

SUSTAINABLE TAMALMONTE
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MILL VALLEY, CA 94941

February 4, 2019

Marin County Board of Supervisors
Brian Crawford, Director, Marin County Community Development Agency
Immanuel Bereket, Senior Planner, Marin County Community Development Agency
3501 Civic Center, Rm 329 and Rm 308
San Rafael, CA 94903

Re: Consideration of amendments to the Marin County Telecommunications Facilities Policy Plan to regulate Small Cell Wireless Facilities

Dear Marin County Board of Supervisors, Director Brian Crawford, and Senior Planner Immanuel Bereket,

Thank you for considering amendments to the Marin County Telecommunications Facilities Policy Plan (TFPP) to better regulate Small Cell Wireless Facilities. We are very concerned about the potentially serious adverse health and environmental effects associated with exposure to radiofrequency electromagnetic microwave radiation (RF-EMR) emitted by Small Cell Wireless Facilities for 5G technology. We are also concerned that deployment of 5G Small Cell Facilities could lead to: 1) Degradation of Marin County's traditional residential character; 2) Decreased property values; and 3) Increased Fire Risk.

We strongly urge you to limit the placement of these risky antennae to the greatest degree possible and direct Staff to develop amendments to the TFPP regarding Small Cell Facilities that are highly protective and stronger than those discussed in the Staff Report.

I. OUR CONCERNS

A. CANCER AND OTHER HEALTH EFFECTS

1. Excerpt from the article by Merinda Teller, MPH, PHD entitled; "Microwave Radiation Coming To A Lampost Near You"¹ (See the link to the article in the below footnote):**

"The rapid proliferation of all these sources of electromagnetic radiation—cell towers, cell phones, cordless phones, Wi-Fi, smart meters and so on—is exacting a high price on our health. There are now thousands of scientific studies documenting myriad adverse bioeffects of microwave radiation, in particular. These biological effects include cancer, DNA damage, cardiovascular problems, increased stress hormones, sleeping disorders, depression, headaches, irritability and impaired fertility.²

¹ Teller, M. Microwave Radiation Coming To A Lampost Near You. Weston A. Price Foundation, Fall 2017. <https://www.westonaprice.org/health-topics/environmental-toxins/microwave-radiation-coming-lamppost-near/>

² Environmental Health Trust. Top experimental and epidemiological studies on wireless radiation. <https://ehtrust.org/science/top-experimental-epidemiological-studies/>

Studies assessing cancer and wireless radiation are particularly disturbing. The World Health Organization's International Agency for Research on Cancer classified the microwave radiation from all wireless devices as a possible human carcinogen in 2011. In 2016, the U.S. National Toxicology Program released results of the world's largest, gold-standard study on wireless health risks (conducted on rats, which are the preferred animal model for studies of carcinogenicity in humans), finding cancer in 5.5 percent of the exposed group and no cancer in the control group.³

Other recent studies highlight strong evidence of a relationship between brain cancers and long-term cell phone use; increased incidence of at least ten other cancers concurrent with the promulgation of wireless technologies, including invasive breast cancers in young women carrying cell phones against their breast; and tumor promotion in response to very low levels of exposure to wireless radiation.⁴

5G technology will likely turn this serious health risk into a public health crisis. Ubiquitous deployment of small cell antennas will unleash unnatural and round-the-clock millimeter microwave radiation that is far more potent than anything previously experienced from the electromagnetic spectrum. In fact, the U.S. military uses millimeter waves—which travel only a short distance—as a non-lethal weapon for crowd control because the waves affect the surface of the body and cause a burning sensation of the skin at higher levels of power. The lower-powered but chronic exposure that most of us will experience outside of our homes, schools and businesses is expected to cause very serious health effects, including higher rates of skin cancer, cataracts, cardiac irregularities and fetal abnormalities.⁵ Moreover, millimeter wave radiation has effects on microbes and may prompt increased antibiotic resistance.⁶

2. Firefighters exposed to cell tower radiation tested positive for abnormal brain function

Cell towers can no longer be placed in proximity to fire stations. A study showed that all the firemen tested had abnormal brain function after exposure to the cell tower radiation, even at low levels. Firefighters' symptoms included problems with memory, intermittent confusion, and weakness. Please view the KPIX news broadcast that reports this by following the below link.

