

## Scott Carey

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**From:** Peter Lesgaft <peter.lesgaft@medmail.ch>  
**Sent:** Sunday, October 30, 2022 10:32 PM  
**To:** Scott Carey  
**Subject:** NTRPA Governing Board Meeting~11/03/22~Public Comment - Agenda Item # 2  
**Attachments:** BioInitiativeReport-RF-Color-Charts.pdf; BiblioRFCharts2014.pdf

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Good Afternoon NTRPA Governing Board,

Please read the [undermentioned BioInitiative Report](#) and the attached PDF's into the Tahoe Regional Planning Agency's public record (<http://bioinitiative.info/bioInitiativeReport2012.pdf>):



# **Biolnitiative 20**

## **A Rationale for Biologically-based Exposure Standards for Low-Intensity Electromagnetic Radiation**

**Biolnitiative Working Group 2012**

Jitendra Behari, PhD, India  
Paulraj Rajamani, PhD, India  
Carlo V. Bellieni, MD, Italy  
Igor Belyaev, Dr.Sc., Slovak Republic  
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Adamantia F. Fragopoulou, PhD, Greece  
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Paul Heroux, PhD, Canada  
Michael Kundi, PhD, Austria  
Henry Lai, PhD, USA  
Ying Li, PhD, Canada  
Abraham R. Liboff, PhD, USA  
Lukas H. Margaritis, PhD, USA  
Henrietta Nittby, MD, Sweden  
Gerd Oberfeld, MD, Germany  
Bertil R. Persson, PhD, Sweden  
Iole Pinto, PhD, Italy  
Cindy Sage, MA, USA

The TRPA staff on multiple occasions have falsely alleged—including [to this Governing Board](#)—that they have never received "proof of adverse impacts of RF particular to Tahoe":

TRPA, having been created by an interstate compact, is a creature of federal law. The application of the TCA to its permitting process is not a matter of preemption. The intent of Congress in passing both the TCA and the Compact statutes should there be any conflict in implementation. In furtherance of its regulatory agency position to date is this: TRPA will defer to the FCC regulations over health and environmental impacts. However, TRPA could choose to regulate should cellular facilities be proven to have a particular adverse effect on the Tahoe Region. TRPA has not received any such proof of adverse impacts on Tahoe and therefore will not reexamine the determinations of the FCC.

The only applicable legal standard of "proof" that might be requisite at this stage is the [burden of production](#). That burden was met during the [Governing Board meeting of February 26th 2020](#), where each of the Governing Board members was presented with a gigantic green binder full of peer-reviewed scientific studies particular to Tahoe:

TAHOE REGIONAL PLANNING AGENCY  
GOVERNING BOARD

TRPA  
Stateline, NV

**Meeting Minutes**

I. CALL TO ORDER AND DETERMINATION OF QUORUM

Vice Chair Mr. Bruce called the meeting to order at 10:20 a.m.

Members present: Ms. Aldean, Mr. Beyer (by phone), Ms. Berkbigler, (by phone), Mrs. Cegavske (by phone), Ms. Faustinos, Ms. Gustafson, Mr. Lawrence, Ms. Novasel, Mr. Yeates (by phone)

Members absent: Mr. Rice, Mr. Shute

II. PLEDGE OF ALLEGIANCE

III. PUBLIC INTEREST COMMENTS

Greg Lien, Tahoe City Attorney said he provided **two reports**; one from expert in EMF standards that can be applied for the benefit of the pro The second report is from Dr. Martin Pall, expert in the impacts of ele radiation on forest health, human health, and other living things. The awareness that the new technologies that are being produced are no maybe affected to some degree, plants and animals are affected to a top layer of soils in the stream environment zone areas affecting full also increase the fire hazard. Five G is already being rolled out at Lake

In the time since, the scientific evidence has only continued to pile up, *thousands and thousands* more pages of peer-reviewed scientific literature have been entered into the administrative records. The TRPA is utterly compelled to look into this matter. *See, Environmental Health Trust v. Federal Communications Commission*, 9 F.4th 893, 906, 910 (2021) (an agency's decision not to initiate a rulemaking must have some reasoned basis, and an agency cannot simply ignore evidence suggesting that a major factual predicate of its position may no longer be accurate; while imitation may be the highest form of flattery, it does not meet even the low threshold of reasoned analysis required by the Administrative Procedure Act (APA) under the deferential arbitrary and capricious standard of review; thus, one agency's unexplained adoption of an unreasoned analysis just compounds rather than vitiates the analytical void, in other words, two wrongs do not make a right). “It is well-established that an agency’s action must be upheld, if at all, on the basis articulated by the agency itself” (e.g., [Nat. Res. Def. Council v. U.S. Env’tl. Prot. Agency](#), No. [20-72794](#) at [p. 9](#) (9th Cir. 2022)). Courts do not accept post-hoc rationalizations for agency action (*Id.*).

TRPA is required under PUBLIC LAW 96-551, Art. VII, to prepare and consider a detailed environmental impact statement (EIS) whereas it is “acting upon matters that [have a significant effect](#) on the environment.” TRPA may not use uncertainty of effects or a lack of existing information as basis for acting without EIS (*see, e.g., American Bird Conservancy, Inc. v. F.C.C.*, 516 F.3d 1027, 1033-1034 (2008) (a precondition of certainty before initiating NEPA procedures would jeopardize NEPA's purpose to ensure that agencies consider environmental impacts before they act rather than wait until it is too late); *Sierra Club v. Norton*, 207 F.Supp.2d 1310, 1336 (2002) (Under NEPA, an agency cannot use the lack of existing information as a basis for acting without preparing an EIS). *See generally*, 42 U.S.C. §§ 4331-4332; 40 C.F.R. §§ 1500-1508). “The EIS required by the Compact is similar to the EIS required by the National Environmental Policy Act (“NEPA”), 42 U.S.C. §4332(2)(C), and to the reporting required by the California Environmental Quality Act, Cal. Pub. Res. Code § 21100. Decisions under NEPA are authoritative” ([Sierra Club, et al v. Tahoe Regional Planning Agency](#), No. [14-15998](#) at [p. 19](#) (9th Cir. 2016)). The TRPA is not a supra-constitutional agency, but must confer with the [Council on Environmental Quality](#) regulations (*see, e.g., United Keetoowah Band of Cherokee Indians in Okla. v. FCC*, 933 F.3d 728, [735](#) (D.C. Cir. 2019) (“In enacting NEPA, Congress established the Council on Environmental Quality, in the Executive Office of the President, to oversee implementation of NEPA across the entire federal government”). *See generally*, [40 CFR Chapter V](#); PUBLIC LAW 96-551—DEC. 19, 1980, Art. V(1)(b).

