the AC current and are the likely source of the dirty electricity in the wing of the school closest to the tower. That little device you plug into the wall to charge your cell phone is one of these. They are present in all computers, copy machines, and television sets.

This is another serious but unrecognized hazard of cellular telephone technology. People who are concerned about health issues regarding cell towers focus on the RF emissions, but dirty electricity is another unrecognized important exposure.

To illustrate just how far dirty electricity effects can extend, after Dave Stetzer filtered a Midwestern school, a dairy farmer a quarter of a mile away noticed that his cows each gave an average of ten pounds more milk per day beginning the day the school was filtered. The cows were responding to dirty electricity being removed from the ground currents.

URINARY NEUROTRANSMITTERS IN LIBRARIANS

In the summer of 2011, at a book signing at the Olympia Timberland Public Library in Olympia WA, I measured very high levels (>20,000 G/S units) of dirty electricity in the outlets of the room where the book signing took place. The recommended level for no effects is 50 G/S units or less. In the hundreds of dirty electricity measurements made by us over the years, only a very few were this high. Excess mortality in 2,608 female librarians dying in Washington State between 1970 and 2010 was seen for the following causes: cancers of the tongue, breast, ovary and brain, Alzheimers' disease, diseases of the veins and pulmonary embolus. (https://fortress.wa.gov/doh/occmort/). Since the La Quinta school teachers study showed a dose/response between increasing dirty electricity classroom levels and increasing cancer incidence, I felt it important to offer to reduce the dirty electricity exposure of the library employees.

With the permission of the City of Olympia, and the cooperation

of the library manager and library staff, on October 10, 2011, Dave Stetzer and I reduced the dirty electricity levels in the library and measured urinary dopamine. and phenylethylamine (PEA) in seven volunteers a few days before and after the clean-up, and every two weeks for the next six months.

The Microsurge meter readings in the same outlet in the manager's office were 11,190 G/S units before the clean-up, 540 G/S units during the clean-up and 39 G/S units at the end of the clean-up which took about two hours. After an initial decrease, over the next six months the average urinary dopamine concentration in the volunteers who provided urine after the clean-up gradually increased to an average of over 225 ug/g creatinine which is well above 170 ug/g creatinine, the high normal level for the lab. Average phenylyethylamine levels also rose gradually to slightly above 70 ug/g creatinine, the high normal level for the lab. After the initial post clean-up urinary sampling, volunteers' homes also had their home dirty electricity levels reduced with filters. These neurotransmitters have been shown to decrease in people who reside near cell towers. (Buchner and Eger, 2011; Eskander et al, 2011). With chronic exposure and stress, neuro-endocrine and immune system dysregulation results in a wide spectrum of human morbidity and mortality. See Milham and Stetzer, 2012.

10 FUTURE INVESTIGATIONS

Here are some areas I believe are worth investigating for possible links with EMFs.

AMYOTROPHIC LATERAL SCLEROSIS (LOU GEHRIG'S DISEASE)

I have a theory regarding the etiology of ALS (amyotrophic lateral sclerosis, popularly called Lou Gehrig's disease, named after the famous baseball player who was afflicted with it.) My theory is that ALS may be caused by exposures to electro-therapeutic devices and elevated EMF/RF environmental exposures.

ALS is a relentlessly progressive neurodegenerative disease, beginning with barely perceptible symptoms like numbness and tingling in the fingers, but leading eventually to total body paralysis. All the while the mind remains intact. Most people with ALS die within five years of diagnosis, with an average survivorship of three years.

The Washington State occupation mortality data shows that ALS

has a very high mortality rate in Boeing engineers. On frequent visits to the company twenty years ago, I noticed that most of their engineers worked in large rooms, surrounded closely on four sides by computers. This is a likely high dirty electricity environment, and I would like to see those workspaces accurately measured, by me or someone else.

When I was at the Washington State Department of Health, I helped Boeing set up a mortality surveillance system using their insurance and worker record systems, and helped them resolve disputes with OSHA. My requests to do a study have been ignored.