Link to the news broadcast:

https://www.youtube.com/watch?time_continue=2&v=61h_vuBujw0

³ Environmental Health Trust. Myths and facts about the National Toxicology Program cell phone radiation cancer study: correcting the misinformation. https://ehtrust.org/wp-content/uploads/NTP_Myth_Fact.pdf

⁴ Environmental Health Trust. Top experimental and epidemiological studies on wireless radiation. <https://ehtrust.org/science/top-experimental-epidemiological-studies/>

⁵ Russell C. A 5G wireless future: will it give us a smart nation or contribute to an unhealthy one? *The Bulletin*, Jan/Feb 2017.

⁶ Moskowitz JM. 5G wireless technology: millimeter wave health effects. 7 Aug 2017. <http://www.saferemr.com/2017/08/5g-wireless-technology-millimeter-wave.html>

3. Manifesto entitled “5G Appeal” (September, 2017) (**See the link to the manifesto in the below footnote):

In the manifesto entitled “5G Appeal” ⁷, 180 esteemed scientists and doctors from 35 countries appeal to the European Union and recommend a moratorium on the roll-out of the fifth generation (5G) for telecommunication until potential hazards for human health and the environment have been fully investigated by scientists independent from industry.

Excerpt from “5G Appeal”:

“More than 230 scientists from 41 countries have expressed their “serious concerns” regarding the ubiquitous and increasing exposure to EMF generated by electric and wireless devices already before the additional 5G roll-out. They refer to the fact that “numerous recent scientific publications have shown that EMF affects living organisms at levels well below most international and national guidelines”. Effects include increased cancer risk, cellular stress, increase in harmful free radicals, genetic damages, structural and functional changes of the reproductive system, learning and memory deficits, neurological disorders, and negative impacts on general well-being in humans. Damage goes well beyond the human race, as there is growing evidence of harmful effects to both plants and animals.”

B. DEGRADATION OF THE TRADITIONAL RESIDENTIAL CHARACTER OF SAN RAFAEL NEIGHBORHOODS

Wireless carriers have the right, under Section 6409(a) of the “Middle-Class Tax Relief and Job Creation Act”, to expand their equipment and expand it an unlimited number of times, thereby potentially creating a huge unattractive industrial mess. (**See photo in **Addendum I** on page 9 of this letter.)

C. DECREASED PROPERTY VALUES

The article entitled; “The Impact of Cell Phone Towers on House Prices in Residential Neighborhoods”, which was published in The Appraisal Journal in 2005, found that buyers would pay as much as 20 percent less for a property near a cell tower or antenna.⁸

According to the results from a survey conducted in June 2014 by the National Institute for Science, Law, and Public Policy (NISLAPP) in Washington D.C., 94% of the survey respondents reported that cell towers and antennae in a neighborhood or on a building would impact interest in a property and the price they would be willing to pay for it. 79% said under no circumstances would they ever purchase or rent a property within a few blocks of a cell tower or an antenna. ⁹

D. INCREASED FIRE RISK

The heavy and bulky “Small Cell Facilities” could overload telephone poles, leading to increased fire risk. For example, Edison and four telecommunication companies were fined for overloading

⁷ 5G Appeal. 2017. <https://ehtrust.org/wp-content/uploads/Scientist-5G-appeal-2017.pdf>

⁸ Bond S. Wang K. The Impact of Cell Phone Towers on House Prices in Residential Neighborhoods. The Appraisal Journal, Summer 2005. <http://electromagnetichealth.org/wp-content/uploads/2014/06/TAJSummer05p256-277.pdf>

⁹ Electromagnetic Health. EMF Real Estate Survey Results: “Neighborhood Cell Tower & Antennas – Do They Impact a Property’s Desirability?”. 2014. <http://electromagnetichealth.org/electromagnetic-health-blog/survey-property-desirability/>

utility poles with antennas and equipment, which caused the poles to collapse and spark the 2007 Malibu Canyon wildfire. ¹⁰

II. FIBER OPTIC CABLE IS A BETTER OPTION

Instead of potentially harmful Small Cell Facilities for 5G technology, we suggest you support the installation of fiber optic cable to provide the best coverage in all Unincorporated Marin neighborhoods.

