by the existing 25 Gamesa 2 MW wind turbines located on lands leased from the Campo Kumeyaay Nation, and transmission / transformation infrastructure owned and operated by SDG&E and others, including numerous suspicious cancer cases; and

WHEREAS said DEIR has identified numerous unresolved AREAS OF CONTROVERSY and would allow for the Board of Supervisors to prepare a statement of overriding considerations *regardless of the number of significant effects on the environment, impacted residents*[12], *cultural, biological,* [13] *and visual resources*; and

WHEREAS the DEIR has identified 24 areas where the proposed project effects STILL REMAIN SIGNIFICANT AND UNAVOIDABLE *AFTER MITIGATION*; and

WHEREAS the Areas of Known Controversy include the following: Development of wind turbines and MET facilities that could affect scenic vistas, visual resources, agricultural lands, special status species , and wildland fires[14]; and

WHEREAS said DEIR proposes to both establish and arbitrarily allow a waiver of low frequency C-weighted sound limits *if that limit would adversely impact the economic feasibility of a wind turbine project objectives*--thereby placing corporate income over and above the disproportionate adverse socioeconomic impacts and the County's mandate to protect the health, safety, and welfare of impacted residents and resources; and

WHEREAS we are of the strong opinion that the proposed project represents additional significant and cumulative adverse impacts that were not properly identified, recognized, or analyzed in said DEIR, including air and ground borne Low Frequency Noise / Infrasound and vibrations[15], EMF, ELF, and /or Radio Frequency / Microwave radiation, produced by wind turbines and related infrastructure, some of which have been recorded up to 6.8 miles[16] from operating wind turbine facilities; and

WHEREAS new information AND science-based peer-reviewed is now readily available that links significant adverse health[17], [18] and safety impacts to humans[19], [20], wildlife[21], pets, and livestock that are

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[12] British Medical Journal: *BMJ* 2012;344:e1527: *Wind turbine noise seems to affect health adversely and an independent review of evidence is needed* : http://betterplan.squarespace.com/todays-special/2012/3/10/31012-british-medical-journal-wind-turbine-noise.html

[13] USWFS: Effects of noise on wildlife: www.**fws**.gov/windenergy/docs/**Noise**.pdf ; http://www.wind-watch.org/news/2012/04/01/federal-government-to-issue-take-permits-for-eagle-kills-by-wind-energy-companies/

[14] POD 1007: Page S1-4

[15] The Society for Wind Vigilance's report with 67 citations: Low Frequency Noise Infrasound and Wind Turbines: http://www.windvigilance.com/about-adverse-health-effects/low-frequency-noise-infrasound-and-wind-turbines

[16] Seismic Noise by Wind Farms: A case study from the Virgo Gravitational Wave Observatory, Italy: http://www.bssaonline.org/content/101/2/568

[17] Society for Wind Vigilance issues a Global Guideline for the Minimum Siting Distance of Industrial Wind Turbines: http://www.windvigilance.com/news

[18] Society for Wind Vigilance: Visual Health Effects and Wind turbines (with 27citations): http://www.windvigilance.com/about-adverse-health-effects/visual-health-effects-and-wind-turbines

exposed to the low frequency noise, vibrations, electrical and light pollution emissions generated by industrial wind turbines, with symptoms reported up to 10 km[22] (6.21 miles) ; and

WHEREAS industrial wind turbines and related infrastructure projects have been identified as significant and having unmitigable Class I effects related to FIRE & FUELS[23] and historic firestorms have proven devastating to both human and natural communities and habitats of San Diego County[24]; and

WHEREAS the San Diego Smart Energy 2020 Plan identifies more than sufficient distributed renewable energy capacity at or near the point of use without reducing critical protections for at-risk resources in order to facilitate and streamline industrial wind turbine projects, as proposed in said DEIR; and

WHEREAS the Independent Science Advisors Report on the Desert Renewable Energy Conservation Plan (for biological resources only) including San Diego County wind resource areas, contains the following quotes: "*We also strongly advocate using "no regrets" strategies in the near term*...the study area also includes non-desert mountain slopes and watersheds that support significantly different ecological communities , species, and processes than do the deserts...Our treatment of such areas in this report is unfortunately more cursory than that of the desert regions. *We therefore strongly recommend* that DRECP obtain additional scientific input concerning the non-desert portions of the planning area, including those associated with oak woodlands, grasslands, sage scrub, pinyon-juniper, and other vegetation communities found on mountain slopes."[25]

WHEREAS the Las Californias Bi-National Conservation Initiative (LCBI)[26] has already identified areas, including Eastern San Diego County, that will be impacted by the Proposed Project, as one of five globally significant biological hotspots of biodiversity, encompassing what conservationists refer to as "Mediterranean Mosaic" where weather and geography combine to create a dense intermingling of diverse habitats and over 400 at-risk and endangered species. Significant and rare Mediterranean Mosaic habitat, migration corridors / linkages[27], and critical wildlife species[28], that should be conserved and protected; and

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[19] Waubra Foundation: Explicit Cautionary Notice to those responsible for wind turbine siting decisions : http://media.crikey.com.au/wp-content/uploads/2011/07/caution.pdf
EPAW-NAPAW Health Warning to Governments: The wind turbine syndrome has become pandemic: http://www.epaw.org/media.php?lang=en&article=pr5;
Wind Turbines & Public Health (7:12 minute video): http://www.youtube.com/watch?v=lEh3sooKU8A&context=C4564e1fADvjVQa1PpcFNftrPRz6RWhumOwa3djFqMkr8CQDlKMAY=

[20] http://betterplan.squarespace.com/2012-wind-turbine-noise-health/

[21] Vulture v wind turbine video: http://www.youtube.com/watch?v=8NAAzBArYdw&feature=related

[23] Page ES 25: http://www.cpuc.ca.gov/environment/info/dudek/ECOSUB/Draft_EIR/00c-ExcutiveSummary.pdf

[24] CBI: The role of fire severity, distance from fire perimeter and vegetation on post-fire recovery of small-mammal communities in chaparral: http://www.consbio.org/products/publications/the-role-of-fire-severity-distance-from-fire-perimeter-and-vegetation-on-post-fire-recovery-of-small-mammal-communities-

[25] Page 3: http://static.consbio.org/media/reports/files/SA_Desert_Renewables.pdf

[26] http://consbio.org/products/projects/56 ; http://consbio.org/products/reports/26 ;

[27] http://www.scwildlands.org/projects/missinglinkages/linkagetour.aspx ;

WHEREAS "The biodiversity of Mediterranean-climate ecosystems is among the highest of any biome in the world...Considering the sensitivity of plant species to repeated burning and the global conservation significance of Mediterranean-climate ecosystems, conservation planning needs to consider the human influence on fire frequency"[29]

WHEREAS the Proposed Project area lies within the Pacific Flyway for avian migration[30]

WHEREAS industrial wind turbines have proven to be detrimental to avian and bat species through collisions with wind towers and blades with tip speeds close to 200 mph, project power lines, and substations; and

WHERAS starting in or around 2004, the Boulevard Planning Group has gone on record numerous times as opposing industrial scale wind turbine projects in or around the McCain Valley National Cooperative Land and Wildlife Management / Recreation Area and Airport Mesa/Table Mountain, Tecate Divide, and other wind resource areas, based on significant adverse impacts to public health and safety including increased risk of fire and impediment to fire fighting, property values, biological, cultural, recreational, visual, and other at-risk resources; and

WHEREAS we find that the proposed project is not in the best interest of San Diego County's human and natural communities and at-risk resources;

THEREFORE BE IT RESOLVED THAT the Boulevard Planning Group opposes the Proposed Project and reduced project alternatives and supports the No Project Alternative; and

IT IS FURTHER RESOLVED THAT in order to protect, defend, and /or to provide relieve for adversely impacted people, wildlife, pets, and livestock, that may be exposed to short and or long-term emissions and related suffering from the installation and operation of industrial wind turbine facilities and / or related infrastructure, the Boulevard Planning Group strongly urges the San Diego County Planning Commission and Board of Supervisors to:

1) Deny the Revised Wind Energy Ordinance & Plan Amendment DEIR
2) Deny any proposed resolutions in support of the Proposed Project, reduced project alternative
3) Deny any Statements of Overriding Considerations
4) Deny the proposed changes (AT PAGE 15) Amending Section 7359 FINDINGS REQUIRED FOR PARTICULAR USE PERMITS for Large Wind Turbines, removing protections for impacted communities, represents an unconscionable and unsupportable double standard for communities and resources that will located in newly designated Wind Resource Area located *and those that are not*

[28] East County MSCP biology: http://www.sdcounty.ca.gov/dplu/mscp/ec_biology.html ; EC MSCP List of species: http://www.sdcounty.ca.gov/dplu/mscp/ec_species.html
[29] http://static.consio.org/media/publications/files/conservationthreatsduetohuman.pdf
[30] Pacific Flyway Map: http://www.pacificflyway.gov/Documents/Pacific_map.pdf

5)Deny the allowance of any noise requirement waivers, such as the newly proposed c-weighting requirement to address potentially harmful and debilitating impacts from low-frequency noise / vibrations.

6)Introduce a moratorium on wind turbine projects

7)Initiate independent comprehensive peer-reviewed science based, multi-disciplinary full spectrum health and field studies on large scale industrial wind turbine generated noise, vibrations, electrical, and light pollution emissions--*without influence or funding from the wind industry or their representatives/ vested interests*--in order to determine and establish what, if any, dose-response related setbacks are truly protective of public health, safety, and welfare.

###

Robert &. Kathryn Mc Callister
3032 McCain Valley Road
Boulevard, CA 91905

San Diego County Planning Commission
Overland Avenue
San Diego, CA 92123
via: Cheryl.Jones@sdcounty.ca.gov

October 1, 2012 5510

RE: Oct 5 hearing: Wind Energy Zoning Ordinance Amendments – Review of Board of Supervisors Amendments POD-1007; Opposition to industrial wind turbines allowed on private land too close to our home and others.

Dear Chairman Pallenger and Commissioners Day, Becks, Brooks, Norby, Reiss and Woods,

Please reject the changes approved by the Board of Supervisors on August 8th, allowing the installation and operation of industrial wind turbines on private Rough Acres Ranch land located on McCain Valley Road, less than 1 mile from our home of over 40 years, and changing the underground transmission line to an overhead transmission line in our fire-prone neighborhood. These projects represent increased risk of catastrophic wildfires and threats to public health and safety for residents and visitors to the McCain Valley Recreation Area.

We are both in our 80's and want to register our major concerns and strong objections to the location of any industrial wind turbines so close to our home on McCain Valley Road and others located on Ribbonwood Road to the west of us. We have enough trouble staying healthy without dealing with the adverse turbine generated noise and shadow flicker impacts and electrical pollution that has made other homeowners ill and driven some to abandon their properties.

McCain Valley Road is our only way into and out of our property and home. We now have the Sunrise Powerlink located here with the Tule Wind project and numerous other wind, solar, and related transmission projects planned here. For the record, we have attached our more in-depth Tule Wind opposition letter dated, February 12, 2011.

We also want to inform you that we believe we were mislead by Mr. John Gibson of Hamann Companies and Rough Acres Ranch regarding the need for a utility easement through our private property to their parcels to the north of us, under the pretense that the easement was needed to provide electricity for several new homes they planned to build there, adjacent to McCain Valley Road and Lark Canyon OHV Park

Later, we learned that instead of the private homes, the Tule Wind substation was proposed for the parcel abutting our land on the north, and wind turbines were planned on their other parcels.

Please help us live our remaining years in our own home without these unnecessary intrusions.

Sincerely,

Robert and Kathryn McCallister Robert + Kathryn Mc Callister

cc: Supervisor Dianne Jacob, Donna Tisdale

Robert & Kathryn Mc Callister
3032 McCain Valley Road
Boulevard, CA 91905

February 12, 2011

Mr. Iain Fisher, CPUC
Mr. Greg Thomsen, BLM,
c/o Dudek
605 Third Street,
Encinitas, CA 92024

Draft EIR-EIS : Tule Wind, ECO Substation, Energia Sierra Juarez

Dear Mr. Fisher and Mr. Thomsen,

This letter is being provided to ensure that our concerns and strong opposition are documented in the record for these large wind turbine, substation, and power line projects that your agencies are reviewing. We may need to join in filing a future lawsuit for damages related to loss of property value, quality of life, the use and enjoyment of our property, and other potential adverse effects.

We are both in our 80's, are in good health, and live full time on the 80 acres we own located at 3032 McCain Valley Road, in Boulevard. Until recently, this was a beautiful and quiet place to live and to invite family and friends join us. All that has changed and we are now very concerned for our own future and that of our neighbors, pets, livestock and the local wildlife.

A moratorium on industrial wind turbine projects should be initiated by local state, and federal agencies, unless and until science-based peer reviewed health and safety tests are conducted to determine a safe setback distance.
To date, those studies have not been done and industrial wind energy supporters cannot claim otherwise.

You are now reviewing three energy projects, along with the additional proposed wind turbine projects on the Manzanita and Campo Reservations and Greg Lansing's ranch lands on Ribbonwood Road and Jewel Valley Road.
San Diego Gas & Electric's large 500 kV Sunrise Powerlink towers and lines will also be installed all along the eastern edge of McCain Valley Road and our eastern property boundary about 1,000 feet or so from our home.

The Tule Wind turbines, that will stand almost 500 feet tall, are planned to be installed approximately 2,200 feet or some from our home along the top of the ridge just west of our property.

The new Tule Wind 138 kV transmission line is also planned to run right next to the Sunrise Powerlink lines along McCain Valley Road, our only access road. More Tule Wind turbines are also planned for private land on the ridgeline to the north east of our home. A new 5 acre substation and 5 acre operation and maintenance building,

for the Tule Wind project, are also planned for the open pasture on private property just to the north of us, or for the Rough Acres Ranch property just to the southwest of us.

There are several main concerns that we want your agencies to address and respond to:

1) Increased risk of fire; increased fire insurance rates or total loss of coverage due to new high risk development near our home; reduced fire fighting access due to increased potential for electrocution to fire fighters.
Power lines, turbines, substation transformers can all start fires. This can translate into a life or death situation for us, with only one access road and limited local fire fighting staff availability, equipment, and funding.

2) Noise and low frequency pollution from industrial wind turbines, some below the level of human hearing, can and does make people and animals ill when turbines are placed too close to homes, livestock, and sensitive wildlife areas. It has been reported that families have even abandoned their homes to escape the unbearable living conditions that are inflicted by these power generating turbine. Increased medical expenses and long-distance round trips for medical attention can really add up. Impacts to pets and livestock can also be severe and expensive.

3) 2,200 feet is way too close for turbines. We don't want them anywhere near our home or the homes of other families. They should be placed several miles away from any occupied buildings, livestock, public recreation areas, campgrounds, and protected wildlife areas.

4) Electrical pollution, stray voltage, has been documented in and around other wind turbine and substation projects and homes within 1,800 feet and much more. There are indications that wind turbines and the substations that serve them are more prone to generate electrical pollution due to the intermittent nature of the energy they produce.

4) Shadow flicker from turbines can extend several thousand feet during certain times of day and can create a harmful pulsing light effect that can result in vertigo, seizures, or other adverse effects. That strobe effect also has adverse effects on pets, livestock and wildlife. Our home and property will likely be impacted during the late afternoon and evening hours.

5) Property value losses are being recorded at other wind turbine projects. We join others in requesting that Tule Wind be required to enter into binding Property Value Protection Agreements to ensure that we do not suffer lost value or the inability to sell our property, if rendered necessary, due to the adverse impacts generated by the proximity of their massive wind turbines, power lines, and substations that will surround us.

6) We are requesting that any project approvals include binding contractual agreements for adequate and ongoing funding for third party unbiased pre-construction testing for ambient noise, low frequencies and infrasound, and dirty electricity levels to be taken both inside and outside our home and at all our property lines. We are also requesting ongoing monitoring and enforceable

compliance guarantees that include shutdown of non-compliant turbines--in the event these projects are approved over our objections.

7) The County noise ordinance and turbine setbacks are currently inadequate to protect public health and safety and cannot be relied upon for these projects. Compliance with those standards, as stated in the Draft EIR/EIS will NOT insure against the generation of a nuisance. Your agencies must address this issue. Our rural ambient noise levels are much lower than stated in the Draft EIR/EIS. Complaints have been generated at other wind energy projects with only minimal increases in noise levels. All ranges of noise levels, audible and inaudible need to be documented at pre-construction levels--and protected.

8) We also have concerns over adverse impacts to both the quality and quantity of our well water. Tule Wind will be clearing, grading, and blasting for turbine footings and new access roads. They will also be drawing large amounts of well water from several wells on Rough Acres Ranch for cement batch plants and other operational uses. Their turbines, substation, transformers, and maintenance buildings will contain hazardous fluids that can spill or leak into the water table. Our water levels should be documented by a licensed unbiased third party prior to commercial uses at nearby wells. We have no economically viable alternative source of water available to replace what we currently have.

9) Day time strobe lights and red blinking night lighting on the turbines and some of the transmission towers will create another nuisance both day and night ,and take away from our beautiful dark night sky, one of the few left in Southern California.

In short, we strongly object to and oppose the introduction of any commercial industrial scale wind turbines , the related infrastructure, and all the adverse impacts that go with them, into our quiet rural neighborhood.

Any approvals of such would constitute a nuisance based on bulk and scale, blinking lights, noise levels (including low frequency and infrasonic), disruption to the peaceful use and enjoyment of our home and property and the very real potential for adverse health effects. While ignored, denied, and dismissed by the wind energy industry, growing evidence documents that some home owners have been bought out by wind energy companies due to undeniable adverse effects. The problems are real and must be addressed by your agencies prior to any project decisions.

Sincerely,

Robert and Kathryn Mc Callister

cc: Donna Tisdale

BACKCOUNTRY AGAINST DUMPS
PO BOX 1275, BOULEVARD, CA 91905

THE PROTECT OUR COMMUNITIES FOUNDATION
PO BOX 305, SANTA YSABEL, CA 92070

DATE: 10-3-12

TO: San Diego County Planning Commission

FROM: Donna Tisdale, as an individual, as BAD President & POC Secretary; 619-766-4170; tisdale.donna@gmail.com

RE: OCT 5TH PLANNING COMMISSION HEARING: WIND ENERGY ZONING ORDINANCE AMENDMENT – REVIEW OF BOARD OF SUPERVISORS AMENDMENTS; POD 10-007

Dear Chairman Pallenger and Commissioners,

The Board of Supervisors' Tule Wind amendments, allowing massive towering electricity generating turbines within 131% of turbine height (now averaging 400-500 feet tall) from non-participating property lines; 131% of turbine height from public road right of ways; and 101% of turbine height from the edge of transmission line easements[1], are unnecessary, unconscionable, and seriously negligent.

We are requesting the following actions:

1. ***Please reconfirm your previous justified and well reasoned vote*** *to deny the 5 Tule Wind turbines proposed for Rough Acres Ranch, and to require that the gen-tie line be placed underground instead of overhead.*
2. ***Please reject the Board's Tule Wind amendments*** for dangerously reduced setbacks that were based in part on an alarming lack of valid information, overall, and on significant misrepresentations made by Iberdrola's Harley McDonald and others, regarding the proximity of homes (and campgrounds that are within 1 mile); their ability to prevent turbine fires and to keep them from spreading into catastrophic wildfires (despite at 2 Iberdrola turbine fires since May[2], including lightning strike fires); the extent of cumulatively significant adverse impacts to public health and safety, viewsheds[3] and other resources; and reliance on the irresponsible and misleading HHS Public Health Position Statement, Human Health Effects of Wind Turbines (7-10-12), that ignores valid peer-reviewed documentation and inexplicably fails to address the very real and damaging *indirect effects* of turbines and related infrastructure, such as noise, low frequency noise, vibrations, and electrical pollution.

[1] Staff Report: Page 15 of Attachment B pdf: Resolution Approving POD 10-007: Strikeout /Underline
[2] May 22, 2012 Iberdrola's Barton Wind turbine fire: http://nawindpower.com/e107_plugins/content/content.php?content.9883
August 6, 2012: Iberdrola's Buffalo Ridge Wind turbine fire: http://www.brookingsregister.com/v2_news_articles.php?heading=0&story_id=15161&page=76
May 14, 2009: Iberdrola's Locust Ridge turbine fire: http://www.windaction.org/news/21321
[3] Tule Wind Visual Impact Map Figure 2 at page 19: http://www.dudek.com/ECOSUB/TuleAED/Appx_F_VisResources.pdf

3. ***Request the Board to reconsider their Tule Wind amendments and address the new Tule Wind Notice of Availability[4] for an additional 20 turbines on Ewiiaapaayp tribal lands and 7 on State Lands Commission Lands*** released by the Bureau of Indian Affairs on September 19th. The 62 turbines approved on BLM land plus the 27 additional turbines will equal 201 MW of capacity using 1.5 MW turbines. *Therefore, the 5 turbines proposed for Rough Acres Ranch land are not needed and would exceed Iberdrola's existing 201 MW CALISO grid connection agreement.*
4. ***Request the Board to reconsider the Manzanita Tribal Chairman's request to*** delay any Tule Wind MUP decisions until after the completion of the formal Health Impact Assessment being conducted now for the Manzanita tribal members[5], who are being adversely impacted by the existing 25 Kumeyaay Wind turbines and will be exposed to cumulative impacts from the Tule Wind turbines. ***Recommend a not-to-exceed turbine height limit*** and larger setbacks for all large-scale turbines and especially for turbines 3 MW and larger that can generate more energy along with more noise and electrical emissions / pollution.
5. ***Ask County Counsel to answer this question: "Does the County have jurisdiction / enforcement authority over private in holdings surrounded by and accessed solely through federal land?*** The Rough Acres Ranch turbines are proposed for private in holdings. Previously, the County had stated they could not enforce groundwater regulations on private in holdings located within the Campo Reservation. Does the same apply in this case? If so, the County should not be approving project components that they have no enforcement authority over.

Contrary to Iberdrola's false claims, an octogenarian couple lives within 1 mile of Tule Wind Rough Acres Ranch turbines, and additional private in holdings, with dwellings, are also located on McCain Valley Road north of Lark Canyon OHV Park and campground:

- *Contrary to the misrepresentations made to the Supervisors, the long-term home of octogenarians, Robert and Kathryn McCallister, is located less than one mile from the turbines authorized by the Supervisors.*
- Their home, at 3032 McCain Valley Road, sits between two private parcels included in the Tule Wind project under the Rough Acres Ranch name, adjacent to turbines identified as R-11 and R-12 in Figure 2 in the [6]BLM's Record of Decision.
- The McCallister's comment letter, dated October 1, 2012, is incorporated by reference along with their previous comments and those submitted by myself, the Boulevard Planning Group, BAD, POC and Volker Law Offices.
- Another octogenarian couple, Joe and Iris Mauris, lives to the west of the Tule Wind turbines, again within less than one mile.
- These retired senior couples are already dealing with limited income and significant health issues and have expressed their opposition to Tule Wind and other proposed projects and the increased levels of stress, nuisance, and hardship that these projects represent.

Recent Boulevard wildfires and firefighter concerns with adding additional fire ignition sources:

[4] http://www.biawind.com/wp-content/uploads/2012/09/NOA.pdf
[5] Manzanita Tribal Chairman's letter to Planning 'Commissioners', dated June 6, 2012
[6] Tule Wind BLM ROD Figure 2: http://www.blm.gov/pgdata/etc/medialib/blm/ca/pdf/elcentro/nepa/tule.Par.91417.File.dat/Tule_Wind_ROD_Final_121911.pdf

- The September 23rd 2,555 acre Shockey Fire[7] and June 17th 995 acre Old Fire[8], both in the Boulevard Planning Area, were incredibly fast moving fires that raced through our dry chaparral –showing little mercy to man or nature.
- One life and 11 homes were lost along with many other structures, centuries old oak trees, chamise-red shank chaparral, and wildlife.
- Veteran fire fighters and local law enforcement officers expressed surprise at the speed of both of these recent fires—without the presence Santa Ana winds.
- Coverage from Channel 10 News includes several clips of my personal home video taken as the Shockey Fire consumed about 250 acres of my own family's 310 acres[9]. In a matter of minutes, about 30 acres of old growth chaparral was incinerated in a horrific display.
- Later, when I personally spoke to a wide variety of senior fire fighters defending the Tierra Del Sol neighborhood (during the Shockey Fire) about the planned location of hundreds of additional turbines, large-scale solar projects, and related electrical infrastructure, in the Tierra Del Sol, Boulevard, and Jacumba area, they all expressed serious concerns with installing *any* additional high profile and dense fire ignition sources that will increase fire risk and impede fire fighting abilities.
- ***Not one fire fighter expressed support for these types of industrial wind, solar, transmission projects being located in our fire-prone rural area,*** some had actually responded to turbine fires elsewhere and had nothing good to say about them.

Visual impacts misrepresented to Board by Iberdrola:

- *Iberdrola's Harley McDonald made false statements during the August 8th Board hearing claiming that they had a hard time finding anywhere in Boulevard where their Tule Wind turbines would be visible*!
- However, Iberdrola's own Tule Wind Visual Impact Map (HDR 2010)[10] shows the high degree of Tule Wind turbine visibility throughout the Boulevard Planning Area, and from Carrizo Gorge Wilderness Area, Sawtooth Mountain Wilderness Area, Sombrero Peak Wilderness Area, and In-Ko-Pah Mountain Area of Critical Environmental Concern.
- And that map does not even include other elevated Boulevard residential areas, south of I-8, that will also be visually impacted by the presence of Tule Wind turbines, such as Tierra Del Sol Road, Jewel Valley Court, Shasta Way,

Turbines and cumulative impact projects located too close to homes, public recreation areas, sole access public roads, sensitive resources, and In-Ko-Pah Mtn ACEC:

- *Once again, we are raising alarms and strong objections to the County's double standards for industrial wind turbine projects, changed Findings for turbines*, and the authorization of large wind turbines and related infrastructure projects within our scenic and vastly underserved High and Very High Fire Severity Zones less than one mile from occupied homes, public recreation

[7] Shockey Fire incident report: http://cdfdata.fire.ca.gov/incidents/incidents_details_info?incident_id=754
[8] Old Fire incident report: http://cdfdata.fire.ca.gov/incidents/incidents_details_info?incident_id=640
[9] http://www.10news.com/news/some-residents-stay-put-despite-orders-to-evacuate-due-to-shockey-fire
[10] Tule Wind Visual Impact Map Figure 2 at page 19:
http://www.dudek.com/ECOSUB/TuleAED/Appx_F_VisResources.pdf

areas, campgrounds and roads, sensitive cultural, biological, and other resources on private Rough Acres Ranch land abutting the In-ko-Pah Mountains Area of Critical Environmental Concern and occupied Bighorn Sheep and Golden Eagle habitat.