I will briefly name just a few of the innumerable examples of adverse environmental [effects](#). First an

overview:



Contents lists available at ScienceDirect

# Toxicology Letters

journal homepage: [www.elsevier.com/locate/toxlet](http://www.elsevier.com/locate/toxlet)

## Adverse health effects of 5G mobile networking technology under conditions

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### GRAPHICAL ABSTRACT



Adverse Health Effects of Wireless Radiation on Humans				
Metabolic Disturbance	Reactive Oxygen Species Generation	Genotoxicity and Carcinogenicity	Immunotoxicity and Inflammation	Apoptosis and Necrosis
Discomfort Symptoms	Sensory Disorders	Sleep Disorders	Congenital Abnormalities	Precancerous Conditions
<b>CANCER</b>	<b>NEURODEGENERATION</b>	<b>INFERTILITY</b>	<b>NEUROBEHAVIORAL</b>	<b>CARDIOVASCULAR</b>

### ARTICLE INFO

**Keywords:**

Electromagnetic fields  
 Wireless radiation  
 Non-ionizing radiation  
 Mobile networking technology  
 5G  
 Adverse health effects  
 Toxicology  
 Toxic stimuli combinations  
 Synergistic effects

### ABSTRACT

This article identifies adverse effects of non-ionizing non-visible radiation reported in the premier biomedical literature. It emphasizes that most to date are not designed to identify the more severe adverse effects environment in which wireless radiation systems operate. Many experimentation of the carrier signal. The vast majority do not account for synergism (such as chemical and biological) acting in concert with the wireless radiation that the nascent 5G mobile networking technology will affect not only individuals but will have adverse systemic effects as well.

This issue commands TRPA examination. Here are *just a few* of the **hundreds of submitted studies** applicable to the Tahoe Basin. The proposed Ski Run macro tower will be right next to a sensitive aspen grove and very well could harm it:



## *Research Article*

# **Adverse Influence of Radio Frequency Background on Trembling Aspen Seedlings: Preliminary Observations**

**Katie Haggerty**

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Numerous incidents of aspen decline have been recorded in North America over the past half century. Mortality of aspen clones have been observed in Colorado since 2004. The radio frequency (RF) background has undergone major changes in the past two centuries due to the development and use of electrical applications, and the anthropogenic RF background continues to increase in intensity and complexity. The RF background may have strong adverse effects on growth rate and fall anthocyanin production, which is an underlying factor in aspen decline.

## **1. Introduction**

Incidents of aspen decline in North America have been observed since the mid-20th Century [1–3]. Stands at the limits of aspen's lower elevation range, on sites with poor drainage, with limited water [4] or nutrient supply [5], are more susceptible to decline. Stand age and clonal differences are also factors in susceptibility to decline [6]. Factors initiating decline include defoliation by insects, damage

Electromagnetic energy from natural sources is present throughout life on earth. Plants rely on electromagnetic energy for photosynthesis and for regulation of growth (flowering, shoot and root growth, dormancy). A plant's response to electromagnetic energy depends on frequency, timing, and intensity of the input. Electromagnetic energy, however, makes up a small portion of the total energy input to plants. Electromagnetic energy is an important mechanism for energy transfer in the

The parcel contains a [stream environmental zone](#) with a creek and surrounding wetlands, which hosts many amphibians, is adjacent to [land which the TRPA has found as suitable habitat](#) for the [federally endangered Sierra Nevada Yellow-legged Frog \(\*Rana sierrae\*\)](#), and for which there are in fact multiple nearby reported research grade sightings of this endangered species (e.g. [1](#), [2](#), [3](#), [4](#), & [5](#)). The undermentioned study is therefore critically relevant to Tahoe's "unique environment":

# Mobile Phone Mast Effects on Commo (*Rana temporaria*) Tadpoles: The City ' into a Laboratory

ALFONSO BALMORI

*C/Navarra, Valladolid, Spain*

*An experiment has been made exposing eggs and tadpoles of the common frog (*Rana temporaria*) to electromagnetic radiation from several mobile phone masts located at a distance of 140 meters. The experiment lasted two months in two phases until an advanced phase of tadpole prior to metamorphosis. The electric field intensity (radiofrequencies and microwaves) in V/m for different devices were 1.8 to 3.5 V/m. In the exposed group (n = 70) irregular movements, an asynchronous growth, resulting in both big and small tadpoles and high mortality (90%) was observed. Regarding the control group (same conditions but inside a Faraday cage, the coordination of movements and the development was synchronous, and a mortality of 4.2% was obtained. These results indicate that radiation emitted by phone masts in a real situation may cause an increase in mortality of exposed tadpoles and may have huge implications for the natural world, which is not the case of microwave radiation levels from a multitude of phone masts.*

**Keywords** Electromagnetic pollution; Microwaves; Phone masts  
Tadpoles.

## Introduction

Next, Tahoe's sensitive alpine fauna are all in some way critically dependent on pollinators and other insects. The science findings should raise serious concern for the sensitive [Monarch Butterfly, a candidate endangered species](#), as well as the rapidly declining bee population. The undermentioned study was casually extracted from the gargantuan pile of scientific studies provided to the TRPA:



Review

# Electromagnetic radiation as an emerging driver factor for the decline of insects

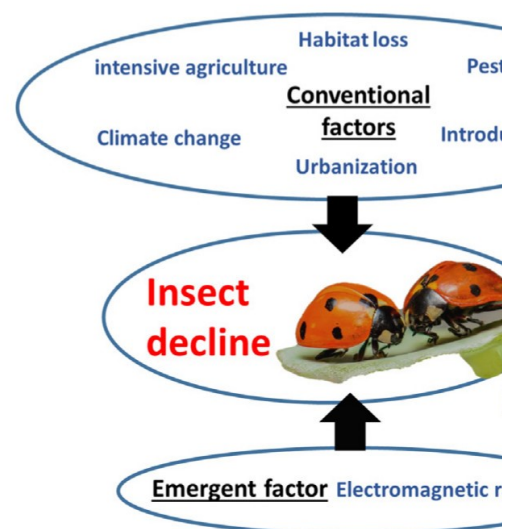
Alfonso Balmori

C/Navarra N°1 5° B, 47007 Valladolid, Spain

## HIGHLIGHTS

- Biodiversity of insects is threatened worldwide.
- These reductions are mainly attributed to agricultural practice and pesticide use.
- There is sufficient evidence on the damage caused by electromagnetic radiation.
- Electromagnetic radiation may be a complementary driver in this decline.
- The precautionary principle should be applied before any new deployment (e.g. 5G).

