Stein Cancer Research Idea: Promote the use of best practices to reduce childhood Leukemia from ELF EMF

Extremely low frequency(ELF) magnetic fields are Possibly Carcinogenic to Humans as declared by NIEHS (1998), IARC (2002), WHO (2007) based on epidemiology for childhood leukemia with home exposures and brain cancer and leukemia from occupational exposures. Wertheimer and Leeper in 1979 found consistent link between exposures of ~4μT increased risk of childhood leukemia; acute lymphoblastic leukemia. Foliart et al. 2006 found even lower exposures (1-2μT) significantly - 280% - decrease survival rate vs. children exposed to less than 1μT fields) for vulnerable children, such as those recovering from leukemia;

In January 2000, the State of California Department of Public Health completed and published a comprehensive study of children's exposures to electromagnetic fields (EMF) in California Schools (Zaffanella & Hooper, 2000). This study systematically selected 89 California public schools and the daycare centers associated with these schools and measured and surveyed EMF fields obtaining unbiased estimates of EMF levels for the entire population of California public schools.

The California EMF Program included the study of children's ELF EMF exposures in schools and also funded a study of ELF EMFs and miscarriage. Importantly the public school study found that ELF EMF (magnetic fields) exposures exceeded 2mG in approximately 6% of the State's classrooms (15,300 classrooms statewide). Strikingly, this study found that the most prevalent source of the ELF EMFs exceeding 2mG was generated from sources inside the school buildings themselves rather than from EMFs generated by outdoor Powerline sources. This study revealed that 70.5% (55,907 classrooms) had exposures above 0.5 mG caused by "net currents" due directly from electrical building wiring errors that are violations of the National Electrical Code© (NEC) and are low-cost to no cost to fix and mitigate.

The cost of reducing the Net Currents in California Public Schools is low cost, involving only MINIMAL hours of work for diagnostic testing of classrooms to find and trace the incorrectly wired net current pathways and electrician hours to correct the wiring errors found. Much of this work is today considered equivalent to regular school facility maintenance work because it addresses electrical code violations to fix possible fire and shock hazards. Measuring the ELF EMF levels and repairing and fixing all NET CURRENT nonconformities should absolutely be included as part of every school and every residential home's regular maintenance regime especially in homes where pregnant women and children reside since it has been found and documented by the CA Department of Public Health and since repairing these exposures is low to no cost and results in uncontroversial TWA ELF EMF reductions as well as reducing fire and shock hazards. After the measurement study was published in CA there has not been any follow up to the Department of Education's division to provide any facilities training on what ELF EMFs are, what low cost hand held measuring devices to use to measure the Districts classrooms, nor any training on how to repair the net current's found to be in 6% of the States Public schools. The study done in CA is likely to be representative of other States. Additionally, there have been published studies of residential buildings similarly finding that NET CURRENTS are major indoor building ELF EMF exposures and that they too can be fixed and easily repaired at no to low cost. One voluntary Sustainability Green Building Standard now in 13 US US States (the Collaborative for High Performance Schools CHPS) has included ELF EMF best practices that check for and correct NET CURRENTS . Checking ELF EMF exposure levels should be practiced in all school, residential and commercial building new construction and modernizations to fix found mis-wiring that creates NEC code violation NET CURRENTS. The State of California Department of Public Health produced in cooperation with Southern California Edison

(SCE) a 22 minute video entitled Fixing Electric Wiring in Schools Video (CDPH, 2000; Holt, 2015) http://www.ehib.org/emf/a_wiring_video.html and has been posted on YouTube by Mike Holt for EC&M magazine.
https://www.youtube.com/watch?v=W6SyJFPYM8c&index=6&list=PLRNS1x1jcKbGZ9uIVMBHmm7-Sh2kePbVg

This video was written and hosted by Karl Riley, author of the book "Tracing EMFs in Building Wiring and Grounding" (Riley, 1995); it provides key information on techniques to minimize exposures to net current magnetic fields found in new and remodeled schools for school facility engineers, inspectors, project managers, school architects, planners and school building advisory committees. The video shows step-by-step methods of measuring the fields and then how to find the faulty circuit and the wiring errors; "… to teach electricians how to fix these wiring errors"; It includes graphics animations from SCE's video department to show how the currents move in misconnected circuits.