- *There is only one public road in and out of the McCain Valley Conservation and Recreation area* that will now be lined by the Sunrise Powerlink, Tule Wind turbines on both sides of the road, and the Tule Wind over head gen-tie line and 3,588 tracking Soitec Solar modules and additional gen-tie line for the proposed 80 MW Rugged Solar LLC project on Rough Acres Ranch land—also located on both sides of McCain Valley Road.

Conclusion:

Please help us convince the Board to reconsider their Tule Wind amendments, reject their changes, and help direct the County to find better, less destructive, point-of-use alternatives that also reduce unnecessary liabilities for the County.

Thank you...

Jack White
Campo Lake Morena Planning Group
29445 Yaweh Lane
Campo, Ca 91906

Matthew Schneider
Department of Planning and Land Use
County of San Diego
5201 Ruffin Road, Suite B
San Diego, CA 92123
matthew.schneider@sdcounty.ca.gov

May 10, 2012

Comments on Wind Energy Zoning Amendment and General Plan Amendment to the Mountain Empire Subregional Plan (Boulevard) POD 10-007

Mr. Schneider,

The Campo Lake Morena Planning Group would like to address the new Wind Energy Zoning Amendment and General Plan Amendment to the Mountain Empire Subregional Plan.

Small Wind Turbine:

1. **Setback**-Setback from homes should be at least that of the buffer for golden eagles, especially when considering neighboring properties.
3. **Golden Eagle Nest Buffer**-Wind turbines should not be allowed near eagle nests. Even if the functioning wind turbine does not impact Golden Eagle nests, the construction of said wind turbines could greatly impact these nest. If nothing else, construction should be limited to seasons when the Eagles are not nesting.
4. **Area of Disturbance**-The area of disturbance after construction is addressed. However, the area of disturbance during construction was not addressed.
5. **Barriers**-In our rural community with the unique issues involved with trespassing and international travelers, it was unclear how the county plans to keep people away from these turbines.
6. **Noise**-We believe the same c-weighted sound requirements used for large turbines should also be used for small turbines, especially with the ability to place 3 or more turbines on an individuals property. This can negatively impact neighboring homes.
7. **Height**-The height of small turbines should be limited not by the power generated, but by the visual impact to neighboring homes. The height should be closer to the height of trees and homes in the area. This would be closer to 35 feet for an individual wind turbine.
8. **Lighting**-Small individual wind turbines should not be lit. We understand due to air traffic it is sometimes necessary to light taller turbines. However, small turbines should not be tall enough to impact air traffic. Our back country is reliant on our night skies and

a lit wind turbine does not match our community character.
9. Historic Resources-The historic resources section is sound. Please take into consideration the historic significance of our back country communities and the importance of our scenic vistas along our historic routes of Highway 94 and Highway 80.
14. Military Operating Area-Our backcountry community is located next to the Mexican Border. Due to this, there is a large presence of border patrol in our backcountry community. These agents rely on not only radio communication between land vehicles, but also among air traffic. Please take into consideration not only the impacts on military, but also the impacts on our border protection in the placement of wind towers. El Paso Texas has put a stop to wind turbine construction due to the interference with emergency radio communications.
In addition, our rural communities rely on emergency radio communication during emergency situations (ie. Wildfires) in which we lose power. Please take into consideration the impacts on radio communications during emergency situations for our emergency workers, but also the community and its volunteers.
Also, due to the distance from hospitals it is often necessary to transport individuals through life flight helicopters. We need to ensure wind turbines will not impact these radio communications.
17. Additional Turbines-Until heath studies have been done, the amounts of turbines on a property should be limited to no more than three 40 foot small wind turbines.

Large Wind Turbine
1. Lot Size-On a minimum 5 acres parcel is there a limited number of towers?
2. Location-Alternative locations should be investigated. Our rural community relies on its scenic vistas, night skies, quiet, and rural character, all of which are impacted by the placement of large wind turbines. In addition, in our rocky mountainous back country communities wind tower noise has been proven to travel further than in other areas.
3. Setbacks-Recent studies have shown set back should be at least 2 miles from homes due to health impacts on people. Until it is scientifically proven otherwise, this should be a serious consideration in protecting the residents in the back country.
4. Setback reductions-These should not be allowed.
5. Barriers-As stated in regards to the small turbines: In our rural community with the unique issues involved with trespassing and international travelers, it was unclear how the county plans to keep people away from these turbines.
7. Noise-Please refer to studies done by Professor Henrik Moller a world-leading specialist in low-frequency sound, Dr. Sarah Laurie of the Waubra Foundation, or epidemiologist Dr. Samuel Milham's study of our own back country. These are three different studies regarding noise produced by wind turbines and their impact on people and wildlife. In addition, sound readings should be done inside homes, where people notice the most impacts. Also, what is the process after wind turbines have been built and the sound is above the regulated amount? How are studies done before the building of wind turbines and their possible impacts on the neighboring home owners?
8. Post-construction sound monitoring-Sound monitoring should be done sooner than one year. It should be done within 3 months and every three months within the first year. This is especially important with the concerns over negative health impacts on residents. This will also get readings at different times of year when the sound can be different.

After the initial reading, monitoring should be done annually and when new health concerns or complaints have been filed. These monitors should also be done during different times of year.

Noise

Sound studies should be done inside neighboring houses in additional to property lines. It is stated that greater than 20 dB can create a disturbance. We believe the county should be conservative and make the variance 10 dB. This allows for error and helps to protect community residents.

General Plan Amendment

1. The communities of Boulevard and Borrego Springs took time and energy creating community plans which fit their community vision and character. In these plans they both specifically mentioned wind turbines and their wishes as people living in these communities. Please listen to their wishes as they are the ones who live there. Do not change community plans if the communities did not ask to have them revisited.

Small Turbines

Restricting towers to previously developed land is an important requirement. The possible height of small wind turbines is too high. Small wind turbines should be consistent with current construction in the community so they match the current community character which is so important in our rural communities.

Public Input

1. **Biology**-A biological study needs to be required. The backcountry has numerous endangered species and is an international wildlife corridor. Small turbines under 30 feet should not need a biological study. However, larger turbines which can seriously impact the wildlife migration patterns and habitats needs to be studied.
2. **Noise**-A setback reduction should not be allowed through obtaining permission from neighbors. This can impact the neighbor's neighbors who did not have a say in the setback reduction but which may have otherwise not been impacted.
3. **Health**-It is stated there is not any published scientific evidence to conclude wind turbine noise could result in health impacts. If this is true, then before any decisions are made which may impact people's lives, the county should either wait for a scientific study or conduct one themselves. To ignore the complaints and concerns which have originated all over the world would be gross negligence on the part of the County of San Diego. We have come across a plethora of documents regarding studies and adverse health affects. Among the professional who have published letters, books, and other documents are world renounced and respected epidemiologists, physicians, professors and other health care professionals. The list includes, but is not limited to, Dr. Nina Pierpont, Dr. Amanda Harry, Dr. David Iser, Dr. Christopher Hanning, Dr. Michael Nissenbaum, Professor Henrik Moller, Professor Mariana Alves, and Professor Robert McMurtry. These professionals have published concerns in England, Denmark, Portugal, Australia, Canada and the United States to name a few. There are too many repeated universal complaints to believe there are not health concerns in regards to large wind turbines.

4. Safety-Large wind turbines are a major safety concern in our back country. According to authorities in El Paso, Texas, they cause interference with emergency systems. This would seriously impact our back country communities which rely on emergency communications during emergency situations. In addition, we have regular flights by military, border patrol, and life flight helicopter services. Any concerns over interference with these flights should be addressed.
There is also no way to make it fire safe without clearing a large area around the wind turbines. However, this would seriously destroy our sensitive habitat. Also, when fighting a burning wind turbine, engines will be unable to fight from the ground. This would require air support and facilities to fill the air support needed. Additional water towers should be required at wind turbine locations.

In conclusion, our small rural communities rely on our community character to bring tourism to our communities. Introducing large wind turbines destroys this community character. Please review not only the impacts of wind turbines on our community character, but also the possible health impacts. If an accepted scientific study has not been done, then one needs to be done before any additional wind turbines are built which may negatively impact people's lives.

Sincerely,

Jack White
Campo Lake Morena Planning Group Chair

c.c. Planning Commissioners

Michael Beck (representing District 2, Supv. Dianne Jacob)

Leon Brooks (representing District 4, Supv. Ron Roberts)

Adam Day (Vice-Chairman, representing District 5, Supv. Bill Horn)

Peder Norby (representing District 3, Supv. Pam Slater-Price)

David Pallinger (Chairman, representing District 5, Supv. Bill Horn)

John Riess (representing District 1, Supv. Greg Cox)

Bryan Woods (representing District 2, Supv. Dianne Jacob)

Correspondence Attn: Cheryl Jones County of San Diego

Lael Montgomery
13678 McNally Road
Valley Center, CA 92082
760-751-0300 ~ laelmontgomery@aol.com

April 10, 2012

TO: San Diego County Planning Commissioners
Michael Beck, Leon Brooks, Adam Day, Peder Norby, David Pallinger, John Reiss, and Brian Woods

RE: Design Guidelines for Residential Projects

These Design Guidelines were intended to implement the Conservation Subdivision Program by illustrating the approaches to site design and project planning that characterize and distinguish this new entity. Even though I think DPLU staffers have done an excellent job presenting the array of site design and planning approaches which in aggregate produce the "conservation subdivision", I have serious concerns about the way these design guidelines are now positioned in the overall implementation scheme.

The idea behind creating **Design Guidelines for Conservation Subdivisions** was to provide a common understanding about the design approaches that characterize a conservation subdivision for applicants, consultants, County planners, community advisory groups, Planning Commissioners and Supervisors. Clarity early in the process about the design of this new entity would produce better projects and quicken processing. As we all know, the use regulations that govern development in the County are not form-based and are inadequate to produce the particular mix of design approaches that constitute a "conservation subdivision. Use regulations do not address overall form or how to create it.

It is a mistake to position guidelines that are required to define a conservation subdivision as voluntary design guidelines for all residential subdivisions. I understand the political mood right now is to eliminate regulation and that positioning these guidelines as "voluntary" for all residential subdivisions fits into this mood. <u>But this murky posture undermines both the original goal AND adds another layer of "suggestion" that will, if anything, delay conventional subdivision processing.</u>

<u>Worse, to position as voluntary the very design approaches that constitute a Conservation Subdivision defeats the Conservation Subdivision program before it starts.</u> The failure to make clear that these are the design approaches that create a Conservation Subdivision confuses rather than clarifies and will result in approvals for any site design that can be justified by the use regulations.

My suggestions are:

1. The title should be **"Design Guidelines for Conservation Subdivisions."**
2. The introduction should state clearly that these design approaches are required in order for a subdivision to be considered a "conservation subdivision".
3. The introduction should also state that many of the design treatments are also appropriate and desirable for conventional subdivisions.
   The manual should also explain the concept of "context sensitive" design. It would be very helpful to remind readers that the General Plan is organized by Village, Semi-Rural and Rural contexts, and that these areas should be designed differently. A "good design" for one context will likely be a poor design for another.

   The premise of context sensitivity is that site design, lot design, street design and myriad details should vary according by context. The manual should point out elements of the whole design that create character and make the significant difference: road design, lot sizes and shape, setbacks, landscape forms and so forth.

4. **Graphics.**
The document needs more graphics that show what we are trying to get. More streets should be curvy, not straight lines. (Linear streets produce linear lots. Curvy streets enable less geometry.) More lots should be varied in shape and size. More streets should be single-loaded revealing peaks through the line of houses of the country-scape. More examples of the diversity we are aiming for.

5. **Citations**
It would help to include citations to works that focus particularly on the design of Conservation Subdivisions.

Thank you for the opportunity to contribute.

Sincerely,

Lael Montgomery

Lael Montgomery
Chair, Valley Center Design Review Board

Valley Center Design Review Board

December 11, 2012

San Diego County Board of Supervisors
1600 Pacific Highway
San Diego, CA 92010

RE: WIND ENERGY ORDINANCE AND PLAN AMENDMENT POD10-007

Dear Chairman Roberts and Members of the Board,

At our regular meeting held on December 13, 2012, our board voted to submit these formal comments for inclusion in the record for the pending Board Hearing now expected to be held in January.

The Valley Center Design Review Board supports development that respects the County General Plan and Community Plans, which were approved barely more than a year ago. These "constitutions of land use" have been created through a lengthy and thorough public process to accommodate growth and change while at the same time protecting the character and essence of back country towns and honoring the rural qualities that residents so cherish.

While our board members support the endeavor to bring renewable energy generation to our area, we encourage our political leaders to seek proposals that achieve this objective without scattering industrial installations across the backcountry, many miles from where this energy is actually used.

We concur with and support the Boulevard Planning Group's well researched concerns, observations, and objections regarding problems generated by industrial wind turbines and the significant damaging changes proposed in the Wind Energy Ordnance & Plan Amendment, including the following:

- The industrialization of rural San Diego County is unnecessary for renewable energy generation that can be done at, or close to, the point of use which also helps reduce the need for additional expensive new high-voltage power infrastructure and corridors.
- Precedent setting and harmful amendments to the Boulevard Community Plan, approved in late 2011, represent an unequal standard for industrial scale energy projects and communities.
- Changes to the Major Use Permit Findings represent additional unequal standards for industrial scale wind and solar projects related to compatibility with surrounding uses, bulk, scale, density and intensity of use, harmony with community character. These drastic and harmful changes would never be allowed in La Jolla or Rancho Santa Fe.

- Increased risk of catastrophic wildfires in underserved low-income fire-prone rural areas, designated as High and Very High Fire Severity Zones, through malfunctioning wind turbines, transformers, substations, utility lines, and lightning strikes that ignite highly flammable composite blades.
- Direct, indirect and cumulative adverse impacts to public health and safety ,quality of life related to turbine generated noise, audible and inaudible low-frequency noise, vibrations, and electrical pollution in the form of stray current / dirty power and increased ground currents that can migrate off-site and into homes and other occupied structures.
- Allowing for a Noise Waiver Area for low-frequency noise restrictions, regardless of conditions, represents yet another unconscionable double standard favoring for-profit wind turbine projects *over the County's mandate to protect public health and safety.*
- Loss of scenic integrity, tourism, and property values as documented by non-industry biased appraisers, with homes in some communities completely abandoned due to invisible pollution.

Therefore, we call on the Board to reject the flawed Wind Energy Ordinance, Plan Amendment, and reduced community protections and to focus instead on a county-wide plan for distributed point of use energy generation, energy efficiency and conservation, and micro grids like the one at UCSD that helped power San Diego during several major power outages.

Sincerely,

Lael Montgomery

Lael Montgomery, Chair
Robson Splane, Vice Chair and Secretary
Jeffrey Herr
Susan Moore
Keith Robertson

cc:
San Diego County Board of Supervisors and their energy advisors
Donna Tisdale, Chair, Boulevard Community Planning Group
Matthew Schneider, DPDS

JAMUL DULZURA
COMMUNITY PLANNING GROUP
P.O. Box 613
Jamul, California 91935

December 14, 2012

San Diego County Board of Supervisors
1600 Pacific Highway
San Diego, CA 92101

Dear Chairman Ron Roberts and Members of the Board:

At our regular Jamul Dulzura Community Planning Group meeting held on December 11, 2012, we voted unanimously to support the Boulevard Planning Group's opposition to the proposed Wind Energy Ordinance and Plan Amendment (POD 10-007). We express the following concerns:

- It appears that the Boulevard Community Plan is being attacked and that approval of this ordinance would set a dangerous precedent.
- We have a concern regarding the waiving of any existing ordinance, including the noise ordinance, to the possible determent of the community in order to benefit the economics of private interests.
- We urge that an independent scientific response study is needed to determine setbacks that would adequately protect the public health and safety. No action should be taken prior to the completion of those studies. In addition, we would urge a review of said studies by Planning Group representatives, in order for us to best communicate the results of the studies and obtain feedback within our communities.

Sincerely,

Michael Casinelli

Michael Casinelli, Chair
Jamul Dulzura Community Planning Group

POD 10-007, Item 1

Manzanita Band of the Kumeyaay Nation

June 6, 2012

San Diego County
Department of Land Use and Planning
5201 Ruffin Road, Suite B
San Diego, CA 92123

Commissioners,

As the Chairman of the Manzanita of the Kumeyaay Nation, we respectfully request that you delay any decision regarding the proposed project entitled TULE WIND, which is under consideration for McCain Valley in the eastern part of our County, until we as a sovereign government conclude our current HEALTH IMPACT ASSESMENT (HIA) Study.

Our Manzanita citizens currently live in close proximity to a high voltage wind project operating adjacent to our residential reservation homelands.
We are experiencing an inordinate level of health challenges for our people.

In order to determine the nature of our health issues Manzanita has engaged in an academically valid research based study conducted by the NATIONAL LATINO RECEARCH CENTER, which is under the umbrella of CALIFORNIA STATE UNIVERSITY, SAN MARCOS.

Through professional survey, screening, interviews, and medical record assessment our Health Impact Assessment study will isolate the various environmental factors that contribute to our adverse health issues, characterize health impacts, evaluate results compared to available standards and thresholds, distinguish inequitable impacts, consider cumulative the effects, forecast health effects, provide an economic valuation of negative impacts, and present recommendations for mitigation and alternatives.

PO Box 1302 Boulevard California 91905 Phone (619) 766-4930 Fax (619) 766-4957

Our people are an ideal subject group for this type of study since we have resided in our current location for decades. This spans many years prior to the wind farm operation and the several years since commercial operation. Additionally, our medical records are centrally located with the Southern California Indian Health Clinic. Thus, our HIA will be the best available information to determine the actual health risks associated with living next to high voltage wind turbines, transmission lines, and infrastructure.

This comprehensive Manzanita-CSUSM health study will take approximately four to six months to complete. Any prior approval of the Tule Wind project will be placing our residents in an unreasonable and increased foreseeable health risk.

Although the application before your Commission by Tule is limited to transmission lines and a half dozen wind turbines, an approval by your Commission will provide the necessary avenue for the applicant to install wind turbines that will entrap Manzanita on our north and east borders. This combined with the existing commercially operational project along our southern border will create a cumulative effect that most likely tenders our residential reservation land uninhabitable. We have been on these lands for thousands of years and we the Kumeyaay are the original stewards of San Diego County.

We are asking you to allow our Health Impact Assessment Study to be completed prior to making any decision of the suitability of wind projects proposed to be developed in close proximity to residential housing. This will allow your Commission to have the most valid and current information to make a responsible decision on the ultimate fate of not only this, the Tule Wind project, but more importantly the health of our Manzanita elders, children, and families.

A short delay in making your decision weighted against the potential devastating impacts that may well produce real and lasting human suffering, result in loss of our quality of life, and even reduce the life span of our citizens is a small thing to ask given what is at stake.

We look forward to you doing the responsible thing by delaying any decision until the medical research is available in just a few months.

Respectfully,

Leroy J. Elliott, Tribal Chairman
The Manzanita Band of the Kumeyaay Nation

VIEJAS®
OFFICE OF LEGAL AFFAIRS

P.O. Box 280
Alpine, CA 91903
5000 Willows Road
Alpine, CA 91901
Phone: 619.659.2710
Fax: 619.659.1970

April 12, 2012

David Pallinger, Chairman
San Diego Planning Commission
520 Ruffin Road, Suite B
San Diego, CA 92123

c/o Cheryl.Jones@sdcounty.gov

Re: April 13, 2012, Planning Commission, Item 5
Wind Energy Ordinance Amendment, POD 10-007, Countywide

Dear Chairman Pallinger and Fellow Commissioners:

On March 5, 2012, the County and Viejas began its consultation under SB 18 for the proposed County Wind Energy Ordinance. Many items were discussed at that meeting, and several action items were assigned, including those listed in the attached email from County Staff to Viejas. We also note that the Staff Report states that SB consultation with Viejas is ongoing (page 5-12).

Viejas takes SB 18 consultation, and its government-to-government relationship with the County, very seriously. We were surprised to see the project on the Planning Commission's agenda for the April 13, 2012, meeting without having the action items completed. County initiation of the SB process at an earlier point in time (prior to the DEIR going out for public review, for example) might have resulted in the consultation being further along.

Viejas agrees that the SB 18 consultation on this item is incomplete. We therefore respectfully request that the Commission continue this item, to allow Viejas and the County the opportunity to try to complete their dialogue before elevating the project to the Board level. In the alternate, if the Commission were to take action at the hearing, we request that any recommendation be made with the express caveat that SB 18 consultation between the County and Viejas will be completed prior to final decision making.

Thank you for your consideration.

Sincerely yours,

Kimberly R. Mettler

Kimberly R. Mettler, Director
Viejas Office of Legal Affairs
Viejas Band of Kumeyaay Indians

Attachment

cc: Hon. Dianne Jacob
Matthew Schneider
Donna Beddow
Courtney Ann Coyle, Esq.

Denise Strobridge-Elwell

From: Kimberly Mettler
Sent: Friday, April 13, 2012 8:36 AM
To: Denise Strobridge-Elwell
Subject: Fwd: SB 18 Consultation - Wind Energy Ordinance Amendment
Attachments: Agenda.pdf; Project Summary.pdf; Meeting Sign-in .pdf

Begin forwarded message:

From: "Schneider, Matthew" <Matthew.Schneider@sdcounty.ca.gov>
Date: March 6, 2012 2:31:49 PM PST
To: Kimberly Mettler <KMettler@VIEJAS.com>, "CourtCoyle@aol.com" <CourtCoyle@aol.com>
Cc: "Fogg, Mindy" <Mindy.Fogg@sdcounty.ca.gov>, "Farace, Joseph" <Joseph.Farace@sdcounty.ca.gov>, "Beddow, Donna" <Donna.Beddow@sdcounty.ca.gov>, "Wright, Gail" <Gail.Wright@sdcounty.ca.gov>, "Mead, Mark C" <Mark.Mead@sdcounty.ca.gov>, "Switzer, Dixie" <Dixie.Switzer@sdcounty.ca.gov>
Subject: SB 18 Consultation - Wind Energy Ordinance Amendment

Courtney & Kim -- We appreciate you meeting with us yesterday to discuss the Viejas Tribe's concerns regarding the County's wind energy ordinance amendment project I have attached the meeting sign in sheet, agenda, and project summary we reviewed at the meeting. I have noted the meeting's follow-up items below. We look forward to working with you and appreciate your input.

Follow-up items: (County staff to provide)

1) Project Objectives

2) Borrego Springs Comment Letter

3) Definition of "disturbed area" per the limited small wind turbine alternative

4) Ground disturbance analysis for small wind turbines

5) Link to public review website: http://www.sdcounty.ca.gov/dplu/ceqa/POD10007.html

6) Revise/clarify Draft EIR Cultural Resources section regarding Traditional Cultural Properties, sacred viewsheds, ceremonial sites, etc.

7) Consider implementing a "decision maker" subcommittee

Please feel free to contact me if you have any questions.

1

Thank You

Matthew Schneider

Land Use/Environmental Planner

County of San Diego, Policy & Ordinance Development

Department of Planning and Land Use

5201 Ruffin Road, Suite B

San Diego, CA 92123

Tel: 858-694-3714 Fax: 858-694-3373

VIEJAS
TRIBAL GOVERNMENT

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viejas.com

Anthony R. Pico, Chairman
Robert Cita Welch, Vice Chairman
Anita R. Uqualla, Tribal Secretary
Samuel Q. Brown, Tribal Treasurer
Greybuck S. Espinoza, Councilman
Victor E. Woods, Councilman
Raymond "Bear" Cuero, Councilman

May 10, 2012

David Pallinger, Chairman
San Diego County Planning Commission
520 Ruffin Road, Suite B
San Diego, CA 92123

c/o Cheryl.Jones@sdcounty.gov

Re: May 11, 2012 Planning Commission Workshop Wind Energy Ordinance Amendment, Countywide

Dear Chairman Pallinger and Fellow Commissioners:

This letter is sent on behalf of the Viejas Band of Kumeyaay Indians. As you may know, Viejas has been tracking several of the many wind projects proposed in San Diego and Imperial Counties.

In general, Viejas is a concerned about these particular facilities' impacts to tribal cultural resources, including Traditional Cultural Properties, and natural resources of cultural value to us, especially golden eagles. We have had several meetings with your staff, including one last week, to try and better understand what the goals are of the wind ordinance amendment and to express our concerns that tribal cultural values may not be being given the level of consideration and protection they require and to propose solutions where possible. We intend to continue meeting with your staff to see if we can reach consensus.

At this time, we have the following recommendations, and would respectfully request the Commission consider and direct staff to:

1. Conduct additional workshops: The issues surrounding the ordinance amendments are multifaceted and often complex. The potential adverse effects and impacts can be great and must be fully vetted and considered in a transparent manner. Also, we were disappointed to see that the Workshop Agenda does not contain a section for Cultural Resources. Additional workshops would provide for a more full agenda and better advance these important goals.

2. Conduct site visits including those of tribally-significant cultural areas: Such site visits should have tribal leaders and representatives present, who are knowledgeable about tribal culture and can help the Commissioners understand the cultural landscapes of San Diego County's backcountry and how large wind turbines could impact those areas. There is more at stake with the proposed ordinance than noise and biological impacts. The Commissioners should have the opportunity to understand that first-hand.

3. Form a subcommittee for tribal issues: This Commission subcommittee could develop a level of expertise on issues of tribal concern that would be beneficial not just regarding the proposed ordinance, but on other projects that come forward through the Commission so that there is a baseline of understanding when these issues come before it. The subcommittee could also sit in on SB 18 consultations, presently conducted between staff and tribes, which would provide a more direct appreciation by the decision makers of tribal concerns.