Wired networks, both optical fiber and copper, are a much better option than the potentially harmful 5G wireless networks. A report by the National Institute for Science, Law, and Public Policy in Washington D.C. titled; “Re-Inventing Wires; The Future of Landlines and Networks” ¹¹ ¹² noted that “Corporations invariably seek the cheapest, quickest, and most profitable path, which has led to the current emphasis on wireless... However, the mistaken upcoming 5G frenzy, with its millions of small cell antennas destined to clutter all neighborhoods and public right-of-ways, is dangerous, wasteful, and unnecessary.” Fiber optic cable is faster, more secure, more reliable, more energy efficient, more cost effective, healthier and safer than wireless networks.

III. LEGAL RECOMMENDATIONS FROM BEST, BEST, & KRIEGERT (BB&K) ATTORNEYS AT LAW

We recommend you follow the advice given in BB&K’s legal alert entitled; “New FCC Shot Clocks and Other Rules Preempting Local Authority Over Wireless Take Effect Today (January 14, 2019)”. ¹³ (**See the link to the BB&K article in the below footnote.)

Excerpts from BB&K’s legal alert:

“The order(s) may eventually be overturned. We believe there are substantial questions as to whether the FCC small cell order is valid and lawful, and we are representing numerous jurisdictions challenging it and the August moratoria order. **We are not recommending that you incorporate the FCC standards into local law per se. If you do so, then you will be bound by your own requirements, even if the FCC order is vacated.** Therefore, we think it is useful to develop regulations that provide you with maximum flexibility to make substantive determinations that you would be comfortable making — even if the FCC had not changed its

¹⁰ Holland G., Rojas R. \$99 million in fines urged over power poles that spark fire. LA Times. October 23, 2011. <http://articles.latimes.com/2011/oct/23/local/la-me-utility-pole-fines-20111023>

¹¹ Wireless Networks Are Not As Fast, Secure, Reliable or Energy-Efficient as Wired Systems, Says New Report. Business Wire, January 2018.

<https://www.businesswire.com/news/home/20180126005137/en/Wireless-Networks-Fast-Secure-Reliable-Energy-Efficient-Wired>

¹² Schoechle, T. PhD. Reinventing Wires: The Future of Landlines and Networks. National Institute for Science, Law, & Public Policy, Washington DC, 2018.

<http://electromagnetichealth.org/wp-content/uploads/2018/05/Wires.pdf>

¹³ Best Best & Krieger LLP. New FCC Shot Clocks and Other Rules Preempting Local Authority Over Wireless Take Effect Today. BB&K Website, Jan. 14, 2019.

https://www.bbklaw.com/news-events/insights/2019/legal-alerts/01/new-fcc-shot-clocks-and-other-rules-preempting-loc?utm_source=Constant_Contact&utm_medium=headline&utm_campaign=LA_FCC_10th_Circuit&utm_content=Legal_Alert

rules — while still complying with procedural requirements, such as shot clocks that, if not complied with, may result in a loss of rights. If you are faced with a situation where you feel compelled to grant an application because of the FCC rules, you may wish to make the permit conditional, so that it terminates if the FCC rule is overturned.”¹⁴

“Some Portions of the FCC Small Cell Order Do Not Go Into Effect Until April 15: It is important to note that, though applicants may tell you otherwise, the portion of the FCC small cell order that requires aesthetic standards for “small wireless facilities” (as defined by the FCC) to be reasonable, no more burdensome than on other infrastructure, and objective and published in advance, does not go into effect until April 15.”¹⁵

We wish to emphasize that if you incorporate FCC standards into local law, then you will be bound by your own requirements, even if the FCC order is vacated. Therefore, except for complying with procedural requirements, such as shot clocks, we recommend that you make the most protective amendments possible to Marin County’s telecommunications ordinance, including those listed in the following section.