## GRAPHICAL ABSTRACT



## ARTICLE INFO

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*Keywords:*

Biological diversity

## ABSTRACT

The biodiversity of insects is threatened worldwide. Numerous studies have shown a decline in insect diversity that has occurred in recent decades. The same is happening with other species that have an essential utility for pollination of crops. Loss of insect diversity and its cascading effects on food webs and ecosystem services. Many authors point out that the decline must be attributed mainly to agricultural practices and pesticide use. On the other hand, the effects of non-thermal microwave radiation on insects has been known for decades. This study shows that electromagnetic radiation should be considered as an emerging driver factor in the dramatic decline in insects, acting in synergy with agricultural practices and climate change. The extent that anthropogenic electromagnetic radiation is contributing to the decline of insects is still unknown.

Next, the trees surrounding the proposed tower are particularly environmentally sensitive because they provide the **requisite visual screening** in order for the project to meet its [scenic threshold standards](#)—as the tower would be installed by a [designated scenic corridor](#). However, there are a plethora of published scientific studies that show the cell towers slowly kill the trees to which they are constructed adjacent:



## Radiofrequency radiation injures trees around mobile phone base stations

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### HIGHLIGHTS

- High frequency nonionizing radiation is becoming increasingly common.
- This study found a high level of damage to trees in the vicinity of phone masts.
- Deployment has been continued without consideration of environmental impact.

### GRAPHICAL ABSTRACT

## Bernartzky (1986), rev



### ARTICLE INFO

#### Article history:

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Accepted 6 August 2016

Available online xxxx

### ABSTRACT

In the last two decades, the deployment of phone masts around the world has led to a discussion in the scientific community about the possible effects of radiofrequency radiation on the environment. Trees have several advantages over animals as experimental subjects for this study: they are stationary, they have a long life span, and they are easy to monitor. To verify whether there is a connection between unusual (gene frequency) exposure and tree damage, a detailed long-term (2006–2015) field study was conducted in the cities of Bamberg and Hallstadt (Germany). During monitoring, obser-

Some of the most common types of peer-reviewed scientific studies of radio-frequency radiation on wildlife are those that repeatedly find that cell towers harm birds in a multitude of ways. The Tahoe Basin is home to several sensitive and federally protected migratory birds, eagles and hawks. The TRPA needs to take precaution to holistically protect these birds. Some of the most morbid scientific findings are those studying the development of avian eggs (note the similarity to findings about amphibian eggs):



## **EFFECT OF MOBILE PHONE FREQUENCY RADIATION ON THE DEVELOPMENT OF CHICK EMBRYO**

**Jyoti<sup>1</sup>, Ravinder Kumar Kohli<sup>2</sup> and Upma Bagai<sup>1</sup>**

<sup>1</sup>Department of Zoology, Panjab University

<sup>2</sup>Department of Botany, Panjab University

**Abstract:** The countless increase in towers and mobile phones has increased non-ionizing radio waves in surroundings during last two decades. Studies have revealed non-desirable after effects of mobile phone frequency electromagnetic radiations at cellular level. Thus, the present study was designed to evaluate the effect of mobile phone frequency electromagnetic field (EMF) radiations on early development of chick embryos. To carry out the studies, zero hour incubated fertilized eggs were divided into four groups including normal control and three EMF treated groups, exposed to EMF for different durations and at different power levels. During the study, somite development alteration in exposed groups has been observed compared to normal control group. Hence, the study concludes that EMF exposure has adverse effects on development of chick embryo during early incubation period.

**Keywords:** EMF, chick embryo, mortality, somite.

### **Introduction**

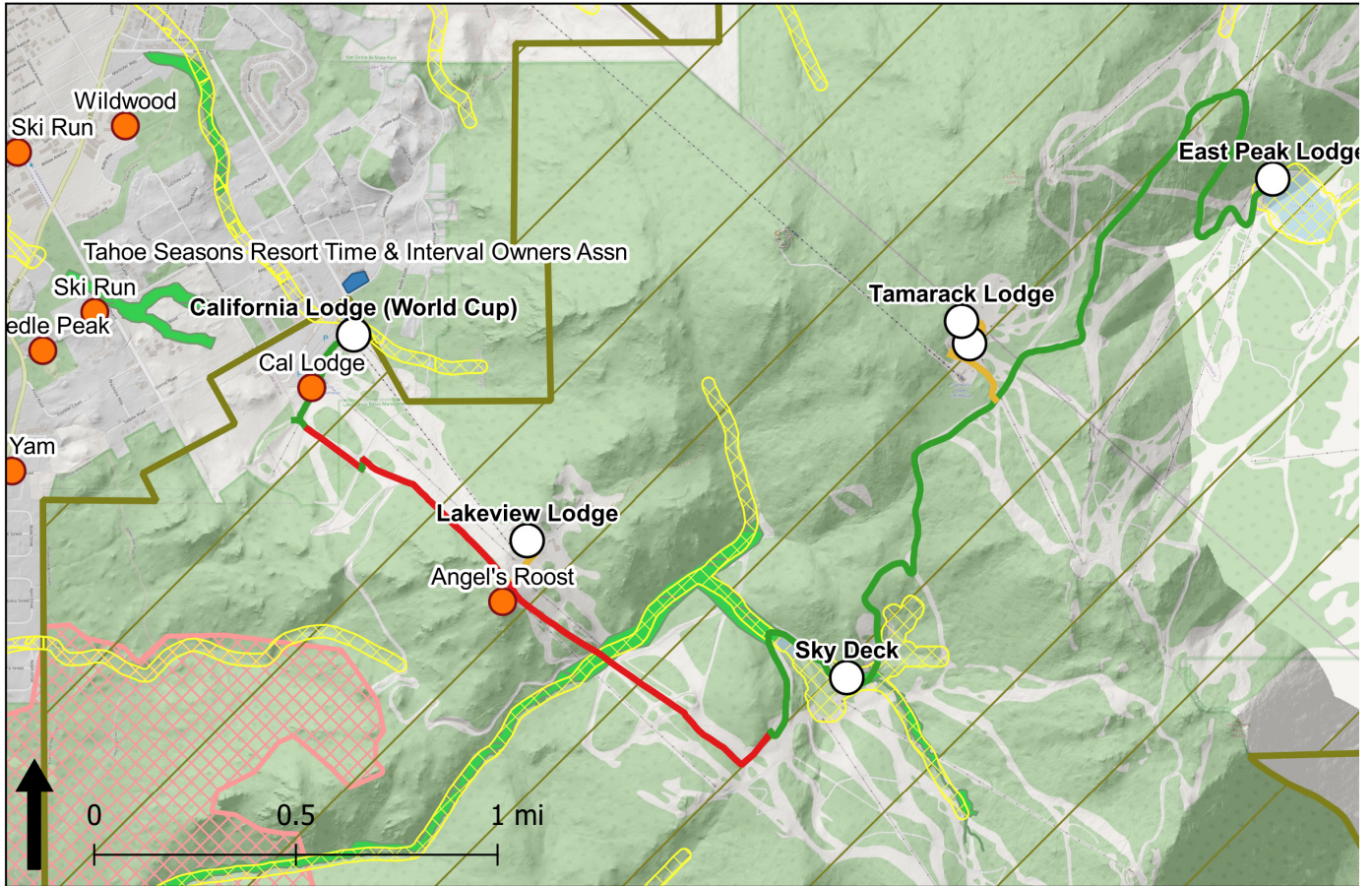
Modern technology has provided comfort and ease to human society. However, non-avoidable factors are also associated with these technical and communication technologies. Electromagnetic radiations are included in these factors which are used in various wireless devices for signal transmission. Various research studies have indicated that electromagnetic radiations are found to be responsible for various harmful effects on human health.

