

## CELL TOWER REPORT

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### CELL TOWERS AND WIRELESS COMMUNICATIONS – LIVING WITH RADIOFREQUENCY RADIATION

#### INTRODUCTION

This report is on the topic of cell towers and the possible ill health effects from exposure to the transmitting antennas for our wireless communications. These antennas are found on all wireless communications devices, such as cell towers, WiMax systems, internet routers\*, cell and cordless phones (DECT), smart meters\* and smart boards\*, ebook readers and baby monitors.

The information in my report is mostly limited to cell towers (also called masts and base stations). Towers, masts and base stations are not the issue in themselves. It is the transmitting antennas that are indicated in ill health effects. These antennas all have electromagnetic fields and emit radiofrequency radiation (EMF/RFR) part of the non ionizing radiation (NIR) on the electromagnetic spectrum.

Transmitting antennas may also be found on buildings and utility poles. The terms wireless communications devices and wireless telecommunications facilities are also used. My report will use many of these terms and they can be used interchangeably.

Please note, all wireless devices – such as cell phones, cordless phones and WiFi routers - have transmitting antennas. There have been many warnings on exposures to these devices as well. In particular cell and cordless phones, due to being held to the head, give much higher short-term exposure to RFR. **If anyone would like more information on cell and cordless phones please refer to Dr. Devra Davis's website Environmental Health Trust at <http://www.environmentalhealthtrust.org/content/cell-phones>**

I am a public health advocate. I am not an expert in this field, however I have researched this issue for the last four years. I started this research after I moved into a house that was 300 feet from cellular antennas and found myself unable to sleep for more than four hours a night and had difficulties with my mental capacity. I found I could not spell simple words and that

my short-term memory was failing. After moving away from the antennas I no longer have these symptoms. From my international networking I have found countless numbers of people who have gone through similar experiences. From my research and my networking on this issue I am convinced that millions of people are being harmed by exposure to EMF/RFR at levels that are deemed safe by our government. As our government has not acknowledged this it is now my work to educate people so that they can take measures to minimize their exposure.

The Federal Communications Commission's (FCC) RFR exposure standards for wireless transmitters have been formulated with the intent to protect us from thermal heating based on 30 minutes of exposure. You may have heard that there is no evidence of harm other than thermal heating from exposure to RFR. The CDC, FDA and the FCC all make this claim. This simply is not true. If one closely examines the body of research on EMF/RFR exposures it becomes apparent that the majority of the industry funded studies show no effect while the majority of the independent studies do.\*\* Studies funded by the mobile phone industry are more than six times more likely to find "no problem" than studies funded by independent sources. Both sides offer conjecture as to why this is so. But the claim by industry and governmental agencies that there is no evidence is plainly false. If the industry funded studies are excluded, the weight of the evidence is that there are indeed non-thermal biological effects, many of which are harmful to health, that occur at exposure levels far below the FCC exposure standards.

\*Internet routers, smart meters and smart boards may operate with either wired or wireless networks.

\*\* (The cell phone industry has funded at least 87% of the research on this subject. See - <http://andrewamarino.com/PDFs/CellphoneEMFs-Review.pdf> )

## A QUICK BACKGROUND

A quick background, we all know that RFR from a microwave oven heats food. The thermal effect is well established. The controversy over this issue is due to the belief of many scientists and governments that RFR can only have a heating effect and our exposure standards protect us from this heating, therefore they claim that it is perfectly safe to have RFR emitting devices in our bedrooms and next to our schools.

Why do they say this? Speculation is that it has to do with the money. Just as the tobacco industry was able to suppress science, the telecommunications industry suppresses science. They fund studies that find no results. They marginalize the researchers in the field who do find harmful effects. (Please see Study Bias Report in references.)

This massive industry had combined revenues of more than \$4.9 trillion in 2009. In 2007 the U.S. telecommunications industry spent almost \$250 million on political lobbying. Over the past decade, they have spent a grand total of nearly \$2.4 billion. Over 247,081 antenna sites have already been approved nationwide without any federal studies to assure the safety of those living nearby.

(See

<http://www.plunkettresearch.com/Telecommunications/TelecommunicationsStatistics/tabid/96/Default.aspx> and

<http://articles.mercola.com/sites/articles/archive/2008/11/29/interview-with-expert-on-dangers-of-cell-phones.aspx>)

## THE BIONITIATIVE REPORT

The **BioInitiative Report**, published in 2007, provides detailed scientific information on health impacts when people are exposed to EMF/RFR hundreds or even thousands of times below limits currently established by the FCC. The authors reviewed more than 2000 scientific studies and reviews, and concluded that the existing public safety limits are inadequate to protect public health. Their conclusion is that: From a public health policy standpoint, new public safety limits, and limits on further deployment of risky technologies are warranted based on the total weight of evidence. Their recommendation is to set an exposure standard of **0.1 microwatt per centimeter squared ( $\mu\text{W}/\text{cm}^2$ ) limit**. This is 10,000 times lower than the FCC standard of 1,000  $1 \mu\text{W}/\text{cm}^2$ .

The report includes studies showing evidence for:

- Effects on gene and protein expression
- Genotoxic effects
- Stress response
- Effects on immune function
- Effects on neurology and behavior
- Brain tumors and acoustic neuromas
- Childhood cancers (leukemia)
- Reduced Melatonin production
- \* Alzheimer's disease
- \* Breast cancer

## HOT SPOTS

Cellular antennas have power peaks at predetermined distances. These vary and are influenced by compounding exposure factors that can cause localized increases of RFR levels. Some of these factors are: other RFR emissions, from WiMax, WiFi, cordless phones, etc. in the area will add to the overall RFR burden; reflective materials reflect RFR and create hot spots (just as they do in microwave ovens); and, metal and wires are RFR conductors and may amplify the signals. In addition locations closest to and/or in direct line of sight of the transmitters will have elevated RFR levels relative to surrounding locations. The Occupational Safety and Health Agency (OSHA) reports: *Metal objects such as steel beams can act as antennas by receiving and then "re-radiating" some of the energy, forming a new radiating surface to consider. **Not only does this new radiating surface have its own near-field regions, the energy levels might be shockingly high. Exercise caution near such metal objects.***

([http://www.osha.gov/SLTC/radiofrequencyradiation/electromagnetic\\_fieldmemo/electromagnetic.html](http://www.osha.gov/SLTC/radiofrequencyradiation/electromagnetic_fieldmemo/electromagnetic.html)) These factors may perhaps cause the people who are in the elevated RFR zones over the tipping point into electrohypersensitivity (EHS) (Explained later).

Our bodies may also have localized internal hot spots. Due to the variable shape, size and thickness of our skulls and dependent on our particular resonance to the frequency of the RFR **regions of relatively high absorption can occur at or near the center of the brain causing internal hot spots**, which can result in tissue damage long before the overall body temperature shows a measurable increase.

Due to a lack of adequate vascular systems for the exchange of heat our eyes are also most susceptible to harm from RFR exposure, which can result in protein coagulation and opacities in the lens. The male testes are another organ particularly susceptible because there is no direct blood supply and therefore no way of dissipating heat.

According to the BioInitiative Report, the RFR level we evolved with was a billionth of a microwatt per centimeter squared ( $10^{-12}$   $\mu\text{W}/\text{cm}^2$ ) In 1997 the background RFR levels measured by Ed Mantiply of the FCC at areas on the ground near towers had increased 0.003 to 0.3  $\mu\text{W}/\text{cm}^2$ . A survey by Sage Associates in 2000 found RFR levels within 300 feet from cell towers to range from 0.01 to 3.0  $\mu\text{W}/\text{cm}^2$ . And an RFR survey near cell towers in Germany in 2002 found RFR levels of 0.02 to 10  $\mu\text{W}/\text{cm}^2$ . These readings were the highest at homes that were closest to and in direct line of sight of the transmitting antennas. **More recently, transmitters installed by T-Mobile on utility poles in San Francisco may emit RFR levels up to 190  $\mu\text{W}/\text{cm}^2$ .**\*

\* (<http://noevalleyvoice.com/2009/December-January/T-Mo.htm>)

### **RFR monitoring uses spatial averaging -**

*“Spatial-averaging is an RF radiation measurement technique used to determine the amount of RF exposure at a particular spot by averaging the electric and magnetic fields (squared) over an area equivalent to the area normally occupied by a standing human body. The FCC ... expressed concerns about situations where a localized (spatial peak) field intensity exceeds the exposure limits near an antenna (which is potentially accessible to workers or the public) despite the fact that the spatially averaged measurement over the area indicates compliance with exposure limits. **The concern is that localized hot spots could lead to exposure in the body of a nearby person that exceeds the partial-body limits while not exceeding the whole-body limit.**”*

([http://www.fcc.gov/Bureaus/Engineering\\_Technology/Documents/bulletins/oet65](http://www.fcc.gov/Bureaus/Engineering_Technology/Documents/bulletins/oet65))

At my former home, which was 300 feet from cell phone antennas located on a two-story building with direct line of sight, the RFR measurements were at the highest level at my head height and the lowest level was at my feet. Personally I am more concerned about the RFR going straight to my head than I am over the average of the exposure to my entire body and I find the use of spatial averaging to be a duplicitous method of determining safe exposure levels to RFR.

## GUIDELINES

According to researcher Magda Havas, PhD, BSc, RFR exposure guidelines, used in our wireless communications, range 5 orders of magnitude in countries around the world. Salzburg, Austria recommends that RFR levels be kept to: Outside  $0.001 \mu\text{W}/\text{cm}^2$  and Inside  $0.0001 \mu\text{W}/\text{cm}^2$ . **The U.S. exposure guideline is  $1000 \mu\text{W}/\text{cm}^2$ .** In China and in Russia the guideline is  $10 \mu\text{W}/\text{cm}^2$ .

Why do we have guidelines that are so much higher? Our guidelines are based on a short-term (30-minute) heating effect called the Specific Absorption Rate (SAR). It is assumed that if this radiation does not heat your tissue it is safe. This is not correct. Effects are documented at levels well below those that are able to heat body tissue. These biological effects include increased permeability of the blood brain barrier, increased calcium flux, increase in cancer and DNA breaks, induced stress proteins, and nerve damage. Exposure to this energy is associated with altered white blood cells in children; childhood leukemia; impaired motor function, reaction time and memory, headaches, dizziness, fatigue, weakness and insomnia.

While most people want wireless communications, the siting of transmitters needs to be based on minimizing harm. If there will be children or homes close to the antennas these **people are more susceptible to harm from RFR exposure as chronic long-term exposure leads to cumulative damage and the development of electrohypersensitivity and children's smaller bodies absorb more radiation.\*** In addition, wildlife, with bees in particular, may have their navigational abilities interfered with due to RFR exposure.