4. Consider the Limited Small Wind Alternative: While Viejas will continue to work with County staff to resolve remaining issues, this Alternative and any revisions to it, should be given full consideration by the Commission as it provides better consideration of tribal cultural resources.

We hope that this information is helpful to your Commission as you go through the Workshop process.

Sincerely yours,

THE VIEJAS BAND OF KUMEYAAY INDIANS

Robert J. Welch Jr.

Hon. Robert "Cita" Welch, Jr.
Vice Chairman

cc:
Hon. Dianne Jacob
Matthew Schneider
Donna Beddow
Mark Slovick
Courtney Ann Coyle, Esq.

IBERDROLA
RENEWABLES

April 5, 2012

VIA FIRST CLASS MAIL AND ELECTRONIC MAIL

Matt Schneider
County of San Diego Dep't of Planning and Land Use
Kearny Mesa Office
5201 Ruffin Road, Suite B
San Diego, CA 92123

Re: POD 10-007, LOG NO. 09-00-003, SCH NO. 2010091030 - Request to Reschedule Wind Ordinance Hearing to Allow Public Review of Final EIR and Revised Ordinance

Dear Mr. Schneider,

Tule Wind LLC, a wholly owned subsidiary of Iberdrola Renewables, LLC (Iberdrola Renewables) requests that the County reschedule the Planning Commission hearing on the proposed Wind Energy Ordinance, POD 10-007, LOG NO. 09-00-003, SCH NO. 2010091030. According to the notice we received this week, the hearing is currently scheduled for April 13, 2012, but the final environmental impact report (EIR) for the ordinance and the final draft of the ordinance that the staff will recommend for approval have yet to be released to the public.

For example, we made a number of substantive comments to the draft EIR, but have not yet seen the responses to those comments. We have requested copies of the revised ordinance and responses to comments. Until we see the staff's revised proposal, we are uncertain which experts we should arrange to attend the Planning Commission hearing, and these experts will not have had time to review the final ordinance and EIR before the scheduled hearing. Even if these materials are made public by the end of this week, it would leave inadequate time for public review of these important documents. Adequate time for the public – and for the Planning Commissioners themselves – to review these documents will be essential to a productive hearing and informed decision-making.

Accordingly, we ask the County to reschedule the Planning Commission hearing on the Wind Energy Ordinance until the public has at least 15 business days to review and comment on the final environmental impact report and the final draft of the ordinance that the staff will present to the Planning Commission.

IBERDROLA RENEWABLES, Inc.
1125 NW Couch St., Suite 700
Portland, OR 97209
Telephone (503) 796-7000
www.iberdrolarenewables.us

IBERDROLA
RENEWABLES

If you have any questions regarding this request, please contact me at 503-796-7781.

Sincerely,

Jeffrey B. Durocher, Esq.
Iberdrola Renewables, LLC.

cc: Eric Gibson, Director, Dep't of Planning and Land Use
Cheryl Jones, San Diego County Planning Commission

Schneider, Matthew

From: Pinney Caldwell [pincal@sbcglobal.net]
Sent: Friday, July 20, 2012 8:16 AM
To: Jones, Cheryl; Schneider, Matthew
Cc: Jacob, Dianne; Donna Tisdale
Subject: WIND ENERGY ORDINANCE & PLAN AMENDMENTS; POD10-007

TO SAN DIEGO COUNTY PLANNING COMMISSIONERS:

FROM: Clifford C. Caldwell and Concepcion Caldwell

We have received a copy of the Public Health Position Statement - Human Health Effects of Wind Turbines dated July 10, 2012. It is our understanding that it is set for hearing today as part of the agenda item Wind Energy Ordinance Amendment; POD10-007; Countywide.

As we own the properties at 2754 and 2750 Ribbonwood Road, Boulevard, CA, it is interesting how the report by the Health and Human Services Agency states that the effects of wind turbines have "no direct pathological effects" although they state that certain effects are not well understood (i.e. sound, noise and annoyance). This is an affirmative conclusion that they are acceptable risks as long as the County does not understand them. Is the County going to make us whole if their assumptions are wrong? Or is it an acceptable risk to the County as long as it is someone else that has the problem and/or because these other people are fewer in number.

As we understand the report's conclusion, since the County does not fully understand the health risk, therefore such effects must be acceptable.

In addition, having an individual in our family that is on anti-seizure medication, we are amazed at how the County simply states that since only a small part of the population is subject to seizures that the minimal risks are acceptable to them. They find it acceptable because they are not part of those at risk. Has the County even tried to determine if there are any individuals in the Boulevard area who are at risk for such type of seizures.

In summary, we feel the County's report is simply conjecture without any type of serious study, that puts our small group (as a result of sparsity of housing) at risk. We object to the findings in said report as they lack any type of substantiation.

We have read the Boulevard Planning Group's comments and its reply to the County about these matters and fully support the stated position of the Boulevard Planning Group.

Very truly yours,

Concepcion Caldwell and Clifford Caldwell
2754 and 2750 Ribbonwood Road
Boulevard, CA

Stephan C. Volker
Joshua A.H. Harris
Alexis E. Krieg
Stephanie L. Abrahams
Daniel P. Garrett-Steinman
Jamey M.B. Volker
M. Benjamin Eichenberg

Law Offices of
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436 – 14th Street, Suite 1300
Oakland, California 94612
Tel: (510) 496-0600 ❖ Fax: (510) 496-1366
svolker@volkerlaw.com

11.147.01

April 12, 2012

VIA EMAIL AND U.S. MAIL

Matt Schneider
Department of Planning and Land Use
5201 Ruffin Road, Suite B
San Diego, California 92123-1666
matthew.schneider@sdcounty.ca.gov

Re: Comments of The Protect Our Communities Foundation, Backcountry Against Dumps and Donna Tisdale on the San Diego County Wind Energy Ordinance Amendment and its General Plan Amendment and EIR (POD 10-007 (District: All)

I. INTRODUCTION

These comments are submitted on behalf of The Protect Our Communities Foundation, ("POC"), Backcountry Against Dumps ("BAD") and Donna Tisdale (collectively "Conservation Groups") in response to San Diego County's (the "County's") proposed Wind Energy Zoning Ordinance Amendment and General Plan Amendment ("Amendments") which are under consideration by the Planning Commission at its public hearing on April 13, 2012. Conservation Groups commend the County for preparing an EIR on the Amendments as we had previously requested, and appreciate the opportunity to submit these comments on the Amendments and their EIR. Please include our comments in the public record.

As we pointed out in our EIR Scoping Comments submitted on October 11, 2010 (which we incorporate here by reference), the Amendments would have numerous significant impacts including both audible and low frequency noise, degradation of scenery, increased wildfire ignition risks, interference with wildfire suppression, electromagnetic field ("EMF") emissions, collisions with birds, bats and other wildlife, and cumulative impacts including the proliferation of industrial-scale power lines that would transmit the electrical energy that the proposed wind turbines would generate. We remain concerned that many of these significant impacts have not been adequately addressed as yet by the County in its EIR and related reviews. We summarize our principal concerns below.

II. BIOLOGICAL RESOURCE IMPACTS

Numerous scientific studies have confirmed that wind turbines have substantial adverse impacts on birds, particularly birds of prey that tend to inhabit the windy ridgetops (where turbines would be sited) where they search the ground below them for voles, field mice and other prey. Because while foraging birds of prey are inspecting the terrain below for animal movements, they tend not to notice the spinning turbines and thus are frequent victims of turbine blade collision. Avoiding siting turbines where birds of prey are present is the only certain means of avoiding adverse impacts on them.

Recent studies have also shown that wind turbine blades not only strike and kill bats, but also kill them through barotrauma, a condition caused by the sudden loss of air pressure behind the moving blades which causes the balloon-like lungs of bats to implode. The EIR should be revised to address this recently recognized, serious adverse impact of wind turbines on bats.

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The EIR fails to adequately address the adverse health impacts on humans and wildlife of wind turbines' excessive noise emissions, both audible and low frequency. The EIR erroneously concludes that "the scientific evidence available to date does not demonstrate a direct causal link between wind turbine noise and adverse health effects." EIR at 2.8-4. The EIR relies on two studies that it claims show that noise from wind turbines has no adverse health effects: (1) *Wind Turbine Sound and Health Effects An Expert Panel Review*, published by a wind energy industry group, the American Wind Energy Association, and (2) *The Potential Health Impact of Wind Turbines*, a review conducted by the Chief Medical Officer of Health of Ontario. *Id.* Neither study reflects current science.

The EIR overlooks more recent studies demonstrating that wind turbine noise *does* have adverse health effects.[2] The EIR also ignores an analysis published by the Society for Wind Vigilance that criticizes the American Wind Energy Association report on which the EIR relies to downplay the health impacts of wind turbine noise. This omission skews the EIR's analysis in favor of industry and against the public. This serious flaw must be rectified.

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VI. CONCLUSION

We appreciate the County's progress in addressing the significant adverse impacts of wind turbines on human health and safety, scenery, and wildlife. However, the EIR's discussion of these impacts is still inadequate and incomplete, as shown above. Accordingly, we ask the Planning Commission to direct the preparers of the EIR to conduct further research and analysis, and address in particular the studies that we have attached to these comments.

Thank you very much for considering our comments on this important matter.

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April 12, 2012

VIA EMAIL AND U.S. MAIL

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Re: Comments of The Protect Our Communities Foundation, Backcountry Against Dumps and Donna Tisdale on the San Diego County Wind Energy Ordinance Amendment and its General Plan Amendment and EIR (POD 10-007 (District: All)

I. INTRODUCTION

These comments are submitted on behalf of The Protect Our Communities Foundation, ("POC"), Backcountry Against Dumps ("BAD") and Donna Tisdale (collectively "Conservation Groups") in response to San Diego County's (the "County's") proposed Wind Energy Zoning Ordinance Amendment and General Plan Amendment ("Amendments") which are under consideration by the Planning Commission at its public hearing on April 13, 2012. Conservation Groups commend the County for preparing an EIR on the Amendments as we had previously requested, and appreciate the opportunity to submit these comments on the Amendments and their EIR. Please include our comments in the public record.

As we pointed out in our EIR Scoping Comments submitted on October 11, 2010 (which we incorporate here by reference), the Amendments would have numerous significant impacts including both audible and low frequency noise, degradation of scenery, increased wildfire ignition risks, interference with wildfire suppression, electromagnetic field ("EMF") emissions, collisions with birds, bats and other wildlife, and cumulative impacts including the proliferation of industrial-scale power lines that would transmit the electrical energy that the proposed wind turbines would generate. We remain concerned that many of these significant impacts have not been adequately addressed as yet by the County in its EIR and related reviews. We summarize our principal concerns below.

II. BIOLOGICAL RESOURCE IMPACTS

Numerous scientific studies have confirmed that wind turbines have substantial adverse impacts on birds, particularly birds of prey that tend to inhabit the windy ridgetops (where turbines would be sited) where they search the ground below them for voles, field mice and other prey. Because while foraging birds of prey are inspecting the terrain below for animal movements, they tend not to notice the spinning turbines and thus are frequent victims of turbine blade collision. Avoiding siting turbines where birds of prey are present is the only certain means of avoiding adverse impacts on them.

Recent studies have also shown that wind turbine blades not only strike and kill bats, but also kill them through barotrauma, a condition caused by the sudden loss of air pressure behind the moving blades which causes the balloon-like lungs of bats to implode. The EIR should be revised to address this recently recognized, serious adverse impact of wind turbines on bats.

The EIR also fails to address the impact of wind turbine color. Recent studies have revealed that insects are more likely to be drawn to turbines that are painted white or other neutral colors than they are to turbines that are painted contrasting colors such as purple. Birds that are insectivores (as well as birds of prey that feed on insectivores) are most common in areas where insects are present. The EIR should be revised to address the development of coloration criteria to mitigate the adverse impact of turbine blades on insectivores and on the birds that prey on them. Although the EIR states on page 1-13 that Federal Aviation Administration regulations apparently require turbines over 200 feet in height to be a neutral white color, there is no indication that this FAA preference precludes the County from requiring a different color for turbines less than 200 feet in height. Additionally, the County should explore with the FAA the potential for requiring colors other than neutral white for turbines over 200 feet in height.

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Bulletin of Science, Technology & Society
http://bst.sagepub.com/

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Bulletin of Science Technology & Society published online 30 September 2011
DOI: 10.1177/0270467611417852

The online version of this article can be found at:
http://bst.sagepub.com/content/early/2011/08/24/0270467611417852

Published by:
SAGE
http://www.sagepublications.com

On behalf of:
National Association for Science, Technology & Society

Bulletin of Science, Technology & Society
XX(X) 1–13

DOI: 10.1177/0270467611417852
http://bsts.sagepub.com
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Wind Turbines Make Waves: Why Some Residents Near Wind Turbines Become Ill

Magda Havas[1] and David Colling[2]

Abstract

People who live near wind turbines complain of symptoms that include some combination of the following: difficulty sleeping, fatigue, depression, irritability, aggressiveness, cognitive dysfunction, chest pain/pressure, headaches, joint pain, skin irritations, nausea, dizziness, tinnitus, and stress. These symptoms have been attributed to the pressure (sound) waves that wind turbines generate in the form of noise and infrasound. However, wind turbines also generate electromagnetic waves in the form of poor power quality (dirty electricity) and ground current, and these can adversely affect those who are electrically hypersensitive. Indeed, the symptoms mentioned above are consistent with electrohypersensitivity. Sensitivity to both sound and electromagnetic waves differs among individuals and may explain why not everyone in the same home experiences similar effects. Ways to mitigate the adverse health effects of wind turbines are presented.

Keywords

wind turbine, dirty electricity, power quality, ground current, contact current, electrohypersensitivity, noise, infrasound, vibroacoustic disease, wind turbine syndrome

Introduction

With growing concern about climate change, the carbon budget, depletion of fossil fuels, air pollution from dirty coal, radiation from nuclear power plants, and the need for a secure energy supply, more attention and funding are being diverted to renewable energy. Among the various types of renewable energy, wind has received a lot of attention due, in part, to opposition from communities earmarked for wind turbines and from communities that have experienced wind turbines firsthand.

Some people who live near wind turbines report difficulty sleeping and various symptoms of ill health and attribute these problems to noise and shadow flicker—two elements they can perceive. Indeed the U.S. National Research Council (Risser et al., 2007) identify noise and shadow flicker as the two key impacts of wind turbines on human health and well-being.

Not all health agencies, however, recognize that sound waves from wind turbines may cause adverse health effects. Following a review of the literature, the Chief Medical Officer of Health for Ontario (2010), concluded

> that while some people living near wind turbines report symptoms such as dizziness, headaches, and sleep disturbance, the scientific evidence available to date does not demonstrate a direct causal link between wind turbine noise and adverse health effects. The sound level from wind turbines at common residential setbacks is not sufficient to cause hearing impairment or other direct health effects, although some people may find it annoying.
>
> Low frequency sound and infrasound from current generation upwind model turbines are well below the pressure sound levels at which known health effects occur. Further, there is no scientific evidence to date that vibration from low frequency wind turbine noise causes adverse health effects.

What specifically is responsible for the illness reported near wind turbines is controversial; while some of this controversy is scientifically valid, some of it is politically motivated (Phillips, 2010).

It is intriguing that not everyone in the same home experiences symptoms, and the symptoms are not necessarily worse for those nearest the turbines. Indeed, the situation may be much more complex than noise and shadow flicker.

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Why do some people who live near wind turbines become sick while others feel no ill effects? What aspects of wind power generation and distribution are responsible for the health problems? What can be done to minimize adverse human biological and health effects? These are some of the questions addressed in this report.

Wind Turbines Make Waves

What aspects of wind power generation and distribution are responsible for the adverse health effects experienced by those who live near wind turbines?

The short answer to this question is that *wind turbines make waves*. They make pressure waves and electromagnetic waves. The pressure waves (or sound waves) generated by the moving turbines can be heard as noise and/or perceived as infrasound. The electromagnetic waves are generated by the conversion of wind energy to electricity. This conversion produces high-frequency transients and harmonics that result in poor power quality. These high frequencies can flow along the wires (dirty electricity) and along the ground, thereby causing ground current. These four types of waves—noise, infrasound, dirty electricity, and ground current—and shadow flicker are each likely to contribute to ill health among those who live near wind turbines.

Characteristics of Sound Waves and Electromagnetic Waves

Sound waves are longitudinal waves that require a medium for transport. They travel at the speed of sound (340 meters/second) through air and are much slower than electromagnetic waves that travel at the speed of light (300,000,000 meters/second) and can travel through a vacuum. Both sound waves and electromagnetic waves have a frequency (cycles per second) and an intensity (amplitude of the wave).

Frequency refers to the number of waves or cycles per second and is known as pitch for sound. The A above middle C, for example, is set to a frequency of 440 cycles per second (hertz, abbreviated as Hz). The audible range for the human ear is between 20 and 20,000 Hz. Frequencies below 20 Hz are referred to as "infrasound," and, although they cannot be heard, they can still have an effect on the body. Infrasound can travel much greater distances than higher frequency sound waves and could potentially reach and affect a much larger population.

The frequencies of electromagnetic waves, generated by wind turbines, fall within two ranges of the electromagnetic spectrum: extremely low frequency (ELF), below 1,000 Hz; and the lower range (kilohertz [kHz] to megahertz [MHz]) of the radio frequency radiation (RFR) band. Electromagnetic waves can enter homes by various paths: through the air, along wires, through the ground, and via plumbing and other metal structures. Electromagnetic waves travelling across the ground contribute to ground current.

Intensity is measured by the amplitude of the wave and, for sound, is measured in decibels (dB). Vibrations with the same frequency but different amplitude will sound the same, but one will be louder than the other. The decibel scale is logarithmic. A quiet bedroom is at 25 dB, conversation is around 60 dB, a rock group is at 110 dB, and the human threshold of pain is at 140 dB.

The intensity of electromagnetic waves is measured in various ways: electric field, magnetic field, voltage, current, and power density. The biological effects of electromagnetic energy are a function of frequency, intensity, and both the manner and the duration of exposure.

Pressure Waves: Noise

Most people who live near wind turbines and complain of ill effects blame the effects on the noise generated by the turbines (Frey & Hadden, 2007).

> Everything changed . . . when the wind turbines arrived . . . approximately 700 metres away from our property . . . Within days of the windfarm coming into operation we began to hear a terrible noise . . . The noise drove us mad. Gave us headaches. Kept us awake at night. Prevented us from having windows and doors open in hot weather, and was extremely disturbing.
>
> This noise is like a washing machine that's gone wrong. It's whooshing, drumming, constant drumming, noise. It is agitating. It is frustrating. It is annoying. It wears you down. You can't sleep at night and you can't concentrate during the day . . . It just goes on and on . . . It's torture . . . [4 years later] You just don't get a full night's sleep and when you drop off it is always disturbed and only like "cat napping." You then get up, tired, agitated and depressed and it makes you short-tempered . . . Our lives are hell.

The French National Academy of Medicine (Chouard, 2006) issued a report that concludes,

> People living near the towers, the heights of which vary from 10 to 100 meters, sometimes complain of functional disturbances similar to those observed in syndromes of chronic sound trauma . . .
>
> The sounds emitted by the blades being low frequency, which therefore travel easily and vary according to the wind . . . constitute a permanent risk for the people exposed to them . . .
>
> . . . sound levels 1 km from an installation occasionally exceeded allowable limits.
>
> . . . the Academy recommends halting wind turbine construction closer than 1.5 km from residences. (Translated from French)

Noise, especially at night, has been associated with an increase in stress hormones leading to hypertension, stroke, heart failure, and immune problems. It is discussed in greater detail elsewhere in this journal.

Pressure Waves: Infrasound

Repetitive noise can be disturbing, especially at night, when sound seems amplified. However, pressure waves at levels outside the range of human hearing can also have unpleasant side effects.

In Nova Scotia, one family was unable to remain in their home and blamed their loss of sleep and headaches on vibrations from 17 turbines (Keller, 2006).

> The d'Entremont family complained of noise and low frequency vibrations in their house after the wind turbines began operation in May 2005. The inaudible noise deprived his family of sleep, gave his children and wife headaches, and "made it impossible for them to concentrate." They now live nearby; if they return to their home, the symptoms return.
>
> Natural Resources Canada, which oversees funding for wind farm projects, found no problems with low-frequency noise or infrasound. The government report concludes that the measurements:
>
> indicate sound at infrasonic frequencies below typical thresholds of perception; infrasound is not an issue. (cited in Frey & Hadden, 2007)

Gordon Whitehead, a retired audiologist with 20 years of experience at Dalhousie University in Halifax, conducted tests and found similar results but came up with a different conclusion:

> They're [Natural Resources Canada] viewing it from the standpoint of an engineer; I'm viewing it from the standpoint of an audiologist who works with ears . . . The report should read that (the sound) is well below the auditory threshold for perception. In other words, it's quiet enough that people would not be able to hear it. But that doesn't mean that people would not be able to perceive it.
>
> " . . . low-frequency noise can affect the balance system of the ear, leading to a range of symptoms including nausea, dizziness and vision problems. It's not perceptible to the ear but it is perceptible. It's perceptible to people with very sensitive balance mechanisms and that's generally people who get very easily seasick.

Resonance may explain why infrasound is harmful at low intensities. Different parts of the human body have different resonance frequencies. When the external frequency generated by a wind turbine approaches the resonance frequency of a part of the human body, that body part will preferentially absorb the energy and begin to vibrate. For example, frequencies that affect the inner ear (between 0.5 and 10 Hz) can interfere with balance, cause dizziness or vertigo, contribute to nausea, and be experienced as tinnitus or ringing in the ears. According to the International Standards Organization (ISO Standards 2631), frequencies for the eye are between 20 and 90 Hz, head 20 and 30 Hz, chest wall 50 and 100 Hz, abdomen 4 and 8 Hz, and spinal column 10 and 12 Hz. Some of the symptoms documented at infrasonic frequencies (between 4 and 20 Hz) include general feeling of discomfort, problems with breathing, abdominal and chest pain, urge to urinate, lump in throat, effect on speech, and head symptoms (Frey & Hadden, 2007).

According to a report by the U.S. Air Force, Institute for National Security Studies, acoustic infrasound can have dramatic and serious effects on human physiology (Bunker, 1997).

> Acoustic, infrasound: very low frequency sound which can travel long distances and easily penetrate most buildings and vehicles. Transmission of long wavelength sound creates biophysical effects, nausea, loss of bowels, disorientation, vomiting, potential organ damage or death may occur. Superior to ultrasound because it is "inband," meaning it does not lose its properties when it changes mediums such as air to tissue. By 1972 an infrasound generator had been built in France, which generated waves at 7Hz. When activated it made the people in range sick for hours.

In a paper known as "The Darmstadt Manifesto," published in September 1998 by the German Academic Initiative Group and endorsed by more than 100 university professors in Germany, the German experience with wind turbines is described as follows (cited in Frey & Hadden, 2007):

> More and more people are describing their lives as unbearable when they are directly exposed to the acoustic and optical effects of wind farms. There are reports of people being signed off sick and unfit for work, there is a growing number of complaints about symptoms such as pulse irregularities and states of anxiety, which are known to be from the effects of infrasound [sound frequencies below the normal audible limit].

Infrasound is influenced by topography, distance, and wind direction (Rogers, Manwell, & Wright, 2006) and differs from home to home and room to room because each room is a distinct cavity with its own resonant frequency. Whether a door is open or closed can alter the effect.

The biological effects of low-frequency noise (20-100 Hz) and infrasound (less than 20 Hz) are a function of intensity, frequency, duration of exposure, and direction of the vibration.

Wind Turbine Syndrome and Vibroacoustic Disease

Exposure to low-frequency noise and infrasound may produce a set of symptoms that include depression, irritability, aggressiveness, cognitive dysfunction, sleep disorder, fatigue, chest pain/pressure, headaches, joint pain, nausea, dizziness, vertigo, tinnitus, stress, heart palpitations, and other symptoms. Not everyone has the same sensitivity. Those who experience motion sickness (car, boat, plane), get dizzy or nauseous on carnival rides, have migraine headaches, or have eye or ear problems may be particularly susceptible to low-frequency vibrations.

Two different "diseases" have been associated with low-frequency noise exposure and infrasound. They are wind turbine syndrome—coined by Pierpont (2009) in her book by the same name—and vibroacoustic disease (VAD). VAD is a whole-body, systemic pathology characterized by the abnormal proliferation of extracellular matrices and caused by excessive exposure to low-frequency noise (Castelo Branco & Alves-Pereira, 2004). These two "diseases" differ as described by Pierpont (2009).

> Wind Turbine Syndrome, I propose, is mediated by the vestibular system—by disturbed sensory input to eyes, inner ears, and stretch and pressure receptors in a variety of body locations. These feed back neurologically onto a person's sense of position and motion in space, which is in turn connected in multiple ways to brain functions as disparate as spatial memory and anxiety. Several lines of evidence suggest that the amplitude (power or intensity) of low frequency noise and vibration needed to create these effects may be even lower than the auditory threshold at the same low frequencies.
>
> Vibroacoustic Disease, on the other hand, is hypothesized to be caused by direct tissue damage to a variety of organs, creating thickening of supporting structures and other pathological changes. The suspected agent is high amplitude (high power or intensity) low frequency noise. (p. 13)

VAD seems to be dose dependent, with symptoms becoming progressively worse with continued exposure. Three stages have been identified based on 70 aircraft technicians who, presumably, were exposed to much higher intensities of low-frequency noise than those who live near wind turbines (Castelo Branco, 1999, Castelo Branco & Alves-Pereira, 2004).