The staff report finding that the public has failed [its burden to produce](#) sufficient studies showing adverse effects particularly applicable to the types of fauna that exist in the Tahoe Basin—*repeated* [as recently as this August](#)—are counterfactual. The aforementioned 1,557 page [BioInitiative Report](#) itself is enough to meet this burden, and examination of all the issues and possible regulation should follow, whereas the TRPA has an obligation to apply the [precautionary principle](#) in protecting the Tahoe Basin. The medical profession is already [teaching precaution in this regard](#).

TRPA's resulting actions were then arbitrary and capricious whereas TRPA has relied on factors which Congress has not intended it to consider, entirely failed to consider an important aspect of the problem, offered an explanation for its decision that runs counter to the evidence before the agency, or is so implausible that it could not be ascribed to a difference in view or the product of agency expertise (*Motor Vehicle Manufacturers Association v. State Farm Auto Mutual Insurance Co.*, 463 U.S. 29, 42-44 (1983)). An agency decision that is the product of “illogical” or inconsistent reasoning; that fails to consider an important factor relevant to its action, such as the policy effects of its decision or vital aspects of the problem in the issue before it; or that fails to consider “less restrictive, yet easily administered” regulatory alternatives, will similarly fail the arbitrary and capricious test (*Ctr. for Biological Diversity v. U.S. Bureau of Land Mgmt.*, 698 F.3d 1101, 1124 (9th Cir. 2012); *Kalispel Tribe of Indians v. U.S. Dep’t of the Interior*, 999 F.3d 683, 688 (9th Cir. 2021)).

TRPA is approving cell towers in [Sierra Nevada Yellow-Legged Frog habitat](#) that appears to be [utilized](#) ([1](#) & [2](#)) and is refusing to consider the environmental effects:

# Heavenly Fiber Plan: Regulatory Issues



## Project May Pose Significant Effect on the Environment

Numerous research studies have found that cell tower radiation causes mortality in frogs and amphibians [e.g., Baln Effects on Common Frog (*Rana temporaria*) Tadpoles: The City Turned into a Laboratory. *Electromagnetic* [10.3109/15368371003685363](https://doi.org/10.3109/15368371003685363)]. A NEPA “categorical exclusion” cannot be issued because there exists substantial evidence of a significant effect on the environment, particularly an endangered frog and protected birds [36 CFR § 220.6(b)(1)(i),(iii); 50 CFR § 497b; 47 CFR § 1.1307(a)(3); 40 CFR § 1508.8]. The affected area contains substantive habitat for endangered, rare and significant effects relating to wetlands [50 CFR § 10.13; EO 13186; 16 U.S.C. § 700 et. seq.; cf. 14 CCR §§ 15192(d), 15193; 15194; 15195; 15196; 15197; 15198; 15199; 15200; 15201; 15202; 15203; 15204; 15205; 15206; 15207; 15208; 15209; 15210; 15211; 15212; 15213; 15214; 15215; 15216; 15217; 15218; 15219; 15220; 15221; 15222; 15223; 15224; 15225; 15226; 15227; 15228; 15229; 15230; 15231; 15232]. The antennas would expose both nesting and migratory birds—including bald eagles—to human exposure limits [47 CFR § 1.1310]. The miles of aerial fiber also blight the visual quality of the TRPA design Recreation Environmental Improvement Area. This is an extraordinary Congressionally protected region warranting further review [36 CFR § 220.6(b)(1)(iii); see also Public Law 96551; Public Law 96586; EO 13057].

NTRPA Governing Board, I pray that you halt these projects. It is abundantly clear from the record that the TRPA staff has entirely failed to consider an important aspect of the problem and offered an explanation for its decision that runs counter to the evidence before them.

Thank you for your time and consideration.

Peter Lesgaft

## Reported Biological Effects from Radiofrequency Radiation at Low-Intensity Exposure (Cell Tower, Wi-Fi, Wireless Laptop and 'Smart' Meter RF Intensities)

Power Density (Microwatts/centimeter <sup>2</sup> - uW/cm <sup>2</sup> )		Reference
As low as (10 <sup>-13</sup> ) or 100 femtowatts/cm <sup>2</sup>	Super-low intensity RFR effects at MW resonant frequencies resulted in changes in genes; problems with chromatin conformation (DNA)	Belyaev, 1997
5 picowatts/cm <sup>2</sup> (10 <sup>-12</sup> )	Changed growth rates in yeast cells	Grundler, 1992
0.1 nanowatt/cm <sup>2</sup> (10 <sup>-10</sup> ) or 100 picowatts/cm <sup>2</sup>	Super-low intensity RFR effects at MW resonant frequencies resulted in changes in genes; problems with chromatin condensation (DNA) intensities comparable to base stations	Belyaev, 1997
0.00034 uW/cm <sup>2</sup>	Chronic exposure to mobile phone pulsed RF significantly reduced sperm count,	Behari, 2006
0.0005 uW/cm <sup>2</sup>	RFR decreased cell proliferation at 960 MHz GSM 217 Hz for 30-min exposure	Velizarov, 1999
0.0006 - 0.0128 uW/cm <sup>2</sup>	Fatigue, depressive tendency, sleeping disorders, concentration difficulties, cardio-vascular 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 <sup>2</sup>	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 <sup>2</sup>	In children and adolescents (8-17 yrs) short-term exposure caused conduct problems in school (behavioral problems)	Thomas, 2010
0.005 uW/cm <sup>2</sup>	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 <sup>2</sup>	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 <sup>2</sup>	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
0.01 - 0.11 uW/cm <sup>2</sup>	RFR from cell towers caused fatigue, headaches, sleeping problems	Navarro, 2003

Stress proteins, HSP, disrupted immune function	Brain tumors and blood-brain barrier
Reproduction/fertility effects	Sleep, neuron firing rate, EEG, memory, learning, behavior
Oxidative damage/ROS/DNA damage/DNA repair failure	Cancer (other than brain), cell proliferation
Disrupted calcium metabolism	Cardiac, heart muscle, blood-pressure, vascular effects

