**(5), 692–698. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2363518/

2. Abdul Rahman HI, Shah SA, Alias H, Ibrahim HM. ***A case-control study on the association between environmental factors and the occurrence of acute leukemia among children in Klang Valley, Malaysia***. Asian Pac J Cancer Prev. 2008 Oct-Dec;9(4):649-52. http://www.ncbi.nlm.nih.gov/pubmed/19256754; http://www.apocpcontrol.org/page/apjcp_issues_view.php?sid=Entrez:PubMed&id=pmid:19256754&key=2008.9.4.649

3. BioInitiative 2012, ***Rationale for a Biologically-based Public Exposure Standard for Electromagnetic Fields (ELF and RF) Section 12 – Evidence for Childhood Cancers (Leukemia) 2012 Supplement.*** BioInitiative Working Group, BioInitiative Report, 2012.

4. Calvente I, Fernandez MF, Villalba J, Olea N, Nuñez MI. ***Exposure to electromagnetic fields (non-ionizing radiation) and its relationship with childhood leukemia: a systematic review.*** Sci Total Environ. 2010 Jul 15;408(16):3062-9. Epub 2010 May 7. http://www.ncbi.nlm.nih.gov/pubmed/20451240

5. Coleman MP, Bell CMJ, Taylor HL, et al. ***Leukemia and residence near electricity transmission equipment: a case-control study***. Br J Cancer 1989;60:793–8. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2247309/

6. Does M, Scélo G, Metayer C, Selvin S, Kavet R, Buffler P. ***Exposure to electrical contact currents and the risk of childhood leukemia.*** Radiat Res. 2011 Mar;175(3):390-6. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3087620/

7. Draper G, Vincent T, Kroll ME, Swanson J. ***Childhood cancer in relation to distance from high voltage power lines in England and Wales: a case-control study***. BMJ. 2005;330:1290. [PMC free article] [PubMed] Pooled Analysis.

8. Feizi AA, Arabi MA. ***Acute childhood leukemias and exposure to magnetic fields generated by high voltage overhead power lines - a risk factor in Iran***. Asian Pac J Cancer Prev. 2007 Jan-Mar;8(1):69-72. http://www.apocpcontrol.org/page/apjcp_issues_view.php?sid=Entrez:PubMed&id=pmid:17477775&key=2007.8.1.69

9. Feychting M, Ahlbom A. ***Magnetic fields and cancer in children residing near Swedish high-voltage power lines.*** Am J Epidemiol 1993;138:467–81. http://www.ncbi.nlm.nih.gov/pubmed/8213751

10. Fulton JP, Cobb S, Preble L, et al. ***Electrical wiring configurations and childhood leukemiain Rhode Island.*** Am J Epidemiol 1980;111:292–6. http://www.ncbi.nlm.nih.gov/pubmed/7361752

11. Greenland, S., Sheppard, A. R., Kaune, W. T., Poole, C., & Kelsh, M. A. (2000). ***A pooled analysis of magnetic fields, wire codes, and childhood leukemia.*** Epidemiology, 11(6), 624-634. http://www.ncbi.nlm.nih.gov/pubmed/11055621

12. IARC, 2002. ***Monographs on the Evaluation of Carcinogenic Risks to Humans. In: Non-ionizing Radiation, Part 1: Static and Extremely Low-frequency (ELF) Electric and Magnetic Fields,*** vol. 80. IARC Press, Lyon.

13. Kheifets L, Ahlbom A, Crespi CM, Feychting M, Johansen C, Monroe J, Murphy MF, Oksuzyan S, Preston-Martin S, Roman E, Saito T, Savitz D, Schüz J, Simpson J, Swanson J, Tynes T, Verkasalo P, Mezei G. ***A pooled analysis of extremely low-frequency magnetic fields and childhood brain tumors.*** Am J Epidemiol. 2010b Oct 1;172(7):752-61. Pooled, Meta Analysis Review. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2965855/

14. Kheifets L, Ahlbom A, Crespi CM, Draper G, Hagihara J, Lowenthal RM, Mezei G, Oksuzyan S, Schüz J, Swanson J, Tittarelli A, Vinceti M, Wunsch Filho V. ***Pooled analysis of recent studies on magnetic fields and childhood leukaemia.*** Br J Cancer. 2010a Sep 28;103(7):1128-35. http://www.ncbi.nlm.nih.gov/pubmed/20877339; http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2965855/

15. Kroll ME, Swanson J, Vincent TJ, Draper GJ. ***Childhood cancer and magnetic fields from high-voltage power lines in England and Wales: a case-control study***. Br J Cancer. 2010;103:1122–1127. [PMC free article] [PubMed]

16. Li C-Y, Lee W-C, Lin RS. ***Risk of leukemia in children living near high-voltage transmission lines.*** J Occup Environ Med 1998; 40:144–7. http://www.ncbi.nlm.nih.gov/pubmed/9503290

17. Linet MS, Hatch EE, Kleinerman RA, Robison LL, Kaune WT, Friedman DR, Severson RK ,Haines CM, Hartsock CT, Niwa S, Wacholder S, Tarone RE. ***Residential exposure to magnetic fields and acute lymphoblastic leukemia in children.*** N Engl J Med 1997;337:1–7. http://www.nejm.org/doi/full/10.1056/NEJM199707033370101

18. London SJ, Thomas DC, Bowman JD, Sobel E, Cheng TC, Peters JM. ***Exposure to residential electric and magnetic fields and risk of childhood leukemia***. Am J Epidemiol 1991;134 923–37. http://www.ncbi.nlm.nih.gov/pubmed/1843457

19. Lowenthal RM, Tuck DM, Bray IC. ***Residential exposure to electric power transmission lines and risk of lymphoproliferative and myeloproliferative disorders: a case-control study.*** Intern Med J. 2007 Sep;37(9):614-9. http://www.ncbi.nlm.nih.gov/pubmed/17543004 Author Abstract: BACKGROUND: Studies have shown an association between electromagnetic fields and childhood leukaemia. The aim of this study was to determine whether there is an increased risk of lymphoproliferative disorders (LPD) or myeloproliferative disorders (MPD) associated with residence < or =300 m from high-voltage power

lines. METHODS: Case-control study of 854 patients diagnosed with LPD or MPD (including leukaemia, lymphoma and related conditions) aged 0-94 years comprising all cases diagnosed in Tasmania between 1972 and 1980. Controls were individually matched for sex and approximate age at the time of diagnosis. RESULTS: Compared with those who had always lived >300 m from a power line, those who had ever lived within 50 m had an odds ratio (OR) of 2.06 (95% confidence interval 0.87-4.91) for developing LPD or MPD (based on 768 adult case-control pairs); those who had lived between 50 and 300 m had an OR of 1.30 (0.88-1.91). Adults who had lived within 300 m of a power line during the first 15 years of life had a threefold increase in risk (OR 3.23; 1.26-8.29); those who had lived within the same distance aged 0-5 years had a fivefold increase in risk (OR 4.74; 0.98-22.9). These associations were strengthened when analyses were repeated for 201 pairs with entirely Tasmanian residential histories. CONCLUSION: Although recognizing that this study has limitations, the results raise the possibility that prolonged residence close to high-voltage power lines, especially early in life, may increase the risk of the development of MPD and LPD later.

20. Malagoli C, Fabbi S, Teggi S, Calzari M, Poli M, Ballotti E, Notari B, Bruni M, Palazzi G, Paolucci P, Vinceti M. ***Risk of hematological malignancies associated with magnetic fields exposure from power lines: a case-control study in two municipalities of northern Italy.*** Environ Health. 2010 Mar 30;9:16. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2856548/

21. McBride ML, Gallagher RP, Theriault G, Armstrong BG, Tamaro S, Spinelli JJ, Deadman JE, Fincham S, Robson D, Choi W. ***Power-frequency electric and magnetic fields and risk of childhood leukemia in Canada.*** Am J Epidemiol 1999;149: 831–42. http://www.ncbi.nlm.nih.gov/pubmed/10221320; http://aje.oxfordjournals.org/content/149/9/831.long

22. Mizoue T, Onoe Y, Moritake H, Okamura J, Sokejima S, Nitta H. ***Residential proximity to high-voltage power lines and risk of childhood hematological malignancies.*** J Epidemiol. **2004** Jul;14(4):118-23. https://www.jstage.jst.go.jp/article/jea/14/4/14_4_118/_article

23. Myers A, Clayden AD, Cartwright RA, Cartwright SC. ***Childhood cancer and overhead powerlines: a case-control study.*** Br J Cancer. **1990** Dec;62(6):1008-14. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1971546/

24. National Research Council. Possible health effects of exposure to residential electric and magnetic fields. National Research Council, Washington: National Academy Press, 1996.

25. Portier CJ,Wolfe MS (eds). National Institute of Environmental Health Sciences Working Group Report. Assessment of health effects from exposure to power-line frequency electric and magnetic fields (NIH publication no. 98-3981). Research Triangle Park: NIEHS,1998.

26. Repacholi MH, Ahlbom A. ***Link between electromagnetic fields and childhood cancer unresolved.*** Lancet 1999;354:1918–9. http://www.ncbi.nlm.nih.gov/pubmed/10622288

27. Repacholi MH, Greenebaum B. ***Interaction of static and extremely low frequency electric and magnetic fields with living systems: health effects and research needs***. *Bioelectromagnetics* 1999; **20:** 133–60. http://www.ncbi.nlm.nih.gov/pubmed/10194557

28. Saito T, Nitta H, Kubo O, Yamamoto S, Yamaguchi N, Akiba S, Honda Y, Hagihara J, Isaka K, Ojima T, Nakamura Y, Mizoue T, Ito S, Eboshida A, Yamazaki S, Sokejima S, Kurokawa Y, Kabuto M. ***Power-frequency magnetic fields and childhood brain tumors: a case-control study in Japan***. J Epidemiol. 2010;20(1):54-61. http://www.ncbi.nlm.nih.gov/pubmed/19915304; https://www.jstage.jst.go.jp/article/jea/20/1/20_JE20081017/_article Abstract: BACKGROUND: The strength of the association between brain tumors in children and residential power-frequency magnetic fields (MF) has varied in previous studies, which may be due in part to possible misclassification of MF exposure. This study aimed to examine this association in Japan by improving measurement techniques, and by extending measurement to a whole week. METHODS: This population-based case-control study encompassed 54% of Japanese children under 15 years of age. After excluding ineligible targeted children, 55 newly diagnosed brain tumor cases and 99 sex-, age-, and residential area-matched controls were included in the analyses. The MF exposures of each set of matching cases and controls were measured in close temporal proximity to control for seasonal variation; the average difference was 12.4 days. The mean interval between diagnosis and MF measurements was 1.1 years. The weekly mean MF level was defined as the exposure. The association was evaluated using conditional logistic regression analysis that controlled for possible confounding factors. RESULTS: The odds ratios (95% CI) for exposure categories of 0.1 to 0.2, 0.2 to 0.4, and above 0.4 microT, against a reference category of <0.1 microT, were 0.74 (0.17-3.18), 1.58 (0.25-9.83), and 10.9 (1.05-113), respectively, after adjusting for maternal education. This dose-response pattern was stable when other variables were included in the model as possible confounding factors. CONCLUSIONS: A positive association was found between high-level exposure-above 0.4 microT-and the risk of brain tumors. This association could not be explained solely by confounding factors or selection bias.

29. Savitz DA, Wachtel H, Barnes FA, John EM, Tvrdik JG. ***Case–control study of childhood cancer and exposure to 60-Hz magnetic fields.*** Am J Epidemiol 1988;128:21–38. http://www.ncbi.nlm.nih.gov/pubmed/3164167

30. Schüz, J., Ahlbom, A., 2008. ***Exposure to electromagnetic fields and the risk of childhood leukaemia: a review.*** Radiat. Prot. Dosim. 132, 202e211. http://www.ncbi.nlm.nih.gov/pubmed/18927133

31. Schüz J. ***Exposure to extremely low-frequency magnetic fields and the risk of childhood cancer: update of the epidemiological evidence.*** Prog Biophys Mol Biol. 2011 Dec;107(3):339-42. http://www.ncbi.nlm.nih.gov/pubmed/21946043 Review. **Abstract:** There is an ongoing scientific controversy whether the observed association between exposure to residential extremely low-frequency magnetic fields (ELF-MF) and the risk of childhood leukaemia observed in epidemiological studies is causal or due to methodological shortcomings of those studies. Recent pooled analysis confirm results from previous studies, namely an approximately two-fold risk increase at ELF-MF exposures ≥0.4 μT, and demonstrate consistency of studies across countries, with different design, different methods of exposure assessment, and different systems of power transmission and distribution. On the other hand, recent pooled analyses for childhood brain tumour show little evidence for an association with ELF-MF, also at exposures ≥0.4 μT. Overall, the assessment that ELF-MF are a possible carcinogen and may cause childhood leukaemia remains valid. Ongoing research activities, mainly experimental and few new epidemiological studies, hopefully provide additional insight to bring clarity to a research area that has remained inconclusive.

32. Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR), ***Research Needs And Methodology To Address The Remaining Knowledge Gaps On The Potential Health Effects Of***

EMF. European Commission 2009
http://ec.europa.eu/health/ph_risk/committees/04_scenihr/docs/scenihr_o_024.Pdf

33. Sohrabi MR, Tarjoman T, Abadi A, Yavari P. ***Living near overhead high voltage transmission power lines as a risk factor for childhood acute lymphoblastic leukemia: a case-control study.*** Asian Pac J Cancer Prev. 2010;11(2):423-7.
http://www.apocpcontrol.org/page/apjcp_issues_view.php?sid=Entrez:PubMed&id=pmid:20843128&key=2010.11.2.423

34. Svendsen A-L, Weihkopf T, Kaatsch P, Schüz J. ***Exposure to magnetic fields and survival after diagnosis of childhood leukemia: A German cohort study.*** Cancer Epidemiology Biomarkers Prevention 2007;16:1167-1171. http://www.ncbi.nlm.nih.gov/pubmed/20843128;
http://www.apocpcontrol.org/page/apjcp_issues_view.php?sid=Entrez:PubMed&id=pmid:20843128&key=2010.11.2.423

35. Teepen JC, van Dijck JA. ***Impact of high electromagnetic field levels on childhood leukemia incidence.*** Int J Cancer. 2012 Aug 15;131(4):769-78. Review.
http://www.ncbi.nlm.nih.gov/pubmed/22437882

36. Tomenius L. ***50-Hz Electromagnetic environment and the incidence of childhood tumors in Stockholm County***. Bioelectromagnetics 1986;7:191–207.
http://www.ncbi.nlm.nih.gov/pubmed/3741493

37. WHO IARC Working Group on the Evaluation of Carcinogenic Risks to Humans. ***Non-ionizing radiation, Part 1: static and extremely low-frequency (ELF) electric and magnetic fields.*** IARC Monographs Evaluation of Carcinogic Risks Humans. 2002;80:1- 95.

38. World Health Organization (2007). ***Research Agenda for Extremely Low Frequency Fields*** Geneva, World Health Organization (see: www.who.int/emf).