Stage 1: Mild, 1 to 4 years, slight mood swings, indigestion, heartburn, mouth/throat infections, bronchitis

Stage 2: Moderate, 4 to 10 years, depression, aggressiveness, pericardial thickening, light to moderate hearing impairment, chest pain, definite mood swings, back pain, fatigue, skin infections (fungal, viral, parasitic), inflammation of stomach lining, pain during urination, blood in urine, conjunctivitis, allergies

Stage 3: Severe, more than 10 years, myocardial infarction, stroke, malignancy, epilepsy, psychiatric disturbances, hemorrhages (nasal, digestive, conjunctive mucosa), varicose veins, hemorrhoids, duodenal ulcers, colitis, decrease in visual acuity, headaches, severe joint pain, intense muscular pain, neurological disturbances

Whatever name is given to the symptoms, the symptoms are real and can be caused by low-frequency sound waves and infrasound.

Electromagnetic Waves

One undesirable consequence of wind-generated electricity is poor power quality due to variable weather conditions, mechanical construction of the towers, and the electronic equipment used (Lobos, Rezmer, Sikorski, & Waclawek, 2008). Electricity in North America has a frequency of 60 Hz and is a sine wave when viewed on an oscilloscope (Figure 1). When a wind turbine generates electricity, the frequency must be converted to 60 Hz by power converters; that conversion generates a large spectrum of current and voltage oscillations leading to poor power quality (Lobos et al., 2008). Wind turbines can generate a wide range of frequencies—from less than 1 Hz (Lobos et al., 2008), with the majority of the frequencies in the kHz range associated with power conversion.

Dirty Electricity

High-frequency transient spikes that contribute to poor power quality, also known as dirty electricity, can flow along wires, damage sensitive electronic equipment, and adversely affect human and animal health.

After wind turbines were activated in Ripley, Ontario, several of the residents complained of ill health. Residents suffered from headaches, poor sleep, elevated blood pressure (requiring medication), heart palpitations, itching, ringing and pain in the ears, watering eyes, and pressure on the chest causing difficulty breathing. These symptoms disappear when the residents leave the area. Some residents were forced to move out of their homes because the symptoms were so severe. Locals complain of headaches and poor radio reception when they drive near these power lines.

One of the authors (DC) measured the power quality near several residences where people were unwell. The primary neutral-to-earth voltage (PNEV) is the electrical potential difference between the earth and the neutral wire on the primary distribution line, as shown in Figure 2. Measurements taken before wind turbines were installed and after they were installed and operating (Figure 3) clearly show the distortion (spikes on the waveform) generated by the wind turbines.

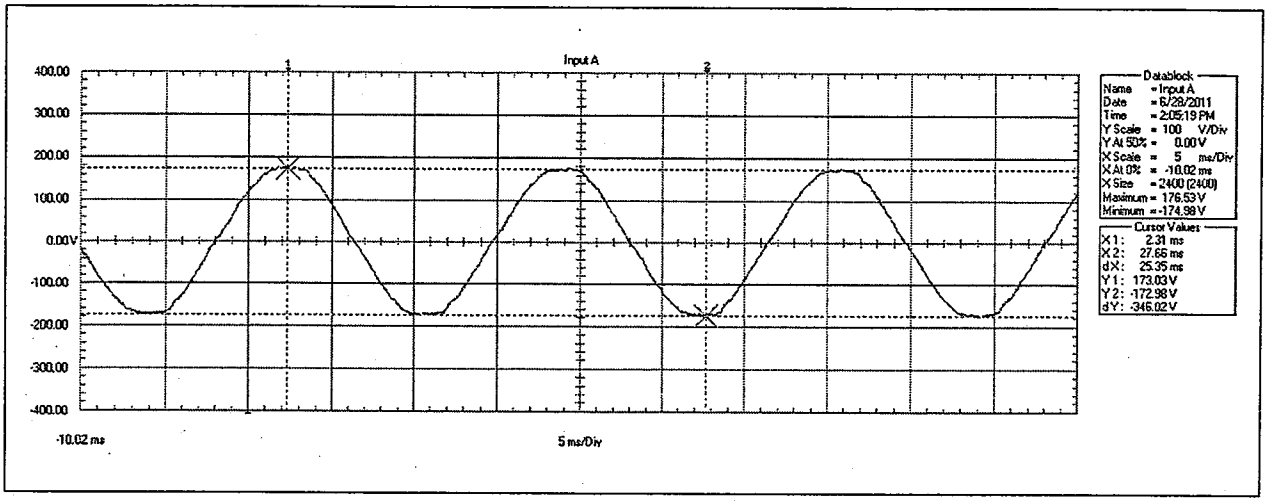

Figure 1. Good power quality exemplified by the 60-Hz sine wave

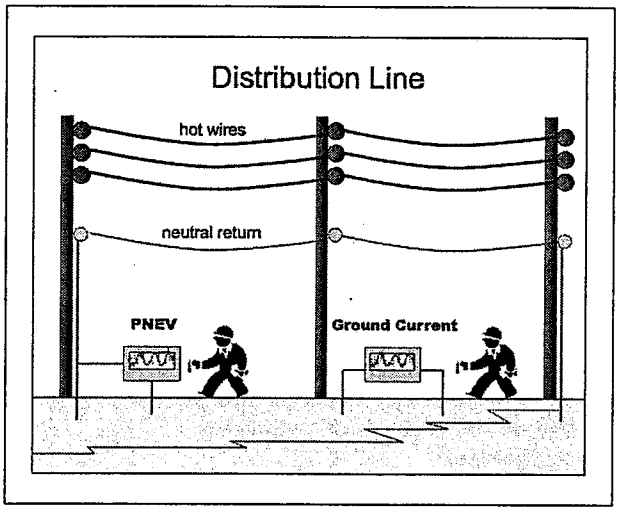

Figure 2. Diagram demonstrating how primary neutral-to-earth voltage (PNEV) and ground voltage measurements are taken

In this area, wind turbines are variable speed and are interconnected. The collection lines connecting the wind turbines to the substation are attached to the same utility pole as the home owners' lines.

According to one of the authors (DC; September 30, 2008),

> We had four families move out of their homes and now if I spend too much time in these homes I get the same symptoms, which is ear aches, ringing in the ears and pressure in the ears. [name removed] eventually buried a portion of the line but have only isolated the lines by insulators so it is better, however there is still some high frequency coming into the houses. The three families that now have buried lines are back in their homes, but things are far from ideal.

Dirty electricity in the kHz range affects human health; this has been shown in schools and homes in both Canada and the United States. Power quality can be improved both on electrical wires by using power line filters (Ontario Hydro, 1998) and inside buildings by using special surge suppressors or power filters that dampen the voltage spikes (http://www.stetzerelectric.com).

In one Wisconsin School that had "sick building syndrome," once power quality was improved, the health of both teachers' and students' improved. According to the school nurse, both staff and students have more energy, fewer allergies, and fewer migraine headaches, and asthmatics rely less on their inhalers (Havas, 2006a).

In a Toronto School, improvements in power quality were accompanied by improvements in teachers' health and students' behavior. Teachers were less tired, less frustrated, less irritable; they had better health and more energy; they had a greater sense of satisfaction and accomplishment; they were more focused and experienced less pain. Students' behavior also improved especially in the elementary grades (Havas, Illiatovitch, & Proctor, 2004). Similar results were reported in a placebo-blinded study in three Minnesota schools (Havas & Olstad, 2008).

Dirty electricity has been associated with increased risk of various types of cancers among teachers in a California school (Milham & Morgan, 2008), with higher blood sugar levels among diabetics, and with exacerbation of tremors and difficulty walking among those with multiple sclerosis (Havas, 2006b). People who are adversely affected by dirty electricity are classified as electrically hypersensitive.

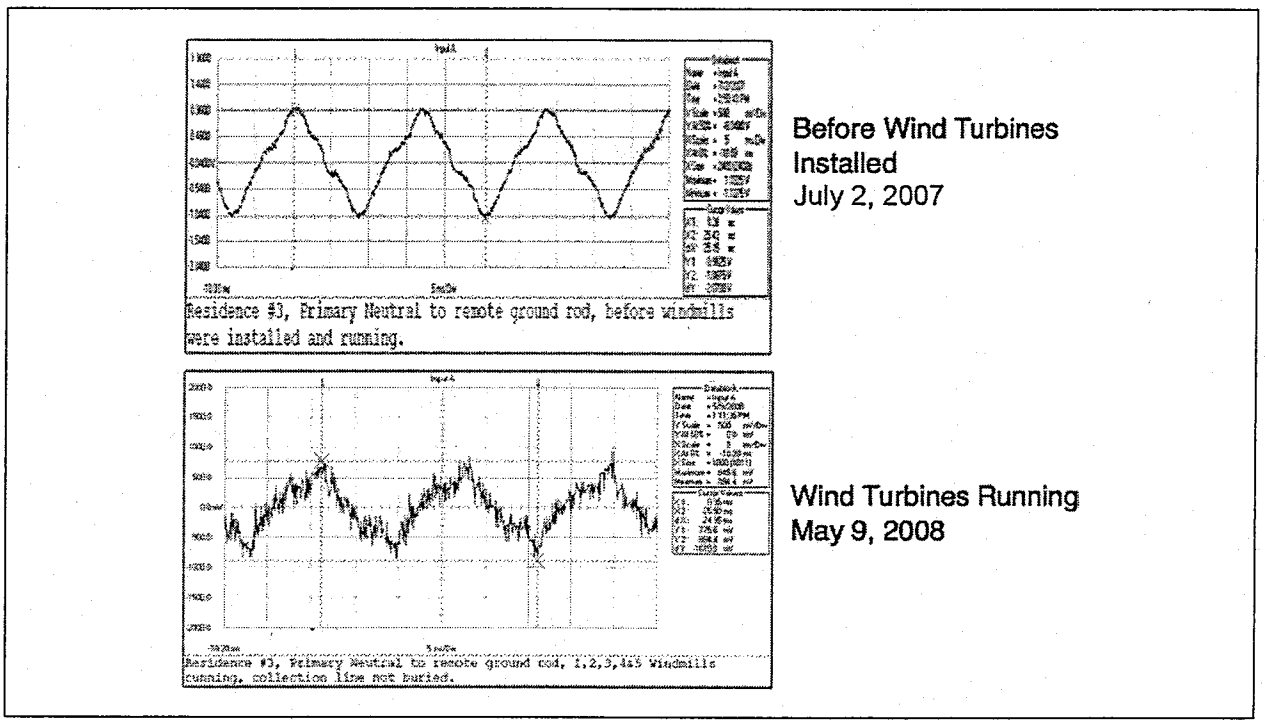

Figure 3. Primary neutral-to-earth voltage (PNEV) at Residence No. 3 in Ripley, Ontario, before wind turbines were installed (July 2, 2007) and when five wind turbines were operating (May 9, 2008)
Note. Collection line was not buried.

Ground Current

Just as dirty electricity can flow along wires, it can also flow along the ground resulting in ground current. Ground current (often measured as voltage and called stray voltage or tingle voltage) is a serious problem in certain locations and has been shown to adversely affect the health of farm families and the health and productivity of farm animals, especially dairy cattle.

The Ontario Federation of Agriculture (2007) provides information on symptoms experienced by farm animals, pets, and people who are exposed to tingle voltage as follows:

> Farmers and their families who suffer from immune disorders such as allergies or rheumatoid arthritis find their symptoms worsen or go into remission in close coordination with livestock symptoms. Periods of fatigue increase. Sleep disorders may increase.
>
> Cats leave the farm, become ill, cease to bear litters or have small, unhealthy litters, or die; coats are usually dull and shaggy and eyes are runny.
>
> Horses may paw the ground and shy away from watering or feeding troughs; behaviour and handling becomes more difficult.
>
> Pigs often take to ear and tail biting; mastitis and baby pig scours are common; piglet mortality may increase.
>
> Cattle lap water from the trough or bowl; feed in the bottom of the manger is not cleaned up; milk out is slow and uneven; cows are reluctant to enter the milk parlour and quick to leave; slow growth in calves and heifers; somatic cell counts are high; unexplained spontaneous abortions of calves; bulls become markedly more irritable.

According to the *National Electrical Safety Code (NESC) Handbook* (Clapp, 1997),

> When the earth returns were used in some rural areas prior to the 1960's, they became notorious offenders in dairy areas because circulating currents often cause both step and touch potentials.
>
> In some cases, they have adversely affected milking operations by shocking the cattle when they were connected to the milking machines, and have affected feeding. (p. 152)

According to Lefcourt (1991) in the U.S. Department of Agriculture book titled *Effects of Electrical Voltage/Current on Farm Animals: How to Detect and Remedy Problems*:

> The effect of a transient voltage superimposed on the regular power voltage (dc or ac) is to cause a momentary

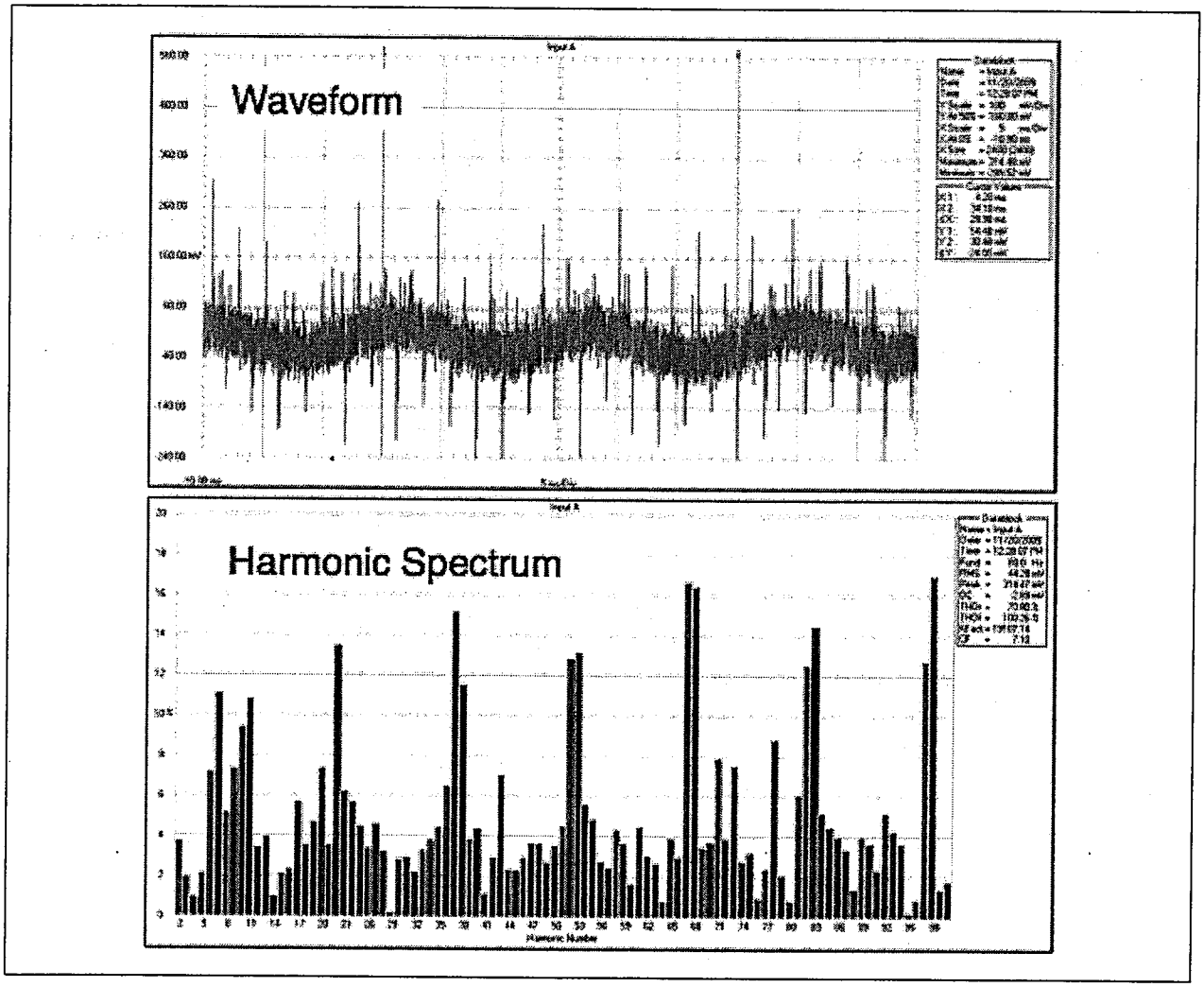

Figure 4. Ground voltage measured at the Palm Springs wind farm in California using 50 feet of copper wire attached to two metal rods in the earth

Note. The top graph shows the distorted 60-Hz waveform, and the bottom graph shows the harmonic frequencies. Data courtesy of Dr. Sam Milham.

> change in the waveform. When the transient causes the momentary voltage to be greater than normal, it may cause a transient current to flow in an animal. If the transient waveform has sufficient energy (magnitude and duration), there may be an animal response. (p. 63-64)

Indeed, dirty electricity flowing along the ground may be more harmful to farm animals than the 60-Hz ground current (Hillman et al., 2003):

> Cows were sensitive to harmonic distortions of step-potential voltage, suggesting that utility compliance with IEEE standards on dairy farms may need to be addressed.
>
> Power quality varied greatly from farm to farm and day to day. Milk production responses to changes in power quality varied inversely with the number of transient events recorded with event recorders, oscilloscope, and power quality meters. Harmonics often gave better estimates of electrical effects on milk production than voltage *per se*. (p. 19)

Do wind turbines generate ground current? They can if proper safeguards are not taken. Generally, this is a problem with power distribution once the energy leaves the turbine.

Figure 4 shows the waveform of ground voltage near an industrial wind farm in Palm Springs, California (as shown in Figure 5 photographs). The waveform distortion in Figure 3 and 4 are considerable when compared with Figure 1.

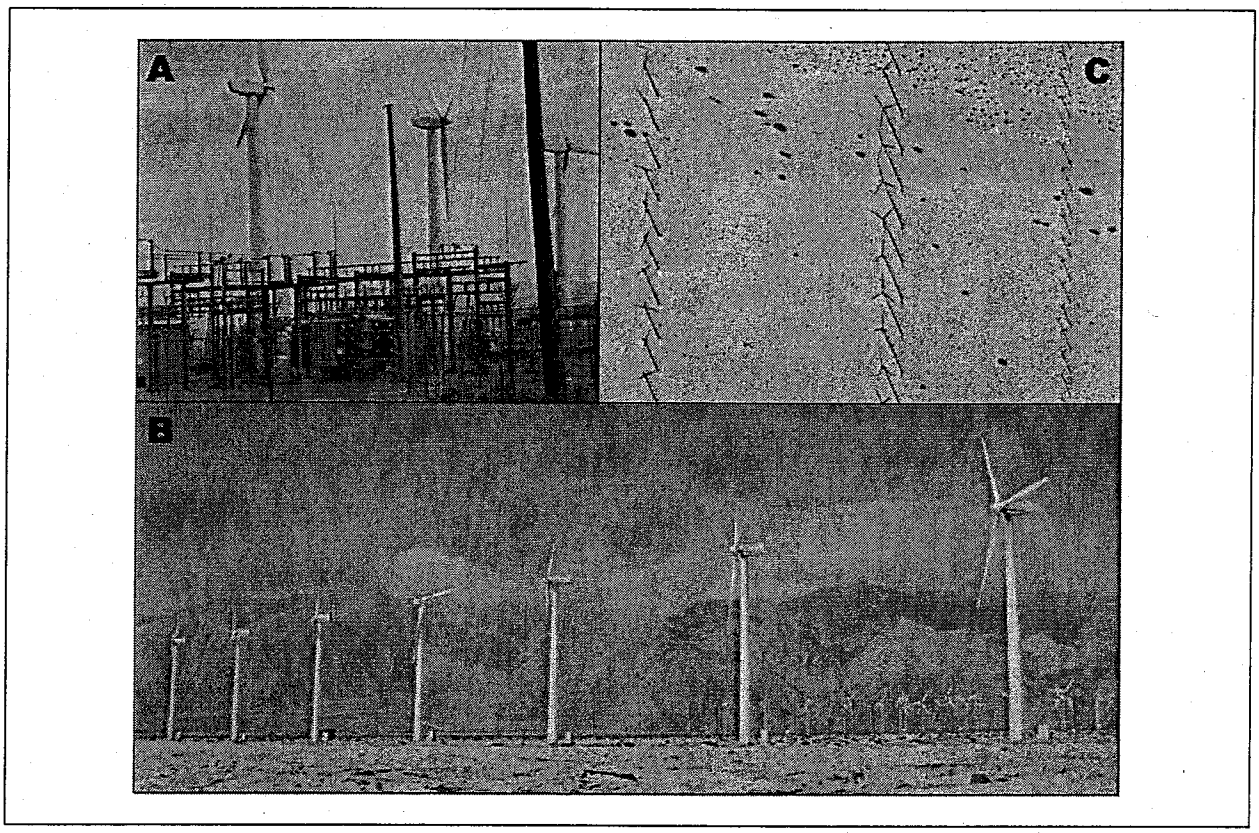

Figure 5. Wind farm in Palm Springs, California, showing (A) location of ground voltage readings; (B), view of wind turbines from the ground; and (C) view of wind turbines from the air
Note. Photograph A from Dr. Sam Milham. Photographs B and C from Google maps.

Burying the collection line may not eliminate the ground voltage but can improve power quality, as shown in Figure 6.

Just as animals are adversely affected by dirty ground current, so are people. If ground current enters a home via the plumbing, touching any part of the plumbing (e.g., faucet) induces a current in the body, known as contact current.

In one Ripley home, the frequency fingerprint (relative intensities of various frequencies) on the plumbing (sink to floor measurement) was similar to the PNEV, indicating that the source of the ground voltage was the wind turbines' collection line (Figure 7). In this home, the sink to floor contact current was calculated to be 400 microamperes (peak to peak based on 200 millivolts and 500 ohms), and this value is 22 times higher than levels associated with cancer according to Kavet, Zaffanella, Daigle, and Ebi (2000).

> "The absolute (as well as modest) level of contact current modeled (18 micro Amps) produces average electric fields in tissue along its path that exceed 1 mV/m. At and above this level, the NIEHS Working Group [1998] accepts that biological effects relevant to cancer have been reported in "numerous well-programmed studies." (p. 547)

Wertheimer, Savitz, and Leeper (1995) documented the link between ground current and cancer in Denver, Colorado. They found that leukemia risk increased by 300% among children exposed to elevated magnetic field from ground current that enters the home through conductive plumbing.

Electrohypersensitivity (EHS)

Why do some people who live near wind turbines become sick while others feel no ill effects?

Exposure to both pressure waves and electromagnetic waves is highly variable—spatially and temporally—as is sensitivity to these vibrations. Not everyone in the same home is going to have the same exposure or the same sensitivity. People who have balance problems, experience motion sickness, or have ear or eye problems are more likely to react to low-frequency sound vibrations. Those who are electrically hypersensitive are more likely to suffer from dirty electricity

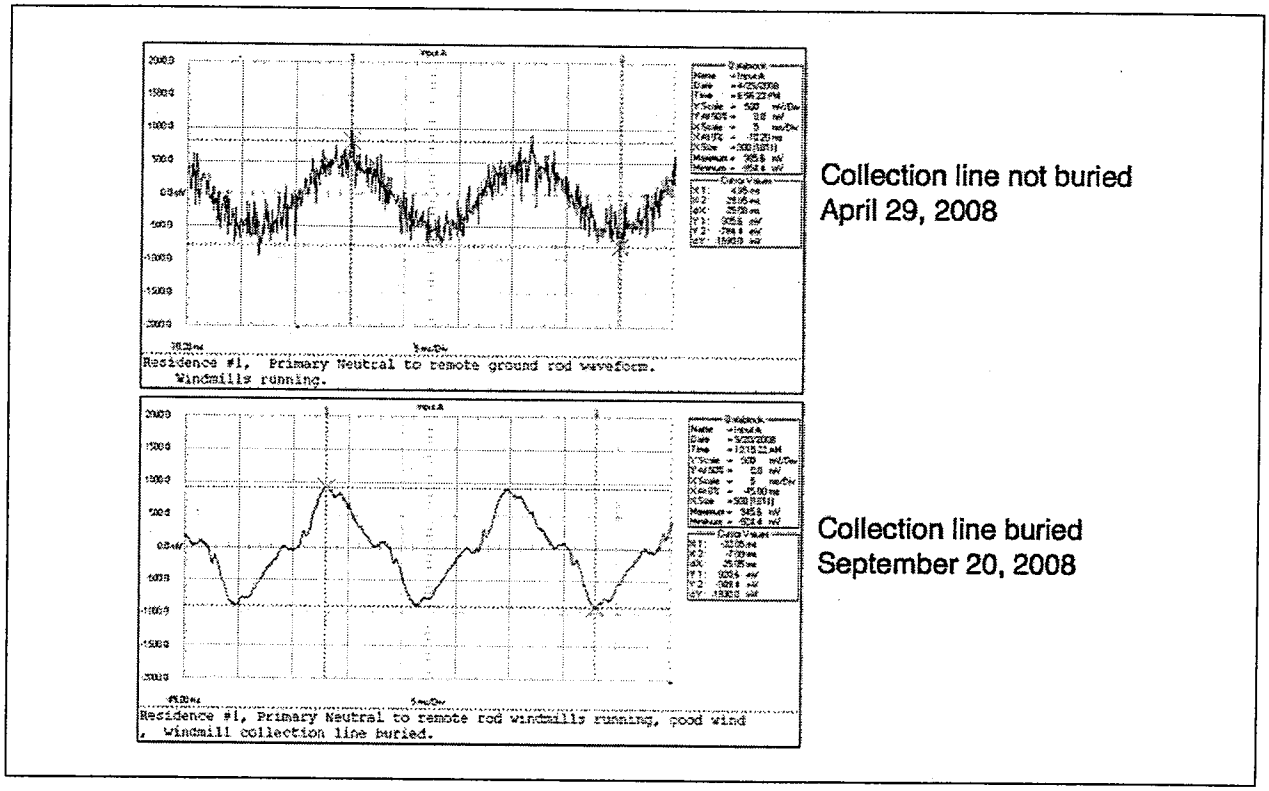

Figure 6. Primary neutral-to-earth voltage (PNEV) at Residence 1 in Ripley, Ontario, when wind turbines were operating
Note. Collection line from wind turbines was buried on September 20, 2008 (bottom graph), but not on April 29, 2008 (top graph).

and contact current. As a result, people living in the same home may have very different sensitivities and may respond differently to these vibrations.