ALS has been shown to be more common in people who have had serious electric shock episodes, and it is more common in electrical workers in general. For several years now, I have tried to interest others in studying people who have had electro-convulsive shock therapy (ECT), to see if they also develop ALS. Another clue to ALS etiology is clusters of the disease that have been reported in Italian soccer players and in United States football players. These players, and other athletes, have often use transcutaneous electric nerve stimulation devices (TENS), which deliver small electric shocks to the skin to ease pain. It acts as a counter-irritant in the same way as liniment.

Athletes are also often treated with shortwave and microwave diathermy for musculoskeletal injuries. Unlike TENS units, diathermy penetrates deeply into tissue and heats it by using RF, just like a microwave oven. I recently contacted a young woman with ALS (age twenty-seven) who had been a professional basketball player. She reported extensive use of TENS devices beginning in high school and continuing through college and her professional sports career. Her case caught my attention, because ALS is uncommon in people under thirty years of age.

There is some circumstantial evidence that Lou Gehrig, whose name is synonymous with ALS, might have been treated with short wave diathermy. In 1933, Boston Red Sox player Dale Alexander had his baseball career cut short by a serious leg burn and gangrene following a diathermy treatment by a Red Sox trainer named "Doc" Woods, so diathermy was in use by major league baseball teams in the early 1930s.

And a long-time New York Yankees trainer, Earle V. "Doc" Painter, burned Joe DiMaggio's foot with a diathermy treatment during spring training in 1936, DiMaggio's first year with the Yankees. Babe Ruth, Lou Gehrig, and Joe DiMaggio were all reported to have been patients of "Doc" Painter. Plus, Bob Waters, one of the three members of the 1964 San Francisco 49ers professional football team who died of ALS, reported being treated for many hours with diathermy in the team's training room. At least a dozen United States and Canadian professional football players have or have died of ALS.

My hypothesis is that sporadic ALS is caused by exogenous electrical currents induced in, or applied to, the body. Since most cases of ALS have no obvious connection to electrical shock or electrical therapy, most non-familial cases (e.g. cases with no identifiable genetic link) may have had currents induced in their bodies by working or living in environments with strong EMFs. Strong contact currents may also be a contributing exposure. In addition to TENS and diathermy exposure, electro-convulsive shock therapy, electro-surgery, and electric acupuncture also generate electric currents in patients (Milham 2010).

There are many more electrotherapeutics in the development pipelines and nowhere near enough study to conclude these are safe. That's why it is so important to study occupational increases in ALS like those at Boeing for clues.

FALLON, NEVADA CHILDHOOD LEUKEMIA CLUSTER

For a number of years I've been involved in a frustrating attempt to study the Fallon, Nevada childhood leukemia cluster, working with a research group headed by Dr. Joe Weimels of University of California at San Francisco.

Beginning in 1997, seventeen children in the small Nevada oasis town of Fallon (pop. 7,500) have been diagnosed with childhood leukemia. Eleven of the cases were diagnosed between 1997 and 2001,

making this the most dramatic childhood leukemia cluster ever reported. This disease is typically caused by fetal exposure during the mother's pregnancy or very early in a child's life, so whatever caused the cluster operated for a very short period of time.

Some clues include: there is a "Top Gun" naval air station close to town, a fuel oil pipeline to the airbase, and a tungsten processing facility in town. The most popular etiologic theories involve agents (tungsten, jet fuel) that have been contaminating the town for a long time.

There are approximately six EMF/RF studies that showed EMF exposures from ground-based antennas, using various frequencies, are associated with childhood leukemia. Yet the Agency for Toxic Substances and Disease Registry (ASTDR) never considered these exposures in its investigation of the cluster. There was a Loran C antenna near the town that I suspect caused the epidemic. The antenna stopped operating in February 2010.

Long after the epidemic peak occurred, a group of local amateur radio operators reported that for a twenty-four hour period around New Year's Day 2006, their transceivers were swamped by the Loran signal. This coincided with a wet weather period, and water makes the earth more conductive to electricity. The Coast Guard, which operated the antennas, admitted to a malfunction. Since it would take a very powerful signal to swamp solid state transceivers twenty-five miles from an antenna, I suspect that the signal travelled through the ground and may have been conducted by the jet fuel pipeline right into town, thereby exposing pregnant women and disabling the amateur radio operators' modern, solid state transceivers. Without actually studying ground current phenomena, we will never know, and no one can do it now that the antenna no longer operates.

