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Declaration by MARTIN BLANK, PhD

1. My name is Martin Blank PhD. Given my expertise as a cellular biologist and experience as a professor and researcher having authored over 90 scientific papers and a recent book “Overpowered” regarding electromagnetic fields effects on cells, I strongly recommend that the City of Los Angeles, the Mayor, the City Council and the Office of the City Attorney **NOT** proceed with the Citywide WiFi/Citylink LA program due to the damage to public health. The research attached and cited shows that, at the power levels required for WiFi to operate reliably over the project’s large areas, the Radio Frequency (RF) Radiation will have significant biological health effects, especially on electrosensitive individuals and children. Many research studies have documented the damage that will result from the ongoing exposure to electromagnetic fields and corresponding Radio Frequency Radiation emitted by the wireless transmitters used by Citywide WiFi. The radiation may not cause thermal or heating effects but will certainly cause non-thermal biological effects that are not being accounted for, and are not protected by our current FCC safety standards.

From 1962 to 2011, I was a professor in the Department of Physiology and Cellular Biophysics at Columbia University, New York, NY where I both taught and conducted research. Currently, I am a Special Lecturer in that department.

My formal education included a Bachelor of Science degree (Magna Cum Laude) in Chemistry from City College of New York, a PhD in Physical Chemistry from Columbia University, and a PhD in Colloid Science from Cambridge University, England. The focus in the Colloid Science department, under the direction of Professor F.J. W. Roughton was on the electrical properties of biological surfaces and membranes. This provided unique training for research on electric and magnetic field effects in biological cells.

My research has focused on living cells, their components (e.g. DNA, proteins, ions, electrons) and their interactions with the environment. The research (detailed in my Curriculum Vitae in Attachment 1) has concentrated on electric and magnetic field effects on electron transfer reactions, enzymes, DNA and fluxes in the ion channels of excitable membranes. This entailed determining how electrically charged components (ions and electrons) of cells are affected by external fields. Studies of electric field effects on proteins, lipids and ions provide insight into the effects of electric and magnetic fields (EMF) on cells in living organisms.

2. To render a professional opinion regarding the health risks associated with exposure to EMF (Electromagnetic Fields) from many sources, including ELF (extremely low frequency) from power lines, and RF (radio frequency) from cell phones, WiFi, smart meters, etc. I have reviewed the relevant information and commented on the reported harmful effects, as well as protective biological reactions of cells to this unnatural (i.e., man-made) radiation in the environment.

3. In addition to teaching and research, I have been involved in EMF related activities for many years. I served as President of the Bioelectromagnetics Society 1989-1990, and was selected to open the First Congress of the European Bioelectromagnetics Association in Belgium in 1992. I was Editor-in-Chief of the First World Congress on "Electricity and Magnetism in Biology and Medicine" proceedings, and Plenary Lecturer on Bioelectromagnetics for international conferences in Brazil, Canada, India, Israel, Italy and Japan. I also served on the "Bioelectrochemistry and Bioenergetics" Editorial Board and as Biology Divisional Editor of the Journal of the Electrochemical Society for thirteen years. In 2015, I was a consultant for the Canadian Parliament regarding EMF safety standards, and was spokesperson for the over 200 published EMF scientists who petitioned the UN and the World Health Organization (W.H.O.) regarding the strong scientific evidence showing the need for stricter control of EMF exposure to protect the public. (See Attachment 2)

I was one of the organizers of the Bioinitiative Report (BIR) and wrote online reviews on the Cellular Stress Response in both 2007 and 2012 editions (See

Attachments 3 and 4). The most recent report, <http://www.bioinitiative.org/freeaccess/report/docs/report.pdf>, summarizes over 1800 recent epidemiology studies, as well as cell and molecular biology research (See Attachment 5). A key summary from the report states:

‘Bioeffects are clearly established and occur at very low levels of exposure to electromagnetic fields and radiofrequency radiation. Bioeffects can occur in the first few minutes of exposure to power lines as well as at levels associated with cell and cordless phone use. Bioeffects can also occur from just minutes of exposure to mobile phone masts (cell towers), WiFi, and wireless utility ‘smart’ meters. Chronic base station level exposures can result in illness.’