At the Working Group meeting on EMF Hypersensitivity in Prague, the World Health Organization (2004) described electrosensitivity as

> a phenomenon where individuals experience adverse health effects while using or being in the vicinity of devices emanating electric, magnetic, or electromagnetic fields (EMFs).
>
> Whatever its cause, EHS is a real and sometimes a debilitating problem for the affected persons, while the level of EMF in their neighborhood is no greater than is encountered in normal living environments. Their exposures are generally several orders of magnitude under the limits in internationally accepted standards.

Symptoms include cognitive dysfunction (memory, concentration, problem solving); fatigue and poor sleep; body aches and headaches; mood disorders (depression, anxiety, irritability, frustration, temper); nausea; problems with balance, dizziness, and vertigo; facial flushing, skin irritations, and skin rashes; chest pressure, rapid heart rate, and altered blood pressure; ringing in the ear (tinnitus); and nosebleeds. A comprehensive list of the symptoms is provided in Table 1.

In Sweden, EHS is recognized as a functional impairment (not as a disease). Between 230,000 and 290,000 Swedes (about 3% of the Swedish population) may be electrohypersensitive (Johansson, 2006). The number of people complaining of EHS seems to be increasing as is the medication sold to deal with the symptoms of insomnia, pain, fatigue, depression, and anxiety. By 2017, as many as 50% of the population may experience these symptoms (Hallberg & Oberfeld, 2006).

Some individuals may have a predisposition to EHS. Those who have experienced physical trauma to their nervous system (whiplash), electrical trauma in the form of multiple shocks or several severe shocks, and/or chemical exposure to mercury or pesticides are likely to be more electrically sensitive. Children, the elderly, and those with impaired immune systems are also likely to be more electrically sensitive.

It is not possible to determine which factors are contributing to ill health until appropriate monitoring is conducted and steps are taken to reduce exposure to the offending agents. Monitoring of both electromagnetic waves and pressure waves in homes where people report ill health is highly recommended as are the mitigation techniques mentioned below

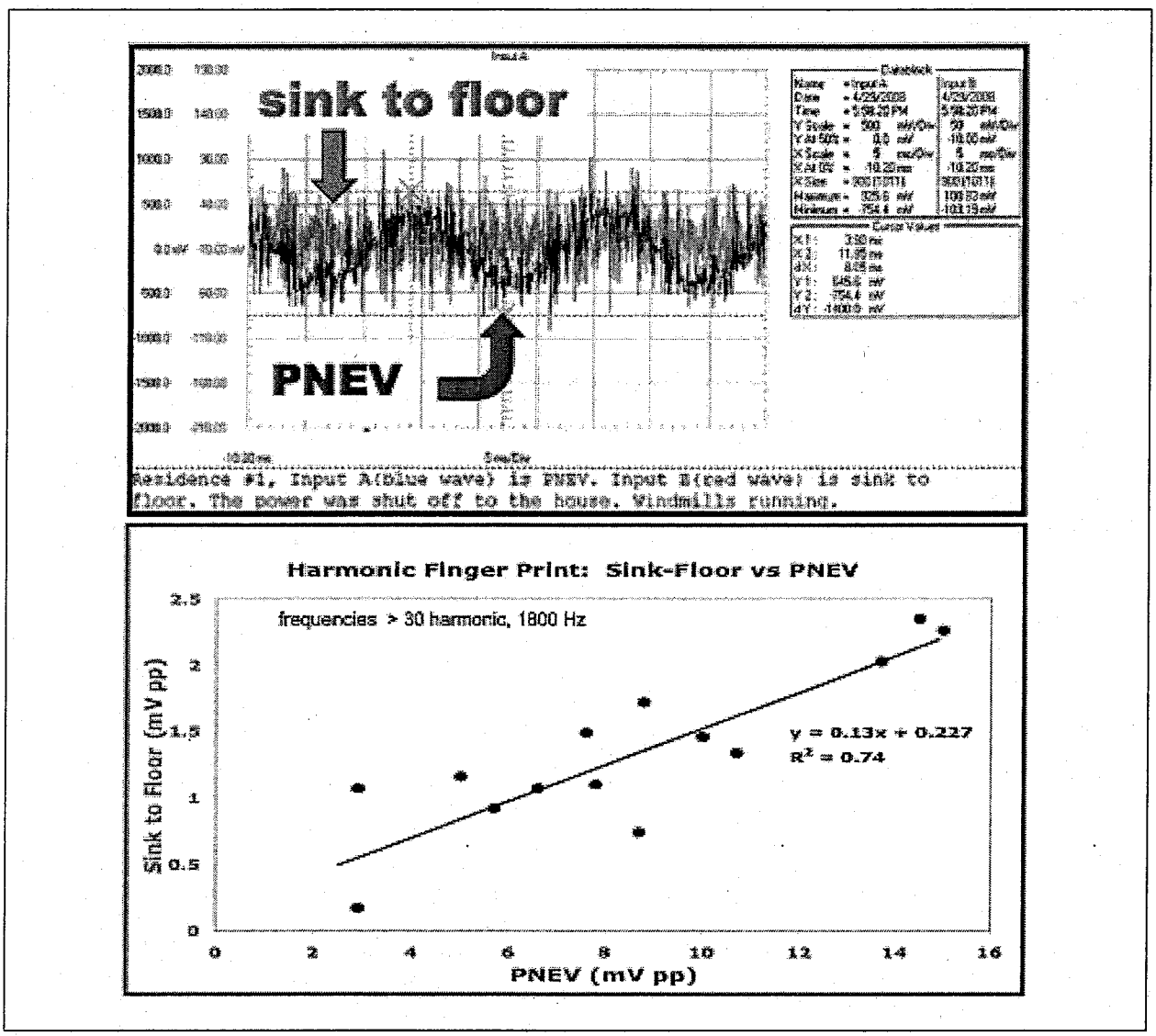

Figure 7. The primary neutral-to-earth voltage (PNEV) and the sink-to-floor voltage for Residence 1 in Ripley, Ontario (top graph), and the harmonic figure print for these voltages (bottom graph).

Recommendations

What can be done to minimize adverse biological and health effects for those living near wind turbines?

One obvious step is to eliminate or reduce exposure to the agent(s) causing the illness.

1. To minimize noise and exposure to infrasound, the following steps should be taken:
   a. Wind turbines should be placed as far away as possible from residential areas. The French National Academy of Medicine (Chouard, 2006) recommends 1.5 km from residential areas.
   b. Buffers can be constructed to disrupt pressure waves and to absorb or deflect sound waves in areas where turbines are closer to homes or where problems have been documented,
2. To improve power quality, the following steps should be taken:
   a. The electricity should be "filtered" at all inverters before it leaves the wind turbine. Ontario Hydro (1998) provides information on power line filters and other ways to improve power quality.
   b. The collector lines from the wind turbines should be attached to utility poles that do not provide power to homes.
   c. Power from the substation supplied by the wind turbines should be filtered before it is distributed to customers.

Table 1. Comprehensive List of Electrohypersensitivity (EHS) Symptoms (Bevington, 2010)

Auditory	Dermatological	Musculoskeletal	Ophthalmologic
earaches, imbalance, lowered auditory threshold, tinnitus	brown 'sun spots', crawling sensations, dry skin, facial flushing, growths & lumps, insect bites & stings, severe acne, skin irritation, skin rashes, skin tingling, swelling of face/neck	aches / numbness pain / prickling sensations in: bones, joints & muscles in: ankles, arms, feet legs, neck, shoulders, wrists, elbows, pelvis, hips, lower back, cramp / tension in: arms, legs, toes, muscle spasms, muscular paralysis, muscular weakness, pain in lips, jaws, teeth with amalgam fillings, restless legs, tremor & shaking	eyelid tremors/'tics', impaired vision, irritating sensation, pain / 'gritty' feeling, pressure behind eyes, shiny eyes, smarting, dry eyes
Cardiovascular altered heart rate, chest pains, cold extremities especially hands & feet, heart arrhythmias, internal bleeding, lowered/raised blood pressure, nosebleeds, shortness of breath, thrombosis effects	**Emotional** anger, anxiety attacks, crying, depression, feeling out of control, irritability, logorrhoea, mood swings,	**Neurological** faintness, dizziness, 'flu-like symptoms, headaches, hyperactivity, nausea, numbness, sleep problems, tiredness	**Other Physiological** abnormal menstruation, brittle nails, hair loss, itchy scalp, metal redistribution, thirst / dryness of lips, tongue, eyes
Cognitive confusion, difficulty in learning new things, lack of concentration, short / long-term memory impairment, spatial disorientation	**Gastrointestinal** altered appetite, digestive problems, flatulence, food intolerances Genito-urinary smelly sweat / urine, urinary urgency, bowel urgency		**Respiratory** asthma, bronchitis, cough /throat irritation, pneumonia, sinusitis **Sensitisation** allergies, chemical sensitivity, light sensitivity, noise sensitivity, smell sensitivity

d. Wind power electrical substations that require power from an external source (electrical distribution network) must ensure that the power quality of this eternal source is not affected as this can result in power quality problems for customers connected to the same external power source.
e. Nearby home owners may need to install power line filters in their homes if levels of dirty electricity remain high.

3. To reduce ground current/voltage, the following steps should be taken:
   a. A proper neutral system (possibly a five-wire system) should be installed to handle the high-frequency return current in overhead lines (Electric Power Research Institute, 1995).
   b. Insulators can be placed between the neutral line and the grounding grid for the wind turbine.
   c. The collection lines from the wind turbine to the substation should be buried if the other techniques to minimize dirty ground current are ineffective.
   d. Local home owners may need to install stray voltage isolators near their transformers until the electric utility can resolve the problem (Hydro One, 2007).

If these steps are taken, improved quality of life and a feeling of wellness may return to some of the people adversely affected by nearby wind turbines.

Conclusions

A subset of the population living near wind turbines is experiencing symptoms of ill health. These symptoms are likely caused by a combination of noise, infrasound, dirty electricity, ground current, and shadow flicker. These frequencies can be highly viable spatially and temporally and are affected by distance; terrain; wind speed and direction; shape, size, and type of dwelling; type of power converters used; state of the electrical distribution line; type and number of grounding systems; and even the type of plumbing in homes. Furthermore, not everyone has the same sensitivity to sound and electromagnetic radiation nor do they have the

same symptoms. The following symptoms seem to be quite common: sleeplessness, fatigue, pain, dizziness, nausea, mood disorders, cognitive difficulties, skin irritations, and tinnitus. To help alleviate symptoms in areas where wind turbines have been erected, remediation is necessary to reduce or eliminate both sound waves and electromagnetic waves. More research is required to help us better understand the relative importance of the various factors contributing to poor health. This type of information will enable a healthy coexistence between wind turbines and the people living nearby.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

References

Bevington, M. (2010). *Electromagnetic-sensitivity and electromagnetic-hypersensitivity: A summary*. London, England: Capability Books.

Bunker, R. J. (Ed.). (1997). *Nonlethal weapons: Terms and references* (INSS Occasional Paper No. 15). Colorado Springs, CO: USAF Institute for National Security Studies. Retrieved from http://www.aquafoam.com/papers/Bunker.pdf

Castelo Branco, N. A. (1999). The clinical stages of vibroacoustic disease. *Aviation, Space, and Environmental Medicine, 70*(3, Pt. 2), A32-A39.

Castelo Branco, N. A., & Alves-Pereira, M. (2004). Vibroacoustic disease. *Noise & Health, 6*(23), 3-20.

Chouard, C.-H. (2006). Le retentissement du fonctionnement des eoliennes sur la sante de l'homme [Repercussions of wind turbine operations on human health]. *Panorama du medecin*. Retrieved from http://ventdubocage.net/documentsoriginaux/sante/eoliennes.pdf

Chief Medical Officer of Health. (2010). *The potential health impact of wind turbines*. Retrieved from http://www.health.gov.on.ca/en/public/publications/ministry_reports/wind_turbine/wind_turbine.pdf

Clapp, A. L. (Ed.). (1997). *NESC handbook: A discussion of the national electrical safety code* (4th ed.). New York, NY: Institute for Electrical and Electronic Engineers.

Electric Power Research Institute. (1995). *Handbook for the assessment and management of magnetic fields caused by distribution lines* (EPRI Report TR-106003). Palo Alto, CA: Author.

Frey, B. J., & Hadden, P. J. (2007). *Noise radiation from wind turbines installed near homes: Effects on health–With an annotated review of the research and related issues*. Retrieved from http://docs.wind-watch.org/wtnoisehealth.pdf

Hallberg, O., & Oberfeld, G. (2006). Letter to the editor: Will we all become electrosensitive? *Electromagnetic Biology and Medicine, 25*, 189-191.

Havas, M. (2006a, November). *Dirty electricity: An invisible pollutant in schools [Feature Article]. Education Forum*. Retrieved from http://www.dirtyelectricity.ca/images/Dirty%20Electricity%20in%20schools.pdf

Havas, M. (2006b). Electromagnetic hypersensitivity: Biological effects of dirty electricity with emphasis on diabetes and multiple sclerosis. *Electromagnetic Biology and Medicine, 25*, 259-268.

Havas, M., Illiatovitch, M., & Proctor, C. (2004, October). *Teacher and student response to the removal of dirty electricity by the Graham/Stetzer filter at Willow Wood school in Toronto, Canada*. Paper presented at the 3rd International Workshop on Biological Effects of EMFs, Kos, Greece.

Havas, M., & Olstad, A. (2008). Power quality affects teacher well-being and student behavior in three Minnesota Schools. *Science of the Total Environment, 402*, 157-162.

Hillman, D., Stetzer, D., Graham, M., Goeke, C. L., Matthson, K. E., VanHorn, H. V., & Wilcox, C. J. (2003, July). *Relationship of electric power quality to milk production of dairy herds*. Paper presented at the Society for Engineering in Agricultural, Food and Biological Systems, Las Vegas, NV.

Hydro One. (2007). *Stray voltage solutions guide for electrical contractors*. Retrieved from http://www.hydroone.com/MyBusiness/MyFarm/Documents/SVSolutionsGuideforElectrical_Contractors.pdf

Johansson, O. (2006). Electrohypersensitivity: State-of-the-art of a functional impairment. *Electromagnetic Biology and Medicine, 25*, 245-258.

Kavet, R., Zaffanella, L. E., Daigle, J. P., & Ebi, K. L. (2000). The possible role of contact current in cancer risk associations with residential magnetic fields. *Bioelectromagnetics, 21*, 538-553.

Keller, J. (2006, November 13). Nova Scotians flee home, blame vibrations from 17 turbines for loss of sleep, headaches. *Toronto Star*. Retrieved from http://www.ventdecolere.org/archives/nuisances/noise%26low_frequency.pdf

Lefcourt, A. M. (Ed.). (1991). *Effects of electrical voltage/current on farm animals: How to detect and remedy problems* (Agriculture Handbook No. 696). Washington, DC: U.S. Department of Agriculture.

Lobos, T., Rezmer, J., Sikorski, T., & Waclawek, Z. (2008). Power distortion issues in wind turbine power systems under transient states. *Turkish Journal of Electrical Engineering & Computer Sciences, 16*, 229-238.

Milham, S., & Morgan, L. L. (2008). A new electromagnetic exposure metric: High frequency voltage transients associated with increased cancer incidence in teachers in a California school. *American Journal of Industrial Medicine, 51*, 579-586.

Ontario Federation of Agriculture. (2007). *Fact sheet: Identifying tingle voltage*. Retrieved from http://www.wlwag.com/uploads/5/2/9/6/5296281/tinglevoltage.pdf

Ontario Hydro. (1998). *Power quality: Reference guide* (6th ed.). Toronto, Ontario, Canada: Author.

Phillips, C. V. (2010, July 3). *An analysis of the epidemiology and related evidence on the health effects of wind turbines on local residents*. Retrieved from http://www.wind-watch.org/documents/analysis-of-the-epidemiology-and-related-evidence-on-the-health-effects-of-wind-turbines-on-local-residents/

Pierpont, N. (2009). *Wind turbine syndrome: A report on a natural experiment*. Santa Fe, NM: K-Selected Books.

Risser, P., Burke, I., Clark, C., English, M., Gauthreaux, S., Jr., Goodman, S., & Whitmore, R. (2007). *Environmental impacts of wind-energy projects*. Washington, DC: National Academies Press.

Rogers, A. L., Manwell, J. F., & Wright, S. (2006). *Wind turbine acoustic noise* (White paper). Amherst: University of Massachusetts.

Wertheimer, N., Savitz, D. A., & Leeper, E. (1995). Childhood cancer in relation to indicators of magnetic fields from ground current sources. *Bioelectromagnetics*, *16*, 86-96.

World Health Organization. (2004, October). WHO International seminar and working group meeting on EMF hypersensitivity, Prague, Czech Republic.

Bios

Magda Havas, PhD, is an associate professor at Trent University where she teaches and conducts research on the biological and health effects of electromagnetic and chemical pollutants. She received her BSc and PhD at the University of Toronto and did postdoctoral research at Cornell University on acid rain and aluminum toxicity.

David Colling has applied his electrical engineering studies at Ryerson Polytechnical Institute and his specialized training in electrical pollution to conduct electrical pollution testing for Bio-Ag on farms, homes, and office buildings. Some of the homes tested are located in the environs of industrial wind turbines.

EXHIBIT
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Attention Deficit Hyperactivity Disorder and Dirty Electricity

To the Editor:

In February 2010, while studying a cancer cluster in teachers at a California elementary school, a fourth-grade teacher complained that her students were hyperactive and unteachable. The classroom levels of high-frequency voltage transients (dirty electricity) in the radio frequencies (RF) between 4 and 100 kHz measured in the outlets of her classroom with a Graham/Stetzer Microsurge meter were very high. Dirty electricity is a term coined by the electrical utilities to describe electrical pollution contaminating the 60 Hz electricity on the electrical grid. A cell phone tower on campus a few feet from this classroom and unshielded fluorescent lights both contributed to the electrical pollution in this room. Cell tower transmitters, like most modern electrical equipment, operate on direct current. The electrical current brought to the tower is alternating current that needs to be changed to direct current. This is done by a switching power supply. These devices interrupt the alternating current and are the likely major source of the dirty electricity in the classroom.

On a Friday afternoon after school, I filtered the 5 outlets in this room with Graham/Stetzer plug-in capacitive filters, reducing the measured dirty electricity in the room wiring from more than 5000 Graham/Stetzer units to less than 50 units. With no change in either the lighting or the cell tower radiation, the teacher reported an immediate dramatic improvement in the behavior of her students in the following week. They were calmer, paid more attention, and were teachable all week except for Wednesday when they spent part of the day in the library.

In his 1973 book, Health and Light,[1] John N. Ott described a 1973 study of 4 first-grade classrooms in a windowless Sarasota, Florida school. Two of the rooms had standard white fluorescent lighting and the other two had full-spectrum fluorescent lighting with a grounded aluminum wire screen to remove the RF radiation produced by fluorescent bulbs and ballasts. Concealed time-lapse cameras recorded student behavior in classrooms for 4 months.[2] In the unshielded rooms, the first graders developed, "... nervous fatigue, irritability, lapses of attention, and hyperactive behavior." "... students could be observed fidgeting to an extreme degree, leaping from their seats, flailing their arms, and paying little attention to their teachers." In the RF-shielded rooms, "Behavior was entirely different. Youngsters were calmer and far more interested in their work."

The Old Order Amish live without electricity. A pediatric group practice in Jasper, Indiana, which cares for more than 800 Amish families has not diagnosed a single child with attention deficit hyperactivity disorder (ADHD).[3] Dozens of cases of childhood ADHD have been "cured" with no further need for drugs by simply changing their electrical environments (Stetzer D, personal communication [www.Stetzerelectric.com]). AQ:A

Before children are treated with drugs for ADHD, the dirty electricity levels in their homes and school environments should first be examined and reduced if needed.

I present the epidemiologic evidence linking dirty electricity to the other diseases of civilization in a recent book.[4,5] AQ:B

Disclosure: The authors declare no conflict of interest. AQ:C

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REFERENCES

1. Ott JN. Afterword. In: *Health and Light.* Columbus, OH; Atlanta, GA: Ariel Press; 1973:200–205. AQ:E
2. Ott JN. *Exploring the Spectrum: The Effects of Natural and Artificial Light on Living Organisms* [DVD]; 2008.
3. Ruff ME. Attention deficit disorder and stimulant use: an epidemic of modernity. *Clin Pediatr (Phila).* 2005;44:557–563.
4. Milham S. *Dirty Electricity.* Bloomington, IN: iUniverse; 2010. AQ:F
5. www.sammilham.com.

IN PRESS: JOURNAL OF DEVELOPMENTAL AND BEHAVIORAL PEDIATRICS

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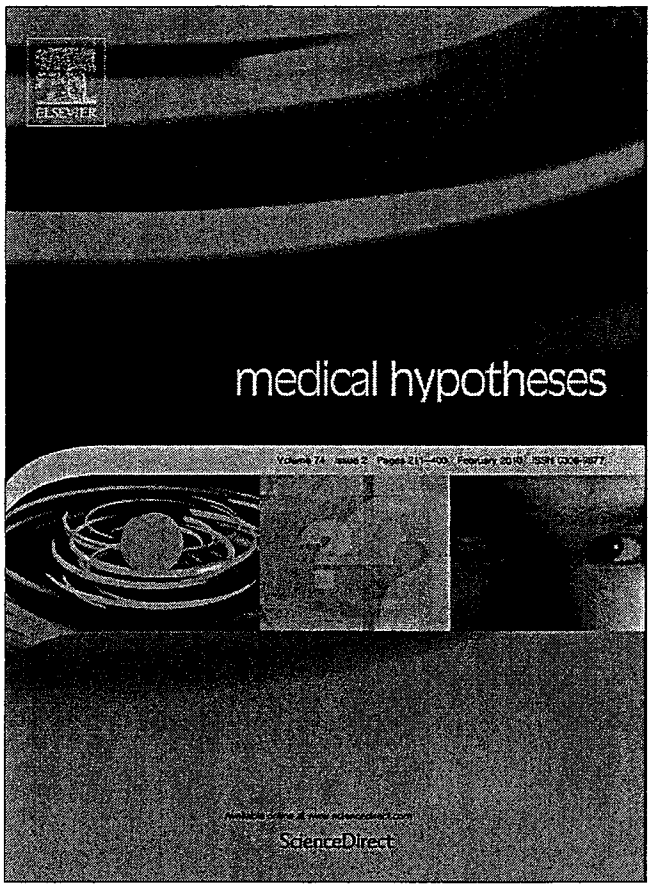

Medical Hypotheses 74 (2010) 337–345

Contents lists available at ScienceDirect

Medical Hypotheses

journal homepage: www.elsevier.com/locate/mehy

Historical evidence that electrification caused the 20th century epidemic of "diseases of civilization" ☆

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ARTICLE INFO

Article history:
Received 14 August 2009
Accepted 18 August 2009

SUMMARY

The slow spread of residential electrification in the US in the first half of the 20th century from urban to rural areas resulted by 1940 in two large populations; urban populations, with nearly complete electrification and rural populations exposed to varying levels of electrification depending on the progress of electrification in their state. It took until 1956 for US farms to reach urban and rural non-farm electrification levels. Both populations were covered by the US vital registration system. US vital statistics tabulations and census records for 1920–1960, and historical US vital statistics documents were examined. Residential electrification data was available in the US census of population for 1930, 1940 and 1950. Crude urban and rural death rates were calculated, and death rates by state were correlated with electrification rates by state for urban and rural areas for 1940 white resident deaths. Urban death rates were much higher than rural rates for cardiovascular diseases, malignant diseases, diabetes and suicide in 1940. Rural death rates were significantly correlated with level of residential electric service by state for most causes examined. I hypothesize that the 20th century epidemic of the so called diseases of civilization including cardiovascular disease, cancer and diabetes and suicide was caused by electrification not by lifestyle. A large proportion of these diseases may therefore be preventable.

Background

In 2001, Ossiander and I [1] presented evidence that the childhood leukemia mortality peak at ages 2–4 which emerged in the US in the 1930s was correlated with the spread of residential electrification in the first half of the 20th century in the US. While doing the childhood leukemia study, I noticed a strong positive correlation between level of residential electrification and the death rate by state due to some adult cancers in 1930 and 1940 vital statistics. At the time, a plausible electrical exposure agent and a method for its delivery within residences was lacking. However, in 2008 I coauthored a study of a cancer cluster in school teachers at a California middle school [2] which indicated that high frequency voltage transients (also known as dirty electricity), were a potent universal carcinogen with cancer risks over 10.0 and significant dose–response for a number of cancers. They have frequencies between 2 and 100 kHz. These findings are supported by a large cancer incidence study in 200,000 California school employees which showed that the same cancers and others were in excess in California teachers statewide [3]. Power frequency magnetic fields (60 Hz) measured at the school were low and not related to cancer incidence, while classroom levels of high frequency voltage transients measured at the electrical outlets in the classrooms accurately predicted a teacher's cancer risk. These fields are potentially present in all wires carrying electricity and are an important component of ground currents returning to substations especially in rural areas. This helped explain the fact that professional and office workers, like the school teachers, have high cancer incidence rates. It also explained why indoor workers had higher malignant melanoma rates, why melanoma occurred on part of the body which never are exposed to sunlight, and why melanoma rates are increasing while the amount of sunshine reaching earth is stable or decreasing due to air pollution. A number of very different types of cancer had elevated risk in the La Quinta school study, in the California school employees study, and in other teacher studies. The only other carcinogenic agent which acts like this is ionizing radiation.

Among the many devices which generate the dirty electricity are compact fluorescent light bulbs, halogen lamps, wireless routers, dimmer switches, and other devices using switching power supplies. Any device which interrupts current flow generates dirty electricity. Arcing, sparking and bad electrical connections can also generate the high frequency voltage transients. Except for the dimmer switches, most of these devices did not exist in the first half of the 20th century. However, early electric generating equipment

☆ Supported by a small grant from Children with Leukemia.

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doi:10.1016/j.mehy.2009.08.032

and electric motors used commutators, carbon brushes, and split rings, which would inject high frequency voltage transients into the 60 Hz electricity being generated and distributed.