39. Wünsch-Filho V, Pelissari DM, Barbieri FE, Sant'Anna L, de Oliveira CT, de Mata JF, Tone LG, Lee ML, de Andréa ML, Bruniera P, Epelman S, Filho VO, Kheifets L. ***Exposure to magnetic fields and childhood acute lymphocytic leukemia in São Paulo, Brazil.*** Cancer Epidemiol. 2011 Dec;35(6):534-9.
http://www.ncbi.nlm.nih.gov/pubmed/21840286

40. Yang Y, Jin X, Yan C, Tian Y, Tang J, Shen X. ***Case-only study of interactions between DNA repair genes (hMLH1, APEX1, MGMT, XRCC1 and XPD) and low-frequency electromagnetic fields in childhood acute leukemia.*** Leuk Lymphoma. 2008 Dec;49(12):2344-50.
http://www.ncbi.nlm.nih.gov/pubmed/19052983

41. Ziegelberger G, Dehos A, Grosche B, Hornhardt S, Jung T, Weiss W. ***Childhood leukemia--risk factors and the need for an interdisciplinary research agenda.*** Prog Biophys Mol Biol. 2011 Dec;107(3):312-4. **Source:** Federal Office for Radiation Protection (BfS), Department of Radiation Protection and Health, Oberschleissheim, Germany.
http://www.sciencedirect.com/science/article/pii/S007961071100109X **Abstract:** The International Agency for Research on Cancer (IARC) has classified high as well as low-frequency fields as "possibly

carcinogenic to humans" (Group 2B). For high frequency fields the recent assessment is based mainly on weak positive associations described in some epidemiological studies between glioma and acoustic neuroma and the use of mobile and other wireless phones. Also for low frequency fields the evidence is based on epidemiological findings revealing a statistic association between childhood leukemia (CL) and low-level magnetic fields. The basic findings are already 10 years old. They have since been supported by further epidemiological studies. However, the knowledge on the main/crucial question of recusal causality has not improved. This fact and in addition the small, but statistically significant increased incidence of CL in the surrounding of German nuclear power plants have motivated the German Office for Radiation Protection (BfS) to work toward a better understanding of the main causes of CL. A long-term strategic research agenda has been developed which builds on an interdisciplinary, international network and aims at clarifying the aetiology of childhood acute lymphoblastic leukemia.

FILED ELECTRONICALLY ON SEPTEMBER 20, 2013

Dianne Wilkins
9 Lakeside Drive
Falmouth, ME 04105
dnwilkins@aol.com

September 20, 2013

Harry Lanphear
Administrative Director
Maine Public Utilities Commission
State House Station #18
242 State Street
Augusta, Maine 04333-0018

Re: Notice of Inquiry; PUC Docket 2013-00402

Dear Mr. Lanphear:

Please note this correction for an addition error on page 15, first sentence in document *Information and Comment by Dianne Wilkins for Notice of Inquiry Regarding LD 950* dated and filed in the referenced docket on September 18, 2013 (PUC Item No. 9 in this docket). The incorrect sentence reads:

> As you can see from my summary, **nine (9)** out of the fifteen (15) studies, that concluded increased risk of childhood cancers from exposures as measured by distance, had significantly increased risk at distances greater than 300 ft (91.44 m) and up to 1,969 ft. (600 m).

The corrected sentence should read:

> As you can see from my summary**, eleven (11)** out of the fifteen (15) studies, that concluded increased risk of childhood cancers from exposures as measured by distance, had significantly increased risk at distances greater than 300 ft (91.44 m) and up to 1,969 ft. (600 m).

Thank you.

Sincerely,

Dianne Wilkins

Mary and David Fournier
16 High Meadow Farm Road
Eliot, Maine 03903
September 19, 2013

Harry Lanphear
Administrative Director
Maine Public Utilities Commission
101 Second Street
Hallowell, Maine 04347
Sent Via Fax*: 207-287-1039

*Please Note: Ten separate, consecutive faxes need to be sent to file this entire filing. All ten faxes should be docketed as one filing and in the order sent. We can't file this on the CMS Electronic Filing System. Within the ten sets if faxes, in addition to this cover letter, we are filing eight attached documents.

RE: Docket #2013-00402
August 7, 2013 Notice of Inquiry

Dear Harry,

Please file this as our response on the above referenced docket. These response comments are regarding the Commission's August 7, 2013 Notice of Inquiry which explains that the Commission received a letter from the Maine Legislature Energy, Utilities and Technology Committee (EUT) regarding proposed legislation to establish electric (distribution) and transmission lines safety setbacks in Maine. An Act to Establish the Electromagnetic Field Safety Act, known as LD 950, was carried over from last year to the upcoming Legislature Session.

We want to point out that we were not notified by the Commission of this docketed Inquiry until Mary contacted Harry Lanphear on August 28, 2013 for information on it after Mary heard of it from someone outside of the Commission. On August 29, 2013, Harry sent the Notice of Inquiry attached to an email, as a courtesy. We do appreciate that Harry sent us the notice. Although, since we both testified on LD 950 at the UTE public hearing when that bill was initially presented and since we are both on the Notification and Service List for LD 950 and Docket #2013-00402, we should have received the August 7, 2013 Notice of Inquiry when others were notified, presumed to be on August 7, 2013. This is not the first time that the Commission has failed to send us required notices.

We want to point out here also, that there are many Mainers who are dealing with being close or closer abutters to newly built or soon to be built electric transmission lines approved in Docket #2008-255 (or 2008-00255 on the CMS docket filings) who either are concerned or

should be concerned with their health and safety impacted by the lines' electric and magnetic fields created by theses "MPRP" lines that include hundreds of miles of new 115 kilovolt (kV) and 345 kV high voltage lines. The abutters to these lines deserve to be notified also, of this Inquiry, by the Commission and given ample opportunity to respond. The Commission has or could have, if they request all of the abutters' contact information from Central Maine Power Company (CMP), Bangor Hydro Company (BHE) and Public Service Company of NH (PSNH), all of who are within the 300 foot setback proposed by LD 950, in our view for transmission lines only, that are built at 34.5 kV or higher voltages. It is important that the Commission protect the health and safety of all of Maine's citizens when determining the outcome of any utility petitioners' requests for approval to construct any transmission lines. We are in a position to understand these proceedings at the Commission quite well in recent years, since we have been parties for six years now on adjudicatory proceedings at the Commission, in which our legal rights have been impacted and we are also "abutters" to CMP transmission lines built and planned to be built on our land on an area of easements which are in close proximity to our swimming pool and our home. We would like to be, at the very least assured that those lines are safe and do not injure our health and that the Commission has taken every step available to it to ensure that; however, we are not assured of those very basic rights thus far.

So, it is our request that the Commission make every abutter, to at least the "MPRP" transmission line projects, aware of this Notice of Inquiry docket and give all of those so impacted at least three weeks to file response comments from the time of Notice, as we are now doing.

We are filing a total of eight separate documents attached hereto. If we had been given more notice, we would have been able to submit more. These documents are related to the magnetic fields health concerns and yet the electric field safety concerns are equally important when considering setback requirements for electric transmission lines from the edge of Right of Ways (ROW). Other safety considerations should include a thorough review of the National Electric Safety Codes (NESC) as they relate to electric transmission lines and also electric transmission lines setbacks from gas transmission lines since the EMF of the electric lines can corrode the gas transmission lines if built too closely to the gas lines that are often located in the same ROW in Maine. We would like to see all NESC related to the issues of health and safety filed in this docket. We have rather recently become aware of this safety hazard factor as there is a 30 inch diameter gas pipeline located on our property in close proximity to CMP's planned Section 3022, a 345 kV line. This concerns us deeply and we never heard or read a word about this safety concern in the "MPRP" proceedings at the Commission, nor in any other proceedings in which we have participated there.

You can see from our attached documents that the state of Connecticut has passed legislation to restrict the siting of transmission lines since 2004. This is commendable that they have chosen to protect their citizens health and safety in this way. The other documents give additional safety information regarding electric lines. We are filing as our Document 1., the

February 10, 2012, OPA Brief on Docket #2011-504 (2011-00504 on the newer CMS docket filings) and its attachment, as our Document 1. a., the September 12, 2008 EMF Testimony of Exponent's William H. Bailey, Ph. D. on behalf of CMP on the "MPRP" Docket #2008-255 (2008-00255 on the CMS file). In Document 1., Atty. Eric Bryant on behalf of the OPA, references page 40., in particular, regarding the very relevant association documented in various valid studies when children with averaged exposures to magnetic fields at 3 to 4 miligauss (mG) have shown a statistical association with developing childhood leukemia. This association is serious and cannot be ignored. However, it was apparently ignored by the Commission in the "MPRP" Docket #2008-255 (2008-00255 on the CMS filings). Childhood leukemia is a serious and devastating disease. Simply to dismiss this association link now in Maine is heartless . To wait until an absolute "causal effect" is established regarding health hazards from EMF before establishing safe setbacks, is like waiting for some of the electric utility companies to volunteer to construct the electric lines with safe setbacks. These companies so vigorously defend their callous actions and often fund studies and in other ways impact results of many of the EMF health and safety studies, to save their high profits. The profits they make from impacting the health and safety of the people they endanger by not buying enough land or land rights to safely construct their lines, are the only important aspect to many in today's electric industry. Often, the same companies who refuse to buy enough land or land rights for safe spacing and setbacks from the ROW boundary lines, buy unnecessary land for the current projects and all is charged up to the mostly unsuspecting ratepayers. This situation of profits over health and safety must be stopped in order to protect the Maine citizens that our legislature and the Maine Public Utilities Commission have been given the duty and responsibility to serve.

We recommend that an amended version of the current language of LD 950 be passed by the legislature in the next session to help to protect the health and safety of all of Maine's children and other citizens. There are many other health and safety impacts known amongst researchers and electric utility companies, associated with EMF's created from electric transmission lines. The following is a list of some: Alzheimer's, miscarriage, negative effects on mental acuity, negative effects on pacemakers and other implanted medical devices, tinnitus (hearing loss with continuous ringing or buzzing in the ear) and a variety of other cancers.

We both have had some concerns with the language used in the proposed LD 950. We will be recommending to the legislature that the language be refined to require minimum setbacks of at least 300 feet from all residences, residential care facilities, hospitals, schools, licensed daycare facilities, playgrounds, youth centers, religious facilities, youth centers and youth camps, for all electric transmission lines in Maine with a voltage capacity of 34.5 kilovolts (kV) or that can become 34.5 kV or higher kilovolts.

We do hope that the Commission will work to support the safety and health of Maine's citizens in supporting safe setbacks for the electric transmission lines in Maine. It could really save lives and suffering that are impacts by the EMF's the lines create. As a further note, we incorporate into our daily lives, keeping safe distances from lighting, electrical appliances, including the microwave oven, televisions and the computer screen when in use and do not use cell phones

or have a "smart" meter on our home to keep our EMF exposure low; however, we can't escape being impacted by the close EMF of the new CMP Section 197 115 kV transmission line built with three 1,113 kcmil acsr electric conductors in close proximity to our in ground swimming pool with its aluminum fence and in close proximity to our home. We live in this EMF exposure and we are quite concerned and doubtful that it is either healthy or safe. CMP plans to add another new 115 kV transmission line next to it very soon with the same type and sized conductors and another new line next to that, a 345 kV line, with three 1595 kcmil acsr conductors. That 345 kV line is planned to be built in very close proximity to the 30 inch diameter gas pipeline which occupies a 50 foot wide easement (within the overall 225 foot wide easement now shared by CMP and the gas company) which was granted to the gas company in a federal court ruling in the late 1990's. CMP has not yet even been made to do surveys on our land and nearby to show the actual 225 foot width boundaries of the easements. We really do doubt strongly that this is safe. So, we have learned awareness of much of these safety issues only recently as a result of our involvement at the Commission and in learning to educate ourselves due to our concerns, which both CMP and the Commission seem not to take seriously enough. We have become aware also of other Maine citizens who have put into similar situations due to too little attention to health and safety hazards. We are now, due to our experiences with CMP dedicated to bringing about more responsible and safe siting of transmission lines in Maine and other improvements for citizens adversely affected by transmission lines. Again, we wish we had more notice so that we could have fled more documents regarding what other states and countries are doing to protect their citizens from the EMF's created by the electric transmission lines. One thing is very clear though and that is that Maine s not nearly doing enough.

Sincerely,

Mary Fournier David Fournier

Mary and David Fournier

Attachments: Documents 1., 1. a., and 2 through 7.

Copies to: Service List and Others

FILED BY EMAIL ON SEPTEMBER 20, 2013

STATE OF MAINE September 20, 2013
PUBLIC UTILITIES COMMISSION

Notice of Inquiry of August 7, 2013 Docket No. 2013-00402

Information and Comment by Wanda Curtis for
Notice of Inquiry Regarding LD 950

Attached is a paper written by public health physician Dr. David O. Carpenter. in which he states that the studies showing a consistent association between childhood leukemia and EMF exposure above 3-4 mG among children living close to high voltage lines are strong studies. He recommends keeping EMF levels below those shown to be associated with increased risk of childhood leukemia (3-4 mG).

The WHO admitted that "nine well conducted studies" and fifteen pooled studies all showed an increased risk of childhood leukemia among children experiencing chronic, longterm exposure to EMF levels above 3-4 mG while living close to high voltage lines.

One of the studies (Linet et al), referenced in the WHO paper Environmental Criteria No. 238, showed a fourfold excess risk of childhood leukemia among American children exposed to EMF levels above 4 mG.

Critical to note is the fact that EMF exposure from living adjacent to high voltage lines constitutes "chronic, longterm exposure." Dr. Carpenter notes that the guidelines which should be applied in regards to chronic, longterm exposure are the 3-4 mG studies.

The LDRT (PUC staff) attempted to apply ICNIRP guidelines to case 2011-00504 stating that it was okay not to mitigate EMF on residential properties if it's less than 2,000 mG but it was agreed upon in that case that the ICNIRP guidelines applied to short term EMF exposure such as from an MRI machine not chronic, longterm exposure to power lines.

Why do MRI technicians stand behind a shielded wall, when the machine, is on if it's okay to be exosed to 2,000 mG 24 hrs./day?

There is a wealth of other information regarding 300 foot setbacks and other pertinent information in the 300+ page appendix filed in case 2011-00504 as well as in the rest of the file on that case.

Respectfully Submitted,
Wanda Curtis, RN,MSN

CENTRAL MAINE
POWER

October 10, 2013

Mr. Harry Lanphear
Administrative Director
Maine Public Utilities Commission
18 State House Station
Augusta, ME 04333-0018

RE: MAINE PUBLIC UTILITIES COMMISSION,
Inquiry into Setback Requirements as Mitigation for Potential Health Effects
of Electromagnetic Fields Associated with Transmission Lines,
Docket No. 2013-402

Dear Mr.Lanphear:

Enclosed please find for filing in the above-captioned proceeding a correction and additional information to the Comments filed by Central Maine Power Company on September 19, 2013. The correction and additional information is on page 5 of the Comments and is highlighted for ease of reference. The additional information was requested by Staff subsequent to the September 19, 2013 filing by CMP.

Sincerely,

Stephanie T. McNeal
Manager, Regulatory Administration

83 Edison Drive, Augusta, Maine 04336
Telephone 207-623-3521
www.cmpco.com

IBERDROLA
USA

STATE OF MAINE
PUBLIC UTILITIES COMMISSION

Docket No. 2013-402

October 10, 2013

MAINE PUBLIC UTILITIES COMMISSION, Inquiry into Setback Requirements as Mitigation for Potential Health Effects of Electromagnetic Fields Associated with Transmission Lines	))))	**CORRECTED** COMMENTS OF CENTRAL MAINE POWER COMPANY

CMP is providing these comments to the Maine Public Utilities' Commission in response to the Commission's inquiry designed to gather information responsive to a letter from the Joint Standing Committee of Energy and Technology (EUT Committee) requesting the Commission provide information related to setback requirements associated with transmission lines. During the last legislative session, the EUT Committee voted to carry over a bill entitled An Act to Establish the Electromagnetic Field Safety Act, LD 95O. The bill proposed that beginning October 1, 2013, all new transmission line and electrical installations capable of carrying 5,000 volts or more of electricity must be set back at least 300 feet from residential homes, residential care facilities, hospitals, schools, licensed daycare facilities, playgrounds, youth centers, religious facilities and youth camps.