## Reported Biological Effects from Radiofrequency Radiation at Low-Intensity Exposure (Cell Tower, Wi-Fi, Wireless Laptop and 'Smart' Meter RF Intensities)

Power Density (Microwatts/centimeter <sup>2</sup> - uW/cm <sup>2</sup> )		Reference
0.01 - 0.05 uW/cm <sup>2</sup>	Adults (18-91 yrs) with short-term exposure to GSM cell phone radiation reported headache, neurological problems, sleep and concentration problems.	Hutter, 2006
0.005 - 0.04 uW/cm <sup>2</sup>	Adults exposed to short-term cell phone radiation reported headaches, concentration difficulties (differences not significant, but elevated)	Thomas, 2008
0.015 - 0.21 uW/cm <sup>2</sup>	Adults exposed to short-term GSM 900 radiation reported changes in mental state (e.g., calmness) but limitations of study on language descriptors prevented refined word choices (stupified, zoned-out)	Augner, 2009
0.05 - 0.1 uW/cm <sup>2</sup>	RFR linked to adverse neurological, cardio symptoms and cancer risk	Khurana, 2010
0.05 - 0.1 uW/cm <sup>2</sup>	RFR related to headache, concentration and sleeping problems, fatigue	Kundi, 2009
0.07 - 0.1 uW/cm <sup>2</sup>	Sperm head abnormalities in mice exposed for 6-months to base station level RF/MW. Sperm head abnormalities occurred in 39% to 46% exposed mice (only 2% in controls) abnormalities was also found to be dose dependent. The implications of the pin-head and banana-shaped sperm head. The occurrence of sperm head observed increase occurrence of sperm head abnormalities on the reproductive health of humans living in close proximity to GSM base stations were discussed."	Otitolaju, 2010
0.38 uW/cm <sup>2</sup>	RFR affected calcium metabolism in heart cells	Schwartz, 1990
0.8 - 10 uW/cm <sup>2</sup>	RFR caused emotional behavior changes, free-radical damage by super-weak MWs	Akoev, 2002
0.13 uW/cm <sup>2</sup>	RFR from 3G cell towers decreased cognition, well-being	Zwamborn, 2003
0.16 uW/cm <sup>2</sup>	Motor function, memory and attention of school children affected (Latvia)	Kolodynski, 1996
0.168 - 1.053 uW/cm <sup>2</sup>	Irreversible infertility in mice after 5 generations of exposure to RFR from an 'antenna park'	Magras & Zenos, 1997
0.2 - 8 uW/cm <sup>2</sup>	RFR caused a two-fold increase in leukemia in children	Hocking, 1996
0.2 - 8 uW/cm <sup>2</sup>	RFR decreased survival in children with leukemia	Hocking, 2000
0.21 - 1.28 uW/cm <sup>2</sup>	Adolescents and adults exposed only 45 min to UMTS cell phone radiation reported increases In headaches.	Riddervold, 2008

Stress proteins, HSP, disrupted immune function	Brain tumors and blood-brain barrier
Reproduction/fertility effects	Sleep, neuron firing rate, EEG, memory, learning, behavior
Oxidative damage/ROS/DNA damage/DNA repair failure	Cancer (other than brain), cell proliferation
Disrupted calcium metabolism	Cardiac, heart muscle, blood-pressure, vascular effects

## Reported Biological Effects from Radiofrequency Radiation at Low-Intensity Exposure (Cell Tower, Wi-Fi, Wireless Laptop and 'Smart' Meter RF Intensities)

Power Density (Microwatts/centimeter <sup>2</sup> - uW/cm <sup>2</sup> )		Reference
0.5 uW/cm <sup>2</sup>	Significant degeneration of seminiferous epithelium in mice at 2.45 GHz, 30-40 min.	Saunders, 1981
0.5 - 1.0 uW/cm <sup>2</sup>	Wi-Fi level laptop exposure for 4-hr resulted in decrease in sperm viability, DNA fragmentation with sperm samples placed in petri dishes under a laptop connected via WI-FI to the internet.	Avendano, 2012
1.0 uW/cm <sup>2</sup>	RFR induced pathological leakage of the blood-brain barrier	Persson, 1997
1.0 uW/cm <sup>2</sup>	RFR caused significant effect on immune function in mice	Fesenko, 1999
1.0 uW/cm <sup>2</sup>	RFR affected function of the immune system	Novoselova, 1999
1.0 uW/cm <sup>2</sup>	Short-term (50 min) exposure in electrosensitive patients, caused loss of well-being after GSM and especially UMTS cell phone radiation exposure	Eltiti, 2007
1.3 - 5.7 uW/cm <sup>2</sup>	RFR associated with a doubling of leukemia in adults	Dolk, 1997
1.25 uW/cm <sup>2</sup>	RFR exposure affected kidney development in rats (in-utero exposure)	Pyrpasopoulou, 2004
1.5 uW/cm <sup>2</sup>	RFR reduced memory function in rats	Nittby, 2007
2 uW/cm <sup>2</sup>	RFR induced double-strand DNA damage in rat brain cells	Kesari, 2008
2.5 uW/cm <sup>2</sup>	RFR affected calcium concentrations in heart muscle cells	Wolke, 1996
2 - 4 uW/cm <sup>2</sup>	Altered cell membranes; acetylcholine-induced ion channel disruption	D'Inzeo, 1988
4 uW/cm <sup>2</sup>	RFR caused changes in hippocampus (brain memory and learning)	Tattersall, 2001
4 - 15 uW/cm <sup>2</sup>	Memory impairment, slowed motor skills and retarded learning in children	Chiang, 1989
5 uW/cm <sup>2</sup>	RFR caused drop in NK lymphocytes (immune function decreased)	Boscolo, 2001
5.25 uW/cm <sup>2</sup>	20 minutes of RFR at cell tower frequencies induced cell stress response	Kwee, 2001
5 - 10 uW/cm <sup>2</sup>	RFR caused impaired nervous system activity	Dumansky, 1974
6 uW/cm <sup>2</sup>	RFR induced DNA damage in cells	Phillips, 1998

Stress proteins, HSP, disrupted immune function	Brain tumors and blood-brain barrier
Reproduction/fertility effects	Sleep, neuron firing rate, EEG, memory, learning, behavior
Oxidative damage/ROS/DNA damage/DNA repair failure	Cancer (other than brain), cell proliferation
Disrupted calcium metabolism	Cardiac, heart muscle, blood-pressure, vascular effects

## Reported Biological Effects from Radiofrequency Radiation at Low-Intensity Exposure (Cell Tower, Wi-Fi, Wireless Laptop and 'Smart' Meter RF Intensities)