With a newly recognized electrical exposure agent and a means for its delivery, I decided to examine whether residential electrification in the US in the first half of the last century was related to any other causes of death. Most cancers showed increasing mortality in this period, and many are still increasing in incidence in the developed world.

Thomas Edison began electrifying New York City in 1880, but by 1920, only 34.7% of all US dwelling units and 1.6% of farms had electric service (Table 1). By 1940, 78% of all dwelling units and 32% of farms had electric service [4]. This means that in 1940 about three quarters of the US population lived in electrified residences and one quarter did not. By 1940, the US vital registration system was essentially complete, in that all the 48 contiguous United States were included. Most large US cities were electrified by the turn of the century, and by 1940, over 90% of all the residences in the northeastern states and California were electrified. In 1940 almost all urban residents in the US were exposed to electromagnetic fields (EMFs) in their residences and at work, while rural residents were exposed to varying levels of EMFs, depending on the progress of rural electrification in their states. In 1940, only 28% of residences in Mississippi were electrified, and five other southern states had less than 50% of residences electrified (Table 2). Eleven states, mostly in the northeast had residential electrification rates above 90%. In the highly electrified northeastern states and in California, urban and rural residents could have similar levels of EMF exposure, while in states with low levels of residential electrification, there were potentially great differences in EMF exposure between urban and rural residents. It took the first half of the 20th century for these differences to disappear. I examined US mortality records by urban and rural residence by percent of residences with electric service by state.

Hypothesis

The diseases of civilization or lifestyle diseases include cardiovascular disease, cancer and diabetes and are thought to be caused by changes in diet, exercise habits, and lifestyle which occur as countries industrialize. I think the critical variable which causes the radical changes in mortality accompanying industrialization is electrification. Beginning in 1979, with the work of Wertheimer and Leeper [5], there has been increasing evidence that some facet of electromagnetic field exposure is associated epidemiologically with an increased incidence of leukemia, certain other cancers and non-cancers like Alzheimer's disease, amyotrophic lateral sclerosis, and suicide. With the exception of a small part of the electromagnetic spectrum from infra red through visible light, ultraviolet light and cosmic rays, the rest of the spectrum is man-made and foreign to human evolutionary experience. I suggest that from the time that Thomas Edison started his direct current electrical distribution system in the 1880s in New York City until now, when most of the world is electrified, the electricity carried high frequency voltage transients which caused and continue to cause what are considered to be the normal diseases of civilization. Even today, many of these diseases are absent or have very low incidence in places without electricity.

Table 1
Growth of residential electric service US 1920–1956 percent of dwelling units with electric service.

Year	All		Urban and rural non-farm
	Dwellings	Farm	
1920	34.7	1.6	47.4
1925	53.2	3.9	69.4
1930	68.2	10.4	84.8
1935	68.0	12.6	83.9
1940	78.7	32.6	90.8
1945	85.0	48.0	93.0
1950	94.0	77.7	96.6
1956	98.8	95.9	99.2

Table 2
Percent of residences with electric lighting 1930 and 1940 by state.

Code	State	1930	1940
AL	Alabama	33.9	43.3
AZ	Arizona	68.8	70.5
AR	Arkansas	25.3	32.8
CA	California	93.9	96
CO	Colorado	69.6	77.6
CT	Connecticut	95.3	96.5
DE	Delaware	78.4	81.8
FL	Florida	60.9	66.5
GA	Georgia	35.5	46.6
ID	Idaho	64.5	79.1
IL	Illinois	86.1	89.9
IN	Indiana	74.8	84
IA	Iowa	65.6	76.7
KS	Kansas	62	71.5
KY	Kentucky	44.2	54.2
LA	Louisiana	42.2	48.9
ME	Maine	76.1	80.4
MD	Maryland	81.8	85.9
MA	Massachusetts	97.1	97.6
MI	Michigan	84.8	92.1
MN	Minnesota	65.9	75.8
MS	Mississippi	19.4	28.3
MO	Missouri	65.5	70.6
MT	Montana	58.2	70.7
NE	Nebraska	61	70.5
NV	Nevada	76.2	80.8
NH	New Hampshire	84.9	87
NJ	New Jersey	95.8	96.6
NM	New Mexico	39.8	49.2
NY	New York	94.5	96.4
NC	North Carolina	40.8	54.4
ND	North Dakota	41.6	53.8
OH	Ohio	85.2	90.6
OK	Oklahoma	45.3	55.1
OR	Oregon	79.5	85.8
PA	Pennsylvania	89.5	92.3
RI	Rhode Island	97.3	97.7
SC	South Carolina	34.3	46.2
SD	South Dakota	44.4	56.6
TN	Tennessee	42	50.9
TX	Texas	*	59
UT	Utah	88.4	93.9
T	Vermont	71.9	80.2
VA	Virginia	50.5	60.6
WA	Washington	86.3	90.9
WV	West Virginia	63.4	69.1
WI	Wisconsin	74.5	83.9
WY	Wyoming	60	70.9

*No data.

Evaluation of the hypothesis

To evaluate the hypothesis, I examined mortality in US populations with and without residential electrification. Vital statistics tabulations of deaths [6], US census records for 1920–1970 [7], and historical US documents [8,9] were examined in hard copy or downloaded from the internet. The same state residential electrification data used in the childhood leukemia study [1] was used in this study. Crude death rates were calculated by dividing number of deaths by population at risk, and death rates by state were then correlated with electrification rates by state using downloaded software [10]. Time trends of death rates for selected causes

of death by state were examined. Most rates were calculated by state for urban and rural residence for whites only in 1940 deaths, since complete racial data was available by urban/rural residence by state for only 13 of 48 states. Data was available for 48 states in the 1940 mortality tabulations. District of Columbia was excluded because it was primarily an urban population. Excel graphing software [11] and "Create a Graph" [12] software was used.

I had hoped to further test this hypothesis by studying mortality in individual US farms with and without electrification, when the 1930 US census 70 year quarantine expired in 2000. Unfortunately, the 1930 US farm census schedules had been destroyed.

Findings

Rural residential electrification did not reach urban levels until 1956 (Table 1). Table 2 shows the level of residential electrification for each state for 1930 and 1940. In 1930 and 1940 only 9.5% and 13%, respectively, of all generated electricity was used in residences. Most electricity was used in commercial and industrial applications.

Figs. 1–4 were copied and scanned from "Vital statistics rates in the United States 1940–1960", by Robert Grove Ph.D. and Alice M. Henzel. This volume was published in 1968. Fig. 1 shows a gradual decline in the all causes death rate from 1900 to 1960 except for a spike caused by the 1918 influenza pandemic. Death rates due to tuberculosis, typhoid fever, diphtheria, dysentery, influenza and pneumonia and measles all fell sharply in this period, and account for most of the decline in the all causes death rate. Figs. 2–4 show that in the same time period when the all causes death rate was declining, all malignant neoplasms (Fig. 2), cardiovascular diseases (Fig. 3), and diabetes (Fig. 4) all had gradually increasing death rates. In 1900, heart disease and cancer were 4th and 8th in a list of 10 leading causes of death. By 1940 heart disease had risen to first and cancer to second place, and have maintained that position ever since. Table 3 shows that for all major causes of death examined, except motor vehicle accidents, there was a sizable urban excess in 1940 deaths. The authors of the extensive 69 page introduction to the 1930 mortality statistics volume noted that the cancer rates for cities were 58.2% higher than those for rural areas. They speculated that some of this excess might have been due to rural residents dying in urban hospitals. In 1940, deaths by place of residence and occurrence are presented in separate volumes. In 1940 only 2.1% of all deaths occurred to residents of one state dying in another state. Most non-resident deaths were residents of other areas of the same state. Table 4 presents correlation coefficients for the relationship between death rates by urban rural areas of each state and the percent of residences in each state with

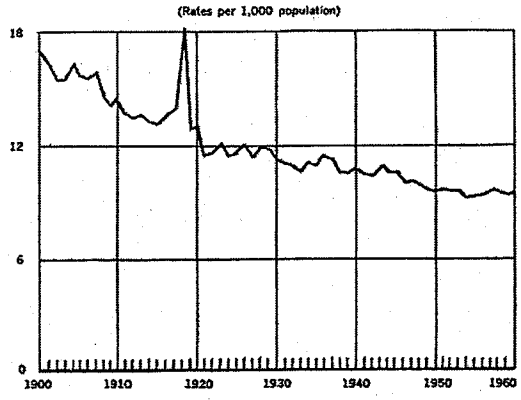

Fig. 1. Death rates: death registration states, 1900–32, and United States, 1933–60.

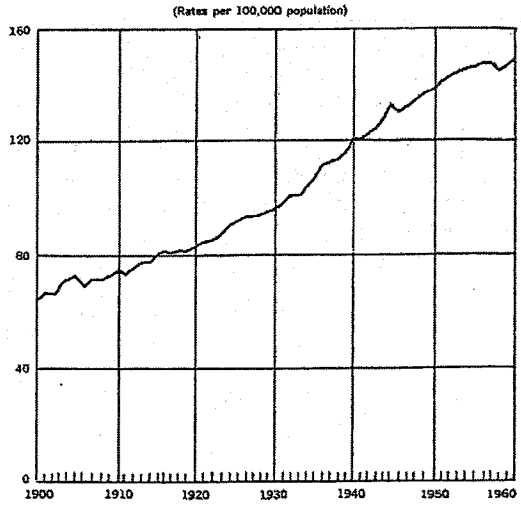

Fig. 2. Death rates for malignant neoplasms: death registration states, 1900–32, and United States, 1933–60.

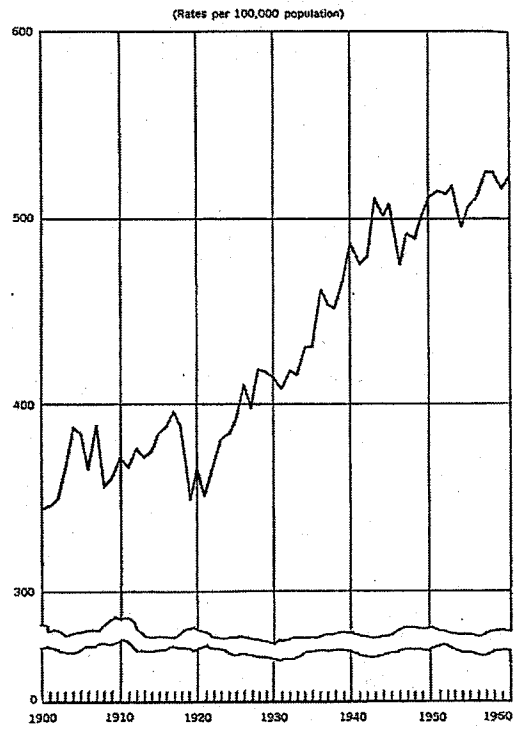

Fig. 3. Death rates for major cardiovascular renal diseases: death registration states, 1900–32, and United States, 1933–60.

electric service. In 1940 urban and rural residence information was not available for individual cancers as it was in 1930, but death rates for each cancer were available by state. They were used to calculate correlations between electric service by state and respiratory cancer, breast cancer and leukemia mortality.

All causes of death

There was no correlation between residential electrification and total death rate for urban areas, but there was a significant

correlation for rural areas ($r = 0.659$, $p = <0.0001$). Fig. 5 shows the 1940 resident white death rates for urban and rural areas of states having greater than 96% of residences electrified and states having less than 50% of residences electrified. In the highly electrified states, urban and rural death rates were similar, but in low electrification states, the urban death rates were systematically higher than the rural death rates. The urban death rates were similar in both high and low electrification states.

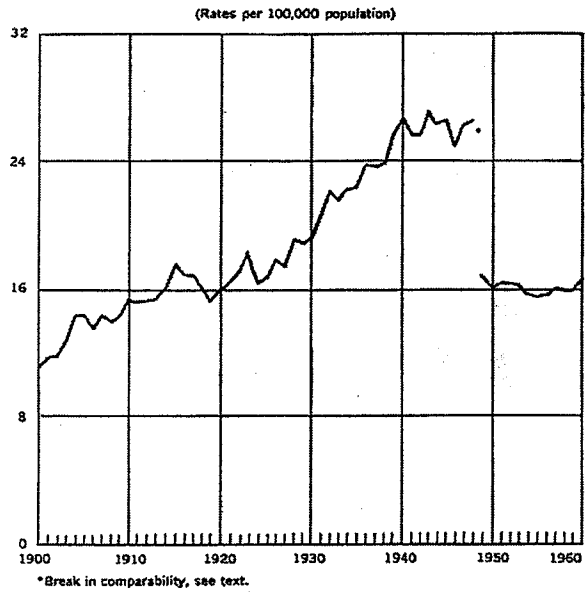

Fig. 4. Death rates for diabetes mellitus: death registration states, 1900–32, and United States, 1933–60.

All malignant neoplasms

In 1940, the urban total cancer rate was 49.2% higher than the rural rate. Both urban and rural cancer deaths rates were significantly correlated with residential electrification. Fig. 6 shows the 1940 resident white total cancer rates for urban and rural areas of states having greater than 96% of residences electrified and states having less than 50% of residences electrified. Four of the five high electrification states had similar urban and rural total cancer rates, while all the low electrification states had urban rates about twice as high as rural rates. Both urban and rural total cancer rates were lower in low electrification states than in high electrification states. Fig. 7 shows the time trend of the total cancer rate between 1920 and 1960 for Massachusetts (1940 electrification rate = 97.6%) and Louisiana (1940 electrification rate = 48.9%). The Massachusetts cancer rate was about twice that of Louisiana between 1920 and 1945. The Massachusetts rate leveled off in 1945, but the Louisiana rate increased steadily between 1920 and 1960. A declining urban–rural gradient for cancer is still evident in 1980–1990 US cancer incidence data [13]. Swedish investigators [14] have reported increasing cancer mortality and incidence time trend breaks in the latter half of the 20th century.

Table 3
1940 US white resident crude death rates per 100,000 by urban/rural residence.

Cause of death	ICD No.[a]	Urban rate	Rural rate	(%) Urban excess
All	1-200	1124.1	929.5	20.9
All cancers	47-55	145.8	97.7	49.2
Coronary disease	94	92.4	69.1	33.7
Other diseases of heart	90b,91,92a,d,e 93a,b,d,e 95a,c	217.0	162.8	33.3
Diabetes	61	33.2	20.0	66.0
Suicide	163-164	17.1	13.2	29.5
Motor vehicle accidents	170	26.6	26.3	1.1

[a] 1938 Revision International classification of disease.

Table 4
Correlation coefficients (r) 1940 crude US death rates by state by electrification for white resident deaths.

Cause	ICD No.[A]	Residence	r	r^2	p One tailed	Slope	Y intercept
All causes	1-200	Urban	0.083	0.007	0.285	0.007	11.114
		Rural	0.659	0.434	<0.0001	0.070	4.185
All cancers	45-55	Urban	0.667	0.445	<0.0001	0.883	75.970
		Rural	0.758	0.575	<0.0001	1.502	−10.040
Respiratory cancer[B]	47	State	0.611	0.374	<0.0001	0.071	1.020
Breast cancer female	50	State	0.794	0.630	<0.0001	0.170	−1.506
Diabetes	61	Urban	0.666	0.444	<0.0001	0.278	8.168
		Rural	0.693	0.480	<0.0001	0.366	−6.184
Leukemia[B]	72a	State	0.375	0.140	0.0042	0.021	1.980
Coronary artery	94	Urban	0.400	0.160	0.0024	0.494	61.570
Disease		Rural	0.781	0.610	<0.0001	1.252	25.319
Other diseases of the heart	90b, 91	Urban	0.449	0.202	0.0006	1.236	100.35
	92a,d,e	Rural	0.799	0.639	0.0001	2.887	−48.989
	93a,b,d,e						
	95a,c						
Suicide	163-4	Urban	0.077	0.006	0.2993	0.028	16.235
		Rural	0.729	0.532	<0.0001	0.181	0.299
Motor vehicle	170	Urban	−0.254	0.064	0.0408	−0.171	44.572
Accidents		Rural	0.451	0.203	0.0006	0.195	12.230

[A] International classification of diseases 1938 revision.
[B] Age adjusted death rate both sexes.

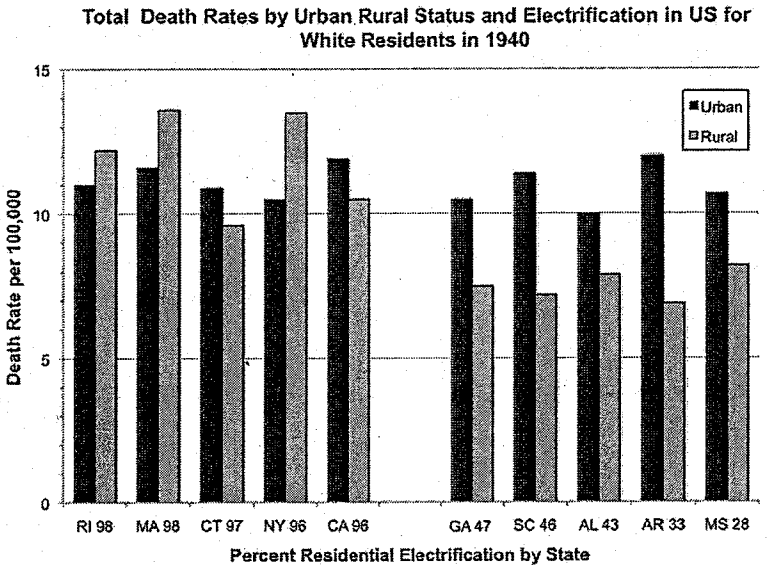

Fig. 5. All causes death rates by urban rural status and electrification in the US for white residents in 1940.

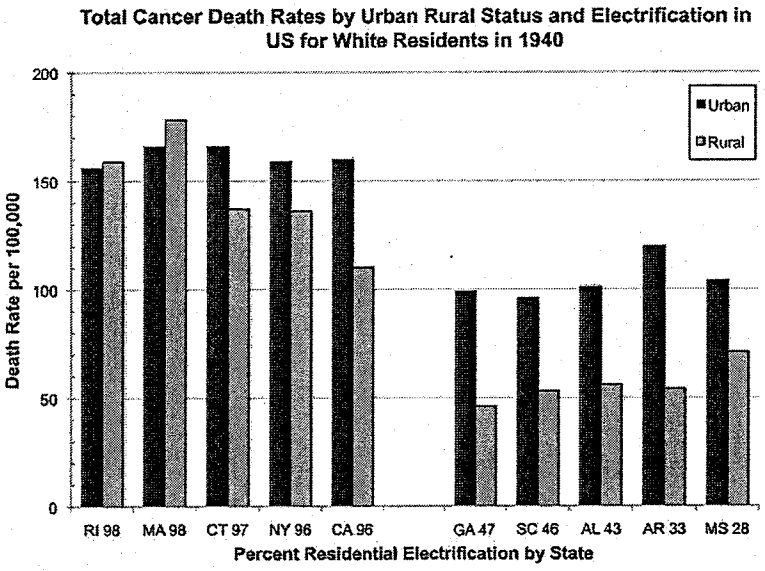

Fig. 6. Total cancer death rates by urban rural status and electrification in the US for white residents in 1940.

Respiratory cancer

No urban rural information was available for respiratory cancer, but the correlation between residential electrification and state death rates was $r = 0.611$; $p = <0.0001$. This cancer is etiologically strongly related to cigarette smoking, so the correlation with electrification is surprising. A large electrical utility worker cohort study found a high respiratory cancer incidence related to high frequency EMF transient exposure independent of cigarette smoking with a significant dose–response relationship [15].

Breast cancer

Although urban/rural information was not available for breast cancer, the 1940 state breast cancer death rates have a correlation of $r = 0.794$; $p = <0.0001$ with residential electrification. Fig. 8 shows the typical time trend of breast cancer death rates for a state with a high level of electrification (96%) and one with a low level of electrification (<50) in 1940. The California breast cancer death rate increased from 1920 to 1940, and then gradually decreased until 1960. The Tennessee breast cancer death rate is less than half of the California rate in 1920 and continues a steady increase until 1960.

Diabetes

This cause has a 66% urban excess. In spite of this, the correlation coefficients for urban and rural areas are similar at $r = 0.66$; $p = <0.0001$. There is some animal and human evidence that EMFs can effect insulin production and blood glucose levels [16]. Fig. 9

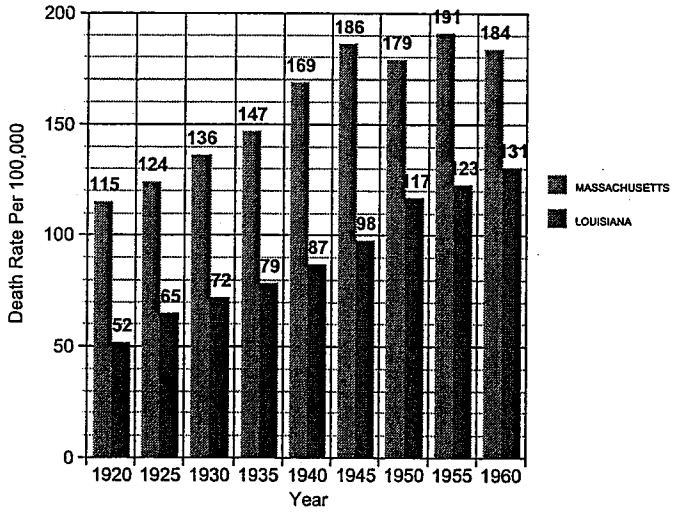

Fig. 7. US white resident total cancer death rates for Massachusetts (97.6% elect.) and Louisiana (48.9% elect.) by year.

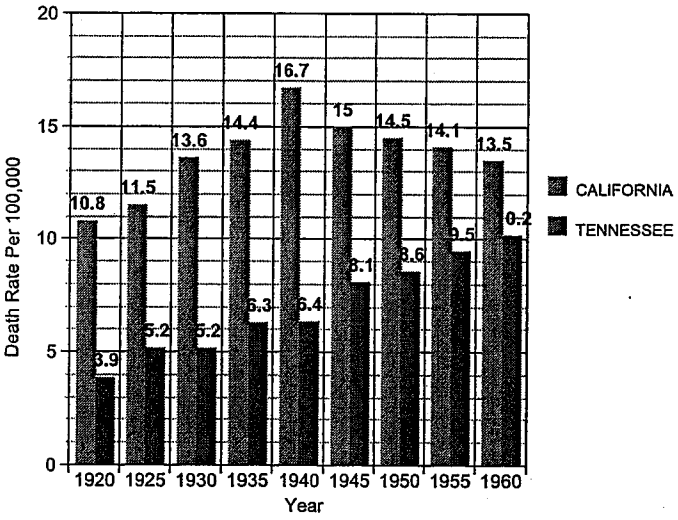

Fig. 8. US white resident breast cancer death rates for California (96% elect.) and Tennessee (50% elect.) by year.

shows that in states with low levels of electrification in 1940, the urban diabetes death rates are consistently higher than the rural rates, but are always lower than the urban and rural rates in the high electrification states.

Leukemia

Since the childhood leukemia age peak is strongly associated with residential electrification, it was interesting that the all leukemia death rate correlation was $r = 0.375$; $p = 0.0042$. Most of these deaths are in adults and are of different types of leukemia. A study of amateur radio operators showed a selective excess only of acute myelogenous leukemia [17].

Coronary artery disease and other heart disease

These two cause groups had the same percentage urban excess (33%), and very similar patterns of urban and rural correlation coefficients with residential electrification. The urban correlations were about $r = 0.4$ and rural deaths had correlations of 0.78 and 0.79, respectively. Fig. 10 shows the 1940 resident white coronary artery disease death rates for urban and rural areas of states having greater than 96% of residences electrified and states having less than 50% of residences electrified. Four of the five high electrification states had similar urban and rural total cancer rates, while all the low electrification states had urban rates about twice as high as rural rates. Urban and rural coronary artery death rates were lower in low electrification states than in high electrification states.

Suicide

The urban suicide death rate is about 30% higher than the rural rate. The urban suicide rate is not correlated with residential electrification ($r = 0.077$; $p = 0.299$), but the rural death rate is correlated with 1940 state residential electrification levels ($r = 0.729$; $p = <0.0001$). Fig. 11 shows the 1940 resident white suicide for

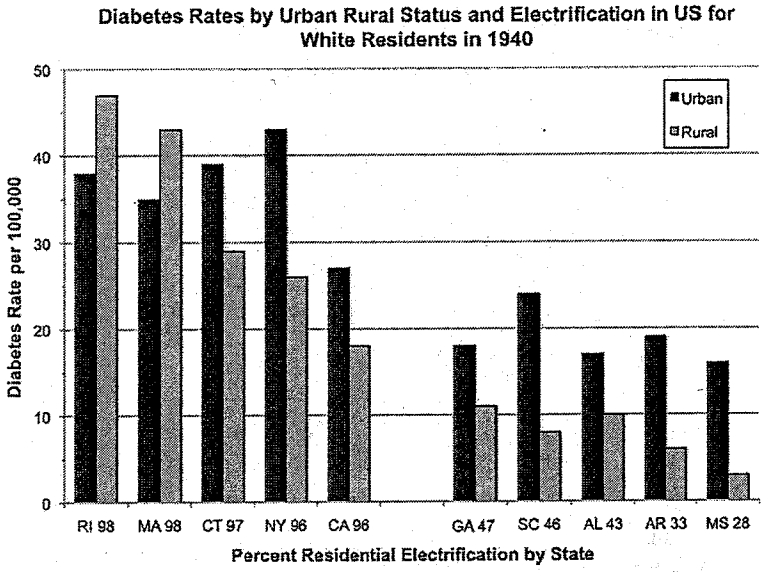

Fig. 9. Total diabetes rates by urban rural status and electrification in the US for white residents in 1940.