More specifically, the letter requests the following information:

- Any information the Commission can provide regarding setback requirements for electric transmission lines[1] in other states from residential homes, residential care facilities, hospitals, schools, licensed daycare facilities, playgrounds, youth centers, religious facilities and youth camps;

[1] While the proposed NOI notes "transmission" lines, the scope of the legislation is potentially broader in that it includes all electric facilities 5,000 volts or more, and thus having an even greater impact specifically to electric distribution facilities.

- A description of the implications of establishing a 300 foot setback requirement for these types of locations on the utilization of existing rights of ways for transmission lines in this State; and

- A description of the current standards used by the Commission when considering the health impacts of EMF associated with transmission lines as well as specific references to support the use of those standards.

Regarding this bill, on March 26, 2013, CMP offered testimony before the EUT Committee opposing the bill because it is unnecessary, impractical and will adversely impact electric delivery services to large numbers of CMP's customers.

As the Commission mentioned in its August 7, 2013 Inquiry, the Commission currently considers health impacts of transmission line siting as part of Certificate of Public Convenience and Necessity (CPCN) proceedings. Section 3132 of Title 35-A requires the Commission to consider public health and safety in determining public need for a proposed transmission line that is subject to a CPCN requirement. This section also requires the Commission to consider the proximity of the proposed transmission line to inhabited dwellings, as well as alternatives to construction of the transmission line, including energy conservation, distributed generation or load management. The Commission's rules implementing Section 3132 require a utility in its petition for a CPCN to provide "a description of the effect of the proposed transmission line on public health and safety and scenic, historic, recreational and environmental values and of the proximity of the proposed transmission line to inhabited dwellings." Chapter 330 § 6(E). The effect on public health and safety is determined on a case by case basis.

CMP believes that the current method used by the Commission to consider the health impacts of transmission line siting via the CPCN process is preferable to a legislative universal setback requirement that lacks a credible scientific basis and is contrary to sound public policy. Any EMF threshold should be based upon science and not an artificial setback requirement that may or may not mitigate EMP impacts. CMP, the Commission and others found the CPCN approach to be acceptable in addressing health impacts of the Maine Power Reliability Program. In the CPCN proceeding, transmission line specific considerations can be taken into account, relying on current science and engineering best practices with any necessary mitigation measures required as part of the approval.

EMF is a function of voltage, distance and current. Therefore higher voltage does not necessarily mean higher EMF levels. In fact, EMF levels from a home's electrical wiring and some household appliances are higher than from transmission lines.

The following section contains CMP's responses to the specific questions asked by the Commission in its Inquiry.

1. Please provide information regarding other jurisdiction's (other states and other countries) setback requirements for electric transmission lines from residential homes, residential care facilities, hospitals, schools, licensed daycare facilities, playgrounds, youth centers, religious facilities and youth camps for the purpose of mitigating possible EMF effects Please specify what level of voltage the setback mitigation applies to (for example 115 kV, 345 kV or different measurement).

   CMP Response: See Attachment 1.

2. Please discuss the feasibility and the practical and cost implications of establishing a 300-foot setback for new and possibly rebuilt construction of electric transmission or distribution facilities of 5 kV or higher if they are located near the locations listed in question 1. Would utilities be able to locate distribution lines along roadways and, if not, how would service be provided? How would the cost of providing distribution service be affected? Would utilities be able to use existing rights of ways for transmission lines and, if not, how would this affect the siting and cost of new transmission lines? What percentage of existing transmission and distribution lines within the utility's territory are closer than 300 feet to the types of locations listed in question 1?

CMP Response: Nearly 100% of CMP's distribution facilities of 5 kV or more[2] are within 300 feet of residential homes residential homes, residential care facilities, hospitals, schools, licensed daycare facilities, playgrounds, youth centers, religious facilities and youth camps. A 300 feet setback is not feasible as the length of overhead services need to be less than 300 feet in order to meet the voltage requirements of MPUC Chapter 320 and other power quality requirements. Please see Illustration No. 31 of CMP's Handbook of Requirements for Electric Service and Meter Installations for allowable secondary and service lengths with overhead conductors (Attachment 2). Standard utility practice requires distribution primary spans closer than 300 feet to points of service. This is necessary to meet service requirements and avoid excessive secondary wire size and length. The typical length of secondary lines is 150 feet or less. Areas with building setbacks of 300 feet or more require lateral distribution lines that bring the primary to within 150 feet to allow standard secondary size and length at these locations as well.

[2] The majority of CMP's distribution system is 12.5 kV and 34.5 kV, though there is a small amount of 4 kV distribution.

Additionally, distribution facilities are most often in the public way, running along roadways. It is not feasible to maintain this clearance in municipalities where minimum building setbacks are less than 300 feet from the public way. Further, it is impossible to maintain this distance for any lots less than 300 feet deep. Locating such facilities off of the public way is not feasible, practicable or cost effective in almost all situations and may be impossible in some situations, such as in urban areas. Even if this could be done, it would dramatically increase operational costs and adversely impact customer service particularly storm restoration and other repairs if CMP is required to move facilities out of public way, which could result in more climbing and off road equipment usage.

CMP's transmission facilities are often in off road rights of way, though many 34.5 kV transmission lines are roadside above the distribution facilities. The roadside transmission will predominately be within 300 feet of residential homes[3]. As to transmission in off-road rights of way, CMP does not have delivery point geographic data in its GIS at this point, so CMP is unable to determine what portion of existing transmission lines are within 300 feet of a residential home or the other facilities mentioned in Question 1. Using data that was tracked manually for MPRP, there are 2,450 residential homes within 300 feet of the right of way of MPRP facilities **which spans 679 circuit miles. CMP estimates that it would cost approximately $200 million to acquire the property rights in order to eliminate any residences within 300 feet of the rights of way. Extrapolating the MPRP estimated costs to the 2,949 of total CMP transmission circuit miles after MPRP, results in an**

[3] CMP is aware of residential homes that are within 300 feet of transmission lines in rights of way. CMP has no knowledge of whether or not there are any residential care facilities, hospitals, schools, licensed daycare facilities, playgrounds, youth centers, religious facilities and youth camps that are within 300 feet of a transmission line in rights of way.

estimated $950 M cost to purchase all residences within 300 feet of all CMP transmission rights of way.

Due to the nature of the transmission and distribution system, distribution lines are likely to be near buildings so as to provide electric service to customers. However, effort is made to locate transmission lines away from buildings in general.

3. The Committee letter asks for information regarding potential health impacts of EMF associated with transmission lines and for a description of the current standards used by the Commission when considering the health impacts of EMF associated with transmission lines. In considering mitigation measures, the Commission may take into consideration the WHO4 recommendations. During consideration of LD 950, there was discussion of the 2007 WHO report referenced above and its recommendations. To the extent there are more recent reports regarding potential health impacts from EMF associated with transmission lines, please provide that information.

   CMP Response: See Attachment 1.

CMP hopes this information is useful in the Commission responding to the EUT Committee.

Respectfully submitted,

Kenneth W. Farber

Kenneth Farber
Senior Counsel

STATE OF MAINE
PUBLIC UTILITIES COMMISSION

MAINE PUBLIC UTILITIES COMMISSION **RE: Inquiry Into Set Back Requirements as Mitigation for Potential Health Effects of Electromagnetic Fields Associated with Transmission Lines** **Docket No. 2013-00402**	**COMMENTS OF THE OFFICE OF THE PUBLIC ADVOCATE** **October 24, 2013**

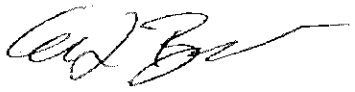
On October 11, 2013, the Commission issued its Draft Report Related to LD 950, An Act to Establish the Electromagnetic Field Safety Act on Setback Requirements Associated with Transmission Lines (the Draft Report). These Comments are responsive to the Commission's invitation to parties to submit comments on the Draft Report.

The purpose of the Draft Report is to provide answers to the Energy, Utilities and Technology Committee's request for information in connection with LD 950 regarding how other jurisdictions address the issue of Electromagnetic Fields (EMFs) caused by power lines, implications of the bill's proposed 300 foot setback requirement, and the current state of knowledge about the health effects of EMFs. The Commission stated that it will not be making a policy recommendation to the Legislature in its Final Report.

We reviewed the findings in the Draft Report and observe that it provides a thorough response to the Committee's questions. We have nothing further to add to the facts presented. As noted in footnote 22, the Office of the Public Advocate participated in a proceeding at the Commission (Docket No. 2011-504). In preparation for that case, we researched various papers and studies on EMF conducted by the World Health Organization and related organizations. The discussion of the WHO's findings and recommendations in the Draft Report goes beyond our research and further illuminates the subject.

With regard to the Draft Report's characterization of the argument we made in Docket No. 2011-504, we ask that the Commission report that the arguments presented in our brief in that case were modified on the record during oral argument. There is no inaccuracy in the Draft Report's description of our position, but a reference to the oral argument would simply complete the record on the Public Advocate's arguments in that case.

Respectfully submitted,



Eric J. Bryant
Senior Counsel

CENTRAL MAINE
POWER

October 25, 2013

Mr. Harry Lanphear
Administrative Director
Maine Public Utilities Commission
18 State House Station
Augusta, ME 04333-0018

RE: MAINE PUBLIC UTILITIES COMMISSION,
Inquiry into Setback Requirements as Mitigation for Potential Health Effects
of Electromagnetic Fields Associated with Transmission Lines,
Docket No. 2013-402

Dear Mr.Lanphear:

In response to the Commission's Draft Report in the above referenced Docket, Central Maine Power Company (CMP) is providing the following brief comments.

Most importantly, CMP requests that the Commission make a recommendation to the Legislature based on the information that has been provided and on the Commission's expertise in this area. While the Legislature has not specifically asked for such a recommendation, it is advisable that the PUC do so in order to foster sound public policy on this important issue. CMP urges the Commission to recommend its current practice of addressing the safety impact of electromagnetic fields (EMF) on a case by case basis during the certificate for public convenience and necessity process. This practice has been successful in ensuring adequate protections. On the contrary, LD 950 would (i) impose unwarranted, proscriptive measures that are not consistent with sound science, (i) not be technically feasible and would pose service quality issues particularly in rural areas where it would be difficult to maintain voltages in secondary lines with such a setback, and (iii) would be extremely costly to customers. It is therefore critical that the Commission's Report to the Legislature address the problems that the Bill would pose if adopted.

CMP also offers the following editorial suggestions/corrections to the draft Report.

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Telephone 207-623-3521
www.cmpco.com

- On page 5, second bullet, the CMP estimate provided was to setback existing transmission, not new transmission. The costs related to new transmission is unknown since the new transmission is undefined. Page 6 – middle of page, ...MPRP, the Commission has determined... (add "has").

- Page 12 – first line - ...except where the line crosses... (add "the").

Please do not hesitate to contact me if you have any questions regarding these comments.

Sincerely,

Kenneth W. Farber

Kenneth Farber
Senior Counsel

FILED ELECTRONICALLY ON November 11, 2013

Dianne Wilkins
9 Lakeside Drive
Falmouth, ME 04105
dnwilkins@aol.com

November 11, 2013

Harry Lanphear
Administrative Director
Maine Public Utilities Commission
State House Station #18
242 State Street
Augusta, Maine 04333-0018

Re: Comments on PUC Draft Report of October 11, 2013 regarding PUC Docket 2013-00402: Notice of Inquiry and LD 950, an Act to Establish the Electromagnetic Field Safety Act on Setback Requirements Associated with Transmission Lines

Dear Mr. Lanphear:

Attached please find the e-mail from the Maine PUC extending the deadline for providing Comments on the PUC Draft Report to the Energy, Utilities and Technology (EUT) committee to November 11, 2013.

The PUC Draft Report (hereinafter) Draft referenced above should be revised for the following reasons:

1. **The Draft report is bias in favor of the utilities' viewpoint because it considers only the utility's Comment in minute detail, extensively quotes from the utility Comments, recreates tables, and attaches a full copy of the utilities paid consultant's report, but neglects to even discuss, quote, adequately summarize each answer provided, recreate tables, attach the full copies of scientific analysis submitted, or even to attach the actual written public Comments, but only created/attached a useless, "bibliography of sources"(Attachment 2 of Draft) used by in the public Commenter's Comments.**

To offer the Energy, Utilities and Technology (EUT) committee a complete and fair representation of the available and submitted information in response to their requests, the Draft should be revised to attach the public Commenter's written Comments as exhibits and to include

a section in the Draft that offers a fair summary of what the public's Comments contained. Without a copy of the public's written Comments and full copies of the studies to refer to, the list of sources currently provided in the Draft is virtually meaningless.

In contrast to the vague, superficial two paragraphs that inadequately summarizes all three public Commenter's Comments in section VII, *Other Comments*, of the Draft report, section VI, *Utility Answer to Questions,* describes the utilities' answers to each question in minute detail, including numerous re-created tables, and provides extensive utility quotes that spans 12 pages of the Draft. The final report to the EUT should include the same level of detail for each answer to EUT questions provided by each of the public Commenters.

In addition, the Draft summary in section VII *Other Comments* mentioned the additional requests to the EUT made by this Commenter, but then left out the substantiated reasons given along with the supporting scientific studies and table provided by the Commenter to support these requests:

> Ms. Wilkins requests that the language in LD950 to increase the setback requirement from 300 feet be modified to require1,969 feet from the non-utility property line.
>
> Ms. Wilkins also requests that LD 950 be modified to impose a 3 mG limit at the property line as a siting requirement for new transmission.

The well supported[1] and substantiated reasons along with the documentation provided should be included in the final report to the EUT.

2. **The Draft report section V, *Current Commission Standard for Determining Health Impacts of Electric and Magnetic Fields Associated with Maine Power Reliability Program Transmission Lines,* fails to relay the most current, relevant information regarding potential health impacts of exposure to EMF ELF from power lines as requested by the EUT committee and provided by this public Commenter. This information should be included in the final report to the EUT committee.**

The full copies of the most current scientific pooled analysis, reviews, and relevant new studies[2] submitted by this public Commenter that were not discussed by, or attached to the PUC Draft

[1] see chart provided of what the 15 most current scientific meta analysis (full copies of eachstudy provided) show for distances, mG levels, & risk rates for each from exposure to power lines

Report, included the very relevant, supplemental 2007 report by the WHO, ***Research Agenda for Extremely Low Frequency Fields.*** [3] (hereinafter Supplemental Report) which was meant to be a companion to the 2007 WHO report[4] referenced and relied upon by the Draft report. This Supplemental Report is relevant because the Maine PUC is requiring compliance from utilities with the recommendations as set forth in the main companion report to this Supplemental Report in certain Certificate of Public Convenience and Necessity (CPCN) proceedings. It is also relevant to the long term protection of our children in light of what the main companion report stated below:

> Regarding possible long-term effects, epidemiological studies suggest that every day, low-intensity ELF magnetic field exposure poses a possible increased risk of childhood leukaemia, but the evidence is not strong enough to be considered causal and therefore ELF magnetic fields remain classified as possibly carcinogenic. The evidence is weaker for other studied effects, including other types of cancers in children and adults, depression, suicide, reproductive dysfunction, developmental disorders, immunological modifications, neurological disease and cardiovascular disease.