IV. RECOMMENDATIONS FOR AMENDMENTS TO THE MARIN COUNTY TELECOMMUNICATIONS FACILITIES POLICY PLAN (TFPP) RE: SMALL CELL WIRELESS FACILITIES

We recommend you make the following amendments to the Marin County TFPP:

A. PROHIBIT WIRELESS COMMUNICATIONS FACILITIES IN ALL RESIDENTIAL ZONING DISTRICTS:

The County Telecommunications Facilities Policy Plan (TFPP) allows wireless communications facilities within residential neighborhoods if no other suitable location area is available (TFPP Policy LU 1.4). This is unacceptable. Instead, prohibit 5G Small Cell Facilities in all residential zoning districts, like the Mill Valley Urgency Ordinance regarding Telecommunications Wireless Facilities.

B. ESTABLISH A MINIMUM DISTANCE OF 1500 FEET (or at least 500 feet) BETWEEN A SMALL CELL FACILITY AND A RESIDENCE:

Ideally, since research studies on cell tower radiation and health have shown that the safe distance between humans and any single antenna is 1500 feet¹⁶ (**See **ADDENDUM II**, Pgs. 10 to 18, of this letter), establish a minimum distance of 1500 feet between a Small Cell Facility

¹⁴ Best Best & Krieger LLP. New FCC Shot Clocks and Other Rules Preempting Local Authority Over Wireless Take Effect Today. BB&K Website, Jan. 14, 2019. https://www.bbklaw.com/news-events/insights/2019/legal-alerts/01/new-fcc-shot-clocks-and-other-rules-preempting-loc?utm_source=Constant_Contact&utm_medium=headline&utm_campaign=LA_FCC_10th_Circuit&utm_content=Legal_Alert

¹⁵ Best Best & Krieger LLP. New FCC Shot Clocks and Other Rules Preempting Local Authority Over Wireless Take Effect Today. BB&K Website, Jan. 14, 2019. https://www.bbklaw.com/news-events/insights/2019/legal-alerts/01/new-fcc-shot-clocks-and-other-rules-preempting-loc?utm_source=Constant_Contact&utm_medium=headline&utm_campaign=LA_FCC_10th_Circuit&utm_content=Legal_Alert

¹⁶ Environmental Health Trust. Compilation Of Research Studies On Cell Tower Radiation And Health. <https://ehtrust.org/science/cell-towers-and-cell-antennae/compilation-of-research-studies-on-cell-tower-radiation-and-health/>

and any existing or approved residence. If you deem this requirement to be too restrictive, then, at minimum, follow the Petaluma Municipal Code 14.44.095 “Small Cell Facilities”¹⁷ and require each small cell to be at least 500 feet away from any existing or approved residence.

C. ESTABLISH A MINIMUM DISTANCE OF 3000 FEET BETWEEN SMALL CELL FACILITIES:

The Staff Report suggests a minimum distance of 500 feet between Small Cell Facilities. This is insufficient. Instead, require a minimum distance of 3000 feet between small cell antennas. Public statements by Verizon executives (CEO Lowell McAdam and Field Engineer Jason L.) prove that telecommunication corporations do not need to install Small Cell Facilities near residences in order to provide coverage for 5G technology. Instead, the 4G and 5G Wireless Telecommunications can be placed 3000 feet away on Macro Towers.