Power Density (Microwatts/centimeter <sup>2</sup> - uW/cm <sup>2</sup> )		Reference
8.75 uW/cm <sup>2</sup>	RFR at 900 MHz for 2-12 hours caused DNA breaks in leukemia cells	Marinelli, 2004
10 uW/cm <sup>2</sup>	Changes in behavior (avoidance) after 0.5 hour exposure to pulsed RFR	Navakatikian, 1994
10 - 100 uW/cm <sup>2</sup>	Increased risk in radar operators of cancer; very short latency period; dose response to exposure level of RFR reported.	Richter, 2000
12.5 uW/cm <sup>2</sup>	RFR caused calcium efflux in cells - can affect many critical cell functions	Dutta, 1989
13.5 uW/cm <sup>2</sup>	RFR affected human lymphocytes - induced stress response in cells	Sarimov, 2004
20 uW/cm <sup>2</sup>	Increase in serum cortisol (a stress hormone)	Mann, 1998
28.2 uW/cm <sup>2</sup>	RFR increased free radical production in rat cells	Yurekli, 2006
37.5 uW/cm <sup>2</sup>	Immune system effects - elevation of PFC count (antibody producing cells)	Veyret, 1991
45 uW/cm <sup>2</sup>	Pulsed RFR affected serum testosterone levels in mice	Forgacs, 2006
50 uW/cm <sup>2</sup>	Cell phone RFR caused a pathological leakage of the blood-brain barrier in 1 hour	Salford, 2003
50 uW/cm <sup>2</sup>	An 18% reduction in REM sleep (important to memory and learning functions)	Mann, 1996
60 uW/cm <sup>2</sup>	RFR caused structural changes in cells of mouse embryos	Somozy, 1991
60 uW/cm <sup>2</sup>	Pulsed RFR affected immune function in white blood cells	Stankiewicz, 2006
60 uW/cm <sup>2</sup>	Cortex of the brain was activated by 15 minutes of 902 MHz cell phone	Lebedeva, 2000
65 uW/cm <sup>2</sup>	RFR affected genes related to cancer	Ivaschuk, 1999
92.5 uW/cm <sup>2</sup>	RFR caused genetic changes in human white blood cells	Belyaev, 2005
100 uW/cm <sup>2</sup>	Changes in immune function	Elekes, 1996
100 uW/cm <sup>2</sup>	A 24.3% drop in testosterone after 6 hours of CW RFR exposure	Navakatikian, 1994
120 uW/cm <sup>2</sup>	A pathological leakage in the blood-brain barrier with 915 MHz cell RF	Salford, 1994

Stress proteins, HSP, disrupted immune function	Brain tumors and blood-brain barrier
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Disrupted calcium metabolism	Cardiac, heart muscle, blood-pressure, vascular effects

## Reported Biological Effects from Radiofrequency Radiation at Low-Intensity Exposure (Cell Tower, Wi-Fi, Wireless Laptop and 'Smart' Meter RF Intensities)

Power Density (Microwatts/centimeter <sup>2</sup> - uW/cm <sup>2</sup> )		Reference
500 uW/cm <sup>2</sup>	Intestinal epithelial cells exposed to 2.45 GHz pulsed at 16 Hz showed changes in intercellular calcium.	Somozy, 1993
500 uW/cm <sup>2</sup>	A 24.6% drop in testosterone and 23.2% drop in insulin after 12 hrs of pulsed RFR exposure.	Navakatikian, 1994
<b>STANDARDS</b>		
530 - 600 uW/cm <sup>2</sup>	Limit for uncontrolled public exposure to 800-900 MHz	ANSI/IEEE and FCC
1000 uW/cm <sup>2</sup>	PCS STANDARD for public exposure (as of September 1, 1997)	FCC, 1996
5000 uW/cm <sup>2</sup>	PCS STANDARD for occupational exposure (as of September 1, 1997)	FCC, 1996
<b>BACKGROUND LEVELS</b>		
0.003 uW/cm <sup>2</sup>	Background RF levels in US cities and suburbs in the 1990s	Mantiplay, 1997
0.05 uW/cm <sup>2</sup>	Median ambient power density in cities in Sweden (30-2000 MHz)	Hamnierius, 2000
0.1 - 10 uW/cm <sup>2</sup>	Ambient power density within 100-200' of cell site in US (data from 2000)	Sage, 2000

Stress proteins, HSP, disrupted immune function	Brain tumors and blood-brain barrier
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## Reported Biological Effects from Radiofrequency Radiation at Low-Intensity Exposure (Cell Tower, Wi-Fi, Wireless Laptop and 'Smart' Meter RF Intensities)

SAR (Watts/Kilogram)		Reference
0.000064 - 0.000078 W/Kg	Well-being and cognitive function affected in humans exposed to GSM-UMTS cell phone frequencies; RF levels similar near cell sites	TNO Physics and
0.00015 - 0.003 W/Kg	Calcium ion movement in isolated frog heart tissue is increased 18% (P<.01) and by 21% (P<.05) by weak RF field modulated at 16 Hz	Schwartz, 1990
0.000021 - 0.0021 W/Kg	Changes in cell cycle; cell proliferation (960 MHz GSM mobile phone)	Kwee, 1997
0.0003 - 0.06 W/Kg	Neurobehavioral disorders in offspring of pregnant mice exposed in utero to cell phones - dose-response impaired glutamatergic synaptic transmission onto layer V pyramidal neurons of the prefrontal cortex. Hyperactivity and impaired memory function in offspring. Altered brain development.	Aldad, 2012
0.0016 - 0.0044 W/Kg	Very low power 700 MHz CW affects excitability of hippocampus tissue, consistent with reported behavioral changes.	Tattersall, 2001
0.0021 W/Kg	Heat shock protein HSP 70 is activated by very low intensity microwave exposure in human epithelial amnion cells	Kwee, 2001
0.0024 - 0.024 W/Kg	Digital cell phone RFR at very low intensities causes DNA damage in human cells; both DNA damage and impairment of DNA is reported	Phillips, 1998
0.0027 W/Kg	Changes in active avoidance conditioned behavioral effect is seen after one-half hour of pulsed radiofrequency radiation	Navakatikian, 1994
0.0035 W/Kg	900 MHz cell phone signal induces DNA breaks and early activation of p53 gene; short exposure of 2-12 hours leads cells to acquire greater survival chance - linked to tumor aggressiveness.	Marinelli, 2004
0.0095 W/Kg	MW modulated at 7 Hz produces more errors in short-term memory function on complex tasks (can affect cognitive processes such as attention and memory)	Lass, 2002
0.001 W/Kg	750 MHz continuous wave (CW) RFR exposure caused increase in heat shock protein (stress proteins). Equivalent to what would be induced by 3 degree C. heating of tissue (but no heating occurred)	De Pomerai, 2000
0.001 W/Kg	Statistically significant change in intracellular calcium concentration in heart muscle cells exposed to RFR (900 MHz/50 Hz modulation)	Wolke, 1996