*\*Lai and Singh confirmed in 1997 that EMF exposure has cumulative effects.*

The report, **Merger of Two Different Dosimetry Rationales - August 2009**, out of Russia, compares the two approaches to establishing exposure guidelines. It says:

<http://www.piers.org/piersproceedings/piers2k9MoscowProc.php?start=0>

### **Merger of Two Different Dosimetry Rationales**

*Sergey Yu. Perov, Quirino Balzano, and Niels Kuster*

PIERS Proceedings, 157 - 160, August 18-21, Moscow, RUSSIA 2009

(Access the html version here - <http://tiny.cc/2CIgv> )

*“...One approach is based on the measure or estimate of specific absorption rate [SAR used in the U.S.], which is the power absorbed per unit weight of an object. The other relies on the measure of the time integrated radiofrequency power density incident on an object. [Cumulative biological effects used in Russia.]...*

***...the Russian Federation exposure limits are founded on chronic biological effects caused by non thermal EMF exposures; the effects were investigated using behavioral, electrophysiological, hematological and biochemical methods...***

*The biological effects of EMF exposure (depending of reaction intensity) can be divided into several categories: perception, adaptation, compensation, reparative regeneration, pathology. Each step of reaction can be characterized by its own threshold EM values of intensity and development times. **The magnitude of an effect grows not only with the exposure intensity but also with the exposure time.** Progressing through stages of reactions to EMF exposure of various intensities, it is possible to define a range of outcomes...”*

**Russia’s RFR exposure standard is 10  $\mu\text{W}/\text{cm}^2$  compared to the 1,000  $\mu\text{W}/\text{cm}^2$  standard used in the U.S.**

Below are excerpts from Wolfgang Scherer’s report on the cumulative exposure to RFR and the need for new exposure standards:

<http://www.reach.net/~scherer/p/biofx.htm>

*“...To be useful exposure standards have to give a peak limit and a dosage limit. The power we get from our utility is measured in Kilo-Watt-Hour, a unit used to measure accumulated power consumption over a time period. A unit for accumulated exposure to radiofrequency radiation should be established in the same manner, for example  $\text{mWh}/\text{cm}^2$ . If we use the exposure rates allowed by [Canadian] Safety Code 6 we get as an accumulated dose 1  $\text{mWh}/\text{cm}^2$  for one hour but 0.4  $\text{mWh}/\text{cm}^2$  for a minute...**science has yet to come up with a dose that can be endured without damage, setting a radiation level that can be considered safe for permanent exposure...***

*From the allowable occupational exposure it could be calculated that by multiplying this number with 8 hours of a work shift, an allowable dose of 8  $\text{mWh}/\text{cm}^2$  per day could be established. But this would then only be valid for an 8-hour work shift with a 16-hour recovery period and would establish an occupational exposure level only.*

*A further linear reduction to 0.3  $\text{mW}/\text{cm}^2$  as a permanent exposure rate causing the same dose over a 24-hour period is merely a mathematical exercise and does not address accumulation with no recovery period. More problematic if that exposure is not occupational but involuntary.”*

Our genetic, chemical, piezoelectric and resonant variation all factor into how much energy is absorbed upon EMF/RF exposure. The rate that we can release energy (heat) also varies between individuals. These varying factors mean that we do not absorb EMF/RF equally and we do not release the energy equally. Our exposure guidelines need to take in these factors as well as the cumulative effect from EMF/RF exposure.

## THE STUDIES

Industry and governments state that there are no studies proving cell towers are unsafe. While it is true that it is impossible to exactly duplicate our ambient exposures to RFR in the environment in a laboratory setting, **there are numerous studies, which show**

## **biological harm at RFR levels well below our environmental exposure from neighborhood cell towers.**

There are more than 13,000 studies on Pub Med on the topic of EMF/RFR exposure and possible harmful effects. I do not have the expertise or the time, and I imagine you do not either, to go through all of these studies to determine if the studies are sound or if they are flawed. Most studies have some flaws, as there are limitations to replicating and measuring real time exposure to RFR. I am relying on the work of researchers in this field and reporting on their findings.

As there are very few valid epidemiological studies on cell towers and health – The World Health Organization has only 14 studies that meet their criteria in their database – it is necessary to examine evidence of exposures that are of a similar level as one would receive from RFR antennas on a cell tower. I have included some of these studies. (See Studies on Low Level Non Thermal Biological Effects of EMF/RF in the reference section.)

Included in Dr. Magda Havas' WiFi report for San Francisco, Dr. Henry Lai, PhD, compiled a list of studies that document biological effects of RFR at low intensities. (See <http://www.magdahavas.com/2009/10/17/wifi-proposal-for-san-francisco/>)

*“All of the 40 reports, reviewed by Dr. Henry Lai, document biological effects or associations, many of them adverse or undesirable, at exposure to RFR below the FCC guidelines for both power density (1000  $\mu\text{W}/\text{cm}^2$ ) and specific absorption rate (0.08 W/kg). Of the 12 studies that provide power density data, 11 document effects below 41  $\mu\text{W}/\text{cm}^2$  (scenario of woman using her laptop computer on her balcony); 6 document effects below 6  $\mu\text{W}/\text{cm}^2$  (exposure to multiple Wi-Fi antennas); and 3 document effects below 1  $\mu\text{W}/\text{cm}^2$  (exposure to 1 Wi-Fi antenna).”*

## **Epidemiological evidence also shows cause for concern over RFR exposure from cell towers.**

In fact 10 out of the 14 peer-reviewed studies analyzed, and conforming to the specified WHO/ICNIRP standards of scientific quality, including their assessment criteria of consistency and replication found significant increases in ill health effects. Included in this database are only those studies that are about cell tower exposures. (Kundi, 2008 at the London EMF International Conference). Populations close to cellular antennas show an increase in the effects of ill health in those closest to the antennas with the risks factors dropping off as distance and RFR levels decrease. Symptoms ranged from sleep disturbances to breast and brain cancers.

Researchers at Powerwatch UK found that 26 out of 44 epidemiological studies that met their criteria show significant health risks.

Epidemiological studies are not proof of cause, however they do show associations and are used to set policy on many environmental exposures. In fact there is very little scientific proof that tobacco causes lung cancer or even for ionizing radiation and ill health effects. For the most part we rely on epidemiological studies to show the strong correlation between environmental exposures and ill health.

## BIOLOGICAL PROCESSES

What is going on here? All electronic devices have an EMF field. Our wireless communications devices also emit RFR. Basically when an electric field is turned on and off fast enough, it switches to a magnetic field and back to an electric field repeatedly, this creates electro-magnetic radiation.

Subsequently, RFR causes the polarity in cells to continuously reverse. This is what causes heating in our food in our microwave ovens. But what happens to living biological systems when the polarity of cells continuously reverses? This phenomenon interferes with cellular function and may explain why there is a wide range of symptoms from RFR exposure. According to Andrew Goldsworthy, BSc, PhD, additionally, *“our wireless communication devices use amplitude-modulated radio waves where the signal strength rises and falls. These have been shown to be further damaging as they can remove structurally important calcium ions from cell membranes at levels far below the thermal effect. This results in an increased leakage of materials through cell membranes that can affect many aspects of metabolism. These include damage to DNA, from digestive enzymes leaking from lysosomes, apoptosis (cell death), the generation of false nerve impulses from calcium leakage in brain cells (causing hyperactivity, impairing normal mental function and generating many of the known symptoms of electromagnetic hypersensitivity.)*

*Claims by the industry that the cellular antennas are safe because the radiation falls off rapidly with distance are flawed. The biological response will remain more or less constant over a wide range of signal strengths due to the ways in which living cells routinely use ‘negative feedback’ to compensate for changes in their environment.”*

## VULNERABLE POPULATIONS

### ELECTROHYPERSENSITIVITY

A growing population is adversely affected by these electromagnetic frequencies. Long-term chronic exposure to RFR may lead to electrohypersensitivity (EHS). EHS is recognized as a disability in Sweden where it is estimated that up to 3% of the population is EHS. Magda Havas, PhD, a researcher in this field, has stated that from her, soon to be published, research she finds that up to 35% of the population exhibits some sensitivity.

The World Health Organization defines EHS as:

<http://www.who.int/mediacentre/factsheets/fs296/en/index.html>

*“[...A phenomenon where] individuals experience adverse health effects while using or being in the vicinity of devices emanating electric, magnetic, or electromagnetic fields (EMFs)...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.”*

The WHO Fact sheet goes on to state:

*“Treatment of affected individuals should focus on the health symptoms and the clinical picture, and not on the person's perceived need for reducing or eliminating EMF in the workplace or home. “*

This indication that EHS is a mental disorder rather than biologically caused from exposure to EMF/RFR is replicated throughout governmental agencies and has led to a worldwide citizen movement of EHS sufferers having to resort to their own efforts to remove themselves from high EMF/RFR exposures.

Dr. Havas' double blind 100 person study on self-identifying EHS subjects and controls examined the heart's reactivity to the RFR emitted by common DECT cordless phones. Most of the volunteers did not respond to the exposure, but those who did respond experienced arrhythmia (irregular beats of the heart) and/or tachycardia (rapid heart rate). These symptoms were often accompanied by feelings of anxiety.

While other exposure studies on self-identifying EHS subjects have not found such strong evidence, these studies have not measured biological effects. Rather they relied on subjective reports from the test subjects.

**Symptoms of EHS** include sleep disturbance, fatigue, pain, nausea, skin disorders, problems with eyes and ears (tinnitus), and dizziness. Again, it is estimated that 3% of the population are severely affected and another 35% have moderate symptoms. Prolonged exposure may be related to sensitivity and for this reason it is imperative that children's exposure to RFR be minimized as much as possible.

## **CHILDREN'S SENSITIVITY**

Children are more sensitive to environmental contaminants and that includes RFR. Their smaller bodies proportionally absorb more RFR than adult bodies. The Stewart Report (UK 2000) recommended that children limit their use of cell phones only for emergencies. Many countries including France, the United Kingdom, Russia, Japan, Germany, Israel, India, Austria and Belgium have all issued public health warnings regarding children and have placed limitations on cell phone use, WIFI in schools and even changed EMR regulations. (See [http://thepeoplesinitiative.org///Home\\_Page.html](http://thepeoplesinitiative.org///Home_Page.html))

## **CONCLUSIONS AND WARNINGS**

### **WARNINGS**

Scientists, doctors and governmental agencies worldwide have issued warnings, restrictions and resolutions urging limiting exposure to EMF/RF. Due to the numbers of people suffering

from symptoms of EHS, medical doctors and scientists have issued resolutions stating that there is a more sensitive population to RFR and that antennas should not be sited near homes, schools and hospitals. These run from the Vienna Resolution in 1998 through to the Porto Alegre Resolution in 2009.

In 2009 and 2010 **three U.S. Governors**, of Florida, Connecticut and Colorado, declared Electrohypersensitivity Awareness months.