Weak evidence for the other studied effects does not mean " no evidence" and current research regarding childhood leukemia can upgrade the association to a causal relationship. This Supplemental Report acknowledges that the companion WHO report relied upon by the Maine PUC in their Draft report, lacked certain substantial and crucial knowledge that puts our children at increased risk of harm regarding why the science shows an association between childhood leukemia at an exposure of 3-4 mG; how power line ELF EMF exposures effect the cognitive/learning ability of children; the need to pool existing scientific data on the emerging risk of brain tumors in children to determine the increased risk rate; and the need to update and combine the current research findings (pooled analysis) with the established association of ELF

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[2] See Information and Comment by Dianne Wilkins for NOI Regarding LD 950, Docket No. 2013-00402, filed September 18, 2013, page 3-14 for discussion of the Ahlbom et al., 2000 & Greenland et al., 2000; pooled analysis along with a more recent pooled analysis, Kheifets et al., 2010; and a meta analysis review; Calvente et al., 2010; two extensive reviews of scientific evidence Teepen et al, 2012 & BioInitiative, 2012; and recent studies that have not been taken into consideration by the WHO, 2007 report Svendsen et al., 2007; Feizi and Arabi, 2007; Mejiz-Arangure e al., 2007; Lowenthal et al., 2007; Yang et al., 2008; Abdul-Rahmann et al., 2008; Malagoli et al., 2010; Calvente et al., 2010; Kroll et al., 2010; Kheifets et al., 2010; Sohrabi et al., 2010; Schuz et al., 2011; Does et al., 2011; Wunsch-Filho et al., 2011.

[3] World Health Organization (2007). ***Research Agenda for Extremely Low Frequency Fields*** Geneva, World Health Organization (see: www.who.int/emf)

[4] World Health Organization (2007), ***Extremely Low Frequency Fields Environmental Health Criteria Monograph no.238***

exposures for childhood leukemia to form a more current risk rate as stated in the Supplemental Report at:

High priority research needs:

• Pooled analyses of existing childhood brain tumour studies

Rationale: Brain cancer studies have shown inconsistent results. This was also the case for childhood leukaemia studies and here, pooled analyses have been very informative. Therefore a pooled analysis of childhood brain cancer studies is recommended. Such pooled analysis can inexpensively provide greater and improved insight into existing data,
including the possibility of a selection bias, and, if studies are sufficiently homogeneous, provide the best estimate of risk.

• Update of existing pooled analyses of childhood leukaemia with new information

Rationale: Since the pooled analyses have been performed, several new epidemiological studies have been published. The pooled analyses should be updated with the results from these recent studies.

• Further study of the risk of amyotrophic lateral sclerosis in 'electric' occupations

Rationale: Several studies have observed an increased risk of amyotrophic lateral sclerosis in 'electric occupations'. It is considered important to investigate this association further in order to find whether ELF magnetic fields are involved in the causation of this rare neurodegenerative disease. This research requires studies in which sufficient information is collected on ELF magnetic field exposure, electric shock exposure as well as exposure to other potential confounders.

Other research needs:

• Update of existing pooled and meta-analyses of adult leukaemia and brain tumour studies and cohorts of occupationally exposed individuals

Rationale: For adult leukaemia and brain cancer, it is recommended that existing large cohorts of occupationally exposed individuals be updated. Occupational studies and pooled and meta-analyses for leukemia and brain cancer have been inconsistent and inconclusive. However, new data have subsequently been published and should be used to update these analyses.

• Further study of the possible link between miscarriage and ELF magnetic field exposure

Rationale: There is some evidence that the risk of miscarriage may be affected by ELF magnetic fields exposure. Taking into account the potentially high public health impact of such an association, further epidemiological research into this hypothesis is recommended.

• Further study of the risk of Alzheimer's disease in relation to ELF magnetic field exposure

Rationale: For Alzheimer's disease, it remains a question whether ELF magnetic fields constitute a risk factor. The data currently available are not sufficient and this association should be further investigated. Of particular importance is the use of morbidity rather than mortality data. [5]

[5] *ibid,* pages 2-3

Pooled analyses (includes meta analyses) is considered the gold standard for synthesizing results from multiple studies because it allows for comparison across different studies and metrics, free of artefacts introduced by analytical differences, and for derivation of more stable results (Kheifets et al., 2010a)[6]. As demonstrated in this public Commenter's Comment, the "Update of existing pooled analyses of childhood leukaemia with new information" listed as a high priority in the Supplemental Report has already taken place after the main 2007 WHO report was published, resulting in several new pooled analyses (Kheifets et al., 2010; Calvente et al, 2010;) which not only confirm but provide more support for the association that exposure to 3-4 mGs of ELF EMF causes increases in cases of childhood leukaemia and also moves the association towards a causal relationship.

In addition, other new extensive reviews of new studies have also taken place which have concluded that the evidence now provides reason to upgrade the association to causal (Teepen et al. 2012; Schuz, 2011; BioInitiative, 2012; Sohrabi et al., 2010). None of these new pooled analysis, reviews, or studies published after 2007 that are contained in this Commenter's Comment are considered by the reports referenced in the Draft report, therefore they should be discussed and added along with the public Comments, in the final report given to the EUT.

In addition to not including the Supplemental WHO Report regarding research gaps in knowledge, glaringly absent from the PUC Draft Report, is the lack of any mention of the 2002 World Health Organization IARC committee's monograph declaring power line ELF EMF a class 2-B possible carcinogen in the same category as DDT and lead. [7] This classification was issued in 2002, and recent opinions by reputable scientists indicate that this classification should be upgraded to a class 2-A carcinogen as shown and supported by this Commenter's Comment but which was ignored by the PUC's Draft report. A summary of this IARC classification; the several scientific pooled analysis it was based on; the 2 new pooled and meta analysis completed after 2002; the other recent comprehensive reviews of evidence; along with

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[6] Kheifets L, Ahlbom A, Crespi CM, Feychting M, Johansen C, Monroe J, Murphy MF, Oksuzyan S, Preston-Martin S, Roman E, Saito T, Savitz D, Schüz J, Simpson J, Swanson J, Tynes T, Verkasalo P, Mezei G. ***A pooled analysis of extremely low-frequency magnetic fields and childhood brain tumors.*** Am J Epidemiol. 2010b Oct 1;172(7):752-61. Pooled, Meta Analysis Review. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2965855/

[7] IARC, 2002. ***Monographs on the Evaluation of Carcinogenic Risks to Humans. In: Non-ionizing Radiation, Part 1: Static and Extremely Low-frequency (ELF) Electric and Magnetic Fields,*** vol. 80. IARC Press, Lyon.

the recent studies should be discussed and attached to the PUC's final report to the EUT committee.

Another omission of the Draft report, is the mention of the 2009 European Union's Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR) report without also mentioning the supplementary companion report issued by the same group later in that same year regarding the high priority research needs due to knowledge gaps in research for the long term effects from ELF EMF exposure. The SCENIHR supplemental report, *Research Needs and Methodology to Address the Remaining Knowledge Gaps on the Potential Health Effects of EMF*, Section 4.1.3.1, *Experimental studies relevant to possible carcinogenicity of ELF fields*, describes a study that is needed to identify the mechanism for the finding of an association between exposure to power line ELF EMF and childhood leukaemia:[8]

> **4.1.3.1. Experimental studies relevant to possible carcinogenicity of ELF fields**
> **Study type**
> Laboratory studies using *in vitro* and/or animal models.
> **Rationale/justification**
> The fact that the epidemiological findings of childhood leukaemia have little support from known mechanisms or experimental studies is intriguing and it is of high priority to reconcile these data.

This SCENIHR supplementary report should also be included in the PUC final report to the EUT committee.

The Draft report does include a more recent report by the European Health Risk Assessment Network (EHFRAN) regarding ELF EMF power line exposures, but also mentioned in the Draft is the fact that this report relies on all of the same studies relied upon in the other reports that have already been included in this Draft.[9] As explained by this Commenter's Comment these reports all suffer from not having reviewed the most current science, i.e. the latest pooled analysis, meta analysis and reviews of all current evidence that should be included in the final report to the EUT.

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[8] Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR),***Research Needs And Methodology To Address The Remaining Knowledge Gaps On The Potential Health Effects Of EMF***. European Commission 2009 http://ec.europa.eu/health/ph_risk/committees/04_scenihr/docs/scenihr_o_024.Pdf

[9] PUC Draft, page 9

3. **The Draft report section V, *Current Commission Standard for Determining Health Impacts of Electric and Magnetic Fields Associated with Maine Power Reliability Program Transmission Lines,* fails to convey the fact there are no existing rules or laws that require the utility or the PUC to provide a comprehensive analysis, review, or report by qualified scientists specializing in research related to the determination of biological effects from exposure to power line EMF ELFs and/or measurements of exposure levels, prior to the approval of an electrical line or equipment installation.**[10]

As stated in the Draft, the Commission currently considers health impacts of transmission line siting as part of a Certificate of Public Convenience and Necessity (CPCN) proceedings and only requires a utility in its petition for a CPCN to provide a "**description of the effect**" of the proposed transmission line on public health and safety; scenic, historic, recreational and environmental values; and of the proximity of the proposed transmission line to inhabited dwellings. Chapter 330 § 6(E)." [11]

First, asking the utility for a "description of effects" is not the same as a codified rule requiring the utility to provide an independent in-depth analysis, meta analysis, or scientific review performed by qualified scientist who have specialized in research on the health effects from exposures to EMF ELF's or requiring qualified independent, third party measurements of exposure levels. The final report to the EUT should define exactly what the "description of effects" consists of, including the degree of detail expected and the qualifications of personal providing said description.

Second, it should be stated in the Draft the degree of reliance the PUC places upon the utilities "description of effect" in rendering their mitigation or other safety decisions since the utility does not have the necessary unbiased status, expertise, or the legal authority to assess the health effects of ELF EMF as it is not one of the federal health agencies designated by congressional act to make these determinations. The FCC Report & Order adopting the current FCC safety guidelines regarding electromagnetic fields specifically delineates the federal health agencies and their jurisdiction with respect to determining the health and safety of EMF

[10] *ibid,* page 19

[11] MPUC Draft Report Related to LD 950, An Act to Establish the Electromagnetic Field Safety Act on Setback Requirements Associated with Transmission Lines; *vide* page 5

radiation emissions, stating that the Federal Drug Administration (FDA) has general jurisdiction for protecting the public from potentially harmful radiation from consumer and industrial devices; the Environmental Protection Agency (EPA) is generally responsible for investigating and making recommendations with regard to environmental issues; the National Institute for Occupational Safety and Health (NIOSH) is responsible for performing research and analysis with respect to worker safety and health; and the Occupational Safety and Health Administration (OSHA) has jurisdiction over Federal regulations dealing with worker safety and health. [12]

Third, the Draft also states that the EMF ELF exposure effects on public health and safety is determined on a case-by-case basis:

> In 2010, in granting a CPCN for the Maine Power Reliability Program (MPRP), the Commission approved a stipulation that among other things set forth the following requirement:
>
> > CMP will take all reasonable steps to mitigate EMF consistent with World Health Organization recommendations, including "reverse phasing" wherever practical.[13]

This stipulation by the PUC was approved for that particular Certificate of Public Convenience and Necessity proceedings and the Draft does not state if this was ever codified into a PUC rule or an amendment to the CPCN requirements so it is unclear whether this stipulation would automatically apply to any other new or old electric lines unless it is specifically stipulated again by the PUC during another request for a CPCN or during litigation involving landowner disputes.[14]

The final report to the EUT should clearly state the conditions of the PUC's use and the legal status of this stipulation.

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[12] See The Federal Communication Commission, *Guidelines for Evaluating the Environmental Effects of Radiofrequency Radiation, Report and Order*, ET Docket No. 93-62, Section III.A subsections 15, 18, 19, & 20.
[13] MPRP Stipulation at § V(E)(9), appended to *Central Maine Power Co. and Public Service of New Hampshire, Request for Certificate of Public Convenience and Necessity for the Maine Power Reliability Program Consisting of the Construction of Approximately 350 Miles of 345 kV and 115 kV Transmission Lines ("MPRP")*, No. 2008-255, Order Approving Stipulation (June 10, 2010) (MPRP Order)
[14] *Ibid.*

4. **Regarding the estimated costs for new lines to adhere to the proposed 300 ft. distance by CMP, BHE/MPS, the Draft report fails to include a cost benefit analysis or enough information to allow the EUT to conduct a due diligence cost benifit analysis.**

BHE/MPS provided a sample of magnetic fields measurements taken around company-owned lines. This sample is reflected in Table 3.[15] The Draft does not, but the final report should state whether BHE/MPS had a qualified (a PhD or Masters in engineering and prior professional experience in measuring EMF exposures), unbiased, independent party perform the measurements contained in Table 3 since these are the only actual field exposure measurements mentioned in the Draft and will be heavily relied on by the EUT committee.

Although the Draft report mentions that California has EMF mitigation requirements that consider the cost of possible EMF mitigation in relation to the cost of the entire project[16] it does not give the EUT a clue as to how Maine can implement the same policy options in the face of possible health risks from power line ELF EMF exposures. In 1993, the California Public Utilities Commission (CPUC) mandated that the Department of Health Services (DHS) oversee a program of research and policy analysis about power frequency EMFs). The resulting California EMF Program was fiscally implemented by the nonprofit Public Health Institute (PHI) and directed by the DHS.[17]

In 2002 the California EMF program issued a report entitled *Policy Options in the Face of Possible Risk from Power Frequency Electric and Magnetic Fields* (copy filed in the current Docket 2013-00402, DW Comment on PUC Draft to EUT, Exhibit A). According to the definitions contained in this report and in regards to ELF power line exposures, the Maine PUC's operates under the "utilitarian" framework that aims at "the most good for the most people at the least cost" that is used by many economists and regulators. Assuming this framework, the California EMF program derived that economist think society is willing to pay approximately $5 million to avoid a single death and still be a cost efficient:

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[15] PUC Draft report at page 17

[16] PUC Draft report at page 4

[17] California EMF Program, *Policy Options in the Face of Possible Risk from Power Frequency Electric and Magnetic Fields (EMF)* June 2002 Final Report; *vide* page 1, lines 1-3 and 60-61 (see www.dhs.ca.gov/ehib/emf)

> The program's policy contractors reviewed the economic (utilitarian) literature that compares various medical, public health, and environmental policies and their efficacy to infer what economists think that society is willing to pay to avoid a statistical death. This varies from program to program, ranging from $1 million to $10 million per death avoided. As a rough indicator of the health benefit that would be needed by the utilitarian framework to justify the cost of various avoidance measures, economists would divide the unit project cost (e.g., the per mile cost of undergrounding a 69 kV line) by say, $5 million per death avoided. This derives the deaths that an economist would require to be avoided per mile to make the unit project cost "cost-beneficial."[18]

They then present the "unfinanced" base case and statewide project cost numbers for mitigation and/or installation of new power lines to avoid harm and still be cost beneficial.[19]

In the detailed analyses of the projects, the total life cycle costs were considered, including maintenance costs, relative reliability, power losses due to resistance, property value impacts, etc.[20]

The numbers presented in Table 1 on page 5 of this report shown below, allow the reader to determine the number of people "exposed" in the state and whether or not the avoidance measures require an implausibly large health benefit to warrant their adoption under the economist's utilitarian cost/benefit framework.[21]

TABLE 1. RESIDENTIAL EMF SOURCES, THE COSTS OF MODERATE AND EXPENSIVE MITIGATION, AND THE REQUIRED DEATHS TO AVOID TO SEEM COST BENEFICIAL FOR ECONOMISTS

EMF SOURCE AND MITIGATION	RESIDENTIAL POPULATION "AFFECTED" TWA>2 MG	AMOUNT**	MODEST COST MEASURES (REPHASING AND COMPACTING LINES)				EXPENSIVE MEASURES (NDERGROUNDING)			
			UNIT COST	TOTAL COST	% OF 10 YEAR REVENUE	STATEWIDE DEATHS TO AVOID IN 35 YEARS TO JUSTIFY COSTS[1]	UNIT COST	TOTAL COST	% OF 10 YEAR REVENUE	STATEWIDE DEATHS TO AVOID IN 35 YEARS TO JUSTIFY COSTS [1]
TRANSMISSION	510,000	1,700 miles	$80,000 per mile	$135 million	0.06%	27	$1.46 million per mile	$2.48 billion	1.13%	495
DISTRIBUTION	1 million	6.700 miles	$35,000 per mile	$234.5 million	0.11%	47	$750 million per mile	$5.03 billion	2.3%	1,005
GROUNDING	1.65 million	550,000	$200 per	$110	0.05%	22	$200	$110	.05%	22

[18] *ibid*, page 3 lines 29-38
[19] *ibid*, page 3 lines 39-44
[20] *ibid*, page 3 lines 45-47
[21] *ibid*, page 4 lines 3-6

		homes	home	million			per mile	million		
TOTAL	2.59 million			$480.5 million	0.22%	96		$7.51 billion	3.46%	1,522

**The miles of line represent the contractor's best estimate. California utilities explained that a special study would be required to provide exact circuit and corridor miles in residential areas.