I recently published **Overpowered (2014)**, a book to introduce the public to the potentially harmful effects of EMF in the environment and how to protect oneself.

4. Based on a wide range of research studies, I conclude that:

- Electricity and magnetism are fundamental forces that interact with charged particles, i.e., primarily with electrons in our cells. The organism, in reaction to these conditions, produces **the cellular stress response, a DNA mechanism that is activated by many potentially harmful stimuli** (e.g., high and low temperature, changes in pH, toxic metals). In other words, **cells react to EMF as potentially harmful.**
- Stress protein synthesis starts with activation of DNA. **Higher RF-EMF levels can cause chemical changes in DNA that lead to mutations and cancer** and other abnormal biological processes (e.g., development and growth of tumors).
- **Biological systems are affected by a wide range of EMF frequencies, including ELF, RF and MW (microwave) ranges.** Because of the many sources in the environment (cell phone towers, WiFi, smart meters) the effects are additive. Unfortunately, the divisions of the EM (electromagnetic) spectrum were created by engineers and physicists who assumed arbitrary frequency boundaries that do not relate to the biology. **Human cells do not recognize EM spectrum divisions. They react to electromagnetic fields across the spectrum.**

- Furthermore, the same engineers and physicists assumed that the biological response was caused by the energy of the EMF stimulus, and could be measured by an increase in temperature. **The biological response is stimulation of stress protein synthesis in DNA, and the stress response occurs across the EM spectrum.** **When stress protein synthesis is stimulated by EMF, the body is essentially telling us that exposure is harmful to living cells.**
- **The stress protein synthesis occurs at field strength and duration thresholds that are very low and below the temperature-based thresholds set by safety standards. (This is especially true in the ELF range where epidemiology studies indicate increased risk of leukemia at 3-4mG and the U.S. Standards are at 1000mG)** This means that cells in the body respond at very low exposure levels.

Because cells activate the stress response to a wide range of EMF frequencies, this reaction would appear to be highly relevant to the setting of safety standards.

However, the stress response has been ignored in the setting of safety standards.

Safety standards have been set based on the ability of EMF to heat tissue! Both non-thermal and thermal EMF signals activate the stress response, (See Attachment 6 - Blank, Goodman. 2004) but thresholds triggering stress on biological systems occur at levels on the order of 0.5 to 1.0 μ T (5-10 mG) for ELF, **thousands of times lower energy than the 'safe levels' in the RF range.** However, this information has not been included in prior scientific reviews because **insufficient attention was paid to the relevant cell biology.**

5. The stress response has provided vital evidence about cellular defense mechanisms – it shows that the reaction starts when EMF interacts with DNA.

Protein synthesis begins when the two chains of DNA come apart and make an mRNA copy of the amino acid code (that is in the DNA composition) for a particular protein. This normally is initiated when a particular chemical stimulus (transcription factor) binds to a specific DNA, and in forming a bond changes the electron distribution. Research has shown electron conduction in DNA (See Attachment 7 - Wan et al, 1999)

enables communication along the molecule, and so EMF affects electron distribution and movement in DNA and enables the two chains of the double helix to come apart to initiate protein synthesis. During this coming apart, along with normal functioning, abnormal processes can also occur (See Attachment 8 - Blank, Goodman. 2001).

Several studies have reported both single and double strand breaks in the DNA ‘double helix’, and other chromosome damage after exposure to extremely low frequency (ELF) fields (See Attachment 9 - Lai, Singh. 1997). Similar malfunction has also been reported after exposure to higher frequency, radiofrequency (RF) fields. The REFLEX Project, a collaboration of twelve laboratories in the European Union (Attachment 10 - REFLEX. 2004), found that **both ELF and RF exposures modified the expression of many genes and proteins well below the safety limits.**