In May, 2009 the **LA Unified School District**, which restricts cell towers on school property passed a resolution attempting to restrict antennas near school property and in April, 2009, the **EU Parliament** adopted, by 559 votes to 22, with 8 abstentions, a resolution on health concerns associated with electromagnetic fields (EMFs) which includes criteria for setting up [Cell Towers] and high-voltage power lines. They state: *“In this context, it is important to ensure at least that schools, crèches [nursery schools], retirement homes, and health care institutions are kept clear, within a specific distance determined by scientific criteria, of facilities of this type.”*

**The Vancouver School Board (VSB)** passed a resolution in January 2005 that prohibits construction of cellular antennas within 1000 feet (305 m) from school property.

**Palm Beach County, Florida, the city and county of Los Angeles, California, and New Zealand** have all prohibited cell phone base stations and antennas near schools due to safety concerns. The decision not to place cell antennas near schools is based on the likelihood that children are more susceptible to this form of radiation.

**In January 2008, the National Research Council (NRC), an arm of the National Academy of Sciences** and the National Academy of Engineering, issued a report saying that we simply do not know enough about the potential health risks of long-term exposure to RF energy from cell phones themselves, cell towers, television towers, and other components of our communications system. **The scientists who prepared the report emphasized, in particular, the unknown risks to the health of children, pregnant women, and fetuses as well as of workers whose jobs entail high exposure to RF (radiofrequency) energy.** The report called for long-term safety studies on all wireless devices including cell phones, computers, and cell phone towers and states:

*“Wireless networks are being built very rapidly, and many more base station antennas are being installed. A crucial research need is to characterize radiated electromagnetic fields for typical multiple-element base station antennas and for the highest radiated power conditions with measurements conducted during peak hours of the day at locations close to the antennas as well as at ground level.”*

## CONCLUSIONS

**The FCCs Telecommunications Act of 1996 (TCA) [47 U.S.C. 332 (c)(7)(B)(iv) of Section 704 preempts local governments from effectively regulating the placement of wireless communications facilities on the basis of potential or known environmental effects from radiofrequency radiation.** It has been

assumed that this prohibits local governments from considering siting on an environmental and health basis. However in this case the regulation does not specifically state health effects, therefore, health effects are not subject to the preemption.

The wireless industry continues to perpetuate the fiction that federal law preempts basing the siting of transmitters due to known or potential health effects from RFR, and, local governments, fearful of being sued by one of the most powerful industries, have not been willing to challenge this misinterpretation of the TCA.

The FCC issued a recent ruling (11/18/09) on antenna siting. They found: *“In the event a State or local government fails to act within the appropriate time period, the applicant is entitled to bring an action in court under Section 332(c)(7)(B) (v) of the Communications Act, and the court will determine whether the delay was in fact unreasonable under all the circumstances of the case. We conclude that the record supports setting the following timeframes: (1) 90 days for the review of collocation applications; and (2) 150 days for the review of siting applications other than collocations.*

*Accordingly, if State or local governments do not act upon applications within those timeframes, then a “failure to act” has occurred and personal wireless service providers may seek redress in a court of competent jurisdiction within 30 days, as provided in Section 332(c)(7)(B) (v). The State or local government, however, will have the opportunity to rebut the presumption of reasonableness.”\**

(\* <http://www.fcc.gov/> November 18, 2009 "FCC Issues Declaratory Ruling Establishing Timeframes for State and Locality Processing of Applications for Wireless Towers")

This means that once an antenna application has been filed the wireless company can sue the state or local government if they have not either approved or denied the application within 150 days. This new ruling will force much faster action on cell tower siting than there has been in the past. Montgomery County, MD filed comments to the FCC against this new ruling, as did many local governments. Our current President Obama also filed comments against this while he was still a Senator from Illinois. The CTIA petition to the FCC asked that an antenna application be considered passed if it was not denied within 45 days so the FCC did not give in completely to their shot clock request.

**The wide variance in RFR exposure limits around the world is due to the fact that some countries dismiss non-thermal biological effects from RFR exposure.**

Their limits only protect against thermal heating. Many countries - New Zealand, Italy, China, Bulgaria, Hungary, Russia, Switzerland, Austria and New South Wales, Australia - have lower limits that factor in the non-thermal cumulative effects, which have been shown to occur at levels thousands of times lower than the thermal effects. The BioInitiative Report recommends an RFR exposure level of 0.1  $\mu\text{W}/\text{cm}^2$ . Our standard is 1,000  $\mu\text{W}/\text{cm}^2$ .

According to Norbert Hankin, an environmental scientist in the U.S. Environmental Protection Agency's Office of Radiation and Indoor Air, who has studied the effects of RFR for 33 years, it is not clear how protective current safety standards are because they are based on preventing the radiation from heating tissue and do not take into account research that has shown biological changes, such as DNA breaks, at much lower levels of exposure.

I do not know what the current background ambient RFR levels are, but as we are experiencing a continuous growth in wireless antennas it is presumably higher than the level found in 2000. Each additional antenna adds to this background level. This means that WiFi, Smart Boards, Smart Meters, DECT cordless phones and individual cell phones and PDAs all add to the ambient background RF levels found near cell towers.\* It is the people who will have long-term involuntary exposure within approximately 1,000 feet (excepting compounding amplifying RF factors) of the antennas that are most susceptible to harm.

\* This survey found that the highest RF exposure environments were on public transportation and likely due the microwave oven effect from the multiple personal wireless devices in use. Mohler E., Frei P., Braun-Fahrlander C., Bürgi A., Egger M., Fröhlich J., Joos N., Neubauer G., Theis G., Rösli M. Personal radio frequency electromagnetic field exposure at different locations. *Umweltmedizin in Forschung und Praxis* 2008, 13 (5): 287-288. Read Abstract [http://www.ispm.ch/index.php?eID=tx\\_nawsecuredl&u=0&file=fileadmin/Qualifex/Abstracts/Abstract\\_E\\_Mohler\\_Graz.pdf&t=1284604616&hash=d12a9bef92594b371c319e674f0b3494](http://www.ispm.ch/index.php?eID=tx_nawsecuredl&u=0&file=fileadmin/Qualifex/Abstracts/Abstract_E_Mohler_Graz.pdf&t=1284604616&hash=d12a9bef92594b371c319e674f0b3494)

**There are simple measures that will minimize harm from EMF/RFR exposure, such as:** keeping WiFi routers out of areas where more time is spent, or even better turned off when not in use; making sure wiring is grounded and either shielded, braided or twisted, which mitigate their picking up and amplifying EMF/RFR; minimizing metals in and out of our bodies; keeping antennas from having direct line of site and at a minimum of 1,000 feet of homes and schools, etc (Although this is dependent on the strength of the transmitters.); minimizing electric devices in bedrooms; making DECT cordless phones and WiFi routers that only emit RFR when in use; and only using cordless and cell phones with head sets, speaker mode and texting. Use wired systems wherever possible. Broadband internet and smart boards and meters are all faster and more secure over wired networks.

**More complex measures** would be to have system compatibility and planned infrastructure roll out. With our Business As Usual attitude this may no longer be possible. Instead of creating the false siting restrictions based on appearance, we should have based it on health. Antennas should be sited where they will do the least harm and anyone who is in a EMF/RFR hot spot should be compensated in some way. Shielding or relocating would both help. The best way to avoid intended and unintended RFR is to install fiber optics as the system has no RFR emissions. Instead of adopting these measures, the injured are left to their own devices. Industry has done its best to label the people they have harmed as being crazy.

**In addition to the above measures,** Dr. George Carlo, chairman of the Wireless Technology Research program (WTR) from 1993 – 1999, a \$28.5 million research program, funded by the cellular phone industry that investigated the possible health effects of cellular phones wrote in a recent article in the *American Trial Lawyer* that:

*“Laws should be enacted to place health warnings on cell phones and wireless devices, as well as warning signs in public spaces that carry WiFi and other wireless signals.*

*The Telecommunications Act must be amended to include victims' compensation provisions; incentives for the development and commercialization of technologies to [protect] users from harmful electromagnetic radiation; and civil rights provisions to promote*

*environmental and health risk protection for homeowners in communities where cell phone base stations and other wireless infrastructure are constructed.”*

It is imperative that the U.S. government reexamines our RFR exposure level and adjusts it to protect populations from having their health adversely impacted by RFR exposure. The Telecommunication’s Act of 1996 needs to be revised to allow local oversight and health concerns as part of the criteria for antenna siting. **The Coalition for Local Oversight of Utility Technologies is working on this effort here in the U.S.** I urge you to get involved and advocate for lower RFR exposure standards. **Please go to <http://www.cloutnow.org> to find out how you can get involved in this important work.**

## REFERENCE WEBSITES

### Cell Tower Siting

**International Conference on Cell Tower Siting  
Linking Science & Public Health  
Salzburg, June 7-8, 2000**

[www.salzburg.gv.at/celltower\\_e](http://www.salzburg.gv.at/celltower_e)

[http://www.salzburg.gv.at/themen/gesundheit/umweltmedizin/elektrosmog/celltower\\_e.htm](http://www.salzburg.gv.at/themen/gesundheit/umweltmedizin/elektrosmog/celltower_e.htm)

#### Summary

...The rapid development in the mobile telecommunications area led and leads to an increasing burden of exposure due to electromagnetic fields in the immediate environment of the population. In order to guarantee, that these technologies, working in the high-frequency range with variable modulations, have no negative impacts on human health and well-being, it is essential to restrict the exposure...

In 1998 ICNIRP (International Commission on Non-Ionizing Radiation Protection) a NGG acknowledged by the World Health Organization (WHO), proposed reference values for the protection of human health from non-ionizing radiation. ICNIRP holds the position, that in the high frequency range relevant effects on human health only appear in the case of excessive warming of tissues of more than 1° Celsius which is related to a specific absorption rate (SAR) of 4 watts/kg tissue. In order to protect also sensitive persons from excessive heating an uncertainty factor of 50 was introduced resulting in an SAR of 0,08 W/kg. Because the SAR is only measurable on a phantom or by a computer model a so called reference level is derived for example as field strength [V/m or A/m] or as power flux density [W/m<sup>2</sup>]. The reference levels proposed by ICNIRP for the currently used mobile telecommunications frequencies, 900 MHz and 1800 MHz, are 4500 mW/m<sup>2</sup> (450 µgW/cm<sup>2</sup>) and 9000 mW/m<sup>2</sup> (900 µgW/cm<sup>2</sup>) respectively.

The International Conference on Cell Tower Siting made it clear, that the proposal of ICNIRP for the protection of human health from highfrequency electromagnetic fields, on which the

current recommendations of WHO and EU-Council are based, are on the one hand scientifically untenable and on the other hand not able to protect human health...