[1] By dividing total cost by $5 million per death avoided, a utilitarian would derive the number of avoided deaths required to make a measure cost beneficial

* The total number of exposed people is smaller than the sum of people affected by each source, because of an overlap between sources.

Source: von Winterfeldt, D. Power Grid Project. www.dhs.ca.gov/ehib/cmf.

As described in this California EMF report:

> As can be seen in Table 1, about 1.51 million Californians receive average EMF residential exposures greater than 2 mG from the power grid and another 1.65 million receive such exposures within their homes from the way neutral currents return to the grid via plumbing instead of the neutral lines. Since there are overlaps between these sources the total exposed is less than the sum of these numbers. Except for selected occupational groups, residential exposures account for most of the daily exposures because most people spend so much time at home during a given 24-hour day. The moderate cost measures of rephasing transmission lines, compacting distribution lines, and modifying plumbing would cost about $0.48 billion statewide, increasing utility rates for a decade by less than 1%. One would need to avoid about 96 (undiscounted) deaths statewide over a 35-year period to make these measures seem cost beneficial to an economist.[22]

Table 1 also shows that an ELF EMF mitigation program that cost $500,000a year would need to save one life statewide every decade to make it cost beneficial.[23]

Using the numbers cited below by the Draft report as provided in the utilities Comments, and any additional information subsequently provided by the PUC, the final report to the EUT should contain a table like Table 1 to show estimated cost benefits for providing a 300 ft or more distance between the edge of utility lot lines and residential home etc. lot lines:

> Very broad estimates of the cost of imposing a 300-foot setback requirement for new transmission are estimated to range from approximately $ 950 million for CMP to $889 million for BHE and $353 million for MPS. (assuming that all of BHE's and MPS's lines were rebuilt or that new transmission was constructed along the transmission ROW).[24]

[22] *ibid*, page 4 lines 56-67

[23] *ibid*, page 4 lines 3-6

[24] PUC Draft report, page 5

In addition the final report to the EUT committee should also contain a Table similar to Table 2 by the California EMF Project shown below[25] that take measurements aimed at eliminating exposures above 3 mG in the areas covered by LD 950.

TABLE 2. COSTS OF MEETING A 2-MG STANDARD FOR THE SPATIALLY-AVER AGED MAGNETIC FIELD IN CLASSROOMS. COSTS ARE BEST ESTIMATES, BASED ON UNIT COST ESTIMATES AND EXPOSURE DATA IN ZAFFANELLA AND HOOPER 2000. ACTUAL COSTS MAY DIFFER SIGNIFICANTLY FROM THESE ESTIMATES.

	SOURCE				
	NET CURRENTS ONLY	ELECTRICAL PANELS ONLY	DISTRIBUTION LINES ONLY	TRANSMISSION LINES ONLY	ALL FOUR
COST PER AFFECTED SCHOOL	$5,300	$37.000	$30,000	$65,000	$13.000
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STATEWIDE COSTS, NOT INCLUDING SURVEY	$8 million	$4 million	$8.3 million	$12.8 million	$33 million
STATEWIDE SURVEY COSTS	$8 million	$8 million	$0.7 million	$0.2 million	$10 million
FRACTION OF STATEWIDE SCHOOL - TIME EMF EXPOSURE ELIMINATED	20%	1%	4%	3%	29%

Source: Florig, K. School Policy Project. www.dhs.ca.gov/ehib/emf

Respectfully submitted,

Dianne Wilkins

[25] *ibid*, CA EMF report page 7

-----Original Message-----
From: Fink, Lisa <Lisa.Fink@maine.gov>
To: dnwilkins <dnwilkins@aol.com>
Sent: Thu, Nov 7, 2013 2:57 pm
Subject: RE: Request for Extention to File Comments

Ms. Wilkins,

The comment deadline set out in the draft report was October 25th. We are required to submit the report to the EUT committee by November 30th so while we can give you some additional days (until November 13), we cannot accommodate your request to extend the comment period to the end of this month.

Sincerely,

Lisa Fink

Presiding Officer

From: dnwilkins@aol.com [mailto:dnwilkins@aol.com]
Sent: Thursday, November 07, 2013 1:49 PM
To: Fink, Lisa
Subject: Request for Extention to File Comments

Dear Lisa,
I do intend to provide a comment but thought I had until the end of the month to file it . Please extend the comment period to at least the end of the month in consideration of the upcoming busy holidays in November. Thank you for your consideration.

Dianne Wilkins
9 Lakeside Drive
Falmouth, ME 04015

FILED ELECTRONICALLY ON November 13, 2013

Dianne Wilkins
9 Lakeside Drive
Falmouth, ME 04105
dnwilkins@aol.com

November 13, 2013

Harry Lanphear
Administrative Director
Maine Public Utilities Commission
State House Station #18
242 State Street
Augusta, Maine 04333-0018

Re: Comments on PUC Draft Report of October 11, 2013 regarding PUC Docket 2013-00402: Notice of Inquiry and LD 950, an Act to Establish the Electromagnetic Field Safety Act on Setback Requirements Associated with Transmission Lines

Dear Mr. Lanphear:

Below please find my corrected Comment on the PUC Draft Report to the Energy, Utilities and Technology (EUT) committee originally filed on November 11, 2013.

The PUC Draft Report (hereinafter) Draft referenced above should be revised for the following reasons:

1. **The Draft report is bias in favor of the utilities' viewpoint because it considers only the utility's Comment in minute detail, extensively quotes from the utility Comments, recreates tables, and attaches a full copy of the utilities paid consultant's report, but neglects to even discuss, quote, adequately summarize each answer provided, recreate tables, attach the full copies of scientific analysis submitted, or even to attach the actual written public Comments, but only created/attached a useless, "bibliography of sources"(Attachment 2 of Draft) that were used in the public Commenter's Comments.**

To offer the Energy, Utilities and Technology (EUT) committee a complete and fair representation of the available and submitted information in response to their requests, the Draft should be revised to attach the public Commenter's written Comments as exhibits and to include a section in the Draft that offers a fair summary of what the public's Comments contained.

Without a copy of the public's written Comments and full copies of the studies to refer to, the list of sources currently provided in the Draft is virtually meaningless.

In contrast to the vague, superficial two paragraphs that inadequately summarizes all three public Commenter's Comments in section VII, *Other Comments*, of the Draft report, section VI, *Utility Answer to Questions,* describes the utilities' answers to each question in minute detail, including numerous re-created tables, and provides extensive utility quotes that spans 12 pages of the Draft. The final report to the EUT should include the same level of detail for each answer to EUT questions provided by each of the public Commenters.

In addition, the Draft summary in section VII *Other Comments* mentioned the additional requests to the EUT made by this Commenter, but then left out the substantiated reasons given along with the supporting scientific studies and table provided by the Commenter to support these requests:

> Ms. Wilkins requests that the language in LD950 to increase the setback requirement from 300 feet be modified to require1,969 feet from the non-utility property line.
>
> Ms. Wilkins also requests that LD 950 be modified to impose a 3 mG limit at the property line as a siting requirement for new transmission.

The well supported[1] and substantiated reasons along with the documentation provided should be included in the final report to the EUT.

2. **The Draft report section V, *Current Commission Standard for Determining Health Impacts of Electric and Magnetic Fields Associated with Maine Power Reliability Program Transmission Lines,* fails to relay the most current, relevant information regarding potential health impacts of exposure to EMF ELF from power lines as requested by the EUT committee and provided by this public Commenter. This information should be included in the final report to the EUT committee.**

The full copies of the most current scientific pooled analysis, reviews, and relevant new studies[2] submitted by this public Commenter that were not discussed by, or attached to the PUC Draft

[1] see chart provided of what the 15 most current scientific meta analysis (full copies of eachstudy provided) show for distances, mG levels, & risk rates for each from exposure to power lines

Report, included the very relevant, supplemental 2007 report by the WHO, ***Research Agenda for Extremely Low Frequency Fields.*** [3] (hereinafter Supplemental Report) which was meant to be a companion to the 2007 WHO report[4] referenced and relied upon by the Draft report. This Supplemental Report is relevant because the Maine PUC is requiring compliance from utilities with the recommendations as set forth in the main companion report to this Supplemental Report in certain Certificate of Public Convenience and Necessity (CPCN) proceedings. It is also relevant to the long term protection of our children in light of what the main companion report stated below:

> Regarding possible long-term effects, epidemiological studies suggest that every day, low-intensity ELF magnetic field exposure poses a possible increased risk of childhood leukaemia, but the evidence is not strong enough to be considered causal and therefore ELF magnetic fields remain classified as possibly carcinogenic. The evidence is weaker for other studied effects, including other types of cancers in children and adults, depression, suicide, reproductive dysfunction, developmental disorders, immunological modifications, neurological disease and cardiovascular disease.

Weak evidence for the other studied effects does not mean " no evidence" and current research regarding childhood leukemia can upgrade the association to a causal relationship. This Supplemental Report acknowledges that the companion WHO report relied upon by the Maine PUC in their Draft report, lacked certain substantial and crucial knowledge that puts our children at increased risk of harm regarding why the science shows an association between childhood leukemia at an exposure of 3-4 mG; how power line ELF EMF exposures effect the cognitive/learning ability of children; the need to pool existing scientific data on the emerging risk of brain tumors in children to determine the increased risk rate; and the need to update and combine the current research findings (pooled analysis) with the established association of ELF

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[2] See Information and Comment by Dianne Wilkins for NOI Regarding LD 950, Docket No. 2013-00402, filed September 18, 2013, page 3-14 for discussion of the Ahlbom et al., 2000 & Greenland et al., 2000; pooled analysis along with a more recent pooled analysis, Kheifets et al., 2010; and a meta analysis review; Calvente et al., 2010; two extensive reviews of scientific evidence Teepen et al, 2012 & BioInitiative, 2012; and recent studies that have not been taken into consideration by the WHO, 2007 report Svendsen et al., 2007; Feizi and Arabi, 2007; Mejiz-Arangure e al., 2007; Lowenthal et al., 2007; Yang et al., 2008; Abdul-Rahmann et al., 2008; Malagoli et al., 2010; Calvente et al., 2010; Kroll et al., 2010; Kheifets et al., 2010; Sohrabi et al., 2010; Schuz et al., 2011; Does et al., 2011; Wunsch-Filho et al., 2011.

[3] World Health Organization (2007). ***Research Agenda for Extremely Low Frequency Fields*** Geneva, World Health Organization (see: www.who.int/emf)

[4] World Health Organization (2007), ***Extremely Low Frequency Fields Environmental Health Criteria Monograph no.238***

exposures for childhood leukemia to form a more current risk rate as stated in the Supplemental Report at:

> **High priority research needs:**
> **• Pooled analyses of existing childhood brain tumour studies**
> *Rationale:* Brain cancer studies have shown inconsistent results. This was also the case for childhood leukaemia studies and here, pooled analyses have been very informative. Therefore a pooled analysis of childhood brain cancer studies is recommended. Such pooled analysis can inexpensively provide greater and improved insight into existing data,
> including the possibility of a selection bias, and, if studies are sufficiently homogeneous, provide the best estimate of risk.
> **• Update of existing pooled analyses of childhood leukaemia with new information**
> *Rationale:* Since the pooled analyses have been performed, several new epidemiological studies have been published. The pooled analyses should be updated with the results from these recent studies.
> **• Further study of the risk of amyotrophic lateral sclerosis in 'electric' occupations**
> *Rationale*: Several studies have observed an increased risk of amyotrophic lateral sclerosis in 'electric occupations'. It is considered important to investigate this association further in order to find whether ELF magnetic fields are involved in the causation of this rare neurodegenerative disease. This research requires studies in which sufficient information is collected on ELF magnetic field exposure, electric shock exposure as well as exposure to other potential confounders.
> **Other research needs:**
> **• Update of existing pooled and meta-analyses of adult leukaemia and brain tumour studies and cohorts of occupationally exposed individuals**
> *Rationale:* For adult leukaemia and brain cancer, it is recommended that existing large cohorts of occupationally exposed individuals be updated. Occupational studies and pooled and meta-analyses for leukemia and brain cancer have been inconsistent and inconclusive. However, new data have subsequently been published and should be used to update these analyses.
> **• Further study of the possible link between miscarriage and ELF magnetic field exposure**
> *Rationale:* There is some evidence that the risk of miscarriage may be affected by ELF magnetic fields exposure. Taking into account the potentially high public health impact of such an association, further epidemiological research into this hypothesis is recommended.
> **• Further study of the risk of Alzheimer's disease in relation to ELF magnetic field exposure**
> *Rationale:* For Alzheimer's disease, it remains a question whether ELF magnetic fields constitute a risk factor. The data currently available are not sufficient and this association should be further investigated. Of particular importance is the use of morbidity rather than mortality data. [5]

[5] *ibid,* pages 2-3

Pooled analyses (includes meta analyses) is considered the gold standard for synthesizing results from multiple studies because it allows for comparison across different studies and metrics, free of artefacts introduced by analytical differences, and for derivation of more stable results (Kheifets et al., 2010a)[6]. As demonstrated in this public Commenter's Comment, the "Update of existing pooled analyses of childhood leukaemia with new information" listed as a high priority in the Supplemental Report has already taken place after the main 2007 WHO report was published, resulting in several new pooled analyses (Kheifets et al., 2010; Calvente et al, 2010;) which not only confirm but provide more support for the association that exposure to 3-4 mGs of ELF EMF causes increases in cases of childhood leukaemia and also moves the association towards a causal relationship.