For a long time, agencies such as ICNIRP (International Commission on non-Ionizing Radiation Protection) and WHO maintained that an EMF must increase the temperature in order to cause changes in cells. Many lines of research now point to changes in DNA without elevation of temperature. The thresholds for a number of biological systems are shown in Table 1 (below), and many are in the range of 0.5 to 1.0 μT (5-10mG), not very much higher than the usual environmental backgrounds of ~0.1μT (1mG). The effects occur in basic cellular systems at relatively low field strengths, similar to those in the environment. **Non-thermal ELF and RF fields can cause DNA damage, and therefore represent health and safety concerns.**

Table 1. Cells React to Very Low EMF (well below safety limit)

<u>Biological System</u>	<u>Threshold</u>	<u>Reference</u>
Stress proteins in cells		
HL60, Sciara, yeast	<8mG	Goodman, Blank, 1998
breast (HTB124, MCF7)	<8mG	Lin et al, 1999
chick embryo (anoxia)	~20mG	DiCarlo et al, 1999
Accelerate electron transfer		
Na,K-ATPase	2-3mG	Blank & Soo, 2001
cytochrome oxidase	5-6mG	Blank & Soo, 2001
ornithine decarboxylase	~20mG	Litovitz et al, 1991

Belousov-Zhabotinsky	<5mG	Blank & Soo, 2003
Disease related		
leukemia epidemiology	3-4mG	Ahlbom et al, 2000
		Greenland et al, 2000
ELF Safety Limit	1000mG	ICNIRP, 1997

All of the reported thresholds are well below the safety limit!!!

In the RF range, research by Lai and Singh (1997) and Litovitz et al. (1991) have shown similar effects (See Attachments 9 and 11). As articulated by the Bioinitiative Report citing over 130 sources showing Radio Frequency radiation emitted by wireless transmitters has biological effects at levels millions of times lower than current FCC Safety Standards (see Attachment 22 Reported Biological Effects from RFR at Low-Intensity Exposure). In addition to very low thresholds, exposure durations in the RF range do not have to be very long to be effective.

Table 2. Cells React to Very Low RF (well below safety limit). Excerpted from the Bioinitiative Report 2012 (see Attachment 23 for the full chart)

Power Density (microWatts/cm ²)	Observed Effects	Reference
As low as (10 ⁻¹³) or 100 femtowatts/cm ²	Super-low intensity RFR effects at MW resonant frequencies resulted in changes in genes; problems with chromatin conformation (DNA)	Belyaev, 1997
0.00034 uW/cm ²	Chronic exposure to mobile phone pulsed RF significantly reduced sperm count,	Behari, 2006
0.0005 uW/cm ²	RFR decreased cell proliferation at 960 MHz GSM 217 Hz for 30-min exposure	Velizarov, 1999
0.0006 - 0.0128 uW/cm ²	Fatigue, depressive tendency, sleeping disorders, concentration difficulties, cardiovascular problems reported with exposure to GSM 900/1800 MHz cell phone signal at base station level exposures.	Oberfeld, 2004
0.003 - 0.02 uW/cm ²	In children and adolescents (8-17 yrs) short-term exposure caused headache, irritation, concentration difficulties in school.	Heinrich, 2010

0.003 to 0.05 uW/cm ²	In children and adolescents (8-17 yrs) short-term exposure caused conduct problems in school (behavioral problems)	Thomas, 2010
0.005 uW/cm ²	In adults (30-60 yrs) chronic exposure caused sleep disturbances, (but not significantly increased across the entire population)	Mohler, 2010
0.005 - 0.04 uW/cm ²	Adults exposed to short-term cell phone radiation reported headaches, concentration difficulties (differences not significant, but elevated)	Thomas, 2008
0.006 - 0.01 uW/cm ²	Chronic exposure to base station RF (whole-body) in humans showed increased stress hormones; dopamine levels substantially decreased; higher levels of adrenaline and nor-adrenaline; dose-response seen; produced chronic physiological stress in cells even after 1.5 years.	Buchner, 2012
1000 uW/cm ²	FCC RF Safety Limit	

Litovitz et al (1991), working with the enzyme ornithine decarboxylase, have shown **a full response to EMF when cells were exposed for only 10 sec** (See Attachment 11). This occurred with ELF sine waves or ELF modulated 915 MHz sine waves. (915MHz is RF but the ELF modulation was effective!) Kultz (2005) summarized the evidence that specific groups of genes are activated along with stress genes and are involved in sensing and repairing damage to DNA and proteins.