### **Cell Tower Siting – A Public Health Issue\*** **Dr. Gerd Oberfeld, Dr. Christoph König**

...As the Salzburg Model demonstrates, through the cooperation of citizens, politicians, governmental authorities and network operators, base stations can be situated, erected and configured so that the acceptance of the local residents, the protection of health in accordance with the recent information, and the protection of the community image and the landscape are all taken into account. The degree of exposure to electromagnetic fields from exterior base stations can vary greatly and differ by several orders of magnitude. Factors influencing the degree of exposure include:

..Effective isotropic radiation power (EIRP) per station. This depends, for instance, on:.

- The transmitting power of the organisation channel
- The number of conversation channels and their utilisation rate as well as the regulation of the radiation power
- Antenna gain
- Vertical loss and for sector antennas also the horizontal loss of the respective antennas
- The distance from the respective base station as well as a possible weakening of the signal through buildings, trees, etc.
- In interior rooms, depending on the existence, the type and execution of walls, windows and the roof, the degree of exposure may be the same as outdoors, or may be lowered by several orders of magnitude.

## **Hot Spots and Reflective Environments**

**OET Bulletin 65 FCC Guidelines for Evaluating Exposure to RF Emissions .....**  
7 ...

[http://www.fcc.gov/Bureaus/Engineering\\_Technology/Documents/bulletins/oet65](http://www.fcc.gov/Bureaus/Engineering_Technology/Documents/bulletins/oet65)

**FCC on Spatial Averaging and Hot Spots** When using a broadband survey instrument, spatially-averaged exposure levels may be determined by slowly moving the probe while scanning over an area approximately equivalent to the vertical cross-section (projected area) of the human body. ...The term "hot spots" has been used to describe locations where peak readings occur...Often such readings are found near conductive objects, and the question arises as to whether it is valid to consider such measurements for compliance purposes. According to the ANSI C95.3 guidelines (Reference [2]) measurements of field strength to determine compliance are to be made, "at distances 20 cm or greater from any object." Therefore, as long as the 20 cm criterion is satisfied, such peak readings should be considered as indicative of the field **at that point...**in many situations there may be several RF sources. For example, a broadcast antenna farm or multiple-use tower could have several types of RF sources including AM, FM, and TV, as well as CMRS and microwave antennas...In such situations it is generally useful to use both broadband and narrowband instrumentation to

fully characterize the electromagnetic environment. Broadband instrumentation could be used to determine what the overall field levels appeared to be, while narrowband instrumentation would be required to determine the relative contributions of each signal to the total field if the broadband measurements exceeded the most restrictive portion of the applicable MPEs...

### **Influence of the reflective environment on the absorption**

by G Vermeeren - 2010

Sep 1, 2010 ... (Hagmann and Gandhi 1979, Durney et al 1986, Vermeeren et al 2007, ...From the literature review, it is clear that worst-case exposure scenarios ... The inhomogeneous virtual family male (VFM) (Christ et al 2010) shown ...

<http://iopscience.iop.org/0031-9155/55/18/018;jsessionid=9AB8D4ECBADF3A104820FA7B7BD2EE87.c2>

The Swiss ITIS laboratory for testing of RF wireless emissions study looked at reflections, which can occur in daily living and working environments within close proximity to cell antenna base stations (30 cm, 1 meters, 3 meters and 10 meters), which could lead to greater exposures than predicted by assessments of RF sources in 'free space'.

They reported that by looking at more realistic "reflective environments", the ICNIRP safety limits may be violated due to varying exposure environments.

### **Passive Exposure to Mobile Phones: Enhancement of Intensity by Reflection**

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<http://jpsj.ipap.jp/link?JPSJ/75/084801/>

In a recent Letter [J. Phys. Soc. Jpn. 71 (2002) 432], we reported a preliminary calculation and concluded that public exposure to mobile phones can be enhanced by microwave reflection in public spaces. In this paper, we confirm the significance of microwave reflection reported in our previous Letter by experimental and numerical studies. Furthermore, we show that "hot spots" often emerge in reflective areas, where the local exposure level is much higher than average. Such places include elevators, and we discuss other possible environments including trains, buses, cars, and airplanes. Our results indicate the risk of "passive exposure" to microwaves. ©2006 The Physical Society of Japan

## [PDF] HF-RADIATION LEVELS OF GSM CELLULAR PHONE TOWERS IN RESIDENTIAL AREAS

File Format: PDF/Adobe Acrobat - Quick View

exposure assessment for cellular phone tower radiation in Germany. .... antenna site, the GSM radiation levels are scattered due to various .... possible role of radio-frequency radiation in the development of uveal melanoma" in: ...

<http://pdfcast.org/pdf/hf-radiation-levels-of-gsm-cellular-phone-towers-in-residential-areas>

RFR levels at cell towers in Germany in 2002 ranged from:

Low reading:  $.02 \mu\text{W}/\text{cm}^2$  ( $200 \mu\text{W}/\text{m}^2$ )

High reading:  $10 \mu\text{W}/\text{cm}^2$  ( $100,000 \mu\text{W}/\text{m}^2$ )

$1 \mu\text{W}/\text{m}^2 = .0001 \mu\text{W}/\text{cm}^2$

### Abstract (Excerpts)

...A statistical evaluation of over 200 representative high frequency field measurements is presented for the years 2001 and 2002. Measurements were conducted at different distances and directions using a frequency selective spectrum analysis to obtain only GSM power densities... Derived from this data, GSM cellular phone tower radiation is dominant in comparison to FM radio or TV emissions. The median power density was found to be in the range of  $200 \mu\text{W}/\text{m}^2$  with the maximum level exceeding  $100,000 \mu\text{W}/\text{m}^2$ . A total of 25 percent of the power densities exceeds  $1,000 \mu\text{W}/\text{m}^2$ , which has been suggested to be the average threshold value for non-thermal biological effects. Two of the most important factors are the distance and the direct line of sight to the antenna site. At the typical residential cell tower distance of about 250 m in cities, with direct line of sight, the observed levels are in the range of  $200 \mu\text{W}/\text{m}^2$ . The results show that, especially for future cellular UMTS applications, there are several options to minimize additional HF radiation exposures for the population and reduce the potential risk for harmful exposures...

### ...Distance, Line of Sight and Exposure Parameters

The power density values are displayed in Figure 2 in respect to line of sight/without line of sight and the distance to the antenna site. It is obvious, that especially in proximity to the antennas site ( $<250$  m), the GSM radiation levels are scattering due to various influencing parameters and cannot be calculated easily by using antenna power and distance modest only. Table 1 shows a significant systematic difference between the percentile data from line of sight and without line of sight measurements. Figure 2 displays the separated sets of data with trend lines decreasing exponentially to larger distances with lower exposures for without line of sight measurements in the range of 90% reduction (-10dB).

In general, the radiation exposure is predominantly determined by e.g. the following parameters:

Distance to antenna

Line of sight to the antenna site

Type of antennas, e.g. omni directional or directional antennas

Number, power, and orientation of the antennas

Capacity of the antenna site (number of channels/frequencies)

Vertical distance between location and antenna site

Type of building construction/ type of window glass

Total reflection of the environment

...Directly below roof top positions (e.g. schools, preschools, homes) significant exposures in the range of a few 1,000  $\mu\text{W}/\text{m}^2$  were observed due to secondary side lobes and reflections. During our data collection, the highest exposure values in the range of 10,000 - 100,000  $\mu\text{W}/\text{m}^2$  were observed very close to low antenna/roof top positions at inside and outside locations in line of site and distance < 100 meter.

## RFR Exposure Assessment/Dosimetry

### Merger of Two Different Dosimetry Rationales - August 2009

<http://www.piers.org/piersproceedings/piers2k9MoscowProc.php?start=0>

#### Merger of Two Different Dosimetry Rationales

*Sergey Yu. Perov, Quirino Balzano, and Niels Kuster*

PIERS Proceedings, 157 - 160, August 18-21, Moscow, RUSSIA 2009

(Access the html version here - <http://tiny.cc/2CIgv> )

#### ...RUSSIAN EXPOSURE ASSESSMENT AND DOSIMETRY

...The history of Russian first hygienic rules and norms (national safety standard) started at the same time as in USA, and the head of this research program was Z. Gordon. In the USSR, and now in the Russian Federation exposure limits are founded on chronic biological effects caused by non thermal EMF exposures; the effects were investigated using behavioral, electrophysiological, hematological and biochemical methods...

... The Russian approach to exposure assessment and dosimetry has two main differences from those of ICNIRP. First, the concept of SAR was never adopted, because near field measurements were not required until recently. The near field evaluation is performed by computations extrapolating the far field measurement values using theoretical equations. Second, the dosimetry is based on the parameter "power exposition" (PE) which is a dynamic estimate of the EMF biological effects from the exposure. This parameter differentiates the exposure dose during a given time interval.

In other words, the Russian exposure limitations consider cumulative the biological effects of RF EMF. PE values depend on time, field level and frequency range...

...This approach defines a dose-dependent biological action of RF EMF and, so, a dependence of time and intensity of the safe RF exposure...

#### Chinese Regulatory considerations

#### Coghill Research Laboratories

#### Derivation of Exposure Limits for RF/MW in China

<http://www.cogreslab.co.uk/china.asp>

...There are two regulatory bodies, the Chinese Public Health Ministry (CPHM) and the Chinese Environmental Protection Agency (CEPA). These used different exposure criteria. The former based its ELVs on thermal and non thermal considerations, while the CEPA based its standards on SAR. To cut to the chase, CPHM adopted a 20-fold safety factor reduction over the experimental threshold limit values (TLVs), and decided that 50microWatts/cm<sup>2</sup> was the ELV for all microwaves, whereas for **CEPA the limit for long medium and short waves is 5-25 Volts/metre and 10 microWatts/cm<sup>2</sup> in areas where there is a requirement for absence of health hazard.** The CEPA SAR limits are 0.1W/kg for occupational exposure (8 hr day, any 6 mins continuously), and 0.02W/kg for general public exposure. (All standards for general public exposure in China are one fifth of the occupational levels.

The derivation of these standards goes back to the 1970s. The first ELVs for microwaves were issued in 1979 by the Chinese Ministry of 4th Machine Industry (CM4MI) as "temporary sanitary rules for workplace", but these were extended and amended in 1989 by CMPH. CM4MI had carried out during 1975-77 a large cross sectional epidemiological study with a working group including Zhejiang Medical University, Beijing Jiuxian Qiao Hospital and another 15 epidemic preventive stations in factories and institutions.

In this large study four groups were formed, 0, <50, <200, and > 200 microWatts/cm<sup>2</sup>. The results showed a higher prevalence of neurosis, bradycardia, ST-T level, delayed P and QRS intervals (all greater than 1 second) changes in electrocardiography (ECG) abnormal ECG, disorders of the nervous system, decreased white blood counts (WBC) - less than 5000/mm<sup>3</sup>, and blood platelets - less than 105/mm<sup>3</sup>. Vacuoles were noted in the lens of the two groups exposed to the higher radiation levels (a feature also reported in several western studies. e.g. by Milton Zaret ). Even the group exposed to less than 50 microWatts/cm<sup>2</sup> also reported symptoms of increased neurosis compared with controls.