Lloyd Morgan, who worked on the La Quinta study with me, also noticed that adult cancers in Churchill County, where Fallon is located, spiked at the same time as the childhood leukemia cluster. There was another wet weather event in the area at about the right time to cause the epidemic. At this late date, twelve years after the first case, we still

haven't been able to obtain case address information that was collected in the ASTDR study. .

Fallon has a major dairy industry. If, as I suspect, ground currents were involved in the epidemic, milk production records, over time, might be revealing. Emergency room records and veterinary records should also be studied. This investigation should have happened years ago, not twelve years after the first case.

POWERFUL TRANSMITTERS AND CANCER

For years, the United States Air Force and others have studied the potential health effects of radiofrequency radiation emitted by the Precision Acquisition Vehicle Entry, Phased-Array Warning System known as PAVE PAWS in Barnstable County on Cape Cod, Massachusetts. Recently, there has been concern that the antenna was involved in a cluster of rare Ewing's sarcoma cases near the antenna. The Massachusetts Department of Public Health and the U.S. Air Force have been studying this antenna for more than twenty years.

Though PAVE PAWS has gotten the most attention in the press over the years, there was another powerful antenna in Massachusetts. A (Loran C) antenna on Nantucket Island off the Cape Cod coast was turned off in February 2010. The National Cancer Institute cancer profiles Web site, listed by state, shows that for the fourteen Massachusetts counties from 2001 to 2004, for all races and both sexes, that Barnstable and Nantucket counties have very high cancer incidence rates for total cancers, as well as for certain selected cancers.

Nantucket and Barnstable rank first and second of the fourteen Massachusetts counties for total cancers. Nantucket County ranks first out of the fourteen Massachusetts counties for all cancers, female breast cancer, colon/rectal cancer, and prostate cancer. Being a small population county, data was not available for many uncommon cancers.

Barnstable County ranked second of the fourteen Massachusetts

counties for all cancers; first for leukemia and urinary bladder cancer; second for brain cancer, malignant melanoma of the skin, and prostate cancer; and third for female breast cancer.

In addition to the NCI database, the excellent Massachusetts Cancer registry series by city and town allows a closer look for the years 2001 to 2005 at the towns around PAVE PAWS and at Nantucket Island (which is also a town as well as a county). The three towns around PAVE PAWS, Barnstable, Sandwich and Bourne, each have a significant excess of total cancers. Barnstable has a significant excess of malignant melanoma, pancreas and prostate cancer; and Sandwich has a significant excess of malignant melanoma, leukemia, prostate, urinary tract, and bladder cancers.

Nantucket Island has significant elevations of total cancers, malignant melanoma, female breast and colon/rectal cancer, and prostate cancer. I predict that Nantucket Island cancer rates will gradually decline, since the Loran C antenna no longer operates.

Despite the nebulous findings of a National Academy of Sciences report on PAVE PAWS in 2003, there is clearly something going on regarding RF environmental exposures and cancer on Cape Cod. There have also been childhood leukemia clusters near powerful (one million watts) military communications transmitters in Hawaii, Guam, and Scotland, as well as several other clusters near broadcast facilities throughout the world.

POLYCYTHEMIA VERA

In the winter of 2009, I met again with the La Quinta school teachers. Most of them have voted with their feet and left for other schools. The new teachers, unfortunately, have little knowledge of their risk, and they and their students continue to be exposed to the same high levels of dirty electricity as before. The teachers have not been able to secure

legal assistance, and are justifiably furious that their union won't help them.

From them, I learned that a second teacher in their group also had a case of polycythemia vera (PCV), in addition to the Burkitt's Lymphoma that killed him. Polycythemia vera is a type of red blood cell leukemia, which can be treated by bloodletting. There were two cases of PCV in that teacher's population, about sixty times what would be expected. Both of the cases taught in rooms that had a maximum reading on the G/S meter (2000 G/S units).