In addition, other new extensive reviews of new studies have also taken place which have concluded that the evidence now provides reason to upgrade the association to causal (Teepen et al. 2012; Schuz, 2011; BioInitiative, 2012; Sohrabi et al., 2010). None of these new pooled analysis, reviews, or studies published after 2007 that are contained in this Commenter's Comment are considered by the reports referenced in the Draft report, therefore they should be discussed and added along with the public Comments, in the final report given to the EUT.

In addition to not including the Supplemental WHO Report regarding research gaps in knowledge, glaringly absent from the PUC Draft Report, is the lack of any mention of the 2002 World Health Organization IARC committee's monograph declaring power line ELF EMF a class 2-B possible carcinogen in the same category as DDT and lead. [7] This classification was issued in 2002, and recent opinions by reputable scientists indicate that this classification should be upgraded to a group/class 1 carcinogen[8] as shown and supported by this Commenter's Comment but which was ignored by the PUC's Draft report. A summary of this IARC

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[6] Kheifets L, Ahlbom A, Crespi CM, Feychting M, Johansen C, Monroe J, Murphy MF, Oksuzyan S, Preston-Martin S, Roman E, Saito T, Savitz D, Schüz J, Simpson J, Swanson J, Tynes T, Verkasalo P, Mezei G. ***A pooled analysis of extremely low-frequency magnetic fields and childhood brain tumors.*** Am J Epidemiol. 2010b Oct 1;172(7):752-61. Pooled, Meta Analysis Review. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2965855/

[7] IARC, 2002. ***Monographs on the Evaluation of Carcinogenic Risks to Humans. In: Non-ionizing Radiation, Part 1: Static and Extremely Low-frequency (ELF) Electric and Magnetic Fields,*** vol. 80. IARC Press, Lyon.

[8] BioInitiative 2012, ***Rationale for a Biologically-based Public Exposure Standard for Electromagnetic Fields (ELF and RF) Section 12 – Evidence for Childhood Cancers (Leukemia) 2012 Supplement.*** BioInitiative Working Group, BioInitiative Report, 2012 (see page 17)

classification; the several scientific pooled analysis it was based on; the 2 new pooled and meta analysis completed after 2002; the other recent comprehensive reviews of evidence; along with the recent studies should be discussed and attached to the PUC's final report to the EUT committee.

Another omission of the Draft report, is the mention of the 2009 European Union's Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR) report without also mentioning the supplementary companion report issued by the same group later in that same year regarding the high priority research needs due to knowledge gaps in research for the long term effects from ELF EMF exposure. The SCENIHR supplemental report, *Research Needs and Methodology to Address the Remaining Knowledge Gaps on the Potential Health Effects of EMF*, Section 4.1.3.1, *Experimental studies relevant to possible carcinogenicity of ELF fields*, describes a study that is needed to identify the mechanism for the finding of an association between exposure to power line ELF EMF and childhood leukaemia:[9]

> **4.1.3.1. Experimental studies relevant to possible carcinogenicity of ELF fields**
> **Study type**
> Laboratory studies using *in vitro* and/or animal models.
> **Rationale/justification**
> The fact that the epidemiological findings of childhood leukaemia have little support from known mechanisms or experimental studies is intriguing and it is of high priority to reconcile these data.

This SCENIHR supplementary report should also be included in the PUC final report to the EUT committee.

The Draft report does include a more recent report by the European Health Risk Assessment Network (EHFRAN) regarding ELF EMF power line exposures, but also mentioned in the Draft is the fact that this report relies on all of the same studies relied upon in the other reports that have already been included in this Draft.[10] As explained by this Commenter's Comment these reports all suffer from not having reviewed the most current science, i.e. the latest pooled

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[9] Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR),***Research Needs And Methodology To Address The Remaining Knowledge Gaps On The Potential Health Effects Of EMF***. European Commission 2009 http://ec.europa.eu/health/ph_risk/committees/04_scenihr/docs/scenihr_o_024.Pdf

[10] PUC Draft, page 9

analysis, meta analysis and reviews of all current evidence that should be included in the final report to the EUT.

3. **The Draft report section V, *Current Commission Standard for Determining Health Impacts of Electric and Magnetic Fields Associated with Maine Power Reliability Program Transmission Lines,* fails to convey the fact there are no existing rules or laws that require the utility or the PUC to provide a comprehensive analysis, review, or report by qualified scientists specializing in research related to the determination of biological effects from exposure to power line EMF ELFs and/or measurements of exposure levels, prior to the approval of an electrical line or equipment installation.**[11]

As stated in the Draft, the Commission currently considers health impacts of transmission line siting as part of a Certificate of Public Convenience and Necessity (CPCN) proceedings and only requires a utility in its petition for a CPCN to provide a "**description of the effect**" of the proposed transmission line on public health and safety; scenic, historic, recreational and environmental values; and of the proximity of the proposed transmission line to inhabited dwellings. Chapter 330 § 6(E)." [12]

First, asking the utility for a "description of effects" is not the same as a codified rule requiring the utility to provide an independent in-depth analysis, meta analysis, or scientific review performed by qualified scientist who have specialized in research on the health effects from exposures to EMF ELF's or requiring qualified independent, third party measurements of exposure levels. The final report to the EUT should define exactly what the "description of effects" consists of, including the degree of detail expected and the qualifications of persons providing said description.

Second, it should be stated in the Draft the degree of reliance the PUC places upon the utilities "description of effect" in rendering their mitigation or other safety decisions since the utility does not have the necessary unbiased status, expertise, or the legal authority to assess the health effects of ELF EMF as it is not one of the federal health agencies designated by congressional act to make these determinations. The FCC Report & Order adopting the current

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[11] *ibid,* page 19

[12] MPUC Draft Report Related to LD 950, An Act to Establish the Electromagnetic Field Safety Act on Setback Requirements Associated with Transmission Lines; *vide* page 5

FCC safety guidelines regarding electromagnetic fields specifically delineates the federal health agencies and their jurisdiction with respect to determining the health and safety of EMF radiation emissions, stating that the Federal Drug Administration (FDA) has general jurisdiction for protecting the public from potentially harmful radiation from consumer and industrial devices; the Environmental Protection Agency (EPA) is generally responsible for investigating and making recommendations with regard to environmental issues; the National Institute for Occupational Safety and Health (NIOSH) is responsible for performing research and analysis with respect to worker safety and health; and the Occupational Safety and Health Administration (OSHA) has jurisdiction over Federal regulations dealing with worker safety and health. [13]

Third, the Draft also states that the EMF ELF exposure effects on public health and safety is determined on a case-by-case basis:

> In 2010, in granting a CPCN for the Maine Power Reliability Program (MPRP), the Commission approved a stipulation that among other things set forth the following requirement:
>
> > CMP will take all reasonable steps to mitigate EMF consistent with World Health Organization recommendations, including "reverse phasing" wherever practical.[14]

This stipulation by the PUC was approved for that particular Certificate of Public Convenience and Necessity proceedings and the Draft does not state if this was ever codified into a PUC rule or an amendment to the CPCN requirements so it is unclear whether this stipulation would automatically apply to any other new or old electric lines unless it is specifically stipulated again by the PUC during another request for a CPCN or during litigation involving landowner disputes.[15]

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[13] See The Federal Communication Commission, *Guidelines for Evaluating the Environmental Effects of Radiofrequency Radiation, Report and Order*, ET Docket No. 93-62, Section III.A subsections 15, 18, 19, & 20.
[14] MPRP Stipulation at § V(E)(9), appended to *Central Maine Power Co. and Public Service of New Hampshire, Request for Certificate of Public Convenience and Necessity for the Maine Power Reliability Program Consisting of the Construction of Approximately 350 Miles of 345 kV and 115 kV Transmission Lines ("MPRP")*, No. 2008-255, Order Approving Stipulation (June 10, 2010) (MPRP Order)
[15] *Ibid.*

The final report to the EUT should clearly state the conditions of the PUC's use and the legal status of this stipulation.

4. Regarding the estimated costs for new lines to adhere to the proposed 300 ft. distance by CMP, BHE/MPS, the Draft report fails to include a cost benefit analysis or enough information to allow the EUT to conduct a due diligence cost benefit analysis.

BHE/MPS provided a sample of magnetic fields measurements taken around company-owned lines. This sample is reflected in Table 3.[16] The Draft does not, but the final report should state whether BHE/MPS had a qualified (a PhD or Masters in engineering and prior professional experience in measuring EMF exposures), unbiased, independent party perform the measurements contained in Table 3 since these are the only actual field exposure measurements mentioned in the Draft and will be heavily relied on by the EUT committee.

Although the Draft report mentions that California has EMF mitigation requirements that consider the cost of possible EMF mitigation in relation to the cost of the entire project[17] it does not give the EUT a clue as to how Maine can implement the same policy options in the face of possible health risks from power line ELF EMF exposures. In 1993, the California Public Utilities Commission (CPUC) mandated that the Department of Health Services (DHS) oversee a program of research and policy analysis about power frequency EMFs. The resulting California EMF Program was fiscally implemented by the nonprofit Public Health Institute (PHI) and directed by the DHS.[18]

In 2002 the California EMF program issued a report entitled *Policy Options in the Face of Possible Risk from Power Frequency Electric and Magnetic Fields* (copy filed in the current Docket 2013-00402, DW Comment on PUC Draft to EUT, Exhibit A). According to the definitions contained in this report and in regards to ELF power line exposures, the Maine PUC's viewpoint coincides with decisions based upon the "utilitarian" framework that aims at "the most good for the most people at the least cost" that is used by many economists and regulators.

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[16] PUC Draft report at page 17

[17] PUC Draft report at page 4

[18] California EMF Program, *Policy Options in the Face of Possible Risk from Power Frequency Electric and Magnetic Fields (EMF)* June 2002 Final Report; *vide* page 1, lines 1-3 and 60-61 (see www.dhs.ca.gov/ehib/emf)

Assuming this framework, the California EMF program derived that economist think society is willing to pay approximately $5 million to avoid a single death and still be cost effective:

> The program's policy contractors reviewed the economic (utilitarian) literature that compares various medical, public health, and environmental policies and their efficacy to infer what economists think that society is willing to pay to avoid a statistical death. This varies from program to program, ranging from $1 million to $10 million per death avoided. As a rough indicator of the health benefit that would be needed by the utilitarian framework to justify the cost of various avoidance measures, economists would divide the unit project cost (e.g., the per mile cost of undergrounding a 69 kV line) by say, $5 million per death avoided. This derives the deaths that an economist would require to be avoided per mile to make the unit project cost "cost-beneficial." [19]

They then present the "unfinanced" base case and statewide project cost numbers for mitigation and/or installation of new power lines to avoid harm and still be cost beneficial.[20]

In the detailed analyses of the projects, the total life cycle costs were considered, including maintenance costs, relative reliability, power losses due to resistance, property value impacts, etc.[21]

The numbers presented in Table 1 on page 5 of this report shown below, allow the reader to determine the number of people "exposed" in the state and whether or not the avoidance measures require an implausibly large health benefit to warrant their adoption under the economist's utilitarian cost/benefit framework.[22]

TABLE 1. RESIDENTIAL EMF SOURCES, THE COSTS OF MODERATE AND EXPENSIVE MITIGATION, AND THE REQUIRED DEATHS TO AVOID TO SEEM COST BENEFICIAL FOR ECONOMISTS

EMF SOURCE AND MITIGATION	RESIDENTIAL POPULATION "AFFECTED" TWA>2 MG	AMOUNT**	MODEST COST MEASURES (REPHASING AND COMPACTING LINES)				EXPENSIVE MEASURES (NDERGROUNDING)			
			UNIT COST	TOTAL COST	% OF 10 YEAR REVENUE	STATEWIDE DEATHS TO AVOID IN 35 YEARS TO JUSTIFY COSTS[1]	UNIT COST	TOTAL COST	% OF 10 YEAR REVENUE	STATEWIDE DEATHS TO AVOID IN 35 YEARS TO JUSTIFY COSTS [1]
TRANSMISSION	510,000	1,700 miles	$80,000 per mile	$135 million	0.06%	27	$1.46 million per	$2.48 billion	1.13%	495

[19] *ibid*, page 3 lines 29-38
[20] *ibid*, page 3 lines 39-44
[21] *ibid*, page 3 lines 45-47
[22] *ibid*, page 4 lines 3-6

							mile			
DISTRIBUTION	1 million	6,700 miles	$35,000 per mile	$234.5 million	0.11%	47	$750 million per mile	$5.03 billion	2.3%	1,005
GROUNDING	1.65 million	550,000 homes	$200 per home	$110 million	0.05%	22	$200 per mile	$110 million	.05%	22
TOTAL	2.59 million			$480.5 million	0.22%	96		$7.51 billion	3.46%	1,522

**The miles of line represent the contractor's best estimate. California utilities explained that a special study would be required to provide exact circuit and corridor miles in residential areas.

[!] By dividing total cost by $5 million per death avoided, a utilitarian would derive the number of avoided deaths required to make a measure cost beneficial

* The total number of exposed people is smaller than the sum of people affected by each source, because of an overlap between sources.

Source: von Winterfeldt, D. Power Grid Project. www.dhs.ca.gov/ehib/emf.

As described in this California EMF report:

> As can be seen in Table 1, about 1.51 million Californians receive average EMF residential exposures greater than 2 mG from the power grid and another 1.65 million receive such exposures within their homes from the way neutral currents return to the grid via plumbing instead of the neutral lines. Since there are overlaps between these sources the total exposed is less than the sum of these numbers. Except for selected occupational groups, residential exposures account for most of the daily exposures because most people spend so much time at home during a given 24-hour day. The moderate cost measures of rephasing transmission lines, compacting distribution lines, and modifying plumbing would cost about $0.48 billion statewide, increasing utility rates for a decade by less than 1%. One would need to avoid about 96 (undiscounted) deaths statewide over a 35-year period to make these measures seem cost beneficial to an economist.[23]

Table 1 also shows that an ELF EMF mitigation program that cost $500,000 a year would need to save one life statewide every decade to make it cost beneficial.[24]

Using the numbers cited below by the Draft report as provided in the utilities Comments, and any additional information subsequently provided by the PUC, the final report to the EUT should contain a table like Table 1 to show estimated cost benefits for providing a 300 ft or more distance between the edge of utility lot lines and residential home etc. lot lines:

> Very broad estimates of the cost of imposing a 300-foot setback requirement for new transmission are estimated to range from approximately $ 950 million for CMP to $889 million for BHE and $353 million for MPS. (assuming that all of BHE's and MPS's lines were rebuilt or that new transmission was constructed along the transmission ROW).[25]

[23] *ibid*, page 4 lines 56-67

[24] *ibid*, page 4 lines 3-6

[25] PUC Draft report, page 5

In addition the final report to the EUT committee should also contain a Table similar to Table 2 by the California EMF Project shown below[26] that take measurements aimed at eliminating exposures above 3 mG in the areas covered by LD 950.

TABLE 2. COSTS OF MEETING A 2-MG STANDARD FOR THE SPATIALLY-AVER AGED MAGNETIC FIELD IN CLASSROOMS. COSTS ARE BEST ESTIMATES, BASED ON UNIT COST ESTIMATES AND EXPOSURE DATA IN ZAFFANELLA AND HOOPER 2000. ACTUAL COSTS MAY DIFFER SIGNIFICANTLY FROM THESE ESTIMATES.