Acute and subacute experiments were also performed on animals, establishing a TLV of 1mW/cm<sup>2</sup>. Allowing for a 20-fold safety factor the ELV was therefore set at 300 microWatts/cm<sup>2</sup>, that is 38microWatts/cm<sup>2</sup> for an 8 hour working day.

A similar epidemiologic study was carried out by CMPH. The amended ELV for microwaves was however set at 50 microwatts/cm<sup>2</sup> for an 8 hour working day. Thus the ELVs were firmly based on at least two large scale human population health effects studies. By contrast the Western values were derived from a few small acute studies on rodents and small primates. It is obvious to any reasonable person the Chinese conclusions are far more realistically based...

### **Biological Effects of Radiofrequency Radiation (revised 2. February 1996)**

Cut/condensed from **Biological Effects of Radiofrequency and Microwave Radiation: Application, Hazards, and Safeguards.** By Wolfgang W.

**Scherer (25. March 1994)**

<http://www.reach.net/~scherer/p/biofx.htm>

- **mW = milli-Watt = 1/thousandth Watt = 10<sup>-3</sup> Watt**
- **µW = micro-Watt = 1/Millionth Watt = 10<sup>-6</sup> Watt**
- **nW = nano-Watt = 1/Billionth Watt = 10<sup>-9</sup> Watt**

- **pW = pico -Watt = 1/Trillionth Watt =  $10^{-12}$  Watt**

... Thermal effects can be measured long before temperature changes are observed. The blood vessels are dilating and the blood flow increases substantially as the thermoregulatory mechanism is activated in order to keep the body temperature constant. With rising body temperature the metabolic rate rises also, what may lead to Stress-Adaptation-Fatigue Syndrome. This may be the thermal explanation for late and cumulative effects of radio-frequency radiation, that other researchers try to explain through non thermal effects of radiation exposure...

What distinguishes radiofrequency introduced heating from other means of heating is the rapidity of heating, the depth of penetration, and the existence of internal hot-spots, that can result in tissue damage long before the overall body temperature increases dramatically. The brain is particularly susceptible to the occurrence of these hot-spots. Depending on the size of the head and the frequency of the radiation, regions of relatively high absorption can occur at or near the center of the brain. These effects are especially uncontrollable in the near-field during the use of mobile communication devices like cordless and cellular phones and very unpredictable due to the variable shape, size, and thickness of skulls.

However, the main objectively measurable hazard of microwave radiation is injury to the eyes, especially damaging at frequencies above 800 MHz. Since the lens of the eye does not have an adequate vascular system for the exchange of heat, even a slight rise in temperature can cause protein coagulation, and opacities in the lens may form...

## **Resolutions/Warnings and Research Needs**

**2002 letter from the EPA (Environment Protection Agency) stating the FCC's standards are "thermally based, and do not apply to chronic, non-thermal exposure situations"**

[http://americanassociationforcellphonesafety.org/uploads/noi\\_epa\\_response.pdf](http://americanassociationforcellphonesafety.org/uploads/noi_epa_response.pdf)

**2009 European Parliament Resolution Health concerns associated with electromagnetic fields**

<http://www.europarl.europa.eu/sides/getDoc.do?pubRef=-//EP//TEXT+TA+P6-TA-2009-0216+0+DOC+XML+Vo//EN>

21.04.2009

The European Parliament's Committee on the Environment, Public Health and Food Safety recently voted overwhelmingly to recommend precautions be taken to protect human health with regard to wireless technologies, such as mobile phones, Wi-Fi/Wi-Max, Bluetooth, DECT portable phones and cell towers That certain establishments be kept free of wireless radiation, including schools, day care centers, retirement homes and health care institutions;

\* Recognition that persons with Electrohypersensitivity are 'disabled' so as to assure them protection and equal opportunity under law.

- \* For member states to create maps of sources of exposure and make them available to citizens on the Internet including description of power line emissions and radiofrequency and microwave radiation;
- \* That Regional Antenna Plans be integrated into Urban Development Plans; and,
- \* That Member states create yearly reports on electromagnetic radiation, describing the sources and actions that have been taken to better protect human health and the environment.

### **January 2008 National Academy of Science Report Identification of Research Needs Relating to Potential Biological or Adverse Health Effects of Wireless Communication Devices**

<http://www.nap.edu/catalog/12036.html>

“In January 2008, the National Research Council (NRC), an arm of the National Academy of Sciences and the National Academy of Engineering, issued a report saying that we simply don't know enough about the potential health risks of long-term exposure to RF energy from cell phones themselves, cell towers, television towers, and other components of our communications system. The scientists who prepared the report emphasized, in particular, the unknown risks to the health of children, pregnant women, and fetuses as well as of workers whose jobs entail high exposure to RF (radiofrequency) energy....Because so much of cell phone technology is new and evolving, we don't have data on the consequences of 10, 20 or 30 years worth of exposure to the RF energy they emit,” Weil concluded. The report called for long-term safety studies on all wireless devices including cell phones, computers, and cell phone towers.

### **EMF resolutions signed by concerned scientists and medical doctors**

These Resolutions are signed by scientists, engineers and medical doctors who have been doing EMF research and working internationally on electromagnetic fields health and safety. The combination of their training, experience and the many contributions they have made in conducting and publishing, represents hundreds of years of expertise and places them at the forefront of knowledge about EMF.

Vienna Resolution 1998 [www.icems.eu/docs/resolutions/Vienna\\_Resolution\\_1998.pdf](http://www.icems.eu/docs/resolutions/Vienna_Resolution_1998.pdf)  
 Salzburg Austria Resolution 2000 [http://www.salzburg.gv.at/salzburg\\_resolution\\_e.htm](http://www.salzburg.gv.at/salzburg_resolution_e.htm)  
 Freiburger Appeal 2002 [www.laleva.cc/environment/freiburger\\_appeal.html](http://www.laleva.cc/environment/freiburger_appeal.html)  
 Catania Italy 2002 [www.emrpolicy.org/faq/catania.pdf](http://www.emrpolicy.org/faq/catania.pdf)  
 Benevento Italy Resolution 2006 [http://www.icems.eu/benevento\\_resolution.htm](http://www.icems.eu/benevento_resolution.htm)  
 Venice Italy Resolution 2008 <http://www.icems.eu/resolution.htm>  
 Porto Alegre Resolution 2009 [http://www.icems.eu/other\\_res.htm](http://www.icems.eu/other_res.htm)

### **International Association of Firefighters moratorium of cell tower siting on Fire stations**

<http://www.iaff.org/hs/Facts/CellTowerFinal.asp>

...There is a large body of internationally accepted scientific evidence which points to the existence of non-thermal effects of RF/MW radiation. The issue at the present time is not whether such evidence exists, but rather what weight to give it.

Internationally acknowledged experts in the field of RF/MW radiation research have shown that RF/MW transmissions of the type used in digital cellular antennas and phones can have critical effects on cell cultures, animals, and people in laboratories and have also found epidemiological evidence (studies of communities, not in the laboratory) of serious health effects at "non-thermal levels," where the intensity of the RF/MW radiation was too low to cause heating. They have found:

- Increased cell growth of brain cancer cells (5)
- A doubling of the rate of lymphoma in mice (6)
- Changes in tumor growth in rats (7)
- An increased number of tumors in rats (8)
- Increased single- and double-strand breaks in DNA, our genetic material (9)
- 2 to 4 times as many cancers in Polish soldiers exposed to RF (10)
- childhood leukemia in children exposed to RF (11)
- Changes in sleep patterns and REM type sleep (12)
- Headaches caused by RF/MW radiation exposure (13)
- Neurologic changes (14) including:
  - Changes in the blood-brain-barrier (15)
  - Changes in cellular morphology (including cell death) (16)
  - Changes in neural electrophysiology (EEG) (17)
  - Changes in neurotransmitters (which affect motivation and pain perception) (18)
  - Metabolic changes (of calcium ions, for instance) (19)
  - Cytogenetic effects (which can affect cancer, Alzheimer's, neurodegenerative diseases) (20)
- Decreased memory, attention, and slower reaction time in school children (21)
- Retarded learning in rats indicating a deficit in spatial "working memory" (22)
- Increased blood pressure in healthy men (23)
- Damage to eye cells when combined with commonly used glaucoma medications (24)

### **Israel bans antennas on residences**

[http://www.democrats.org.au/docs/2007/Joining\\_the\\_Dots11.pdf](http://www.democrats.org.au/docs/2007/Joining_the_Dots11.pdf)

### **Taiwan removes 1500 cell towers near schools**

<http://www.chinapost.com.tw/taiwan/2007/11/06/129715/1500-cellphone.htm>

### **Local Government Resolutions (U.S.)**

<http://www.cloutnow.org/localres/>

### **Los Angeles, California**

The Los Angeles County Board of Supervisors voted unanimously on Tuesday, June 2, 2009, to "actively seek and support federal legislation to repeal limitations on state and local authority imposed by the Telecommunications Act of 1996 that infringe upon the authority of local governments to regulate the placement, construction, and modification of telecommunications towers and other personal wireless services facilities on the basis of the health and environmental effects of these facilities."

### **Tucson, Arizona**

The Pima County Board of Supervisors passed a resolution on August 4, 2009, calling "for the U.S. Congress and the Obama administration to repeal Section 704 of the Federal Telecommunication Act of 1996, and otherwise let local jurisdictions control fully the siting, construction and installation of wireless communications facilities in order to ensure that their constituents' environment, health and safety are protected from the potentially damaging effects of electromagnetic radiation."

### **Sebastopol City Council**

The City Council of Sebastopol, California, passed a resolution on July 7, 2009, instructing the City's legislative advocates "to actively seek and support federal legislation to repeal limitations on state and local authority imposed by the Telecommunications Act of 1996 that infringe upon the authority of local governments to regulate the placement, construction, and modification of telecommunications towers and other wireless facilities on the basis of the health and environmental effects of these facilities."

### **Glendale, California**

The City Council of Glendale, California, passed a resolution on June 9, 2009, directing the City staff "to have its federal legislative advocates communicate to the U.S. Congress, the President and executive branch members to: (1) actively seek and support federal legislation that would give local governments greater flexibility to regulate the placement of wireless communications facilities given the unique aesthetic and safety issues that said facilities raise and to regulate such facilities in favor of less intrusive and more efficient technologies; (2) urge that the federal government engage in a comprehensive study of the effects of Wireless facilities RF emissions to assess the health impacts of these emissions; and (3) to review and revise those provisions of the Telecommunications Act of 1996, including but not limited to Section 332(c)(7)(B), that limit or compromise the rights of local zoning authorities to govern over the placement, construction and modification of wireless communications facilities on the basis of environmental effects of radio frequency emissions, until all environmental exposures are cumulatively considered."