CDPH CA School Measurements Summary

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EMF RF listed as possible carcinogen

- **May, 2011, the World Health Organization International Agency for Research on Cancer (WHO/IARC) classified radiofrequency electromagnetic fields (EMF RF) as possibly carcinogenic to humans (Group 2B), based on an increased risk for glioma, a malignant type of brain cancer.**

EMF ELF listed as possible carcinogen

- **2002 the WHO/IARC classified static and extremely low-frequency (ELF) electric and magnetic fields as possibly carcinogenic to humans (Group 2B), based on increased risk of childhood leukemia**

Studies of Exposures of ELF EMF and Leukemia

- **Wertheimer and Leeper in 1979 found consistent link between exposures of ~4μT increased risk of childhood leukemia; acute lymphoblastic leukemia**

- **Foliart et al. 2006 found even lower exposures (1-2μT) significantly - 280% - decrease survival rate vs. children exposed to less than 1μT fields) for vulnerable children, such as those recovering from leukemia;**

- **Lowenthal et al. 2007**

Lets look at CA K-12 Schools

Comprehensive School measurements

Funded by the California Department of Public Health

2000

ELECTRIC AND MAGNETIC FIELD EXPOSURE ASSESSMENT OF POWERLINE AND NON-POWERLINE SOURCES FOR CALIFORNIA PUBLIC SCHOOL ENVIRONMENTS

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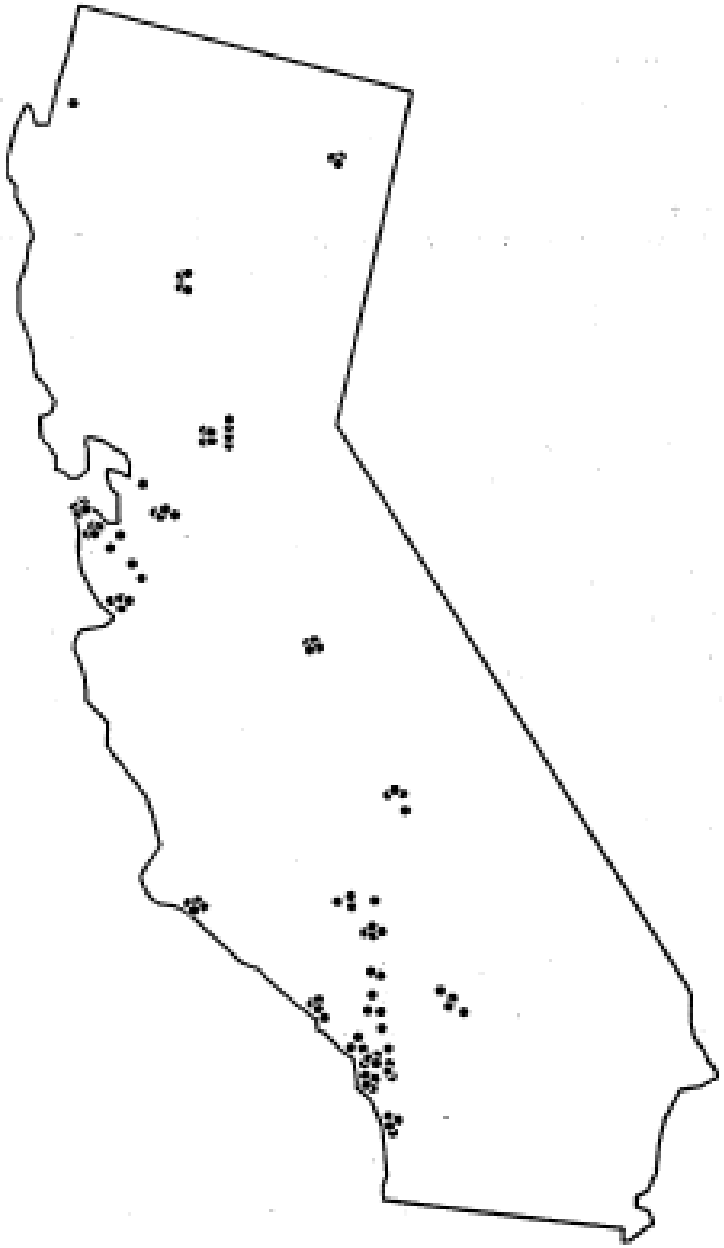

Figure 4-1. Diagram of the Participating Schools within the State of California

Table 8.36 Number of School Areas in Which Different Sources Cause a Field Greater than Given Value in more than 5% of the Area