In an online search of PCV, I learned of a PCV cluster in Pennsylvania that was being studied by ASTDR. Four confirmed cases lived on Ben Titus Road in Tamaqua, Pennsylvania. After investigating through Google Earth, I noticed a cogenerating utility plant nearby. These plants burn waste anthracite coal called culm to generate electricity. Culm is deposited in large mounds around coal-producing states, including Pennsylvania. In theory, every electron generated by a utility plant returns to a substation at the plant either through the neutral line of the electric distribution system or through the earth.

I suspect that often, electricity returns through the ground rather than the neutral line, and can therefore get into homes through ground rods and metal plumbing. A clue that high frequency transients might be involved in causing PCV was reported in a 1981 letter to the *New England Journal of Medicine* by Dr. H.L. Freidman. He noted that microwave exposed workers were over-represented among the PCV cases he had examined. The title of his letter was self-explanatory: "Are chronic exposure to microwaves and polycythemia associated?" I sent a G/S meter to a local Tamaqua resident to check the high-frequency voltage transients in the PCV neighborhood. The levels were high. Further study is necessary.

CANCER CLUSTERS

Disease clusters always represent unique opportunities to gain insight into illness and causation.

In the spring of 2009, I learned of a cancer cluster in the Literature Building at San Diego State University (UCSD), which included eight cases of breast cancer since 2000. UCSD epidemiologist, Dr. Cedric Garland, had linked strong electromagnetic fields generated by the building's elevator system to the high rate of cancer in building employees. I contacted three faculty members and the university leadership and offered to investigate the cluster free of charge. Although the faculty was supportive of my participation, the university instead hired Dr. Leeka Kheifets, a long-time consultant for the electric utility industry. Her final report was essentially a literature review of studies already published. Interestingly, Dr. Garland, who did the original study, first learned of her report when I sent him a copy. A new Literature Building committee chairman there has unfortunately shut the door on any further investigation.

Three other cancer clusters in the news recently may well have an EMF connection. A Google Earth flight to the Acreage, Florida shows a high voltage transmission line traversing the area with a utility substation near the school, Cameron, Missouri has a prison north of town with a high voltage electric fence, and Clyde, Ohio has a large Whirlpool appliance assembly plant.

FERTILITY AND ELECTRIFICATION

When conducting the large mortality study using the 1930 and 1940 vital statistics, I noticed that birth rates and fertility were inversely correlated with residential electrification levels; the more electrification, the lower the fertility and birthrates became.

Birth rates and death rates are sometime published in adjacent

columns in United States vital statistics books. Third world electrification projects also resulted in lower fertility and birth rates. The people doing this work were economists and sociologists and ascribed the changes to societal and social variables. I think that the changes are due directly to EMF exposures because in one place, the birth rate dropped within a year of electrification. In another place the birth rate was lower in women who didn't practice family planning in an electrified village, compared to women who didn't practice family planning in a village without electricity.

Places in rural China and India are now undergoing electrification. It would be a marvelous opportunity to prospectively study populations being exposed to EMFs for the first time.

Clues to this relationship also exist in animals. There have been several studies that found that cows give less milk with increased EMF exposures, and both cows and pigs have shown fertility problems in such environments.

Dave Stetzer has an interesting fertility anecdote from his area of Wisconsin regarding bank employees. The women bank clerks were having difficulty getting pregnant or were suffering spontaneous abortions. He examined the bank, found high levels of dirty electricity, and reduced them with filters. A year or so later he got an angry call from the bank manager, complaining that many of his workers had left simultaneously on maternity leave. **I think that the boom in fertility clinics may be due to increasing environmental EMF levels.**

TESTICULAR CANCER AND RADAR EXPOSURES

Once in a rare while, all it takes is a letter to decision-makers to make a huge difference for a worker. In 2006, I received a letter from Thomas McCaskell, a retired member of the Royal Canadian Mounted Police, who had developed testicular cancer from holding energized radar guns in his lap. One of my Centers for Disease Control (CDC) trainees, Dr.

Robert Davis, had co-authored a case report showing that police officers who held radar guns in their laps had about seven times the expected risk of testicular cancer. I wrote a letter to the Department of Veterans Affairs in Canada stating my reasons for believing that radar causes testicular cancer and attached a copy of the Davis paper.