Stress proteins, HSP, disrupted immune function	Brain tumors and blood-brain barrier
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## Reported Biological Effects from Radiofrequency Radiation at Low-Intensity Exposure (Cell Tower, Wi-Fi, Wireless Laptop and 'Smart' Meter RF Intensities)

SAR (Watts/Kilogram)		Reference
0.0021 W/Kg	A significant change in cell proliferation not attributable to thermal heating. RFR induces non-thermal stress proteins (960 MHz GSM)	Velizarov, 1999
0.004 - 0.008 W/Kg	915 MHz cell phone RFR caused pathological leakage of blood-brain barrier. Worst at lower SAR levels and worse with CW compared to Frequency of pathological changes was 35% in rats exposed to pulsed radiation at 50% to continuous wave RFR. Effects observed at a specific absorption (SA) of > 1.5 joules/Kg in human tissues	Persson, 1997
0.0059 W/Kg	Cell phone RFR induces glioma (brain cancer) cells to significantly increase thymidine uptake, which may be indication of more cell division	Stagg, 1997
0.014 W/Kg	Sperm damage from oxidative stress and lowered melatonin levels resulted from 2-hr per day/45 days exposure to 10 GHz.	Kumar, 2012
0.015 W/Kg	Immune system effects - elevation of PFC count (antibody-producing cells)	Veyret, 1991
0.02 W/Kg	A single, 2-hr exposure to GSM cell phone radiation results in serious neuron damage (brain cell damage) and death in cortex, hippocampus, and basal ganglia of brain- even 50+ days later blood-brain barrier is still leaking albumin (P<.002) following only one cell phone exposure	Salford, 2003
0.026 W/Kg	Activity of c-jun (oncogene or cancer gene) was altered in cells after 20 minutes exposure to cell phone digital TDMA signal	Ivaschuk, 1997
0.0317 W/Kg	Decrease in eating and drinking behavior	Ray, 1990
0.037 W/Kg	Hyperactivity caused by nitric oxide synthase inhibitor is countered by exposure to ultra-wide band pulses (600/sec) for 30 min	Seaman, 1999
0.037 - 0.040 W/Kg	A 1-hr cell phone exposure causes chromatin condensation; impaired DNA repair mechanisms; last 3 days (longer than stress response) the effect reaches saturation in only one hour of exposure; electro- sensitive (ES) people have different response in formation of DNA repair foci, compared to healthy individuals; effects depend on carrier frequency (915 MHz = 0.037 W/Kg but 1947 MHz = 0.040 W/Kg)	Belyaev, 2008
0.05 W/Kg	Significant increase in firing rate of neurons (350%) with pulsed 900 MHz cell phone radiation exposure (but not with CW) in avian brain cells	Beason, 2002

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## Reported Biological Effects from Radiofrequency Radiation at Low-Intensity Exposure (Cell Tower, Wi-Fi, Wireless Laptop and 'Smart' Meter RF Intensities)

SAR (Watts/Kilogram)		Reference
0.09 W/Kg	900 MHz study of mice for 7 days, 12-hr per day (whole-body) resulted in significant effect on mitochondria and genome stability	Aitken, 2005
0.091 W/Kg	Wireless internet 2400 MHz, 24-hrs per day/20 weeks increased DNA damage and reduced DNA repair; levels below 802.11 g Authors say "findings raise questions about safety of radiofrequency exposure from Wi-Fi internet access devices for growing organisms of reproductive age, with a potential effect on fertility and integrity of germ cells" (male germ cells are the reproductive cells=sperm)	Atasoy, 2012
0.11 W/Kg	Increased cell death (apoptosis) and DNA fragmentation at 2.45 GHz for 35 days exposure (chronic exposure study)	Kesari, 2010
0.121 W/Kg	Cardiovascular system shows significant decrease in arterial blood pressure (hypotension) after exposure to ultra-wide band pulses	Lu, 1999
0.13 - 1.4 W/Kg	Lymphoma cancer rate doubled with two 1/2-hr exposures per day of cell phone radiation for 18 months (pulsed 900 MHz cell signal)	Repacholi, 1997
0.14 W/Kg	Elevation of immune response to RFR exposure	Elekes, 1996
0.141 W/Kg	Structural changes in testes - smaller diameter of seminiferous	Dasdag, 1999
0.15 - 0.4 W/Kg	Statistically significant increase in malignant tumors in rats chronically exposed to RFR	Chou, 1992
0.26 W/Kg	Harmful effects to the eye/certain drugs sensitize the eye to RFR	Kues, 1992
0.28 - 1.33 W/Kg	Significant increase in reported headaches with increasing use of hand-held cell phone use (maximum tested was 60 min per day)	Chia, 2000
0.3 - 0.44 W/Kg	Cell phone use results in changes in cognitive thinking/mental tasks related to memory retrieval	Krause, 2000
0.3 - 0.44 W/Kg	Attention function of brain and brain responses are speeded up	Preece, 1999
0.3 - 0.46 W/Kg	Cell phone RFR doubles pathological leakage of blood-brain barrier permeability at two days (P=.002) and triples permeability at four days (P=.001) at 1800 MHz GSM cell phone radiation	Schirmacher, 2000
0.43 W/Kg	Significant decrease in sperm mobility; drop in sperm concentration; and decrease in seminiferous tubules at 800 MHz, 8-hr/day, 12 weeks, with mobile phone radiation level on STANDBY ONLY (in rabbits)	Salama, 2008

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## Reported Biological Effects from Radiofrequency Radiation at Low-Intensity Exposure (Cell Tower, Wi-Fi, Wireless Laptop and 'Smart' Meter RF Intensities)