Field Source	>1 mG	>2 mG	>5 mG	>10 mG
Net Current	110,000	62,000	15,000	4,600
Electrical Panel	29,000	13,200	5,000	1,500
Power Transformer	3,000	2,000	780	120
Office Equipment	26,000	15,000	2,900	200
Transmission Line	4,300	1,700	580	21
Distribution Line	13,500	4,600	840	0
Power Cable	4,200	1,800	250	120
Air Conditioners	2,300	900	0	0
Fluorescent Lights	14,200	1,000	0	0
Current in Water Main	370	130	16	0

Total school areas: 456,500

Table 8.39 Relative Impact of Different Magnetic Field Sources on Exposure

(Exposure above 0.5 mG, $mG \cdot area$)	All California Schools			
	All Areas		Classrooms	
Caused by all sources combined	172,350		79,329	
Due to net currents	110,488	64.1%	55,907	70.5%
Due to distribution lines	10,728	6.2%	6,183	7.8%
Due to electrical panels	10,394	6.0%	3,620	4.6%
Due to transmission lines	3,601	2.1%	2,825	3.6%
Due to office equipment	12,232	7.1%	2,584	3.3%
Due to fluorescent lights	3,719	2.2%	1,773	2.2%
Due to power cables	2,411	1.4%	1,377	1.7%
Due to power transformers	1,015	0.6%	850	1.1%
Due to air conditioners and heaters	901	0.5%	204	0.3%
Due to unknown sources	205	0.1%	172	0.2%
Due to other sources	7,797	4.5%	37	0.0%
Due to water main currents	218	0.1%	19	0.0%
		95.0%		95.2%

Table 8.2 Number of Classrooms with Magnetic Fields Exceeding Given Values

Average Field in the Classroom	Estimated Percentage	95% Confidence Interval	
		percentage	number of classrooms
> 0.5 mG	39.4 %	34.3% - 45.4%	92,000 - 122,000
> 1 mG	16.9 %	13.5% - 21.2%	36,000 - 57,000
> 1.5 mG	9.8 %	7.5% - 12.7%	20,000 - 34,000
> 2 mG	5.7 %	4.2% - 7.6%	11,300 - 20,000
> 3 mG	2.13 %	1.4% - 3.3%	3,700 - 8,700
> 5 mG	0.63 %	0.3% - 1.6%	700 - 4,200

Area Source		Field Reduction Technique	
Type	Description	Type	Description
3 and 12	Power Supply Cable	3.1	Install steel plates above the cables
	(3: to main panel)	3.2	Reroute the cable
	(12: between panels)	3.3	Net Current Control Transformer
		3.4	Dielectric Insert in water pipe entrance to school building
		3.5	Place cables in welded steel pipes
		3.6	Limitation of access to affected areas
4	Main Distribution Panel	4.1	Place shielding plates on walls (or floor) of adjacent rooms
		4.2	Limitation of access to affected areas
5	Net Current in Electrical Conduits	5.1	Locate and fix the wiring errors: inspect and measure currents at panels, identify circuits with net current, estimate type of wiring errors, locate and repair wiring errors, recheck field.
		5.2	Limitation of access to affected areas
6	Electrical Panel	6.1	Place a shielding plate on the wall in the back of the panel
		6.2	Shield the front of the panel
		6.3	Limitation of access to affected areas
7	Heater / Air Conditioner	7.1	Replace device with another with low EMF
	/ Air Filter Fan	7.2	Limit access to affected areas
8	Fluorescent Lights	8.1	Increase height of light above the floor (if affected area is in the same room)
		8.2	Lower height of light above the floor (if affected area is on the floor above)
		8.3	Replace with lights with electronic ballast
		8.4	Move kindergarten rooms to rooms that do not have fluorescent

10	Power	10.1	Move transformer to another location
	Transformer	10.2	Place steel plates on walls of adjacent rooms
		10.3	Limit access to affected areas
11	Office Equipment / Computer lab equipment / Appliances / Copy room equipment / Shop equipment	11.1	Change equipment layout
		11.2	Replace high field equipment (certain typewriters and monitors that have high fields)
		11.3	Rearrangement of appliances
		11.4	Reduce field exposure in copy room
		11.5	Reduce field from appliances in kitchen
13	Water Main	13.1	Insert dielectric union in water main and water lines
		13.2	Limitation of access to affected areas
14	Service Drop	14.1	Install Net Current Control Transformer
		14.2	Limitation of access to affected areas
15	Unknown	15.1	Engineering work to identify source. Assuming that the source is a net current, locate and fix wiring errors
		15.2	Limitation of access to affected areas
16	Field is low. No source identified.	16.1	No field reduction technique is applied
17	Other Source	17.1	Technique and related cost vary from source to source.
		17.2	Limitation of access to affected areas