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STATEWIDE COSTS, NOT INCLUDING SURVEY	$8 million	$4 million	$8.3 million	$12.8 million	$33 million
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Source: Florig, K. School Policy Project. www.dhs.ca.gov/ehib/emf

Respectfully submitted,

Dianne Wilkins

[26] *ibid*, CA EMF report page 7

FILED ELECTRONICALLY ON November 13, 2013

-----Original Message-----
From: Fink, Lisa <Lisa.Fink@maine.gov>
To: dnwilkins <dnwilkins@aol.com>
Sent: Thu, Nov 7, 2013 2:57 pm
Subject: RE: Request for Extention to File Comments

Ms. Wilkins,

The comment deadline set out in the draft report was October 25th. We are required to submit the report to the EUT committee by November 30th so while we can give you some additional days (until November 13), we cannot accommodate your request to extend the comment period to the end of this month.

Sincerely,

Lisa Fink

Presiding Officer

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Sent: Thursday, November 07, 2013 1:49 PM
To: Fink, Lisa
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Dear Lisa,
I do intend to provide a comment but thought I had until the end of the month to file it . Please extend the comment period to at least the end of the month in consideration of the upcoming busy holidays in November. Thank you for your consideration.

Dianne Wilkins
9 Lakeside Drive
Falmouth, ME 04015

November 13, 2013

Mr. Harry Lanphear
Maine Public Utilities Commission
State House Station 18
Augusta, ME 04333-0018

Dear Mr. Lanphear,

Please find my comments related to the PUC's draft report on LD 950.

Very Truly Yours,
Wanda Curtis,RN,MSN

COMMENTS ON PUC'S DRAFT REPORT ON LD 950

The PUC draft report references much of CMP's report but did not include any medical information from the reports that I have submitted.

In regards to LD 950, CMP said in footnote 3 on page 5 of their comments on LD 950 that they had no knowledge of any transmission lines within 300 feet of a school. Yet I read online that just a few years ago, the Maine PUC overruled Saco's local ordinance requiring undergrounding of transmission lines within 200 feet of schools and the PUC granted permission for CMP to construct a 115,000 volt transmission line (and also a 34.5 volt line I believe) adjacent to the Saco Middle School where 600+ children attend.

CMP also constructed a 115,000 volt transmission line in the front yard of two Chelsea homes where children reside and many children congregate in the front yard. They also plan to construct a 345,000 volt line adjacent to that 115,000 volt line where children will be exposed to EMF levels from both those lines and have been exposed to EMF from the 115,000 volt line the past year.

***See Dr. David O. Carpenter's statement below regarding EMF exposure, childhood leukemia, EMF inhibiting the ability of Tamoxifen to stop the growth of breast cancer cells, and lymphoma in dogs living near overhead high voltage lines. That's the medical information upon which this decision, that will affect the life and health of all Maine residents and especially children, should be based. There has been no medical testimony from a physician regarding the MPRP and any medical reports that I've submitted have been ignored.

This past summer I visited a family living adjacent to the 115,000 volt line and heard the story of their three year old dog that just put to sleep because of lymphoma that same day. That's the same line which crosses those children's yards.

I sent a photo of the home with the 115,000 volt line in one of the front yards but it was ignored. I asked for mitigation in Chelsea but the PUC has fought me even to the point of the LDRT imposing a 2,000 mG standard on our case 2011-00504 stating that because EMF levels are below 2,000 mG that CMP has no responsibility to use mitigation.

I saw recently a 9,000 mG standard for EMF exposure has been referenced in comments regarding LD 950 which is even more alarming!

The 2,000 mG and 9,000 mG standards are not to be applied to chronic, longterm exposure for persons living adjacent to power lines. That was discussed thoroughly in

case 2011-00504. The 2,000 mG standard applies to short-term, acute exposure such as from an MRI machine. Even MRI technicians leave them room during an MRI!!!

Millions of dollars have been approved for mitigations for certain Maine communities ,while the little children of Chelsea along the corridor and children with high voltage lines in their front yard. CMP said during our LDRT hearing, that no reverse phasing was even used on the 115,000 volt line which crosses the front yards.

I don't know how the people who have made the decision to refuse mitigations to children can go to sleep at night. I don't. I lay awake thinking about those children and the childhood leukemia studies and the dog that died this summer near the 115,000 volt line from a lymphoma.

LD 950 is needed in Maine and should be passed as an emergency measure effective immediately.

****LD 950 could be amended to state that utilities must use mitigations (like tall steel monopoles, a Delta configuration or split phasing or reverse phasing) on all new electrical installations to reduce EMF levels below 3 mG at the edge of right of ways, which is the level at which the childhood leukemia studies become statistically significant according to Dr. David O. Carpenter MD.

***The bill should also address how far away from homes, schools, daycare centers, and other places that children reside or frequent that substations must be constructed.

That's why it's critical for the public and legislators to know what EMF levels are emitted by substations right now which is a question that the community relations representative for CMP has said was never asked by the Maine PUC in regards to the current MPRP substations under construction.

In regards to the 300 foot setback for power lines, there's already an exception clause in the eminent domain section of MRSA Title35-A stating that no electrical line desinged to carry 5,000 volts or more of electricity shall be constructed with 300 feet of an inhabited dwelling.

According to the Federal Register (already referenced in LDRT brief 2011-00504,) Tennessee requires a 300-foot setback for homes and an even greater setback for schools.

According to NH physician Campbell McLaren, a number of countries also require a 300-foot setback. (Those were also referenced in our LDRT brief.)

Contrary to the picture painted when mtigations have been requested for the MPRP, the WHO refers to moving lines away from schools and the use of optimized phasing as "low cost" mitigation measures in their publication Extremely Low Frequency Fields Environmental Health Criteria No. 238.

These are human lives that we are talking about, the lives of innocent young children and Maine residents who trust their government to protect them by ensuring that the service is safe.

If EMF is nothing to be concerned about, why was the line moved to another corridor in Yarmouth, moved farther away in Farmingdale where residents expressed concerns regarding not only property value but also health problems and EMF ,and why was mitigation ordered in other cases? Why did the PUC and CMP and the OPA sign a stipulation stating that CMP will take all reasonable steps to reduce EMF?

During the public hearing on LD 950, the Committee requested information from the PUC regarding mitigations being used in the MPRP but instead, a new set of questions have

been addressed.

The PUC and CMP should be accountable for the expenditure of millions of dollars of rate payer money that's already been approved. for MPRP mitigations The public deserves to know how and where and why that much money has been spent and the justification for spending it.

STATEMENT BY DAVID O. CARPENTER, M.D.
for the
STATE OF CONNECTICUT SITING COUNCIL
Proceeding 754

I am currently the Director of the Institute for Health and the Environment at the University at Albany , as well as Professor in the Departments of Environmental Health Sciences and Biomedical Sciences in the School of Public Health at the University at Albany . I served as Director of the Wadsworth Center for Laboratories and Research of the New York State Department of Health from 1980-1985 and as Dean of the School of Public Health of the University at Albany from 1985-1998. From 1980-1987, I was given administrative responsibility for direction of the New York State Powerlines Project, a five million dollar research project designed to determine whether there were significant health effects from electric and magnetic fields generated by power lines. When that study ended in 1987, I became the official spokesperson for New York State on issues relating to electromagnetic fields. In 1991-1992, I served as a member of a committee established by the Connecticut Academy of Sciences and Engineering concerning health effects of EMFs.

In my judgment, the proposal to establish a magnetic field screening level of 100 mG at the edge of right-of-ways is misguided. It will not be protective of human health, especially to children. As documented by Wartenburg (1998), epidemiological studies of residential exposure to magnetic fields and childhood leukemia show a positive relationship that cannot be explained by random variation. Two independent meta analyses show that prolonged exposure to power line fields of 3 or 4 mG is associated with an increase in the risk of leukemia in children (Ahlbom et al., 2000; Greenland et al., 2000). Furthermore, there is reason to believe that, as with other carcinogens, exposure to lower intensity fields also increases risk of cancer. To devise an exposure standard on the basis of negative rat studies when there is strong evidence of increased risk of leukemia in children associated with magnetic fields from power lines is simply foolish. It is children and other humans that we are supposed to protect, not rats.

Since others are providing detailed comments on human studies, I have been asked to discuss animal and cell culture studies that might provide a mechanistic basis for the relationship between exposure to 60 Hz magnetic fields and leukemia in children. No rodent study, to date, has demonstrated that magnetic field exposure over a range of intensities has resulted in leukemia or lymphoma (Boorman et al., 2000). There are several possible reasons for the failure to find leukemia in this animal model system. Human studies of childhood leukemia have concluded that leukemia results from a combination of two events – one primary event in the prenatal period, probably involving a genetic alteration, followed by an exposure to an environmental factor in the early postnatal period (Kim et al., 2006). Unfortunately, most rodent exposure studies have been of young or adult animals, not with prenatal exposure or exposure of juvenile animals. Rapacholi et al. (1997) demonstrated elevation in the rate of lymphoma in transgenic mice predisposed to develop lymphoma after exposure to radiofrequency fields, although the same strain did not develop lymphoma after 50 Hz magnetic field exposure (Harris et al., 1998). There is, however, no evidence that this particular mutation is relevant to human leukemia, while the TEL- AML 1 fusion gene which is documented to be associated with up to 25% of all childhood acute lymphocytic leukemia (Kim et al., 2006) has not been studied in an animal model. The Harris et al. (1998) study was of animals 6-8 months of age, which again is not an appropriate model for childhood leukemia because it did not include prenatal or early life exposure. The most convincing animal model which has demonstrated a relationship between risk of lymphoma and magnetic field exposure is the study of Reif et al. (1995) who showed that dogs living in homes that fell in the "very high current" residential category of

Wertheimer and Leeper (1979) had a significant 6.8 fold (95% CI, 1.6-28.5) elevated risk of developing lymphoma.

Other animal studies have reported elevations in different kinds of cancer, even though evidence for a relationship in humans is less convincing for any cancer other than leukemia. Mevissen et al. (1998) reported that 50 Hz magnetic fields at 1000 mG caused a significant increase in skin tumors induced by the chemical carcinogen, DMBA. However, other laboratories have not been able to replicate this finding, using somewhat different procedures (Anderson et al., 2000). Svedenstal et al. (1999) have reported DNA damage, which can lead to cancer, using the comet assay applied to brain cells of mice raised under a high-voltage power line. This study confirms that DNA breaks occur with low intensity EMFs, as reported by others (see Lai and Singh, 2004). Goodman and Blank (1998) have reported that magnetic fields alter transcript levels for specific genes. They found that an 80 mG, 60 Hz magnetic field applied for 20 min induces heat shock protein 70 synthesis in mammalian cells. Alteration of this and other genes is another possible pathway to cancer. Magnetic fields are known to reduce secretion of melatonin in animals and humans, which could relate to elevated risk of breast cancer (Reiter, 1995). Girgert et al. (2005) have shown that 12 mG magnetic fields block the ability of tamoxifen to regulate growth of human breast cancer cells in culture, confirming previous observations.

In my opinion, these animal studies should not be used as the basis for setting standards at right-of-ways for several reasons. Adult rodents exposure is likely not a good model of human childhood leukemia, the cancer of concern, because childhood leukemia depends upon a combination of prenatal and postnatal events. While we do not know the mechanism of cancer induction, induced currents are likely critical, and will be very different in animals of different shapes, again indicating that rodents may not be good models of human childhood leukemia. Finally, we have strong evidence of an association of exposure to magnetic fields of low intensity and leukemia in humans, especially children. The fact that we do not as yet know the mechanism does not change the existence of this association. This evidence of an association between childhood exposure to magnetic fields and leukemia should be the basis for setting standards at the edge of right-of-ways.

References:

Ahlbom A, Day N, Feychting M, Roman E, Skinner J, Dockerty J, Linet M, McBride M, Michaelis J, Olsen JH, Tynes T and Verkasalo PK (2000) A pooled analysis of magnetic fields and childhood leukemia. Brit J Cancer 83: 692-698.

Anderson LE, Morris JE, Sasser LB and Loscher W (2000) Effects of 50- or 60-hertz, 100 μT magnetic field exposure in the DMBA mammary cancer model in Sprague-Dawley rats: Possible explanations for different results from two laboratories. Environ Health Perspect 108: 797-802.

Boorman GM, Rafferty CN, Ward JM, Sills RC (2000) Leukemia and lymphoma incidence in rodents exposed to low-frequency magnetic fields. Radiat Res 153: 627-636.

Girgert R, Schimming H, Korner W, Grundker C and Hanf V (2005) Induction of tamoxifen resistance in breast cancer cells by ELF electromagnetic fields. BBRC 336: 1144-1149.

Goodman R and Blank M (1998) Magnetic field stress induces expression of hsp70. Cell Stress Chap 3: 74-88.

Greenland S, Sheppard AR, Kaune WT, Poole Ch, Kelsh MA for the Childhood Leukemia-EMF Study Group (2000) A pooled analysis of magnetic fields, wire codes, and childhood leukemia. Epidemiology 11: 624-634.

Harris AW, Basten A, Gebski V, Noonam D, Finnie J, Bath ML, Bangay MJ and Repacholi MH (1998) A test of lymphoma induction by long-term exposure of Eμ-Pim1 transgenic mice to 50 Hz magnetic fields. Rad Res 149: 300-307.

Kim AS, Eastmond DA and Preston RJ (2006) Childhood acute lymphocytic leukemia and perspectives on risk assessment of early-life stage exposures. Mut Res 613: 138-160.

Lai H and Singh NP (2004) Magnetic field-induced DNA strand breaks in the brain cells of the rat. Environ Health Perspect 112: 687-694.
Mevissen M, Haussler M, Lerchl A and Loscher W (1998) Acceleration of mammary tumorigenesis by exposure of 7,-12-dimethylbenz[a]anthracene-treated female rats in a 50-Hz, 100 μT magnetic field: Replication study. J Toxicol Environ Health A: 53: 401-418.
Reif JS , Lower KS , and Oglivie GK (1995) Residential exposure to magnetic fields and risk of canine lymphoma. Am J Epidemiol 141: 352-359: 1995.
Reiter RJ (1995) Reported biological consequences related to the suppression of melatonin by electric and magnetic field exposure. Integrative Physiological and Behavioral Science 30: 314-330.
Repacholi MH, Basten An, Gebski V, Noonan D, Finnie J and Harris AW (1997) Lymphomas in Eμ-Pim1 transgenic mice exposed to pulsed 900 MHz electromagnetic fields. Rad Res 147: 631-640.
Svedenstal BM, Johanson KJ, Mattsson MO and Paulsson LE (1999) DNA damage, cell kinetics and ODC activities studied in CBA mice exposed to electromagnetic fields generated by transmission lines. In Vivo 13: 507-514.
Wartenberg D (1998) Residential magnetic fields and childhood leukemia: A meta-analysis. Am J Public Health 88: 1787-1794.
Wertheimer N and Leeper E (1979) Electrical wiring configurations and childhood cancer. Am J Epidemiol 109: 273-284.