The stress response is a natural defense mechanism activated by molecular damage caused by environmental forces. The response involves reaction with DNA, i.e., stimulating stress genes as well as genes that sense and repair damage to DNA and proteins. At high EMF intensities, the interaction with DNA can lead to DNA strand breaks that can result in mutations, an initiating step in the development of cancer. (See Attachment 12 - Blank, Electromagnetic Biology and Medicine, 2008).

EMF have been shown to cause other potentially harmful biological effects, such as leakage of the blood brain barrier that can lead to damage of neurons in the brain,

increased micronuclei (DNA fragments) in human blood lymphocytes, all at exposures well below the limits in the current FCC guidelines in the US.

In summary, the human health consequences of long-term exposure to high EMF levels lead to molecular damage, including DNA. If the molecular damage is not fully repaired and the damaged cells are not eliminated by apoptosis (cell suicide), the diseases that are most likely to develop are: (a) cancer, primarily leukemia in children and breast cancer in women; (b) neurodegenerative diseases such as Alzheimer's disease and ALS; (c) immunological disorders, including electrohypersensitivity (EHS).

6. Epidemiology studies

Epidemiology research, that is, research on large populations over time, has served as a key guide for EMF policy on health risks associated with ELF (power lines) and RF (cell phones). These studies, which show the effects of long term exposures demonstrate quantitative dose-response relations (i.e., the health effects are proportional to the EMF dose).

The paper published in 1979 by Wertheimer and Leeper (1979) showed a dose-response link between EMF and leukemia (See Attachment 13). Since then, there have been many studies on the relation between EMF and human disease. Among the key studies are two pooled analyses by Greenland et al (2000) and Ahlbom et al (2000) which confirmed a statistically significant doubling of the risk of leukemia in children when exposures exceed 3-4mG (See Attachments 14 and 15). The link between DNA damage and development of cancer is further supported by Yang et al (2009) who correlated **a significantly increased risk of leukemia in children with a deficiency in DNA repair genes** (See Attachment 16). (i.e., when repair genes were present, they appear to be able to repair some of the damage and prevent disease.)

Dr. Neil Cherry found strong corroborating evidence for these effects in the archives of public health statistics of all childhood cancers around the Sutro Broadcasting Tower in San Francisco between the years 1937 and 1988. The **50 years of data from the archives** involved a total of 123 cases of childhood cancer from a population of 50,686 children, and included 51 cases of leukaemia, 35 cases of brain cancer and 37 cases of lymphatic cancer. The risk ratio (RR) for all childhood cancers was elevated in

the area studied. **The risk declined with radial distance from the antennas, but it was still above a risk ratio of 5 even at a distance of 3km where the field was measured to be $1\mu\text{W}/\text{cm}^2$, comparable to what has been measured near cellphone towers (See Attachment 17). (Similar results have been reported around RF broadcasting antennas in Sydney, Australia and Rome, Italy, and there are now studies of effects of cellphones on brain cancer and cancer of the salivary glands.)**

There is also evidence that EMF plays a role in breast cancer in women by inhibiting the ability of normally secreted melatonin to slow the growth of breast cancer cells. Liburdy et al. (1993) showed that the threshold for inhibiting melatonin lies between 2-12mG (See Attachment 18).

Inhibition of melatonin secretion by the pineal gland is also associated with sleep disorders and disturbances of the immune system through various allergic and inflammatory responses and effects on tissue repair processes. The pineal gland also secretes serotonin, and a deficiency in serotonin due to EMF is also associated with insomnia, as well as memory and mood disorders.