About a year later, Mr. McCaskell sent me an E-mail that included a copy of the favorable decision in his case from Veterans Affairs. Most importantly, this sets a precedent for similar cases. Too often, attempts by an outside professional to spontaneously assist in these situations are met with suspicion rather than goodwill.

BRUSHED GENERATORS AND MOTORS

Edison's nine "Jumbo" generators had serious brush arcing problems and commutator wear. This means that from the very beginning of electrification in the US and the rest of the world, dirty electricity was being sent out into the grid. In an attempt to control the arcing, he added metallic mercury to the commutators, but this caused illness in his workers. Brushed generators and motors have the same problem today. At my request, David Stetzer captured wave forms and measured the dirty electricity from three large commercial generators. All had dirty electricity levels above 200 Microsurge meter units and dirty sine waves.

In 2011 the Lancet published a paper (Danaei G. et al, 2011) listing fasting plasma glucose (FPG) and diabetes prevalence in 199 countries and territories around the world. Islands are over-represented in places with high blood glucose and diabetes prevalence. Seven of ten of the places with highest FPG in males are small islands, while only one of the ten places with the lowest FPG are. In 2011, the same group, Global Burden of Metabolic Risk Factors in Chronic Diseases Collaborating Group, also published a similar analysis of body mass index (obesity) (Finucane MM et

al, 2011), with nearly identical results. I believe that the world wide epidemics of diabetes and obesity are both due to exposure to dirty electricity on electric utility wiring coming from generator brush arcing, bad wiring connections and from cell tower switching power supplies. Islands without fuel supplies are likely to import diesel oil to fuel generator sets which generate dirty electricity which rides along on the 50 and 60 Hz transmission frequencies. My letter to the Lancet about this was rejected (see my web site).

De-Kun Li (Li DK 2011,2012) has published two important prospective studies showing that magnetic field exposure during pregnancy increases the risk of asthma and obesity in offspring. If the islands of Oceania are cleaned up, it may take a generation to see the effects.

I think I also know the etiology of the excess suicides, post traumatic stress disorders, and a number of other Gulf War illnesses. About 85 percent of the fuel oil imported into Afghanistan and Iraq is used for air conditioning at a cost of $20.2 billion per year (2011 report). The portable diesel-fueled generator sets which power the air conditioners generate a lot of dirty electricity. The wiring also can't be very good, because of the reports of increased accidental electrocution in military personnel in Iraq and Afghanistan. Interestingly, Navy and Air Force personnel don't share the recent suicide increase seen in the Army and Marine Corps.

The highest asthma prevalence rate reported is in the population of Tristan da Cunha, a small Atlantic island with six diesel generator sets for electrical power.

11
WHAT TO DO

EVER SINCE THE Wertheimer-Leeper 1979 study, the focus of most EMF research has been on the power frequencies of 50- and 60-Hz. These are in the extremely low frequency (ELF) part of the electromagnetic spectrum.

Electricity travels at the speed of light, or about 186,000 miles per second. The wavelength of various frequencies is measured in relationship to the speed of light. For instance, distances in the galaxy are measured in light years, i.e., the distance light travels in a year. Similarly, the wavelength of residential electricity in the United States would be calculated as 186,000 divided by 60-Hz, or 3,200. That means that the distance between successive peaks of a 60-Hz sine wave is more than three thousand miles.

This calculation holds true for all frequencies. The higher the frequency, the shorter the wavelength. For instance, gamma rays have wavelengths of a billionth of an inch. Visible light is also part of the electromagnetic spectrum. The various colors of visible light also differ in wavelength and frequency: red has the longest wavelength and

lowest frequency, while violet has the shortest wavelength and highest frequency. Ultraviolet is of course important as our major source of vitamin D.

The energy of EMFs is proportional to frequency. The frequencies above ultraviolet are said to be ionizing, since they have enough energy to knock electrons out of orbit, creating ions. The inadequate existing U.S. safety standards for EMF/RF are based solely on certain frequency's ability to heat tissue the way a microwave oven heats food. The standards acknowledge the importance of frequency in their models because as frequency increases, exposure limits are lowered.