### **Portland City Council**

The City Council of Portland, Oregon, passed a resolution on May 12, 2009, requesting "the FCC to work in cooperation with the FDA and other relevant federal agencies to revisit and update studies on potential health concerns arising from RF wireless emissions in light of the national proliferation of wireless use."

### **Albany, California**

The City Council of Albany, California, passed a resolution on July 20, 2009, requesting "the FCC to work in cooperation with the FDA and other relevant federal agencies to revisit and update studies on potential health concerns arising from RF wireless emissions in light of the national proliferation of wireless use."

### **Agoura Hills, California**

The City Council of Agoura Hills, California, passed a resolution on December 9, 2009, that "Urges Congress to initiate and pursue legislation to repeal those sections of the 1996

Telecommunications Act that preempt local control and prevent local governments from considering health effects when deciding whether to approve a wireless communications facility... Informs the California Public Utilities Commission (CPUC) that the City opposes the unrestricted use of rights of way for wireless telecommunications facilities."

### **Santa Barbara, California**

The Santa Barbara County Board of Supervisors passed a resolution on November 10, 2009, that states, "There is ongoing debate within the scientific community regarding how thoroughly the long-term health effects of low-frequency electromagnetic and radio-frequency emissions are understood and questions regarding how well the existing regulations established by the Federal Communications Commission [FCC] protect more vulnerable populations such as school-aged children..." The resolution urges the County's Congressional representatives to initiate and pursue legislation to repeal the health pre-emption in the Telecommunications Act of 1996, and opposes the unrestricted use of right-of-ways for wireless facilities.

### **School Board Vote to Ban Cell Towers**

#### **Los Angeles Unified School District May 26, 2009 Resolution on Wireless Telecommunication Installations**

<http://www.cloutnow.org/>

...Whereas, On June 27, 2000 and May 26, 2009, the Governing Board of the Los Angeles Unified School District adopted resolutions opposing the siting of cellular facilities on or in close proximity to schools to ensure individuals, especially children, are protected from the potential health effects associated with exposures to extremely low frequency electromagnetic and radiofrequency radiation;

Whereas, The District has been successful in restricting the placement of wireless communication installations on its school facilities, but it has had limited success in preventing wireless service facilities from siting near its schools due to apparent restrictions placed upon zoning authorities to consider the health and environmental effects of radio-frequency radiation;

Whereas, The desire of the wireless companies to market new wireless services has since led to a proliferation of cellular facilities targeting residential areas and areas near schools;

Whereas, Wireless infrastructure is being deployed at an unprecedented speed and cellular facilities have been approved without proper justification and proof that the placement is to serve existing demand or provide public safety benefits;

Whereas, Serious concerns exist regarding wireless permits approved near schools without proper notification to school officials and nearby property owners or proper review and oversight of the wireless applications;

Whereas, Cities, counties, and local municipalities have relied upon Section 704 of the Federal Telecommunications Act of 1996 to preempt local communities and school districts from opposing the placement, construction, and modification of personal wireless service facilities on the basis of environmental effects of radio-frequency emissions to the extent that the proposed facilities comply with the Federal Communications Commission regulations concerning such emissions;...

## **Hempstead, New York Telecommunications Ordinance**

<http://toh.li/content/home/news/telecomlaw.html>

Requires a Special Use Permit for Distributed Antenna Systems within 1,500 from residential property boundaries, house of worship, day care centers and schools.

## **West Lin-Wilsonville School Board in Oregon Prohibits Cell Towers on and adjacent to school property**

<http://www.momsforsafewireless.org/Cell-Phone-Towers-and-Antennas-on-School-Property.php>

In 2008 the West Lin-Wilsonville School Board in Oregon voted to prohibit commercial microwave cell sites on and adjacent to school property. The School Board allows the one existing cell tower contract to expire. Board members were concerned that the cell sites were not proven safe.

## **Communities and Groups Vote for Tower Setbacks from Schools and Daycare Facilities**

Greenwich, CT generated a bill to require a 750 square setback of cell towers from schools and daycare facilities.

The Connecticut PTA passed a resolution in 2003 that supports legislation calling for a 1500 feet setback from a school or day care and a cell phone tower.

The town of Bar Harbor, Maine includes in its communication tower ordinance a provision for a 1,500 feet setback for cell towers near schools and day care facilities.

## **Epidemiological evidence**

### **Biological effects from exposure to electromagnetic radiation emitted by cell tower base stations and other antenna arrays**

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Received 30 April 2010. Accepted 6 August 2010. Published on the NRC Research Press Web site at <http://er.nrc.ca> on 5 November 2010.

**Abstract:** The siting of cellular phone base stations and other cellular infrastructure such as roof-mounted antenna arrays, especially in residential neighborhoods, is a contentious subject in land-use regulation. Local resistance from nearby residents and landowners is often based on fears of adverse health effects despite reassurances from telecommunications service providers that international exposure standards will be followed. Both anecdotal reports and some epidemiology studies have found headaches, skin rashes, sleep disturbances, depression, decreased libido, increased rates of suicide, concentration problems, dizziness, memory changes, increased risk of cancer, tremors, and other neurophysiological effects in populations near base stations. The objective of this paper is to review the existing studies of people living or working near cellular infrastructure and other pertinent studies that could apply to long-term, low-level radiofrequency radiation (RFR) exposures. While specific epidemiological research in this area is sparse and contradictory, and such exposures are difficult to quantify given the increasing background levels of RFR from myriad personal consumer products, some research does exist to warrant caution in infrastructure siting. Further epidemiology research that takes total ambient RFR exposures into consideration is warranted. Symptoms reported today may be classic microwave sickness, first described in 1978. Nonionizing electromagnetic fields are among the fastest growing forms of environmental pollution. Some extrapolations can be made from research other than epidemiology regarding biological effects from exposures at levels far below current exposure guidelines. PowerWatch UK Database of Cell Tower Studies

[http://rparticle.web-p.cisti.nrc.ca/rparticle/RpArticleViewer?\\_handler\\_=HandleInitialGet&journal=er&volume=18&calyLang=eng&media=html&articleFile=a10-018.pdf](http://rparticle.web-p.cisti.nrc.ca/rparticle/RpArticleViewer?_handler_=HandleInitialGet&journal=er&volume=18&calyLang=eng&media=html&articleFile=a10-018.pdf)

<http://www.powerwatch.org.uk/science/studies.asp> (Please scroll down to the section on Mobile Phone Masts, the term for Cell Towers in the UK)

26 out of 44 epidemiological studies they found to meet their criteria show significant health risks.

### **WHO Database - 10 Out of 14 Peer Reviewed Studies Found Significant Health Symptoms**

<http://www.scribd.com/doc/11484728/10-Out-of-14-Peer-Reviewed-Studies-Found-Significant-Health-Symptoms>

[http://www.sciencedirect.com/science?\\_ob=ArticleURL&\\_udi=B6TBB-4VRWNH1-2&\\_user=10&\\_rdoc=1&\\_fmt=&\\_orig=search&\\_sort=d&\\_docanchor=&\\_view=c&\\_acct=COO050221&\\_version=1&\\_urlVersion=0&\\_userid=10&md5=b22f07bbd6f4e2076bdco7dbc4e94df6](http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6TBB-4VRWNH1-2&_user=10&_rdoc=1&_fmt=&_orig=search&_sort=d&_docanchor=&_view=c&_acct=COO050221&_version=1&_urlVersion=0&_userid=10&md5=b22f07bbd6f4e2076bdco7dbc4e94df6)

Review of 14 studies collected from the WHO database and put together by Michael Kundi, a, and Hans-Peter Huttera. 10 out of the 14 peer-reviewed studies analyzed, and conforming to the specified WHO / ICNIRP standards of scientific quality, including their assessment criteria of consistency and replication found significant increases in ill health effects. Included in this database are only those studies that are about cell tower exposures. (Kundi,

2008 at the London EMF International Conference). Populations close to cellular antennas show an increase in the effects of ill health in those closest to the antennas with the risks factors dropping off as distance and RFR levels decrease. Symptoms range from sleep disturbances to breast and brain cancers.

**DEC/JAN 2008 issue of The Ecologist** report on the health impacts of wireless transmissions. The following peer-reviewed studies on health effects from cell towers ("mobile phone masts" in U.K. parlance) and other sources of RF radiation were included in the report.

<http://www.theecologist.org/>

**Santini et al., 2002:** 530 people living near to mobile phone masts reported more symptoms of headache, sleep disturbance, discomfort, irritability, depression, memory loss, and concentration problems the closer they lived to the mast.

**Oberfeld et al., 2004:** 97 people living near to mobile phone masts reported more symptoms of fatigue, irritability, headaches, nausea, loss of memory, visual disorder, dizziness and cardiovascular problems the higher their level of microwave exposure.

**Eger et al., 2004:** A three-fold increase in the incidence of malignant tumours was found after 5 years exposure in people living 400 metres from a mobile phone mast.

**Wolf & Wolf, 2004:** A four-fold increase in the incidence of cancer among residents living near a mobile phone mast for between 3 and 7 years was detected.

**REFLEX, 2004:** A four year study on human cells found that, after exposure to low-power microwaves, the cells showed signs of DNA damage and mutations which were passed on to the next generation.

**Abdel-Rassoul, 2007:** Residents living under and opposite a long-established mobile phone mast in Egypt reported significantly higher occurrences of headaches, memory changes, dizziness, tremors, depressive symptoms and sleep disturbance than a control group.

**Bortkiewicz et al., 2004:** Residents close to mobile phone masts report more incidences of circulatory problems, sleep disturbances, irritability, depression, blurred vision, and concentration difficulties the nearer they live to the mast.

**Hutter et al., 2006:** 365 people living near to mobile phone masts reported higher incidences of headaches the greater the closer they lived to the masts.

**Stewart report, 2000:** Research conducted by HPA [Health Protection Agency, UK] chief William Stewart advised that the main beam of a mobile phone mast should not be allowed to fall on any part of a school's grounds.

**Hecht & Balzer, 1997:** A huge review of studies which concluded a vast array of health effects, including insomnia, changes in brain-wave activity, cardiovascular problems and increased susceptibility to infections.

**Carpenter & Sage, 2007:** Conclude that an outdoor maximum exposure limit of 0.6 V/m should be set, and that Wi-Fi systems should be replaced with wired alternatives

**ECOLOG-Institut, 2000:** Found evidence for increases in immune system damage, central nervous system damage, and reduced cognitive function. Recommends an exposure limit 1000 times lower than current guidelines.

**Kolodynski & Kolodynska, 1999:** School children living near a radio location station in Latvia suffered reduced motor function, memory and attention spans.