Submitted By,
Wanda Curtis,RN,MSN

ATTACHMENT 3

BIBLIOGRAPHY OF SOURCES ON HEALTH EFFECTS OF EXPOSURE TO EMF

1. Ahlbom A, Day N, Feychting M, Roman E, Skinner J, Dockerty J, Linet M, McBride M, Michaelis J, Olsen JH, Tynes T, Verkasalo PK.***A pooled analysis of magnetic fields and childhood leukaemia.*** British Journal of Cancer (2000) **83**(5), 692–698. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2363518/

2. Abdul Rahman HI, Shah SA, Alias H, Ibrahim HM. ***A case-control study on the association between environmental factors and the occurrence of acute leukemia among children in Klang Valley, Malaysia***. Asian Pac J Cancer Prev. 2008 Oct-Dec;9(4):649-52.
http://www.ncbi.nlm.nih.gov/pubmed/19256754;
http://www.apocpcontrol.org/page/apjcp_issues_view.php?sid=Entrez:PubMed&id=pmid:19256754&key=2008.9.4.649.

3. BioInitiative 2012, ***Rationale for a Biologically-based Public Exposure Standard for Electromagnetic Fields (ELF and RF) Section 12 – Evidence for Childhood Cancers (Leukemia) 2012 Supplement.***
BioInitiative Working Group, BioInitiative Report, 2012.

4. Calvente I, Fernandez MF, Villalba J, Olea N, Nuñez MI. *Exposure to electromagnetic fields (nonionizing radiation) and its relationship with childhood leukemia: a systematic review***.** Sci Total Environ. 2010 Jul 15;408(16):3062-9. Epub 2010 May 7.
http://www.ncbi.nlm.nih.gov/pubmed/20451240

5. Carpenter, David O and Sage, Cindy, *Setting Prudent Public Health Policy for Electromagnetic Field Exposures,* Reviews on Environmental Health, Volume 23, no. 2, 2008.

6. Coleman MP, Bell CMJ, Taylor HL, et al. *Leukemia and residence near electricity transmission equipment: a case-control study*. Br J Cancer 1989;60:793–8.
http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2247309/

7. Does M, Scélo G, Metayer C, Selvin S, Kavet R, Buffler P. *Exposure to electrical contact currents and the risk of childhood leukemia***.** Radiat Res. 2011 Mar;175(3):390-6.
http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3087620/

8. Draper G, Vincent T, Kroll ME, Swanson J. *Childhood cancer in relation to distance from high voltage power lines in England and Wales: a case-control study*. BMJ. 2005;330:1290. [PMC free article] [PubMed] Pooled Analysis.

9. European Health Risk Assessment Network on Electromagnetic Fields Exposure, *Risk analysis of Human Exposure to Electromagnetic fields (revised) (2012)*
http://efhran.polimi.it/docs/D2_Finalversion_oct2012.pdf.

10. Feizi AA, Arabi MA. *Acute childhood leukemias and exposure to magnetic fields generated by high voltage overhead power lines - a risk factor in Iran*. Asian Pac J Cancer Prev. 2007 Jan-Mar;8(1):69-72.
http://www.apocpcontrol.org/page/apjcp_issues_view.php?sid=Entrez:PubMed&id=pmid:17477775&key=2007.8.1.69

11. Feychting M, Ahlbom A*. Magnetic fields and cancer in children residing near Swedish high-voltage power lines.* Am J Epidemiol 1993;138:467–81.
http://www.ncbi.nlm.nih.gov/pubmed/8213751

12. Fulton JP, Cobb S, Preble L, et al. *Electrical wiring configurations and childhood leukemia in Rhode Island.* Am J Epidemiol 1980;111:292–6.
http://www.ncbi.nlm.nih.gov/pubmed/7361752

13. Greenland, S., Sheppard, A. R., Kaune, W. T., Poole, C., & Kelsh, M. A. (2000). ***A** pooled analysis of magnetic fields, wire codes, and childhood leukemia.* Epidemiology, 11(6), 624-634.
http://www.ncbi.nlm.nih.gov/pubmed/11055621

14. IARC, 2002. *Monographs on the Evaluation of Carcinogenic Risks to Humans. In: Non-ionizing Radiation, Part 1: Static and Extremely Low-frequency (ELF) Electric and Magnetic Fields,* vol. 80. IARC Press, Lyon.

15. Kheifets L, Ahlbom A, Crespi CM, Feychting M, Johansen C, Monroe J, Murphy MF, Oksuzyan S, Preston-Martin S, Roman E, Saito T, Savitz D, Schüz J, Simpson J, Swanson J, Tynes T, Verkasalo P, Mezei G. *A pooled analysis of extremely low-frequency magnetic fields and childhood brain tumors.*
Am J Epidemiol. 2010b Oct 1;172(7):752-61. Pooled, Meta Analysis Review.
http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2965855/

16. Kheifets L, Ahlbom A, Crespi CM, Draper G, Hagihara J, Lowenthal RM, Mezei G, Oksuzyan S, Schüz J, Swanson J, Tittarelli A, Vinceti M, Wunsch Filho V. *Pooled analysis of recent studies on magnetic fields and childhood leukaemia.* Br J Cancer. 2010a Sep 28;103(7):1128-35.
http://www.ncbi.nlm.nih.gov/pubmed/20877339;
http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2965855/

17. Kroll ME, Swanson J, Vincent TJ, Draper GJ. ***Childhood cancer and magnetic fields from high-voltage power lines in England and Wales: a case-control study***. Br J Cancer. 2010;103:1122–1127. [PMC free article] [PubMed]

18. Li C-Y, Lee W-C, Lin RS. ***Risk of leukemia in children living near high-voltage transmission lines.*** J Occup Environ Med 1998; 40:144–7.
http://www.ncbi.nlm.nih.gov/pubmed/9503290

19. Linet MS, Hatch EE, Kleinerman RA, Robison LL, Kaune WT, Friedman DR, Severson RK ,Haines CM, Hartsock CT, Niwa S, Wacholder S, Tarone RE. *Residential exposure to magnetic fields and acute lymphoblastic leukemia in children.* N Engl J Med 1997;337:1–7.
http://www.nejm.org/doi/full/10.1056/NEJM199707033370101

20. London SJ, Thomas DC, Bowman JD, Sobel E, Cheng TC, Peters JM. *Exposure to residential electric and magnetic fields and risk of childhood leukemia*. Am J Epidemiol 1991;134 923–37.
http://www.ncbi.nlm.nih.gov/pubmed/1843457

21. Lowenthal RM, Tuck DM, Bray IC*. Residential exposure to electric power transmission lines and risk of lymphoproliferative and myeloproliferative disorders: a case-control study.* Intern Med J. 2007
Sep;37(9):614-9. http://www.ncbi.nlm.nih.gov/pubmed/17543004.

22. Malagoli C, Fabbi S, Teggi S, Calzari M, Poli M, Ballotti E, Notari B, Bruni M, Palazzi G, Paolucci P, Vinceti M. *Risk of hematological malignancies associated with magnetic fields exposure from power lines: a case-control study in two municipalities of northern Italy.* Environ Health. 2010 Mar 30;9:16.
http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2856548/

23. McBride ML, Gallagher RP, Theriault G, Armstrong BG, Tamaro S, Spinelli JJ, Deadman JE, Fincham S, Robson D, Choi W. *Power-frequency electric and magnetic fields and risk of childhood leukemia in Canada.* Am J Epidemiol 1999;149: 831–42.
http://www.ncbi.nlm.nih.gov/pubmed/10221320;
http://aje.oxfordjournals.org/content/149/9/831.long

24. Mizoue T, Onoe Y, Moritake H, Okamura J, Sokejima S, Nitta H. *Residential proximity to high-voltage power lines and risk of childhood hematological malignancies.* J Epidemiol. **2004** Jul;14(4):118-23.
https://www.jstage.jst.go.jp/article/jea/14/4/14_4_118/_article

25. Myers A, Clayden AD, Cartwright RA, Cartwright SC*. Childhood cancer and overhead power lines: a case-control study.* Br J Cancer. **1990** Dec;62(6):1008-14.
http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1971546/

26. National Institute of Environmental Health Sciences and National Institutes of Health, *EMF, Electri and Magnetic Fields Associated with the Use of Electric Power, Questions and Answers, 2002.* http://www.cdc.gov/niosh/topics/emf/.

27. National Research Council. *Possible health effects of exposure to residential electric and magnetic fields*. National Research Council, Washington: National Academy Press, 1996.

28. Portier CJ,Wolfe MS (eds). National Institute of Environmental Health Sciences Working Group Report, Assessment of health effects from exposure to power-line frequency electric and magnetic fields (NIH publication no. 98-3981). Research Triangle Park: NIEHS,1998.

29. Repacholi MH, Ahlbom A. *Link between electromagnetic fields and childhood cancer unresolved.*
Lancet 1999;354:1918–9. http://www.ncbi.nlm.nih.gov/pubmed/10622288

30. Repacholi MH, Greenebaum B*. Interaction of static and extremely low frequency electric andmagnetic fields with living systems: health effects and research needs*. *Bioelectromagnetics* 1999; **20:**
133–60. http://www.ncbi.nlm.nih.gov/pubmed/10194557

31. Saito T, Nitta H, Kubo O, Yamamoto S, Yamaguchi N, Akiba S, Honda Y, Hagihara J, Isaka K, Ojima T, Nakamura Y, Mizoue T, Ito S, Eboshida A, Yamazaki S, Sokejima S, Kurokawa Y, Kabuto M. *Power-frequency magnetic fields and childhood brain tumors: a case-control study in Japan*. J Epidemiol. 2010;20(1):54-61.
http://www.ncbi.nlm.nih.gov/pubmed/19915304;
https://www.jstage.jst.go.jp/article/jea/20/1/20_JE20081017/_

32. Savitz DA, Wachtel H, Barnes FA, John EM, Tvrdik JG. *Case–control study of childhood cancer and exposure to 60-Hz magnetic fields.* Am J Epidemiol 1988;128:21–38.
http://www.ncbi.nlm.nih.gov/pubmed/3164167

33. Schüz, J., Ahlbom, A., 2008. *Exposure to electromagnetic fields and the risk of childhood leukaemia:a review.* Radiat. Prot. Dosim. 132, 202e211.
http://www.ncbi.nlm.nih.gov/pubmed/18927133

34. Schüz J. ***Exposure to extremely low-frequency magnetic fields and the risk of childhood cancer: update of the epidemiological evidence.*** Prog Biophys Mol Biol. 2011 Dec;107(3):339-42. http://www.ncbi.nlm.nih.gov/pubmed/21946043.

35. Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR), ***Research Needs And Methodology To Address The Remaining Knowledge Gaps On The Potential Health Effects Of EMF***. European Commission 2009
http://ec.europa.eu/health/ph_risk/committees/04_scenihr/docs/scenihr_o_024.Pdf

36. Sohrabi MR, Tarjoman T, Abadi A, Yavari P. *Living near overhead high voltage transmission power lines as a risk factor for childhood acute lymphoblastic leukemia: a case-control study.* Asian Pac J Cancer Prev. 2010;11(2):423-7.
http://www.apocpcontrol.org/page/apjcp_issues_view.php?sid=Entrez:PubMed&id=pmid:20843128&key=2010.11.2.423.

37. Svendsen A-L, Weihkopf T, Kaatsch P, Schüz J. *Exposure to magnetic fields and survival after diagnosis of childhood leukemia: A German cohort study.* Cancer Epidemiology Biomarkers
Prevention 2007;16:1167-1171. http://www.ncbi.nlm.nih.gov/pubmed/20843128; http://www.apocpcontrol.org/page/apjcp_issues_view.php?sid=Entrez:PubMed&id=pmid:20843128&key=2010.11.2.423

38. Teepen JC, van Dijck JA. *Impact of high electromagnetic field levels on childhood leukemia incidence.* Int J Cancer. 2012 Aug 15;131(4):769-78. Review. http://www.ncbi.nlm.nih.gov/pubmed/22437882

39. Tomenius L. *50-Hz Electromagnetic environment and the incidence of childhood tumors in Stockholm County*. Bioelectromagnetics 1986;7:191–207. http://www.ncbi.nlm.nih.gov/pubmed/3741493

40. WHO IARC Working Group on the Evaluation of Carcinogenic Risks to Humans. ***Non-ionizing radiation, Part 1: static and extremely low-frequency (ELF) electric and magnetic fields.*** IARC Monographs Evaluation of Carcinogic Risks Humans. 2002;80:1- 95.

41. World Health Organization World Health Organization (WHO). Environmental Health Criteria 238: Extremely Low Frequency (ELF) Fields. WHO, Geneva, Switzerland, ISBN 978-92-4-157238-5, 2007b. http://www.who.int/peh-emf/publications/elf_ehc/en/.

42. World Health Organization (2007). *Research Agenda for Extremely Low Frequency Fields* Geneva, World Health Organization.www.who.int/emf.

43. Wünsch-Filho V, Pelissari DM, Barbieri FE, Sant'Anna L, de Oliveira CT, de Mata JF, Tone LG, Lee ML, de Andréa ML, Bruniera P, Epelman S, Filho VO, Kheifets L. *Exposure to magnetic fields and childhood acute lymphocytic leukemia in São Paulo, Brazil.* Cancer Epidemiol. 2011 Dec;35(6):534-9. http://www.ncbi.nlm.nih.gov/pubmed/21840286

44. Yang Y, Jin X, Yan C, Tian Y, Tang J, Shen X. *Case-only study of interactions between DNA repair genes (hMLH1, APEX1, MGMT, XRCC1 and XPD) and low-frequency electromagnetic fields in childhood acute leukemia.* Leuk Lymphoma. 2008 Dec;49(12):2344-50. http://www.ncbi.nlm.nih.gov/pubmed/19052983

45. Ziegelberger G, Dehos A, Grosche B, Hornhardt S, Jung T, Weiss W. *Childhood leukemia--risk factors and the need for an interdisciplinary research agenda.* Prog Biophys Mol Biol. 2011 Dec;107(3):312-4. **Source:** Federal Office for Radiation Protection (BfS), Department of Radiation Protection and Health, Oberschleissheim, Germany.
http://www.sciencedirect.com/science/article/pii/S007961071100109X

CC - Paulina

State of Maine
ONE HUNDRED AND TWENTY-SIXTH LEGISLATURE
COMMITTEE ON ENERGY, UTILITIES AND TECHNOLOGY

June 19, 2013

Thomas L. Welch, Chairman
Public Utilities Commission
18 State House Station
Augusta, ME 04333-0018

RE: LD 950, *An Act to Establish the Electromagnetic Field Safety Act*

Dear Chairman Welch:

LD 950, *An Act to Establish the Electromagnetic Field Safety Act,* raised concerns regarding the safety of electromagnetic fields associated with transmission lines. The Joint Standing Committee on Energy, Utilities and Technology voted to carry over the bill to the 2nd Regular Session of the 126th Legislature and to send a letter requesting that your agency provide the committee with information regarding the potential health impacts of electromagnetic fields associated with transmission lines and additional information regarding the mitigation techniques proposed in the bill.

Specifically, the committee would find the following information useful in its deliberations:

- Any information the Commission can provide regarding setback requirements for electric transmission lines in other states from residential homes, residential care facilities, hospitals, schools, licensed daycare facilities, playgrounds, youth centers, religious facilities and youth camps;

- A description of the implications of establishing a 300-foot setback requirement for these types of locations on the utilization of existing right of ways for transmission lines in this State; and

- A description of the current standards used by the commission when considering the health impacts of electromagnetic fields associated with transmission lines as well as specific references to support the use of those standards.

Please send this information to the committee by November 30, 2013.

Thank you for your attention to this important matter.

Sincerely,

John Cleveland
Senate Chair

Barry Hobbins
House Chair