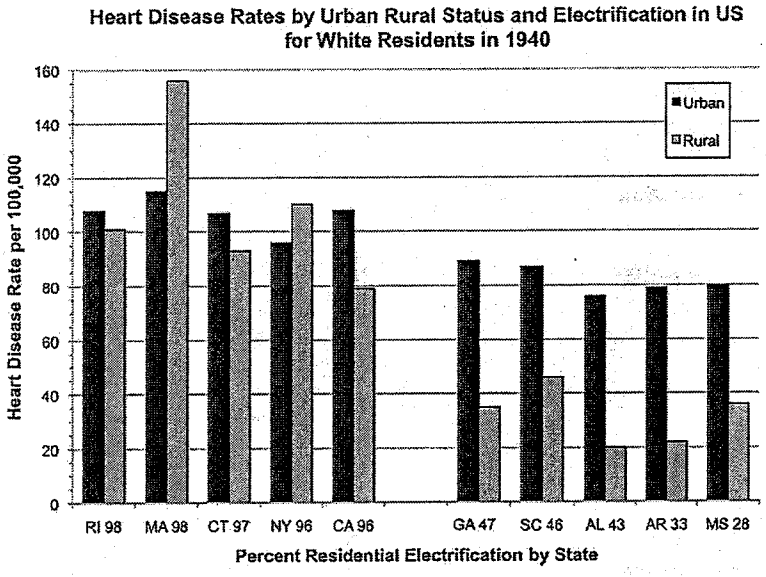

Fig. 10. Total heart disease rates by urban rural status and electrification in the US for white residents in 1940.

urban and rural areas of states having greater than 96% of residences electrified and states having less than 50% of residences electrified. In four of five high electrification states, rural suicide rates are higher than the urban rates. In all of the low electrification states, the urban rate is higher. The rural rates in the high electrification states are higher than the rural rates in the low electrification states. Fig. 12 shows X Y scatter plots for urban and rural suicide by electrification for 48 states. Suicide has been associated with both residential [18] and occupational [19] EMF exposure. Suicide is probably the visible peak of the clinical depression iceberg.

Motor vehicle accidents

Although the mortality rates are similar in urban and rural areas, the correlations with residential electrification levels are different. There is a slight negative correlation ($r = -0.254$) in urban areas and a positive correlation ($r = 0.451$) in rural areas. Since motor vehicle fatality is related to access to a vehicle and to speed. It may be that in the larger cities it was difficult to go fast enough for a fatal accident, and in rural areas especially on farms, a farmer who could afford electrification could also afford a car.

Discussion

When Edison and Tesla opened the Pandora's box of electrification in the 1880s, the US vital registration system was primitive at best, and infectious disease death rates were falling rapidly. City residents had higher mortality rates and shorter life expectancy than rural residents [8]. Rural white males in 1900 had an expectation of life at birth of over 10 years longer than urban residents.

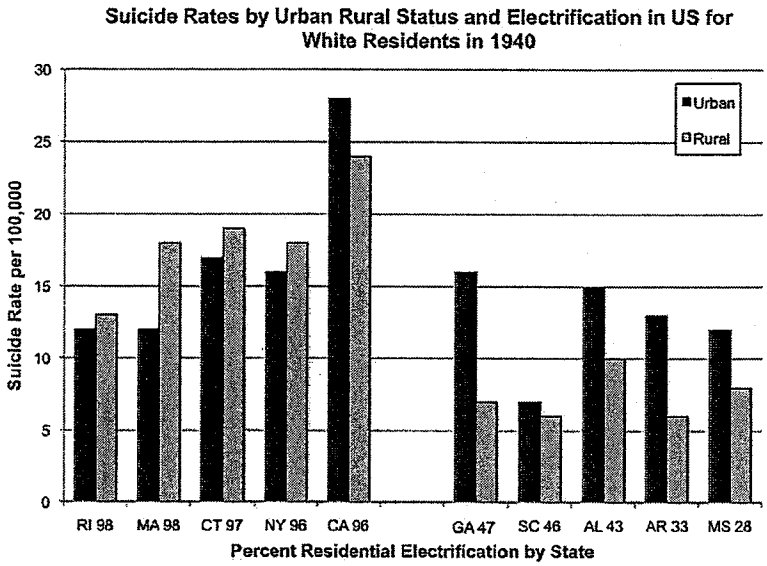

Fig. 11. Total suicide death rates by urban rural status and electrification in the US for white residents in 1940.

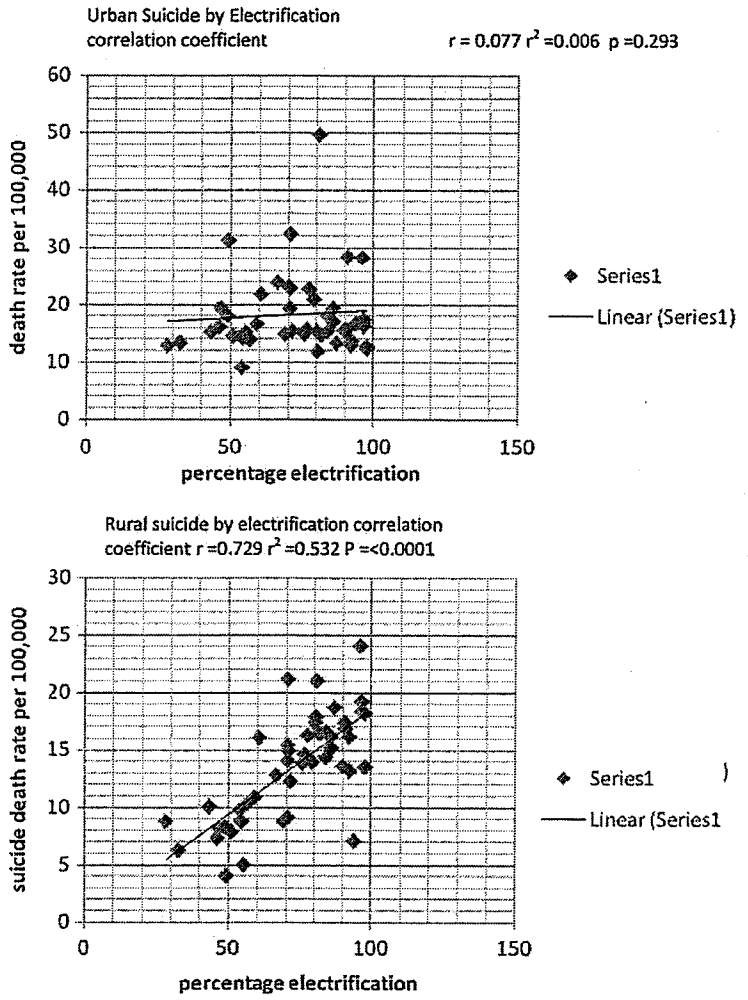

Fig. 12. 1940 US white resident urban rural suicide death rates by state and electrification.

Although the authors of the 1930 US vital statistics report noted a 58.2% cancer mortality excess in urban areas, it raised no red flags. The census bureau residential electrification data was obviously not linked to the mortality data. Epidemiologists in that era were still concerned with the communicable diseases.

Court Brown and Doll reported [20] the appearance of the childhood leukemia age peak in 1961, forty years after the US vital statistics mortality data on which it was based was available. I reported a cluster of childhood leukemia [21] a decade after it occurred, only because I looked for it. Real time or periodic analysis of national or regional vital statistics data is still only rarely done in the US.

The real surprise in this data set is that cardiovascular disease, diabetes and suicide, as well as cancer seem to be strongly related to level of residential electrification. A community-based epidemiologic study of urban rural differences in coronary heart disease and its risk factors was carried out in the mid 1980s in New Delhi, India and in a rural area 50 km away [22]. The prevalence of coronary heart disease was three times higher in the urban residents, despite the fact that the rural residents smoked more and had higher total caloric and saturated fat intakes. Most cardiovascular disease risk factors were two to three times more common in the urban residents. Rural electrification projects are still being carried out in parts of the rural area which was studied.

It seems unbelievable that mortality differences of this magnitude could go unexplained for over 70 years after they were first reported and 40 years after they were noticed. I think that in the early part of the 20th century nobody was looking for answers. By the time EMF epidemiology got started in 1979 the entire population was exposed to EMFs. Cohort studies were therefore using EMF-exposed population statistics to compute expected values, and case-control studies were comparing more exposed cases to less exposed controls. The mortality from lung cancer in two pack a day smokers is over 20 times that of non-smokers but only three times that of one pack a day smokers. After 1956, the EMF equivalent of a non-smoker ceased to exist in the US. An exception to this is the Amish who live without electricity. Like rural US residents in the 1940s, Amish males in the 1970s had very low cancer and cardiovascular disease mortality rates [23].

If this hypothesis and findings outlined here are even partially true, the explosive recent increase in radiofrequency radiation, and high frequency voltage transients sources, especially in urban areas from cell phones and towers, terrestrial antennas, wi-fi and wi-max systems, broadband internet over power lines, and personal electronic equipment, suggests that like the 20th century EMF epidemic, we may already have a 21st century epidemic of morbidity and mortality underway caused by electromagnetic fields. The good news is that many of these diseases may be preventable by environmental manipulation, if society chooses to.

Conflicts of interest statement

None declared.

References

[1] Milham S, Ossiander EM. Historical evidence that residential electrification caused the emergence of the childhood leukemia peak. Med Hypotheses 2001;56(3):290–5.

[2] Milham S, Morgan LL. A new electromagnetic field exposure metric: high frequency voltage transients associated with increased cancer incidence in teachers in a California school. Am J Ind Med 2008;51(8):579–86.

[3] Reynolds P, Elkin EP, Layefsky ME, Lee JM. Cancer in California school employees. Am J Ind Med 1999;36:271–8.

[4] US bureau of the Census. The statistical history of the United States from colonial times to the present. New York: Basic Books; 1976.

[5] Wertheimer N, Leeper E. Electrical wiring configurations and cancer. Am J Epidemiol 1979;109(3):273–84.

[6] Vital statistics of the United States (annual volumes 1930, 1940). Washington, DC: US Government Printing Office.

[7] US Census Bureau. Washington, DC: US Department of Commerce; 2009. <www.census.gov>.

[8] Vital statistics rates in the US 1940–1960, National Center for Health Statistics. Washington, DC: US Government Printing Office.

[9] Historical statistics of the United States colonial times to 1970. US Bureau of the Census. Washington, DC: US Commerce Department.

[10] Vassar statistical computation web site. Authored by Richard Lowry, Emeritus professor of psychology. Vassar College, Poughkeepsie NY, USA; 2009. <http://faculty.vassar.edu/lowry/VassarStats.html>.

[11] Microsoft Excel 2007. Microsoft Corporation. One Microsoft Way, Redmond, WA, 98052-6399.

[12] National Center for Education Statistics (NCES) web site. US Department of Education. Washington, DC: Institute of Educational Sciences; 2009. <http://nces.ed.gov/nceskids/createAgraph/>.

[13] Howe HL, Keller JE, Lehnherr M. The relation of population density and cancer incidence. Illinois 1986–1990. Am J Epidemiol 1993;138:29–36.

[14] Hallberg O, Johannson O. Cancer trends during the 20th century. J Aust College Nutr Environ Med 2002;21(1):3–8.

[15] Armstrong B, Theriault G, Guenel P, Deadman J, Goldgerg M, Heroux P. Association between exposure to pulsed electromagnetic fields and cancer in electric utility workers in Quebec, Canada, and France. Am J Epidemiol 1994;140(9):805–20.

[16] Navakatikian MA, Tomashevskaya LA. Phasic behavior and endocrine effects of microwaves of nonthermal intensity. In: Carpenter DO, editor. Biological effects of magnetic fields, vol. 1. San Diego, CA: Academic Press; 1994. p. 333–42.

[17] Milham S. Increased mortality in amateur radio operators due to lymphatic and hematopoietic malignancies. Am J Epidemiol 1988;127(1):50–4.

[18] Perry S, Reichmanis M, Marino AA, Becker RO. Environmental power-frequency fields and suicide. Health Phys 1981;41(2):267–77.

[19] van Wijngaarden E, Savitz DA, Kleckner RC, Cai J, Loomis D. Exposure to electromagnetic fields and suicide among electric utility workers: a nested case-control study. West J Med 2000;173(2):94–100.

[20] Court Brown WM, Doll R. Leukemia in childhood and young adult life: Trends in mortality in relation to aetiology. BMJ 1961;26:981–8.

[21] Milham S. Leukemia clusters. Lancet 1963;23(7317):1122–3.

[22] Chadna SL, Gopinath N, Shekhawat S. Urban-rural difference in the prevalence of coronary heart disease and its risk factors. Bull World Health Org 1997;75(1):31–8.

[23] Hamman RF, Barancik JJ, Lilienfeld AM. Patterns of mortality in the Old Order Amish. Am J Epidemiol 1981;114(6):345–61.

EXHIBIT
4

A New Electromagnetic Exposure Metric: High Frequency Voltage Transients Associated With Increased Cancer Incidence in Teachers in a California School

Samuel Milham, MD, MPH*,† and L. Lloyd Morgan, BS‡

Background *In 2003 the teachers at La Quinta, California middle school complained that they had more cancers than would be expected. A consultant for the school district denied that there was a problem.*

Objectives *To investigate the cancer incidence in the teachers, and its cause.*

Method *We conducted a retrospective study of cancer incidence in the teachers' cohort in relationship to the school's electrical environment.*

Results *Sixteen school teachers in a cohort of 137 teachers hired in 1988 through 2005 were diagnosed with 18 cancers. The observed to expected (O/E) risk ratio for all cancers was 2.78 ($P = 0.000098$), while the O/E risk ratio for malignant melanoma was 9.8 ($P = 0.0008$). Thyroid cancer had a risk ratio of 13.3 ($P = 0.0098$), and uterine cancer had a risk ratio of 9.2 ($P = 0.019$). Sixty Hertz magnetic fields showed no association with cancer incidence. A new exposure metric, high frequency voltage transients, did show a positive correlation to cancer incidence. A cohort cancer incidence analysis of the teacher population showed a positive trend ($P = 7.1 \times 10^{-10}$) of increasing cancer risk with increasing cumulative exposure to high frequency voltage transients on the classroom's electrical wiring measured with a Graham/Stetzer (G/S) meter. The attributable risk of cancer associated with this exposure was 64%. A single year of employment at this school increased a teacher's cancer risk by 21%.*

Conclusion *The cancer incidence in the teachers at this school is unusually high and is strongly associated with high frequency voltage transients, which may be a universal carcinogen, similar to ionizing radiation.* Am. J. Ind. Med. 2008. © *2008 Wiley-Liss, Inc.*

KEY WORDS: high frequency voltage transients; electricity; dirty power; cancer; school teachers; carcinogen

BACKGROUND

Since the 1979 Wertheimer–Leeper study [Wertheimer and Leeper, 1979] there has been concern that exposure to power frequency (50/60 Hz) EMFs, especially magnetic fields, may contribute to adverse health effects including cancer. Until now, the most commonly used exposure metric has been the time-weighted average of the power-frequency magnetic field. However, the low risk ratios in most studies suggest that magnetic fields might be a surrogate for a more important metric. In this paper we present evidence that a

Abbreviations: EMF, electromagnetic fields; O, observed cases; E, expected cases; O/E, risk ratio; p, probability; Hz, Hertz or cycles per second; OSHA, Occupational Safety and Health Administration; OCMAP, occupational mortality analysis program; AM, amplitude modulation; GS units, Graham/Stetzer units; G/S meter, Graham/Stetzer meter; MS II, Microsurge II meter; mG, milligauss; EKG, electrocardiogram; LQMS, La Quinta Middle School.

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Accepted 29 April 2008

DOI 10.1002/ajim.20598. Published online in Wiley InterScience (www.interscience.wiley.com)

new exposure metric, high frequency voltage transients existing on electrical power wiring, is an important predictor of cancer incidence in an exposed population.

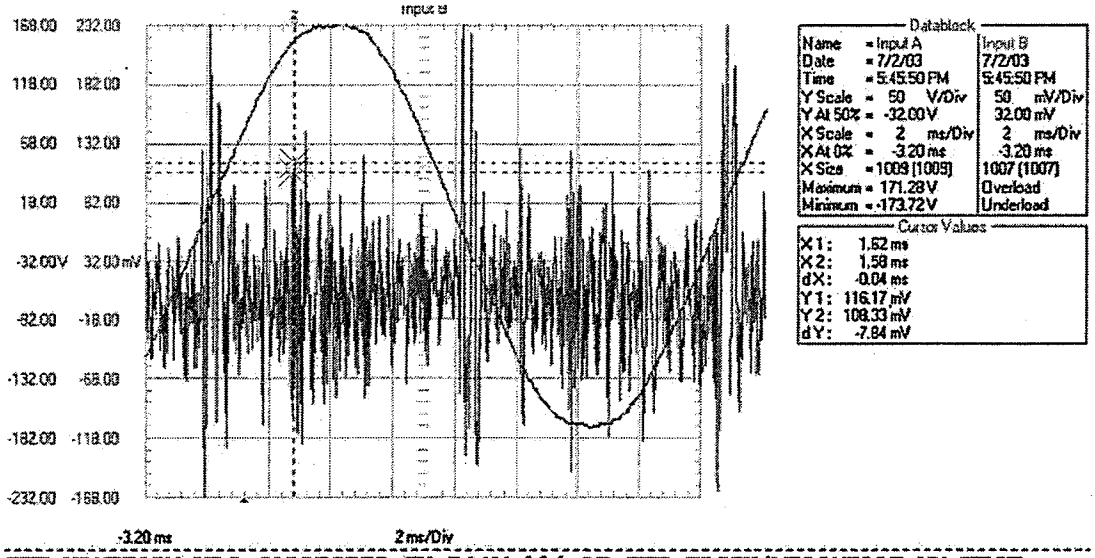
The new metric, GS units, used in this investigation is measured with a Graham/Stetzer meter (G/S meter) also known as a Microsurge II meter (MS II meter), which is plugged into electric outlets [Graham, 2005]. This meter displays the average rate of change of these high frequency voltage transients that exist everywhere on electric power wiring. High frequency voltage transients found on electrical wiring both inside and outside of buildings are caused by an interruption of electrical current flow. The electrical utility industry has referred to these transients as "dirty power."

There are many sources of "dirty power" in today's electrical equipment. Examples of electrical equipment designed to operate with interrupted current flow are light dimmer switches that interrupt the current twice per cycle (120 times/s), power saving compact fluorescent lights that interrupt the current at least 20,000 times/s, halogen lamps, electronic transformers and most electronic equipment manufactured since the mid-1980s that use switching power supplies. Dirty power generated by electrical equipment in a building is distributed throughout the building on the electric wiring. Dirty power generated outside the building enters the building on electric wiring and through ground rods and conductive plumbing, while within buildings, it is usually the result of interrupted current generated by electrical appliances and equipment.

Each interruption of current flow results in a voltage spike described by the equation $V = L \times di/dt$, where V is the voltage, L is the inductance of the electrical wiring circuit and di/dt is the rate of change of the interrupted current. The voltage spike decays in an oscillatory manner. The oscillation frequency is the resonant frequency of the electrical circuit. The G/S meter measures the average magnitude of the rate of change of voltage as a function of time (dV/dT). This preferentially measures the higher frequency transients. The measurements of dV/dT read by the meter are defined as GS (Graham/Stetzer) units.

The bandwidth of the G/S meter is in the frequency range of these decaying oscillations. Figure 1 shows a two-channel oscilloscope display. One channel displays the 60 Hz voltage on an electrical outlet while the other channel with a 10 kHz hi-pass filter between the oscilloscope and the electrical outlet, displays the high frequency voltage transients on the same electrical outlet [Havas and Stetzer, 2004, reproduced with permission].

Although no other published studies have measured high frequency voltage transients and risk of cancer, one study of electric utility workers exposed to transients from pulsed



THE WAVEFORM WAS COLLECTED IN ROOM 114 AT THE ELGIN/MILLVILLE MN HIGH SCHOOL. CHANNEL 1 WAS CONNECTED TO THE 120 VAC UTILITY SUPPLIED POWER RECEPTACLE. CHANNEL 2 WAS CONNECTED TO THE SAME POTENTIAL, EXCEPT THROUGH THE GRAHAM UBIQUITOUS FILTER. (REMOVES THE 60 HERTZ) THE AREA BETWEEN THE CURSORS REPRESENTS A FREQUENCY OF 25 KILO HERTZ. A TEACHER WHO PREVIOUSLY OCCUPIED THE ROOM DIED OF BRAIN TUMORS AND THE TEACHER IN THE ADJOINING ROOM DIED OF LUEKEMIA.

FIGURE 1. Oscilloscope display of dirty power: 60 Hz electrical power (channel 1) with concurrent high frequency voltage transients (channel 2). A 10 kHz hi-pass filter was used on channel 2 in order to filter out the 60 Hz voltage and its harmonics. [Color figure can be viewed in the online issue, which is available at www.interscience.wiley.com.]

electromagnetic fields found an increased incidence of lung cancer among exposed workers [Armstrong et al., 1994].

INTRODUCTION

In February 2004, a Palm Springs, California newspaper, The Desert Sun, printed an article titled, "Specialist discounts cancer cluster at school," in which a local tumor registry epidemiologist claimed that there was no cancer cluster or increased cancer incidence at the school [Perrault, 2004]. An Internet search revealed that the teacher population at La Quinta Middle School (LQMS) was too small to generate the 11 teachers with cancer who were reported in the article. The school was opened in 1988 with 20 teachers hired that year. For the first 2 years, the school operated in three temporary buildings, one of which remains. In 1990, a newly constructed school opened. In 2003, the teachers complained to school district management that they believed that they had too many cancers. Repeated requests to the school administration for physical access to the school and for teachers' information were denied. We contacted the teachers, and with their help, the cancers in the group were characterized. One teacher suggested using yearbooks to develop population-at-risk counts for calculating expected cancers. We were anxious to assess the electrical environment at the school, since elevated power frequency magnetic field exposure with a positive correlation between duration of exposure and cancer incidence had been reported in first floor office workers who worked in strong magnetic fields above three basement-mounted 12,000 V transformers [Milham, 1996]. We also wanted to use a new electrical measurement tool, the Graham/Stetzer meter, which measures high frequency voltage transients.

The Graham/Stetzer Microsurge II meter measures the average rate of change of the transients in Graham/Stetzer units (GS units). Anecdotal reports had linked dirty power exposure with a number of illnesses [Havas and Stetzer, 2004]. We decided to investigate whether power frequency magnetic field exposure or dirty power exposure could explain the cancer increase in the school teachers.

METHODS

After the school administration (Desert Sands Unified School District) had refused a number of requests to assist in helping us evaluate the cancers reported by the teachers, we were invited by a teacher to visit the school after hours to make magnetic field and dirty power measurements. During that visit, we noted that, with the exception of one classroom near the electrical service room, the classroom magnetic field levels were uniformly low, but the dirty power levels were very high, giving many overload readings. When we reported this to Dr. Doris Wilson, then the superintendent of schools (retired December, 2007), one of us (SM) was threatened with prosecution for "unlawful.. trespass," and the teacher who had invited us into the school received a letter of reprimand. The teachers then filed a California OSHA complaint which ultimately lead to a thorough measurement of magnetic fields and dirty power levels at the school by the California Department of Health Services which provided the exposure data for this study. They also provided comparison dirty power data from residences and an office building, and expedited tumor registry confirmation of cancer cases.

Classrooms were measured at different times using 3 meters: an FW Bell model 4080 tri-axial Gaussmeter, a Dexsil 310 Gaussmeter, and a Graham-Stetzer (G/S) meter. The Bell meter measures magnetic fields between 25 and 1,000 Hz. The Dexsil meter measures magnetic fields between 30 and 300 Hz. The G/S meter measures the average rate of change of the high frequency voltage transients between 4 and 150 KHz.

All measurements of high frequency voltage transients were made with the G/S meter. This meter was plugged into outlets, and a liquid crystal display was read. All measurements reported were in GS units. The average value was reported where more than one measurement was made in a classroom.

We measured seven classrooms in February 2005 using the Bell meter and the G/S meter. Later in 2005, the teachers measured 37 rooms using the same meters. On June 8, 2006, electrical consultants for the school district and the California Department of Health Services (Dr. Raymond Neutra) repeated the survey using the G/S meter and a Dexsil 320 Gaussmeter, measuring 51 rooms. We used results of this June 8, 2006 sampling in our exposure calculations, since all classrooms were sampled, multiple outlets per room were sampled, and an experienced team did the sampling. Additionally, GS readings were taken at Griffin Elementary school near Olympia, Washington, and Dr. Raymond Neutra provided GS readings for his Richmond California office building and 125 private California residences measured in another Northern California study.

All the cancer case information was developed by personal, telephone, and E-mail contact with the teachers or their families without any assistance from the school district. The local tumor registry verified all the cancer cases with the exception of one case diagnosed out of state and the two cases reported in 2007. The out-of state case was verified by pathologic information provided by the treating hospital. The teachers gathered population-at-risk information (age at hire, year of hire, vital status, date of diagnosis, date of death, and termination year) from yearbooks and from personal contact. The teachers also provided a history of classroom assignments for all teachers from annual classroom assignment rosters (academic years 1990–1991 to 2006–2007) generated by the school administration. The school administration provided a listing of school employees, including

the teachers, to the regional tumor registry after the teachers involved the state health agency by submitting an OSHA complaint. The information we obtained anecdotally from the teachers, yearbooks, and classroom assignment rosters was nearly identical to that given to the tumor registry. None of the cancer cases were ascertained initially through the cancer registry search.

Published cancer incidence rates by age, sex, and race for all cancers, as well as for malignant melanoma, thyroid, uterine, breast, colon, ovarian cancers, and non-Hodgkin's lymphoma (NHL) were obtained from a California Cancer Registry publication [Kwong et al., 2001]. We estimated the expected cancer rate for each teacher by applying year, age, sex, and race-specific cancer incidence rates from hire date until June 2007, or until death. We then summed each teacher's expected cancer rate for the total cohort.

Using the California cancer incidence data, the school teacher data, and the GS exposure data, we calculated cancer incidence and risks. A replicate data set was sent to Dr. Gary Marsh and to Mike Cunningham at the University of Pittsburgh School of Public Health for independent analysis using OCMAP software. We calculated cancer risk ratios by duration of employment and by cumulative GS unit-years of exposure. We calculated an attributable risk percent using the frequencies of total observed and expected cancers, and performed trend tests [Breslow and Day, 1987] for cancer risk versus duration of employment and cumulative GS unit-years of exposure. Poisson P values were calculated using the Stat Trek website (Stat Trek, 2007). We also performed a linear regression of cancer risk by duration of employment in years and by time-weighted exposure in GS unit-years.