The "smooth" 60-Hz sine wave EMFs seem to have few biological effects in animal exposure studies. If frequencies are pulsed or modulated, they seem to become more bioactive.

When industry apologists say that these fields are too weak to cause biological effects, I point them to any number of electro-therapeutic devices, such as pulsed high-frequency field generators that are used to accelerate the healing of bone fractures. Anything that can stimulate cell division and growth is a potential carcinogen.

HIGH DIRTY ELECTRICITY LEVELS

I carry a G/S meter around and measure outlets whenever I get a chance. I have a modified meter with a maximum reading of 20,000 units, compared to the commercially available meter, which can read 2,000 units. The highest levels I've seen so far are in excess of 20,000 compared to the recommended 50 units. The worst offenders were a lamp store, hospital emergency rooms, and an oncology clinic. A strip mall near a cell tower, a school near a cell tower and a fire station near a cell tower, all have high dirty electricity levels. An electrical outlet in a bicycle repair shop about thirty feet from a cell tower read above 20,000 G/S units. It is ironic that the oncologists, nurses, and staff at an oncology clinic are being exposed eight hours a day where they work to diagnose

and treat cancer patients, yet are unaware themselves of their own potential exposures to a controllable carcinogen. Nothing ever came of notifying the hospital facilities people of what I found.

REMEDIES

Most of the devices that generate dirty electricity can be redesigned to eliminate it at very low cost. New buildings should be designed with dirty electricity levels in mind. Existing schools, hospitals, and medical facilities should be surveyed and filtered to reduce dirty electricity levels. Many of the large childhood and adult cancer studies done over the past thirty years should be revisited using the new G/S meter. I predict that their risk ratios will increase. Also a new generation of animal exposure studies should be done using dirty electricity as the new exposure metric.

New case-control studies, especially of malignant melanoma and thyroid cancer, should measure the high frequency transient exposures. These two cancers have among the highest rates of increase in Western populations

In the early days of magnetic field research, the utility companies sponsored magnetic field surveys of residences and offices around the country. Many utility companies will still come to a home or business when asked to take measurements, and we now need to request that they include dirty electricity as part of their surveys.

If dirty electricity can dramatically increase blood sugar levels, it can cause problems in trying to stabilize "brittle" diabetes, the term used to describe poorly controlled blood glucose levels. Childhood asthma has also been linked to dirty electricity exposure in one Wisconsin school. Clinical studies of the effects of dirty electricity exposures in asthma and diabetes are essential. Every school in the country should be looked at and filtered if necessary. With the difficult financial climate,

jurisdictions are increasingly leasing school and fire station property for cell tower sites.

Tanning beds should be banned, because they cause malignant melanoma. I don't think it is solely the ultraviolet light that is the carcinogen, but the electrical equipment powering the fluorescent bulbs, too. I have measured very high levels of magnetic fields (above 100 mG) on tanning beds, and high levels of dirty electricity in the outlets of the tanning parlors.

Radial tires can be made with non-magnetic wire. Tire balancing machines can be made to de-magnetize tires as they spin for dynamic balancing.

One easy way to detect higher frequency radiation in your environment is to use a simple portable AM radio, a sensitive detector of dirty electricity. Tune the AM radio to an "off" station, meaning where there is no broadcast occurring, just white noise. Any place in your house or office that generates obvious, increased AM static will indicate high levels of dirty electricity or higher frequencies. Put the radio near a compact fluorescent light and turn the light on and off. Dimmer switches and wireless routers, computers, and copy machines, TV sets and fax machines also generate a lot of dirty electricity. The difference in noise will be obvious. For instance, I bought a halogen lamp which, when plugged in at one end of my house, created static near the outlets at the other end of the house. All AM radio reception, even on the strongest stations, is impossible near the La Quinta school and at a strip mall near a cell tower in Indio, California.

A meter that gives a digital readout of the high frequency voltage transient levels when plugged into electrical outlets is available from Stetzer Electric (*www.stetzerelectric.com/*). There are instructions on how to interpret the numbers, and what ranges are considered safe.

There are also methods to counteract transients that may be coming in over your power line distribution network, or through your ground rods or plumbing, as opposed to what you generate from your own electronic appliances. It is best to consult a licensed electrician before

attempting any of this on your own. Sadly, few electricians understand or know how to deal with dirty electricity.