In addition to the risk of cancer and effects on the immune system, Huss et al (2009) found an increased risk of Alzheimer's disease and death from neurodegenerative diseases for people who live within 50 meters of 220-380 kV power lines compared with people who live 600 meters or more, where the fields were about 1mG. **The estimated fields at 50 meters for the 220kV line are about 5mG and for the 380kV line are about 8mG. The fields would be very much higher at 20 meters.** (See Attachment 19)

After reviewing the full range of studies, the International Agency for Research on Cancer (IARC) in 2002 found that there is reliable scientific evidence that EMFs in the ELF range are a possible human carcinogen (In 2011, IARC made a similar evaluation regarding the RF range.) (See Attachments 20 and 21). Since 2002, additional evidence has supported the IARC statement. Hence, like the cell biology studies, epidemiological studies show adverse biological changes on exposure to EMF. The EMF interactions with DNA and the low levels at which these reactions occur offer a plausible mechanism connecting environmental exposure and human carcinogenesis (See Attachment 12 - Blank, Electromagnetic Biology and Medicine, 2008).

7. Mechanism of EMF Interaction with DNA as a Fractal Antenna

The responses of deoxyribonucleic acid (DNA) to electromagnetic fields (EMF) in different frequency ranges can be understood in terms of the double helical structure of the DNA and the electronic conduction within the DNA molecule and its compact structure in the nucleus. Human DNA is 2 meters long and it is coiled many fold in order to fit into a nucleus that is only microns in size. The need to fit into this cramped space results in the DNA being coiled many times, and a molecule having electron conduction paths of many different lengths. The many different lengths mean that the DNA can act as an antenna that is sensitive to many non-ionizing frequencies in the extremely low frequency (ELF) and radio frequency (RF) ranges.

The wide frequency range of interaction with EMF is the functional characteristic of a fractal antenna, and **DNA appears to possess the two structural characteristics of fractal antennas, electronic conduction and self symmetry. These properties contribute to greater reactivity of DNA with EMF in the environment, and the DNA damage could account for increases in cancer epidemiology,** as well as variations in the rate of chemical evolution in early geologic history.

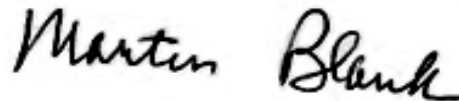
8. The Growing Presence of EMF in the Environment

All of the studies cited above occurred when EMF levels were lower than they are today. Increasingly, people are exposed to a much wider range of EMF as a result of advancing technological developments, such as cell phones, WiFi, smart meters, radiation from installation of cell towers, etc. Also, the scientists (primarily engineers and physicists) who set the divisions of the EM spectrum, selected frequency boundaries that do not relate to the biology. For example, they incorrectly assumed that the only dangerous range was EMF that caused the body temperature to increase. Human cells do not recognize EM spectrum divisions. The same biological reactions (including the cellular stress response), can be stimulated in more than one subdivision of the EM spectrum and in subdivisions that do not cause temperature increases.

There are now sufficient scientific data about the biological effects of EMF to limit human exposure. We can state unequivocally that EMF can cause damage (single and double strand breaks) to DNA at exposure levels that are considered safe under the FCC guidelines in the USA (See Attachment 9 - Lai and Singh, 1997). Further, these

guidelines do not take into account the accumulation of changes or mutations in DNA that occur with prolonged exposure—and the actual use of the various devices involves prolonged exposure, indeed increasingly prolonged exposure.

In conclusion, given my expertise as a cellular biologist and experience as a professor and researcher authoring over 90 scientific papers and a recent book “Overpowered” regarding EMF effects on the cells, I strongly recommend that the city of Los Angeles, the Mayor, the City Council and the office of the City Attorney **NOT** proceed with the Citywide WiFi/Citylink LA program due to the damage to public health, that will result from the ongoing exposure to electromagnetic fields and corresponding Radio Frequency Radiation emitted by the wireless transmitters used by citywide WiFi. The proposed system may not cause thermal or heating effects but will certainly cause non-thermal biological effects that are not being accounted for or protected by our current FCC safety standards. It is clear that the safety standards must be revised to take into account the potentially harmful non-thermal biological processes that occur. I’m available for further consultation or questions.



Martin Blank, PhD.

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