## Studies on Low Level Non Thermal Biological Effects of EMF/RF

### **Non Thermal Effects and Mechanisms of Interaction 2010**

National Institute for Prevention and Safety at Work (ISPESL), Rome, Italy

<http://dl.dropbox.com/u/11443525/An%20ICEMS%20Monograph%202010.pdf>

**BioInitiative Report** published August 2007

<http://www.bioinitiative.org/>

(See also - Sage C, Carpenter DO. 2009. Public health implications of wireless technologies, Pathophysiology Aug; 16(2-3): 233-46)

Pathophysiology (2009) Electromagnetic Fields in Biology and Medicine. Vol. 7, No. 2.

[http://www.elsevier.com/wps/find/journaldescription.cws\\_home/524214/description#description](http://www.elsevier.com/wps/find/journaldescription.cws_home/524214/description#description)

[http://www.journals.elsevierhealth.com/periodicals/yemem/article/PIIS0196064405007110/related?article\\_id=S0196-0644%2805%2900711-0](http://www.journals.elsevierhealth.com/periodicals/yemem/article/PIIS0196064405007110/related?article_id=S0196-0644%2805%2900711-0)

### **European Union's REFLEX Project**

(Risk Evaluation of Potential Environmental Hazards from Low Frequency Electromagnetic Field Exposure Using Sensitive in vitro Methods),

November 2004. The Project studied ELF and RF exposures to various animal cell types.

[http://www.itis.ethz.ch/downloads/REFLEX\\_Final%20Report\\_171104.pdf](http://www.itis.ethz.ch/downloads/REFLEX_Final%20Report_171104.pdf)

The twelve partners conducted experiments on human, rat and mouse cells of various types. Roughly half of those experiments used RF (RadioFrequency) EMFs, as emitted by mobile phones and masts; the other half used ELF (Extremely Low Frequency) EMFs as emitted from power lines and similar sources. Both types of emission were shown to have a number of significant effects on the behavior of cells.

Conclusions based on the findings obtained in RF EMF research" listed in the REFLEX Report:

"RF-EMF produced genotoxic effects in fibroblasts, Cells responded to RF-EMF exposure with a significant increase in single and double strand DNA breaks and in micronuclei frequency Chromosomal aberrations in fibroblasts were also observed after RF-EMF exposure. In HL-60 cells an increase in the intracellular generation of free radicals accompanying RF-EMF exposure could clearly be demonstrated

"There is some indication that RF-EMF may have some influence on the bcl-2 mediated anti-apoptotic pathway in neural progenitor cells and on the p38MAPK/hsp27 stress response pathway in endothelial cells of human which may in turn exert an inhibitory effect on apoptosis."

Note: 'apoptosis' is 'programmed cell death' - the body's defense mechanism that kills off cells that are malformed or running out of control, a natural protection against possibly cancerous cells..

## **Reported Biological Effects From Radiofrequency Non-Ionizing Radiation**

<http://www.wave-guide.org/library/studies.html#std>

The following studies indicate biological effects at exposure levels far below what would be explained by "thermal effects", and well within the range people are commonly exposed to every day. NOTE: Most of these exposures lie FAR BELOW the current advisory exposure standards in the US, which are based on thermal effects only.

**Havas, M. 2007. Analysis of Health and Environmental Effects of Proposed San Francisco Earthlink Wi-Fi Network. Sent to Board of Supervisors, City and County of San Francisco, May 31, 2007, 51 pp.**

<http://www.magdahavas.org/2009/10/10/san-francisco-wi-fi-and-health/>

Dr. Henry Lai (University of Washington) compiled a list of studies that document biological effects of radio frequency radiation at low intensities (Table 2).

**Radio Wave Packet by. ARTHUR FIRSTENBERG. President, Cellular Phone Taskforce. September 2001. Contents. 1. Some Biological Effects of Radio Waves**

[www.goodhealthinfo.net/radiation/radio\\_wave\\_packet.pdf](http://www.goodhealthinfo.net/radiation/radio_wave_packet.pdf)

Firstenberg (6) also compiled a list of studies showing biological effects at levels below federal guidelines for radio frequency radiation

**Havas, M., J. Marrongelle, B. Pollner, E. Kelley, and L. Tully. Provocation Study using Heart Rate Variability shows Microwave Radiation from DECT phone affects Autonomic Nervous System.**

Journal of the Ramazzini Institute, Annual Series on Environmental Health Issues, Italy, submitted.

<http://www.magdahavas.org/list-of-publications/>

## **2008 MOBILE TELEPHONY RADIATION EFFECTS ON LIVING ORGANISMS**

Dimitris J. Panagopoulos\* and Lukas H. Margaritis

Department of Cell Biology and Biophysics, Faculty of Biology, University of Athens, Panepistimiopolis, 15784, Athens, Greece

<http://tinyurl.com/24wjaug>

## **Abstract**

A number of serious non thermal biological effects, ranging from changes in cellular function like proliferation rate changes or gene expression changes to cell death induction, decrease in the rate of melatonin production and changes in electroencephalogram patterns in humans, population declinations of birds and insects, and small but statistically significant increases of certain types of cancer, are attributed in our days to the radiations emitted by mobile telephony antennas of both handsets and base stations. This chapter reviews briefly the most important experimental, clinical and statistical findings and presents more extensively a series of experiments, concerning cell death induction on a model biological system....

## **Conclusion**

...Digital mobile telephony radiations nowadays exert an intense biological action able to kill cells, damage DNA, or decrease dramatically the reproductive capacity of living organisms. Diminishes of bird and insect populations can be explained according to reproduction decreases. Phenomena like headaches, fatigue, sleep disturbances, memory loss e.t.c. reported as “microwave syndrome” can possibly be explained by cell death on a number of brain cells during daily exposures from mobile telephony antennas...

...Scientific evidence implies the need of reconsideration of the current exposure criteria to account for non-thermal effects which constitute the large majority of the recorded biological and health effects. Since Mobile Telephony has become part of our daily life, a better design of base station antenna networks towards the least exposure of residential areas and a very cautious use of mobile phones, is necessary.

### **1. Clastogenic effects in human lymphocytes of power frequency electric fields: in vivo and in vitro studies.**

Nordenson I, Mild KH, Nordström S, Sweins A, Birke E.  
Radiat Environ Biophys. 1984;23(3):191-201.  
PMID: 6473704 [PubMed - indexed for MEDLINE]  
Related citations

### **2. Chromosomal effects in lymphocytes of 400 kV-substation workers.**

Nordenson I, Mild KH, Ostman U, Ljungberg H.  
Radiat Environ Biophys. 1988;27(1):39-47.  
PMID: 3353493 [PubMed - indexed for MEDLINE]  
Related citations

### **3. Rat liver foci study on coexposure with 50 Hz magnetic fields and known carcinogens.**

Rannug A, Holmberg B, Ekström T, Mild KH.  
Bioelectromagnetics. 1993;14(1):17-27.  
PMID: 8442779 [PubMed - indexed for MEDLINE]  
Related citations

### **4. Chromosomal aberrations in human amniotic cells after intermittent exposure to fifty hertz magnetic fields.**

Nordenson I, Mild KH, Andersson G, Sandström M.  
Bioelectromagnetics. 1994;15(4):293-301.  
PMID: 7980658 [PubMed - indexed for MEDLINE]  
Related citations

**5. Intermittent 50 Hz magnetic field and skin tumor promotion in SENCAR mice.**

Rannug A, Holmberg B, Ekström T, Mild KH, Gimenez-Conti I, Slaga TJ.  
Carcinogenesis. 1994 Feb;15(2):153-7.  
PMID: 8313501 [PubMed - indexed for MEDLINE]  
Related citations

**6. DNA damage, cell kinetics and ODC activities studied in CBA mice exposed to electromagnetic fields generated by transmission lines.**

Svedenstål BM, Johanson KJ, Mattsson MO, Paulsson LE.  
In Vivo. 1999 Nov-Dec;13(6):507-13.  
PMID: 10757046 [PubMed - indexed for MEDLINE]  
Related citations

**7. DNA damage induced in brain cells of CBA mice exposed to magnetic fields.**

Svedenstål BM, Johanson KJ, Mild KH.  
In Vivo. 1999 Nov-Dec;13(6):551-2.  
PMID: 10757053 [PubMed - indexed for MEDLINE]  
Related citations

**8. Chromosomal aberrations in peripheral lymphocytes of train engine drivers.**

Nordenson I, Mild KH, Järventaus H, Hirvonen A, Sandström M, Wilén J, Blix N, Norppa H.  
Bioelectromagnetics. 2001 Jul;22(5):306-15.  
PMID: 11424153 [PubMed - indexed for MEDLINE]  
Related citations

<http://www.ncbi.nlm.nih.gov/pubmed/6473704,3353493,8442779,7980658,8313501,10757046,10757053,11424153>

In Vivo. 1999 Nov-Dec;13(6):507-13.

**DNA damage, cell kinetics and ODC activities studied in CBA mice exposed to electromagnetic fields generated by transmission lines.**

Svedenstål BM, Johanson KJ, Mattsson MO, Paulsson LE.  
Department of Radioecology, Swedish University of Agricultural Sciences, Uppsala, Sweden.  
svedenstal@delta.telenordia.se  
Abstract

CBA mice were exposed outdoors to 50 Hz electromagnetic fields (EMF), with a flux density of about 8 microT rms (root mean square), generated by a 220 kV transmission line. Assays were performed in order to investigate, the possible genotoxic effects after 11, 20 and 32 days of exposure, as well as the effects on body weight, leukocytes, erythrocytes, and the level of ornithine decarboxylase (ODC) activity in spleen and testis. DNA migration was studied on brain cells by single cell electrophoresis (comet assay). After 32 days of exposure a highly significant change of the tail/head ratio of the comets was observed ( $p < 0.001$ ), showing

DNA-damage. Further, a decreased number of mononuclear leukocytes ( $0.02 < p < 0.05$ ) was observed in mice EMF-exposed for 20 days. In summary, our data indicate that transmission lines of this type may induce genotoxic effects in mice, seen as changes in the DNA migration. These results might have an important implication for health effects.

PMID: 10757046 [PubMed - indexed for MEDLINE]

Publication Types, MeSH Terms, Substances

<http://www.ncbi.nlm.nih.gov/pubmed/10757046>

Mutat Res. 2010 Jan 5;683(1-2):74-83.

**DNA fragmentation in human fibroblasts under extremely low frequency electromagnetic field exposure.**

Focke F, Schuermann D, Kuster N, Schär P.

Institute of Biochemistry and Genetics, Department of Biomedicine, University of Basel, Basel, Switzerland.