**Please follow the below link to view the YouTube video of Verizon CEO Lowell McAdam and Field Engineer Jason L. as they demonstrate the 3000-foot radius of a single 5G antenna:

https://www.youtube.com/watch?time_continue=4&v=FwAsr1pC13Q

Any resident who is standing between two antennae positioned 3000 feet apart will be in the path of both. Therefore, any positioning of antennae closer than 3000 feet apart will radiate at double the FCC standards in any location between the two antennas. Moreover, as already stated, research studies have shown that the safe distance between a human and any single antenna is 1500 feet.¹⁸

D. ESTABLISH AN UPPER LIMIT OF 150 $\mu\text{W}/\text{m}^2$ FOR RADIO FREQUENCY (RF) ELECTROMAGNETIC MICROWAVE RADIATION (RF-EMR) PUBLIC EXPOSURES:

Require that the permittee install only equipment that has **no chance of outputting peak RF-EMR exposures any higher than 150 $\mu\text{W}/\text{m}^2$ anywhere people live** (metered as peak RF-EMR exposures outside on the ground or outside of the highest windows of any building within a 3000- foot radius of any antenna).

E. NOTIFY RESIDENCES & BUSINESSES WITHIN 3000 FEET OF A PROPOSED SMALL CELL FACILITY:

Since Small Cell Facilities can emit microwave radiation for 3000 feet, notify all residences and businesses located within a 3000-foot radius of a proposed Small Cell Facility at the beginning of the permit process.

F. REQUIRE PERMITTEES OF SMALL CELL FACILITIES TO FUND ANNUAL MONITORING:

Similar to the Mill Valley Telecommunications Wireless Facilities Urgency Ordinance, require the permittee of a Small Cell Facility to pay for a contractor, chosen by the County, to provide

¹⁷ Petaluma Municipal Code Chapter 14.44 Telecommunications Facility and Antenna Criteria – Code 14.44.095 Small Cell Facilities. Passed November 19, 2018.

<http://scientists4wiredtech.com/petaluma/petaluma-municipal-code/>

¹⁸ Environmental Health Trust. Compilation Of Research Studies On Cell Tower Radiation And Health. <https://ehtrust.org/science/cell-towers-and-cell-antennae/compilation-of-research-studies-on-cell-tower-radiation-and-health/>

annual test results that demonstrate whether or not the facility complies with current regulations. The County would have the right to turn off antennas that exceed the stated compliance levels.

G. DEVELOP CRITERIA FOR REVIEWING & RECERTIFYING SMALL CELL APPLICATIONS ANNUALLY:

Similar to Montgomery County, Maryland as described in the article entitled; “Strong Opposition to 5G Halts Small Cell Bill in Montgomery County Maryland & Verizon Drops Applications in Burlington”¹⁹ (**See the link to the article in the below footnote), develop criteria for reviewing small cell applications which include an annual recertification of equipment installations, with a fee assessed to the telecommunications vendor to pay for town employee time to oversee the recertification process.

H. REQUIRE SMALL CELL FACILITIES TO BE ADA COMPLIANT:

Require 5G Small Cell Antennas to be ADA compliant for residents with Electromagnetic Sensitivity (EHS). Include the provision that any noncompliant Small Cell Facility must be removed.

The article by Center for Electrosmog Prevention (CEP) entitled; “Recognition of the Electromagnetic Sensitivity as a Disability Under the ADA”²⁰ demonstrates that the Federal Architectural and Transportation Barriers Compliance Board recognizes Electromagnetic Sensitivity as a disability under the ADA. (**See the link to the article in the below footnote.)

Excerpt from the CEP article:

“The Architectural and Transportation Barriers Compliance Board (Access Board) is the Federal agency devoted to the accessibility for people with disabilities. As stated in the Background for the Access Board’s ‘Final Rule Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Recreation Facilities’ that was published in September 2002:

‘The Board recognizes that multiple chemical sensitivities and electromagnetic sensitivities may be considered disabilities under the ADA if they so severely impair the neurological, respiratory or other functions of an individual that it substantially limits one or more of the individual’s major life activities. The Board plans to closely examine the needs of this population, and undertake activities that address accessibility issues for these individuals.’ ”

I. REVIEW THE POLICY FROM BURLINGTON, MA TO UPDATE THE APPLICATION & RE-CERTIFICATION PROCESS FOR SMALL CELL WIRELESS FACILITIES:

Study the “Town of Burlington Policy Applications for Small Cell Wireless Installations” (**See below link) and update Marin County’s application and re-certification process for small cell wireless installations with more comprehensive and detailed procedures and language.