SAR (Watts/Kilogram)		Reference
0.5 W/Kg	900 MHz pulsed RF affects firing rate of neurons ( <i>Lymnea stagnalis</i> ) but continuous wave had no effect	Bolshakov, 1992
0.58 - 0.75 W/Kg	Decrease in brain tumors after chronic exposure to RFR at 836 MHz	Adey, 1999
0.6 - 0.9 W/Kg	Mouse embryos develop fragile cranial bones from in utero 900 MHz The authors say "(O)ur results clearly show that even modest exposure (e.g., 6 min daily for 21 days" is sufficient to interfere with the normal mouse developmental process"	Fragopoulou, 2009
0.6 and 1.2 W/Kg	Increase in DNA single and double-strand DNA breaks in rat brain cells with exposure to 2450 MHz RFR	Lai & Singh, 1996
0.795 W/Kg	GSM 900 MHz, 217 Hz significantly decreases ovarian development and size of ovaries, due to DNA damage and premature cell death of nurse cells and follicles in ovaries (that nourish egg cells)	Panagopoulous, 2012
0.87 W/Kg	Altered human mental performance after exposure to GSM cell phone radiation (900 MHz TDMA digital cell phone signal)	Hamblin, 2004
0.87 W/Kg	Change in human brainwaves; decrease in EEG potential and statistically significant change in alpha (8-13 Hz) and beta (13-22 Hz) brainwave activity in humans at 900 MHz; exposures 6/min per day for 21 days (chronic exposure)	D'Costa, 2003
0.9 W/Kg	Decreased sperm count and more sperm cell death (apoptosis) after 35 days exposure, 2-hr per day	Kesari, 2012
< 1.0 W/Kg	Rats exposed to mobile phone radiation on STANDBY ONLY for 11-hr 45-min plus 15-min TRANSMIT mode; 2 times per day for 21 days showed decreased number of ovarian follicles in pups born to these pregnant rats. The authors conclude "the decreased number of follicles in pups exposed to mobile phone microwaves suggest that intrauterine exposure has toxic effects on ovaries."	Gul, 2009
0.4 - 1.0 W/Kg	One 6-hr exposure to 1800 MHz cell phone radiation in human sperm cells caused a significant dose response and reduced sperm motility and viability; reactive oxygen species levels were significantly increased after exposure to 1.0 W/Kg; study confirms detrimental effects of RF/MW to human sperm. The authors conclude "(T)hese findings have clear implicatiions for the safety of extensive mobile phone use by males of reproductive age, potentially affecting both their fertility and the health and wellbeing of their offspring."	De Iuliis, 2009
1.0 W/Kg	Human semen degraded by exposure to cell phone frequency RF increased free-radical damage.	De Iuliis, 2009

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SAR (Watts/Kilogram)		Reference
1.0 W/Kg	Motility, sperm count, sperm morphology, and viability reduced in active cell phone users (human males) in dose-dependent manner.	Agarwal, 2008
1.0 W/Kg	GSM cell phone use modulates brain wave oscillations and sleep EEG	Huber, 2002
1.0 W/Kg	Cell phone RFR during waking hours affects brain wave activity. (EEG patterns) during subsequent sleep	Achermann, 2000
1.0 W/Kg	Cell phone use causes nitric oxide (NO) nasal vasodilation (swelling inside nasal passage) on side of head phone use	Paredi, 2001
1.0 W/Kg	Increase in headache, fatigue and heating behind ear in cell phone users	Sandstrom, 2001
1.0 W/Kg	Significant increase in concentration difficulties using 1800 MHz cell phone compared to 900 MHz cell phone	Santini, 2001
1.0 W/Kg	Sleep patterns and brain wave activity are changed with 900 MHz cell phone radiation exposure during sleep	Borbely, 1999
1.4 W/Kg	GSM cell phone exposure induced heat shock protein HSP 70 by 360% (stress response) and phosphorylation of ELK-1 by 390%	Weisbrot, 2003
1.46 W/Kg	850 MHz cell phone radiation decreases sperm motility, viability is significantly decreased; increased oxidative damage (free-radicals) significantly decreased; increased oxidative damage (free-radicals)	Agarwal, 2009
1.48 W/Kg	A significant decrease in protein kinase C activity at 112 MHz with 2-hr per day for 35 days; hippocampus is site, consistent with reports that RFR negatively affects learning and memory functions	Paulraj, 2004
1.0 - 2.0 W/Kg	Significant elevation in micronuclei in peripheral blood cells at 2450 MHz (8 treatments of 2-hr each)	Trosic, 2002
1.5 W/Kg	GSM cell phone exposure affected gene expression levels in tumor suppressor p53-deficient embryonic stem cells; and significantly increased HSP 70 heat shock protein production	Czyz, 2004
1.8 W/Kg	Whole-body exposure to RF cell phone radiation of 900-1800 MHz 1 cm from head of rats caused high incidence of sperm cell death; deformation of sperm cells; prominent clumping together of sperm cells into "grass bundle shapes" that are unable to separate/swim. Sperm cells unable to swim and fertilize in normal manner.	Yan, 2007

Stress proteins, HSP, disrupted immune function	Brain tumors and blood-brain barrier
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## Reported Biological Effects from Radiofrequency Radiation at Low-Intensity Exposure (Cell Tower, Wi-Fi, Wireless Laptop and 'Smart' Meter RF Intensities)

SAR (Watts/Kilogram)		Reference
2.0 W/Kg	GSM cell phone exposure of 1-hr activated heat shock protein HSP 27 (stress response) and P38 MAPK (mutagen-activated protein kinase) that authors say facilitates brain cancer and increased blood-brain barrier permeability, allowing toxins to cross BBB into brain	Leszczynski, 2002
2 W/Kg	900 MHz cell phone exposure caused brain cell oxidative damage by increasing levels of NO, MDA, XO and ADA in brain cells; caused statistically significant increase in 'dark neurons' or damaged brain cells in cortex, hippocampus and basal ganglia with a 1-hr exposure for 7 consecutive days	Ilhan, 2004
2.6 W/Kg	900 MHz cell phone exposure for 1-hr significantly altered protein expression levels in 38 proteins following irradiation; activates P38 MAP kinase stress signalling pathway and leads to changes in cell size and shape (shrinking and rounding up) and to activation of HSP 27, a stress protein (heat shock protein)	Leszczynski, 2004
2.0 - 3.0 W/Kg	RFR accelerated development of both skin and breast tumors	Szmigielski, 1982
2 W/Kg	Pulse-modulated RFR and MF affect brain physiology (sleep study)	Schmidt, 2012

STANDARDS		
0.08 W/Kg	IEEE Standard uncontrolled public environment (whole body)	IEEE
0.4 W/Kg	IEEE Standard controlled occupational environment (whole body)	IEEE
1.6 W/Kg	FCC (IEEE) SAR limit for 1 gram of tissue in a partial body exposure	FCC, 1996
2 W/Kg	ICNIRP SAR limit for 10 grams of tissue	ICNIRP, 1996

Stress proteins, HSP, disrupted immune function	Brain tumors and blood-brain barrier
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Oxidative damage/ROS/DNA damage/DNA repair failure	Cancer (other than brain), cell proliferation
Disrupted calcium metabolism	Cardiac, heart muscle, blood-pressure, vascular effects

**Reference List**  
**Reported Biological Effects from Radiofrequency Radiation (RFR)**  
**at Low-Intensity Exposure Levels**  
(Cell Tower, WI-FI, Wireless Laptop,  
Wireless Utility Meters 'smart meters')

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