Many companies make and market good meters for measuring various parts of the electromagnetic spectrum. A plug-in capacitive filter is also available from Stetzer Electric to reduce the dirty electricity levels, but removal of the offending devices is a better strategy. Though every location is different, in my experience, removal of twelve compact fluorescent bulbs from a track lighting system allowed me to get below the recommended 50 G/S units, using only about a dozen filters for my entire home in Washington State.

LONG-TERM SOLUTIONS

Unfortunately, funding sources for EMF research have almost completely dried up in the United States, unlike in Europe and other countries. We have also lost a whole generation of young investigators in university, private, and government labs who were forced into other research areas by the lack of money to support this important research. Industry and cell phone money have corrupted the research process, politicians, the media, and the government. After my generation of investigators has moved on, there will be nobody to take our place in the United States.

Ultimately, to get a real handle on the problem, we will have to rethink how we distribute electricity and communicate. Getting rid of wireless forms of communication is a logical first step. I predict that when the latency periods (time between first exposure and diagnosis) for brain tumors have been achieved, we are in for a calamitous epidemic of cell phone-induced brain tumors.

With rare exceptions, such as Lennart Hardell's work in Europe, most of the cell phone brain tumor epidemiology is of such low quality that it doesn't merit publication. With non-participation rates among controls around 50 percent, it is impossible to have any confidence in

study results. I suspect that cell phone money has compromised both the investigators and the journals.

Today, homes are being built without wiring for landline telephones. The large telecommunication companies are in a race to force consumers go all wireless. They plan to saturate urban and rural areas with Wi-Fi and Wi-Max systems, and the Federal Communications Commission (FCC) is assisting this with recommendations for private/public (taxpayer) cooperative funding. In addition, broadband Internet connections transmitted over power lines (BPL) have been deployed in certain areas and are spreading quickly. This technology delivers high frequencies to every outlet in the grid.

Many jurisdictions are unfortunately outlawing incandescent light bulbs in favor of the compact fluorescent bulbs (CFLs), which generate RF and high frequency voltage transients in addition to containing mercury. This, too, is a mistake. CFLs will prove more dangerous to the environment and to people than any energy savings they promise. Light emitting diode (LED) bulbs will probably be the best power saving light bulb alternative.

The electric grid should be rebuilt with wiring adequate enough to return currents to the substation without using the ground. The grid was originally built for return currents to travel over wires. It should also be possible to engineer the high-frequency voltage transients out of the electricity that is delivered to our homes and offices.

The trend to "green" energy sources like wind and photovoltaic solar generating facilities may increase exposures to dirty electricity. They use grid intertie inverters and controllers to convert the power they generate into utility-grade electricity that can be sent out on the grid. I expect that commercial fuel cell generating facilities will have the same problem. The devices that do the conversion inject transients onto the grid. **The dirty electricity in a home with a photovoltaic system was 60 G/S units with the inverter turned off and 600 G/S units with it on. Every residential and commercial photovoltaic solar generating facility I've examined generates high levels of dirty electricity.**

Wind farms create two serious health problems; low frequency sound waves (infrasound) caused by the turbine blades and dirty electricity caused by their inverters. Dr. Nina Peirpont has written a book called *Wind Turbine Syndrome,* and Magda Havas and David Colling have a paper describing wind farm dirty electricity (Havas & Colling, 2011).

Similarly, since the electronic equipment of cell towers and terrestrial RF transmitters (AM, FM, TV) operates on direct current, the inverters and switching power supplies that change the AC line voltage to DC, interrupt the current flow and inject dirty electricity into the grid that powers them. I'm sure it is possible to build inverters that won't generate dirty electricity, but until rules and regulations force this, power quality will be sacrificed for profit.

Recent deployment of "smart meters" for residential electricity, water, and gas billing at homes emit RF **and dirty electricity**. The billing information could be sent over existing phone lines, or over fiber-optic lines. Other "smart grid" schemes for self-regulating appliances will also increase residential RF exposure. **Most new appliances have microwave transmitters built into them which communicate constantly with the smart meter.** I believe that the recent increase in the incidence of malignant melanoma and thyroid cancer is due to these fields.