¹⁹ Environmental Health Trust. Strong Opposition to 5G Halts Small Cell Bill In Montgomery County Maryland & Verizon Drops Applications in Burlington. <https://ehtrust.org/strong-opposition-to-5g-halts-small-cell-bill-in-montgomery-county-maryland-verizon-drops-applications-in-burlington/>

²⁰ Center for Electrosmog Prevention. Recognition of the Electromagnetic Sensitivity as a Disability Under the ADA.

<http://www.electrosmogprevention.org/smart-meter-resources-links/ada-accommodations-info/recognition-of-the-electromagnetic-sensitivity-as-a-disability-under-the-ada/>

Here is a link to the “Town of Burlington Policy Applications for Small Cell Wireless Installations”:

<http://www.burlington.org/Small.Cell.Wireless.Equipment.Policy.Approved.10.22.2018.BURLINGTON.MA.pdf>

J. REVIEW THE CITY OF MILL VALLEY TELECOMMUNICATIONS FACILITIES URGENCY ORDINANCE FOR IDEAS ON DESIGN GUIDELINES & CONCEALMENT OF SMALL CELL FACILITIES:

Please review the “Urgency Ordinance of the City of Mill Valley Amending Title 20 of the Mill Valley Municipal Code to Establish Regulations for Wireless Telecommunications Facilities” and incorporate their design guidelines for wireless facilities into the Marin County TFPP. Such guidelines would limit the size and visual intrusiveness of the facilities. Design requirements would include visual screening, camouflage, concealment, limiting size, ect.

Examples taken from Mill Valley’s Urgency Ordinance:

“2. Where feasible, as new technology becomes available, the permittee shall:

(a) place above-ground wireless telecommunications facilities below ground, including, but not limited to, accessory equipment that has been mounted to a telecommunications tower or mounted on the ground; and

(b) replace larger, more visually intrusive facilities with smaller, less visually intrusive facilities, after receiving all necessary permits and approvals required pursuant to the Mill Valley Municipal Code.”

“2. Aside from the antenna itself, no additional equipment may be visible. All cables, including, but not limited to, electrical and utility cables, shall be run within the interior of the telecommunications tower and shall be camouflaged or hidden to the fullest extent feasible without jeopardizing the physical integrity of the tower.”

V. CONCLUSION

We strongly urge you to direct Staff to develop amendments for the Marin County Telecommunications Facilities Policy Plan and include Small Cell Wireless Facilities regulations that limit the placement of these potentially harmful antennae to the greatest degree possible and incorporate the above recommendations. Stronger regulations for Small Cell Wireless Facilities could protect Unincorporated Marin’s neighborhood character, property values, and public health and safety. We further recommend that you encourage installation of wired networks with fiber optic cable.

Thank you in advance for your conscientious consideration.

Very truly yours,

/s/

Sharon Rushton, Chairperson,
Sustainable TamAlmonte

ADDENDUM I

Photo showing what a small cell looks like after multiple expansions:



Once a small cell or DAS node is attached to a pole, the wireless carriers have the right under [Section 6409\(a\) of the Middle-Class Tax Relief and Job Creation Act](#) to expand their equipment. In other words, once a site is built, municipalities have little power to restrict further expansions of the pole's small cell antenna equipment if the applicants stay within the limits of 6409(a). Moreover, wireless companies can request to expand an unlimited number of times. So even if a small cell starts off looking small and svelte – it could be expanded in size immediately without the municipality being able to stop the expansion. And this can happen over and over again.