Since neither author had a current institutional affiliation, institutional review board approval was not possible. The teachers requested the study, and their participation in the study was both voluntary and complete. All the active teachers at the school signed the Cal OSHA request. The authors fully explained the nature of the study to study participants and offered no remuneration to the teachers for participation in the study. The authors maintained strict confidentiality of all medical and personal information provided to us by the teachers, and removed personal identifiers from the data set which was analyzed by the University of Pittsburgh. Possession of personal medical information was limited to the two authors. No patient-specific information was obtained from the tumor registry. With the individual's permission we provided the registry with case information for a teacher with malignant melanoma diagnosed out of state. The exposure information was provided by the California Department of Health Services. The basic findings of the study were presented to the Desert Sands Unified School District School Board and at a public meeting arranged by the teachers.

RESULTS

Electrical Measurements

In our seven-room survey of the school in 2005, magnetic field readings were as high as 177 mG in a classroom adjacent to the electrical service room. A number of outlets had overload readings with the G/S meter. Magnetic fields were not elevated (>3.0 mG) in the interior space of any of the classrooms except in the classroom adjacent to the electrical service room, and near classroom electrical appliances such as overhead transparency projectors. There was no association between the risk of cancer and 60 Hz magnetic field exposures in this cohort, since the classroom magnetic field exposures were the same for teachers with and without cancer (results not shown).

This school had very high GS readings and an association between high frequency voltage transient exposure in the teachers and risk of cancer. The G/S meter gives readings in the range from 0 to 1,999 GS units. The case school had 13 of 51 measured rooms with at least one electrical outlet measuring "overload" (≥2,000 GS units). These readings were high compared to another school near Olympia Washington, a Richmond California office building, and private residences in Northern California (Table I). Altogether, 631 rooms were surveyed for this study. Only 17 (2.69%) of the 631 rooms had an "overload" (maximum, ≥2,000 GS units) reading. Applying this percentage to the 51 rooms surveyed at the case school, we would expect 1.4 rooms at the school to have overload GS readings ($0.0269 \times 51 = 1.37$). However, thirteen rooms (25%) measured at the case school had "overload" measurements above the highest value (1,999 GS units) that the G/S meter can

TABLE I. Graham/Stetzer Meter Readings: Median Values in Schools, Homes and an Office Building

Place	Homes	Office bldg	Olympia WA School	LQMS	Total
No. of rooms surveyed	500	39	41	51	531
Median GS units	159	210	160	750	<270[a]
Rooms with overload GS units (≥2,000)	4	0	0	13*	17

[a]Excludes homes as specific room data was not available.
*$P = 3.14 \times 10^{-9}$.

TABLE II. Risk of Cancer by Type Among Teachers at La Quinta Middle School

Cancer	Observed	Expected	Risk ratio (O/E)	*P*-value
All cancers	18	6.51	2.78*	0.000098
Malignant melanoma	4	0.41	9.76*	0.0008
Thyroid cancer	2	0.15	13.3*	0.011
Uterus cancer	2	0.22	9.19*	0.019
Female breast cancer	2	1.5	1.34	0.24
All cancers less melanoma	14	6.10	2.30*	0.0025

*$P \leq 0.05$.

measure. This is a highly statistically significant excess over expectation (Poisson $P = 3.14 \times 10^{-9}$).

We noticed AM radio interference in the vicinity of the school. A teacher also reported similar radio interference in his classroom and in the field near his ground floor classroom. In May 2007, he reported that 11 of 15 outlets in his classroom overloaded the G/S meter. An AM radio tuned off station is a sensitive detector of dirty power, giving a loud buzzing noise in the presence of dirty power sources even though the AM band is beyond the bandwidth of the G/S meter.

Cancer Incidence

Three more teachers were diagnosed with cancer in 2005 after the first 11 cancer diagnoses were reported, and another former teacher (diagnosed out-of-state in 2000) was reported by a family member employed in the school system. One cancer was diagnosed in 2006 and two more in 2007. In the years 1988–2005, 137 teachers were employed at the school. The 18 cancers in the 16 teachers were: 4 malignant melanomas, 2 female breast cancers, 2 cancers of the thyroid, 2 uterine cancers and one each of Burkitt's lymphoma (a type of non-Hodgkins lymphoma), polycythemia vera, multiple myeloma, leiomyosarcoma and cancer of the colon, pancreas, ovary and larynx. Two teachers had two primary cancers each: malignant melanoma and multiple myeloma, and colon and pancreatic cancer. Four teachers had died of cancer through August 2007. There have been no non-cancer deaths to date.

The teachers' cohort accumulated 1,576 teacher-years of risk between September 1988 and June 2007 based on a 12-month academic year. Average age at hire was 36 years. In 2007, the average age of the cohort was 47.5 years.

When we applied total cancer and specific cancer incidence rates by year, age, sex, race, and adjusted for cohort ageing, we found an estimate of 6.5 expected cancers, 0.41 melanomas, 0.15 thyroid cancers, 0.22 uterine cancers, and 1.5 female breast cancers (Table II). For all cancers, the risk ratio (Observed/Expected = 18/6.5) was 2.78 ($P = 0.000098$, Poisson test); for melanoma, (O/E = 4/0.41) was 9.8 ($P = 0.0008$, Poisson test); for thyroid cancer (O/E = 2/0.15) was 13.3 ($P = 0.0011$, Poisson test); for uterine cancer (O/E = 2/0.22), was 9.19 ($P = 0.019$, Poisson test).

Table III shows the cancer risk among the teachers by duration of employment. Half the teachers worked at the school for less than 3 years (average 1.52 years). The cancer risk increases with duration of employment, as is expected when there is exposure to an occupational carcinogen. The cancer risk ratio rose from 1.7 for less than 3 years, to 2.9 for 3–14 years, to 4.2 for 15+ years of employment. There was a positive trend of increasing cancer incidence with increasing duration of employment ($P = 4.6 \times 10^{-10}$). A single year of employment at this school increases a teacher's risk of cancer by 21%.

Using the June 8, 2006 survey data (Table IV), the cancer risk of a teacher having ever worked in a room with at least one outlet with an overload GS reading (≥2000 GS units) and employed for 10 years or more, was 7.1 ($P = 0.00007$, Poisson test). In this group, there were six teachers diagnosed

TABLE III. Cancer Risk by Duration of Employment

Time at school	Average time	Teachers	% of teachers	Cancer observed	Cancer expected	Risk ratio (O/E)	Poisson p
<3 years	1.52 years	68	49.6	4	2.34	1.72	0.12
3–14 years	7.48 years	56	40.9	9	3.14	2.87*	0.0037
15+ years	16.77 years	12	8.8	5	1.02	4.89*	0.0034
Total		137	100	18	6.51	2.78*	0.000098

Positive trend test (Chi square with one degree of freedom = 38.8, $P = 4.61 \times 10^{-10}$).
*$P \leq 0.05$.

TABLE IV. Cancer in Teachers Who Ever Taught in Classrooms With at Least One Overload GS Reading (≥2000 GS Units) by Duration of Employment

Ever in a room >2,000 GS units	Employed 10 + years	Total teachers	Cancers observed	Cancers expected	Risk ratio (O/E)	Poisson p
Yes	Yes	10	7[a]	0.988	7.1*	0.00007
Yes	No	30	3[a]	0.939	3.2	0.054
Total		40	10	1.93	5.1*	0.00003
No	Yes	19	2	1.28	1.6	0.23
No	No	78	6	3.25	1.8	0.063
Total		97	8	4.56	1.8*	0.047
Grand total		137	18	6.49	2.8*	0.000098

[a]One teacher had two primary cancers.
*$P < 0.05$.

with a total of seven cancers, and four teachers without a cancer diagnosis, who were employed for 10 or more years and who ever worked in one of these rooms. Five teachers had one primary cancer and one teacher had two primary cancers. These teachers made up 7.3% of the teachers' population (10/137) but had 7 cancers or 39% (7/18) of the total cancers. The 10 teachers who worked in an overload classroom for 10 years or more had 7 cancers when 0.99 would have been expected ($P = 6.8 \times 10^{-5}$ Poisson test). The risk ratio for the 8 teachers with cancer and 32 teachers without cancer, who ever worked in a room with an overload GS reading, regardless of the time at the school, was 5.1 ($P = 0.00003$, Poisson test). The risk ratio for 8 teachers with cancer and 89 teachers without cancer who never worked in a room with an overload G-S reading was 1.8 ($P = 0.047$, Poisson test). Teachers who never worked in an overload classroom also had a statistically significantly increased risk of cancer.

A positive dose-response was seen between the risk of cancer and the cumulative GS exposure (Table V). Three categories of cumulative GS unit-years of exposure were selected: <5,000, 5,000 to 10,000, and more than 10,000 cumulative GS unit-years. We found elevated risk ratios of 2.0, 5.0, and 4.2, respectively, all statistically significant, for each category. There was a positive trend of increasing cancer incidence with increasing cumulative GS unit-years of exposure ($P = 7.1 \times 10^{-10}$). An exposure of 1,000 GS unit-years increased a teacher's cancer risk by 13%. Working in a room with a GS overload (≥2,000 GS units) for 1 year increased cancer risk by 26%.

An attributable risk percentage was calculated: (observed cancers-expected cancers)/observed cancers = (18−6.51)/18 = 63.8%.

The fact that these cancer incidence findings were generated by a single day of G/S meter readings made on June 8, 2006 suggests that the readings were fairly constant over time since the school was built in 1990. For example, if the 13 classrooms which overloaded the meter on June 8, 2006 were not the same since the start of the study and constant throughout, the cancer risk of teachers who ever worked in the overload rooms would have been the same as the teachers who never worked in an overload room.

Although teachers with melanoma and cancers of the thyroid, and uterus, had very high, statistically significant risk ratios, there was nothing exceptional about their age at hire, duration of employment, or cumulative GS exposure. However, thyroid cancer and melanoma had relatively short latency times compared to the average latency time for all 18 cancers. The average latency time between start of

TABLE V. Observed and Expected Cancers by Cumulative GS Exposure (GS Unit-Years)

Exposure group	<5,000 GS unit-years	5,000 to 10,000	>10,000 GS unit-years	Total
Average GS unit-years	914	7,007	15,483	
Cancers obs.	9	4	5	18
Cancers exp.	4.507	0.799	1.20	6.49
Risk ratio (O/E)	2.01*	5.00*	4.17*	2.78*
Poisson p	0.0229	0.0076	0.0062	0.000098

Positive trend test (Chi square with one degree of freedom = 38.0, $P = 7.1 \times 10^{-10}$).
*$P < 0.05$.

employment at the school and diagnosis for all cancers was 9.7 years. The average latency time for thyroid cancer was 3.0 years and for melanoma it was 7.3 years (with three of the four cases diagnosed at 2, 5, and 5 years).

An independent analysis of this data set by the University of Pittsburgh School of Public Health using OCMAP software supported our findings.

DISCUSSION

Because of access denial, we have no information about the source, or characterization of the high frequency voltage transients. We can assume, because the school uses metal conduit to contain the electrical wiring, that any resultant radiated electric fields from these high frequency voltage transients would radiate mainly from the power cords and from electrical equipment using the power cords within a classroom.

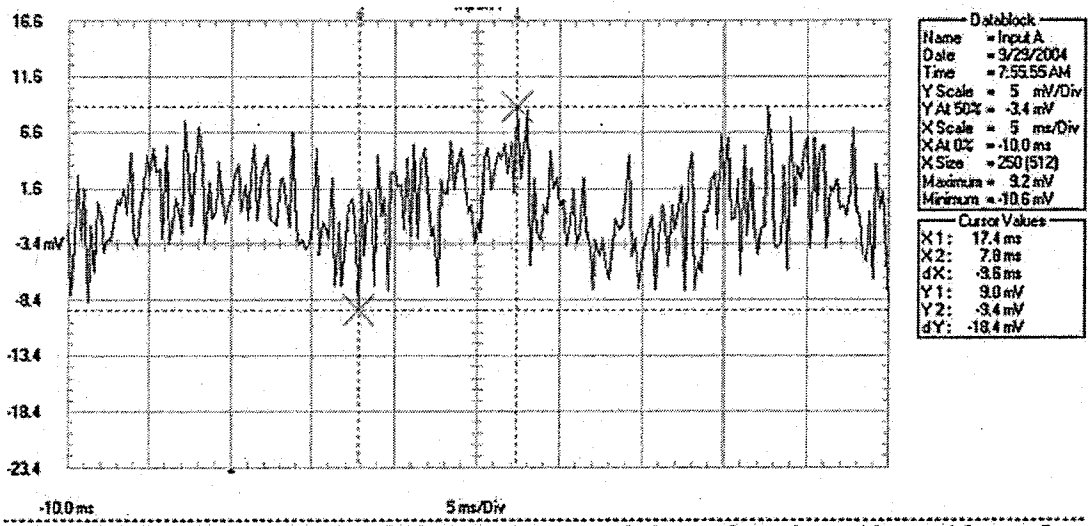
The school's GS readings of high frequency voltage transients are much higher than in other tested places (Table I). Also, teachers in the case school who were employed for over 10 years and who had ever worked in a room with an overload GS reading had a much higher rate of cancer. They made up 7.3% of the cohort but experienced 39% of all cancers.

The relatively short latency time of melanoma and thyroid cancers suggests that these cancers may be more sensitive to the effects of high frequency voltage transients than the other cancers seen in this population.

In occupational cohort studies, it is very unusual to have a number of different cancers with an increased risk. An exception to this is that cohorts exposed to ionizing radiation show an increased incidence of a number of different cancers. The three cancers in this cohort with significantly elevated incidence, malignant melanoma, thyroid cancer and uterine cancer, also have significantly elevated incidence in the large California school employees cohort [Reynolds et al., 1999].

These cancer risk estimates are probably low because 23 of the 137 members of the cohort remain untraced. Since exposure was calculated based on 7 days a week for a year, this will overstate the actual teachers' exposure of 5 days a week for 9 months a year.

We could not study field exposures in the classrooms since we were denied access to the school. We postulate that the dirty power in the classroom wiring exerted its effect by capacitive coupling which induced electrical currents in the



The waveform was recorded between 2 EKG patches placed on the ankles of XXXXXX XXXXXXXXX standing in front of his kitchen sink at his home near Bright Ontario. It shows a distorted 60 cycle sine wave containing high frequencies applied to each foot, allowing high frequency current to freely oscillate up one leg and down the other. XXXXXX has been diagnosed with prostrate cancer since moving to the house in less than a year. He was standing with feet shoulder width apart, wearing shoes, at the time of the readings. The amplitude increased as the feet were placed farther apart.

FIGURE 2. Oscilliscope display of 60 Hz current distorted with high frequencies taken between EKG patches applied to the ankles of a man standing with shoes on at a kitchen sink. [Color figure can be viewed in the online issue, which is available at www.interscience.wiley.com.]

teachers' bodies. The energy that is capacitively coupled to the teachers' bodies is proportional to the frequency. It is this characteristic that highlights the usefulness of the G/S meter. High frequency dirty power travels along the electrical distribution system in and between buildings and through the ground. Humans and conducting objects in contact with the ground become part of the circuit. Figure 2 [Havas and Stetzer, 2004, reproduced with permission] shows an oscilloscope tracing taken between EKG patches on the ankles of a man wearing shoes, standing at a kitchen sink. The 60 Hz sine wave is distorted by high frequencies, which allows high frequency currents to oscillate up one leg and down the other between the EKG patches.

Although not demonstrated in this data set, dirty power levels are usually higher in environments with high levels of 60 Hz magnetic fields. Many of the electronic devices which generate magnetic fields also inject dirty power into the utility wiring. Magnetic fields may, therefore, be a surrogate for dirty power exposures. In future studies of the EMF-cancer association, dirty power levels should be studied along with magnetic fields.

The question of cancer incidence in students who attended La Quinta Middle School for 3 years has not been addressed.

CONCLUSION

The cancer incidence in the teachers at this school is unusually high and is strongly associated with exposure to high frequency voltage transients. In the 28 years since electromagnetic fields (EMFs) were first associated with cancer, a number of exposure metrics have been suggested. If our findings are substantiated, high frequency voltage transients are a new and important exposure metric and a possible universal human carcinogen similar to ionizing radiation.

ACKNOWLEDGMENTS

The authors would like to thank The La Quinta, California middle school teachers, especially Gayle Cohen. Thanks also to Eric Ossiander, Dr. Raymond Neutra, Dr. Gary Marsh and Mike Cunningham and Dr. Louis Slesin. LM thanks Diana Bilovsky for editorial assistance.

REFERENCES

Armstrong B, Theriault G, Guenel P, Deadman J, Goldberg M, Heroux P. 1994. Association between exposure to pulsed electromagnetic fields and cancer in electric utility workers in Quebec, Canada, and France. Am J Epidemiol 140(9):805–820.

Breslow NE, Day NE. 1987. Statistical Methods in Cancer Research, Vol. II—The Design and Analysis of Cohort Studies. IARC Scientific Publication No. 82, International Agency for Research on Cancer, Lyon France, 1987.96 (equation 3.12).

Graham MH. 2005. Circuit for Measurement of Electrical Pollution on Power Line. United States Patent 6,914,435 B2.

Havas M, Stetzer D. 2004. Dirty electricity and electrical hypersensitivity: Five case studies. World Health Organization Workshop on Electrical Hypersensitivity. 25–26 October, Prague, Czech Republic, available online at: http://www.stetzerelectric.com/filters/research/havas_stetzer_who04.pdf.

Kwong SL, Perkins CI, Morris CR, Cohen R, Allen M, Wright WE. 2001. Cancer in California 1988–1999. Sacramento CA: California Department of Health Services, Cancer Surveillance Section.

Milham S. 1996. Increased incidence of cancer in a cohort of office workers exposed to strong magnetic fields. Am J Ind Med 30(6):702–704.

Perrault M. 2004. Specialist Discounts Cancer Cluster at School. The Desert Sun (Palm Springs, CA), 22 February, A1.

Reynolds P, Elkin EP, Layefsky ME, Lee JM. 1999. Cancer in California school employees. Am J Ind Med 36:271–278.

Stat Trek http://stattrek.com/tables/poisson.aspx (accessed August 2007).

Wertheimer N, Leeper E. 1979. Electrical wiring configurations and childhood cancer. Am J Epidemiol 109(3):273–284.

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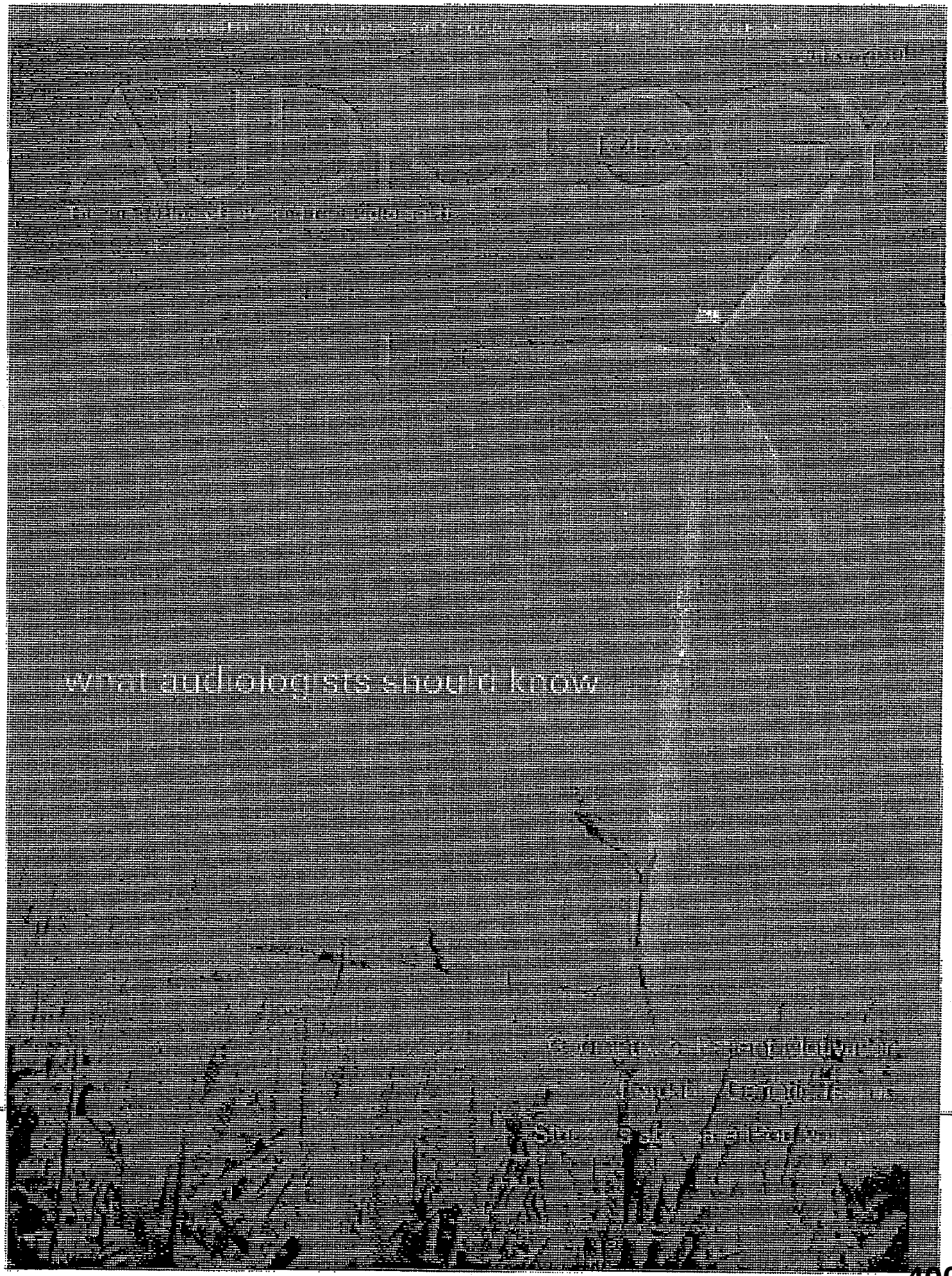

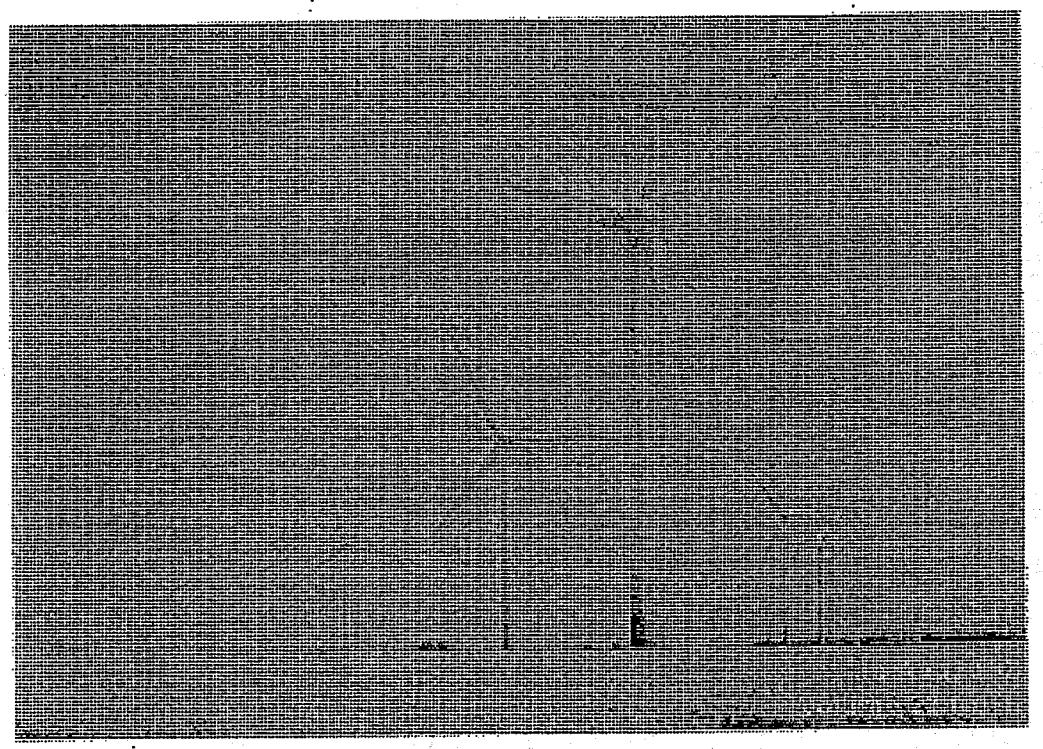

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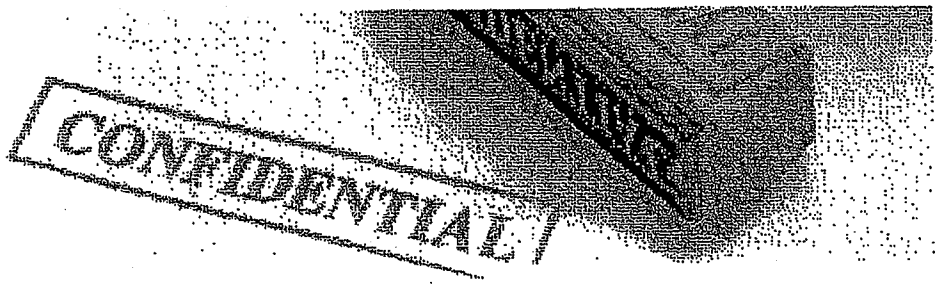

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Audiology Today (ISSN 1535-2609) is published bi-monthly by the American Academy of Audiology, 11730 Plaza America Drive, Suite 300, Reston, VA 20190; Phone: 703-790-8466. Periodicals postage paid at Herndon, VA, and additional mailing offices.

Postmaster: Please send postal address changes to *Audiology Today*, c/o Membership Department, American Academy of Audiology, 11730 Plaza America Drive, Suite 300, Reston, VA 20190.

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BY JERRY PUNCH, RICHARD JAMES, AND DAN PABST

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