Since most of the electricity that is generated is literally used to turn the wheels of industry with electric motors, it is important that they be made as clean as possible. There is a recent trend toward variable speed motors that generate a lot of dirty electricity. Most new furnace fan motors use variable speed motors to minimize electricity use.

CONCLUSION

The explosive recent increase in radio frequency radiation and high-frequency voltage transient 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 twentieth century EMF epidemic, we may already have a twenty-first century epidemic of morbidity and mortality underway, caused by high frequency electromagnetic fields. The good news is that many of these EMF diseases may be preventable by simple environmental manipulation, if society chooses to pay attention. Unless public outrage intervenes, I'm afraid that our "diseases of civilization" will only get worse. Good science alone is never enough to force sensible public policy. Only citizens can do that.

APPENDIX

BIOGRAPHICAL INFORMATION

Samuel Milham, MD, attended the Albany NY public schools and earned the BS degree from Union College in Schenectady, New York, the MD degree from Albany Medical College, and an MPH degree from Johns Hopkins University. He is board certified in Public Health, has a Washington State medical license, and has published more than one hundred peer-reviewed articles in his fifty years as a chronic disease epidemiologist. His special interests are: congenital defects, occupational and environmental illness, methods in occupational and environmental studies, and EMF epidemiology.

EDUCATION AND EXPERIENCE

Union College, Schenectady, New York, September 1950–June 1954. B.S. Sigma Xi, Fuller Chemistry Prize

New York State Medical Scholarship

Albany Medical College, September 1954–June 1958, MD. Alpha Omega Alpha

Intern, U.S. Public Health Hospital, Boston, Massachusetts, July 1958–July 1959.

U.S. Public Health Service Residency in Public Health Assigned to Monroe County Health Department, Rochester, New York, July 1959–August 1960.

Johns Hopkins School of Hygiene and Public Health, September 1960–June 1961, MPH.

Senior Resident in Epidemiology, Residency Program, New York State Department of Health, June 1961–1962.

Development Consultant New York State Department of Health, 1963–1967.

Assistant Professor, Department of Pediatrics, Albany Medical College, July 1964–1967.

Diplomate, American Board of Preventive Medicine, June 1966.

Associate Professor, University of Hawaii School of Public Health and Medical School, 1967–1968.

Section Head, Epidemiology, Washington State Department of Health, 1968–1986.

Travel Fellowship, IARC 1971.

Travel Fellowship, International Cancer Research Technology Transfer, 1981.

Washington State Public Health Association Annual Award, 1986.

Chronic Disease Epidemiologist, Washington State Department of Health, 1968–1988.

Clinical Associate Professor, University of Washington School of Public Health, 1968.

Section Head, Chronic Disease Epidemiology Section, Washington State Department of Health, 1988–May 1992.

Adjunct Professor, Mount Sinai School of Medicine, 1989.

Robert Carl Strom Foundation Humanitarian Award, 1990.

Member of Bioelectromagnetics Society, 1984.

Self-employed, June 1992.

Elected to Fellowship, Collegium Ramazzini, October 1994.

Ramazzini Award, 1997.

RESOURCES

For information about all aspects of EMF, *Microwave News* has no peer. *Microwave News* also lists meters for measuring EMFs (http://www.microwavenews.com/).

Magda Havas's work is online at http://www.magdahavas.com/.

The Bioiniative Report reviews the rationale for EMF and RF exposure standards: www.bioinitiative.org/report/index.htm

Catherine Kleiber : http://www.electricalpollution.com

Janet Newton, EMR Policy Institute: www.emrpolicy.org

"Dirty Electricity" meters, filters, and plug strips are available from Stetzer Electric (http://www.stetzerelectric.com/).

I like the Tri-Field Meter from Alpha Labs (http://www.trifield.com/).

Less EMF Inc (www.lessemf.com/) has about anything else you might need for measuring or shielding EMFs.

Radio Shack sells a $15 portable AM/FM radio, model no. 12-586, which is a very sensitive detector of dirty electricity over a wide range of frequencies in the AM band.