Abstract

Extremely low frequency electromagnetic fields (ELF-EMFs) were reported to affect DNA integrity in human cells with evidence based on the Comet assay. These findings were heavily debated for two main reasons; the lack of reproducibility, and the absence of a plausible scientific rationale for how EMFs could damage DNA. Starting out from a replication of the relevant experiments, we performed this study to clarify the existence and explore origin and nature of ELF-EMF induced DNA effects. Our data confirm that intermittent (but not continuous) exposure of human primary fibroblasts to a 50 Hz EMF at a flux density of 1 mT induces a slight but significant increase of DNA fragmentation in the Comet assay, and we provide first evidence for this to be caused by the magnetic rather than the electric field. Moreover, we show that EMF-induced responses in the Comet assay are dependent on cell proliferation, suggesting that processes of DNA replication rather than the DNA itself may be affected. Consistently, the Comet effects correlated with a reduction of actively replicating cells and a concomitant increase of apoptotic cells in exposed cultures, whereas a combined Fpg-Comet test failed to produce evidence for a notable contribution of oxidative DNA base damage. Hence, ELF-EMF induced effects in the Comet assay are reproducible under specific conditions and can be explained by minor disturbances in S-phase processes and occasional triggering of apoptosis rather than by the generation of DNA damage.

PMID: 19896957 [PubMed - indexed for MEDLINE]

<http://www.ncbi.nlm.nih.gov/pubmed/19896957>

## International Guidance Levels

**Guidelines, exposures and effects of radio frequency radiation at various power densities. Data from Firstenberg (6).** (Page 4 and 5)

[http://www.magdahavas.org/wordpress/wp-content/uploads/2009/10/07\\_Havas\\_WiFi-SNAFU.pdf](http://www.magdahavas.org/wordpress/wp-content/uploads/2009/10/07_Havas_WiFi-SNAFU.pdf)

Radio frequency guidelines vary by orders of magnitude in countries around the world (See Figure 1).

The FCC guideline ranges from 200 to 1000 microW/cm<sup>2</sup> based on frequency and is much higher than the guidelines recommended in New Zealand, Italy, China, Bulgaria, Hungary, Russia, Switzerland, Austria and in New South Wales, Australia. Since the science upon which these guidelines are based remains the same, one way of interpreting this discrepancy is that some countries place a greater value on science and on preventative health regulations while others may place a greater value on commerce.

A number of adverse health effects have been documented at levels below the FCC guidelines, which include altered white blood cells in school children; childhood leukemia; impaired motor function, reaction time, and memory; headaches, dizziness, fatigue, weakness, and insomnia. At the frequency in question for Wi-Fi technology the guideline in the US is 1000 microW/cm<sup>2</sup> (or 1 milliW/cm<sup>2</sup>).

The current federal guideline is based on a short-term heating effect set at 6-minutes for those occupationally exposed and 30 minutes for public exposure. An FCC guideline based on a 30-minute exposure is unrealistic for exposure that is likely to be 24/7 for decades. However, if this guideline is extrapolated for long-term exposure, the exposure limit decreases and approaches guidelines established by other countries (Table 1).

According to Table 1, if the goal is to protect people who use a wireless computer daily for one year, their exposure should not exceed 0.33 microW/cm<sup>2</sup> (a value similar to the Salzburg guideline) and to protect them for 10 years their exposure should not exceed 0.03 microW/cm<sup>2</sup>

## **International Guidance Levels**

<http://www.powerwatch.org.uk/science/intguidance.asp>

## **EMF/RF Limits for Maximum Permissible Exposures**

[http://pcbheaven.com/blogpages/To\\_WiFi\\_or\\_not\\_to\\_WiFi/](http://pcbheaven.com/blogpages/To_WiFi_or_not_to_WiFi/)

## **RFR Standards and Measurements Over Time**

[www.bioinitiative.org](http://www.bioinitiative.org)

## **Section 20**

Original extra-planetary sources of microwave radiation were infinitesimally small, on the order of a billionth of a microwatt per centimeter squared ( $10^{-12}$  uW/cm<sup>2</sup>). Human evolution took place without any appreciable exposure to microwave radiation from background sources. The human body has no evolutionary protection against microwave radiation, as it does for ultraviolet radiation from the sun (Johannson, 2000). Wireless voice and communications have introduced unprecedented levels of public exposure in the last decade.

Mantiply (1997) measured and reported common sources and levels of RF in the environment. He identified areas near cellular base stations on the ground near towers to be

from 0.003 to 0.3  $\mu\text{W}/\text{cm}^2$ . Background level ambient RF exposures in cities and suburbs in the 1990's were generally reported to be below 0.003  $\mu\text{W}/\text{cm}^2$ .

Hamnerius (2000) reported that ambient RF power density measurements in twelve (12) large cities in Sweden were roughly ten times higher than in the United States for equivalent measurement locations by Mantiply in 1978 (when no cellular phone service existed in the US). He reported a total mean value of 26 measured sites in the study was 0.05  $\mu\text{W}/\text{cm}^2$  and the median value was 40  $\mu\text{W}/\text{cm}^2$ . An office location with a base station nearby at about 300 feet distance tested 150  $\mu\text{W}/\text{cm}^2$ . A train station with antennas mounted indoors tested at about 3  $\mu\text{W}/\text{cm}^2$ . Both indoor and outdoor ambient RF power density measurements showed high variability depending on proximity to transmitting antennas.

Sage Associates reported on microwave frequency RF power density levels at outdoor locations both near and far from wireless antenna sites in the United States (Sage, 2000).

Within the first 100-300 feet, power density levels have been measured at 0.01 to 3.0  $\mu\text{W}/\text{cm}^2$ . Elevated RF power density levels from a major wireless antenna site can often be detected at 1000 feet or more. Power density levels away from wireless antenna sites measure between 0.001  $\mu\text{W}/\text{cm}^2$  to 0.000001  $\mu\text{W}/\text{cm}^2$

## Warnings for children

[http://thepeoplesinitiative.org///Home\\_Page.html](http://thepeoplesinitiative.org///Home_Page.html)

The following countries have issued warnings and precautionary measures regarding cell phones and children. This is an incomplete list and ever changing. It is not kept up to date and these recommendations may change with the politics of the country, the UK being a classic example of that

Indian Government Urges Cautions for Children and Pregnant Women

<http://us.oneworld.net/article/indian-government-cautions-against-ill-effects-mobile-phones>

Germany, Frankfurt - Bans WIFI in the Classroom in Fear of Health Effects...Bavarian Parliament Recommends the Same

<http://omega.twoday.net/stories/3974159/>

Israel - No use in children under 12 years of age

Russia - General limitation; no use under 12 years

France - No long calls, no use under 16, banning of advertising to children under 12, mandatory earphones with all cell phones

<http://www.next-up.org/pdf/FranceNationalLibraryGivesUpWiFio7042008.pdf>

Japan - General limitation under 18 years of age

United Kingdom - General limitation under 12 years of age

Toronto's public health department has recommended children under eight should use a cell phone only in emergencies.

Health warnings for children and the use of WIFI in the classroom have also recently arisen out of Germany.

**Short summaries of wireless actions regarding children, schools and libraries by:**

<http://wiredchild.org/government-alias.html>

**The UK Chief Medical Officers  
The European Parliament  
The German government's health protection agency  
The French government  
The Russian National Committee on Non-Ionizing Radiation Protection  
The Indian Ministry of Telecommunication  
The Israeli Ministry of Health  
The Finnish Radiation and Nuclear Safety Authority (STUK)  
The International Commission for Electromagnetic Safety (ICEMS)  
The Education Professionals Union  
Association of Teachers and Lecturers  
The German Teacher's Union for Education and Knowledge  
Public Health Department of Salzburg  
The Austrian Medical Association  
Lakehead, University, Canada  
Libraries in France  
The Progressive Librarian's Guild**

**Advocacy Groups in US (Sites in addition to the sites referred to above.)**

<http://emrpolicy.org/>  
<http://electromagnetichealth.org>  
<http://www.microwavenews.com>  
<http://www.antennafreeunion.org>  
<http://emfsafetynetwork.org/>

**Advocacy Groups for Children**

[http://www.safeschool.ca/International\\_Warnings.html](http://www.safeschool.ca/International_Warnings.html)  
<http://www.expelcelltowers.org/>  
<http://www.wiredchild.org>

<http://www.wifiinschools.org.uk>,  
<http://www.momsforsafewireless.org/>  
<http://respectpdx.org/index.aspx>

## Prominent EMF/RF Researchers

<http://bemri.org/archive/hese-uk/en/heseuk/who.php>  
<http://bemri.org/archive/hese-uk/en/niemr/scientists.php>  
<http://www.neilcherry.com/>  
<http://www.youtube.com/watch?v=a6wLFeIrCtU>  
<http://www.physiology.columbia.edu/MartinBlank.html>  
<http://ki.se/ki/jsp/polopoly.jsp?d=21984&a=54583&l=en>

## RFR Impacts on Nature

### The Birds, Bees and Mankind, Destroying Nature with EMF/RFR

<http://www.kompetenzinitiative.net/britannien/>

Brochure Series download

<http://broschuerenreihe.net/britannien-uk/brochure/bees-birds-and-mankind/index.html>

## Electrosensitivity

### Three U.S. Governors declared May 2009/10 Electromagnetic Hypersensitivity Awareness Month

<http://www.americanchronicle.com/articles/view/102653>  
(Refer to EMS and EHS proclamations)

### Advocacy site for Electrosensitive People

[www.electrosensitivity.org](http://www.electrosensitivity.org)

## Study Bias/Legal

### Study bias Report, RFR researcher Dr. Henry Lai, PhD, and Louis Slesin, editor of Microwave News

<http://www.microwavenews.com/RR.html>

**The American Trial Lawyer Fall 2008  
Illusion & Escape – The Cell Phone Disease Quagmire. Are We Being Deceived?  
By Dr. George L. Carlo**

<http://d.scribd.com/docs/3zkxnbqo25hwwnvqmqm.pdf>

## Cell Phone Report

**Cellphones and Brain Tumors. 15 Reasons for Concern. Science, Spin and the Truth Behind Interphone.** August 25, 2009

[http://www.radiationresearch.org/pdfs/reasons\\_us.pdf](http://www.radiationresearch.org/pdfs/reasons_us.pdf)

## Supplemental Images

**a. Electromagnetic Spectrum** - <http://www.astrosurf.com/luxorion/Radio/spectrum-radiation.png>

**b. RFR absorption in adult Vs child** -

[http://beyondcreativity.blogs.com/photos/uncategorized/2008/09/14/om\\_gandhi\\_penetration\\_of\\_radiatio\\_2.jpg](http://beyondcreativity.blogs.com/photos/uncategorized/2008/09/14/om_gandhi_penetration_of_radiatio_2.jpg)

(Source <http://www.ncbi.nlm.nih.gov/pubmed/12117757>.)

For updates/revision to this report please see online version: **CELL TOWERS AND WIRELESS COMMUNICATIONS – LIVING WITH RADIOFREQUENCY RADIATION** - <http://www.scribd.com/doc/24352550/Cell-Tower-Rpt>