ADDENDUM II

The following compilation of research studies was taken from the Environmental Health Trust website. Below is the link to the compilation:

<https://ehtrust.org/science/cell-towers-and-cell-antennae/compilation-of-research-studies-on-cell-tower-radiation-and-health/>

Compilation of Research Studies on Cell Tower Radiation and Health

Anthony B. Miller, L. Lloyd Morgan, Iris Udasin, Devra Lee Davis, [Cancer epidemiology update, following the 2011 IARC evaluation of radiofrequency electromagnetic fields \(Monograph 102\)](#), *Environmental Research*, Volume 167, 2018, Pages 673-683, ISSN 0013-9351

- Radiofrequency radiation is emitted by cell towers. This review paper concludes that “Based on the evidence reviewed it is our opinion that IARC’s current categorization of RFR as a possible human carcinogen (Group 2B) should be upgraded to Carcinogenic to Humans (Group 1).”

Zothansiamia, et al. [“Impact of radiofrequency radiation on DNA damage and antioxidants in peripheral blood lymphocytes of humans residing in the vicinity of mobile phone base stations.”](#) *Electromagnetic Biology and Medicine* 36.3 (2017): 295-305.

- This study evaluated effects in the human blood of individuals living near mobile phone base stations (within 80 meters) compared with healthy controls (over 300 meters). The study found higher radiofrequency radiation exposures and statistically significant differences in the blood of people living closer to the cellular antennas. The group living closer to the antennas had for example, statistically significant higher frequency of micronuclei and a rise in lipid peroxidation in their blood. These changes are considered biomarkers predictive of cancer.

Meo, S. A., Almahmoud, M., Alsultan, Q., Alotaibi, N., Alnajashi, I., & Hajjar, W. M. (2018). [Mobile Phone Base Station Tower Settings Adjacent to School Buildings: Impact on Students’ Cognitive Health.](#) *American Journal of Men’s Health*.

- High exposure to RF-EMF produced by mobile phone base station towers was associated with delayed fine and gross motor skills, spatial working memory, and attention in school adolescents compared to students who were exposed to low RF-EMF.

[Long-term exposure to microwave radiation provokes cancer growth: evidences from radars and mobile communication systems.](#) *Yakymenko* (2011) *Exp Oncology*, 33(2):62-70.

- Even a year of operation of a powerful base transmitting station for mobile communication reportedly resulted in a dramatic increase of cancer incidence among population living nearby.

[Association of Exposure to Radio-Frequency Electromagnetic Field Radiation \(RF-EMFR\) Generated by Mobile Phone Base Stations \(MPBS\)with Glycated Hemoglobin \(HbA1c\) and Risk](#)

[of Type 2 Diabetes Mellitus](#) , Sultan Ayoub Meo et al, International Journal of Environmental Research and Public Health, 2015

- Elementary school students who were exposed to high RF-EMFR generated by MPBS had a significantly higher risk of type 2 diabetes mellitus relative to their counterparts who were exposed to lower RF-EMFR.

[Neurobehavioral effects among inhabitants around mobile phone base stations](#) Abdel-Rassoul et al, Neurotoxicology, 2007

- This study found that living nearby mobile phone base stations (cell antennas) increased the risk for neuropsychiatric problems such as headaches, memory problems, dizziness, tremors, depression, sleep problems and some changes in the performance of neurobehavioral functions.

Meo SA, Almahmoud M, Alsultan Q, Alotaibi N, Alnajashi I, Hajjar WM, [Mobile Phone Base Station Tower Settings Adjacent to School Buildings: Impact on Students' Cognitive Health](#). Am J Mens Health. 2018 Dec 7:1557988318816914. doi: 10.1177/1557988318816914.

- This study investigated the impact of exposure to radiofrequency electromagnetic field (RF-EMF) radiation generated by mobile phone base station towers (MPBSTs) on cognitive functions. Two hundred and seventeen volunteer male students aged between 13 and 16 registered from two different intermediate schools: 124 students were from School 1 and 93 students were from School 2. The MPBSTs were located within 200 m from the school buildings. In School 1, RF-EMF was $2.010 \mu\text{W}/\text{cm}^2$ with a frequency of 925 MHz and in School 2, RF-EMF was $10.021 \mu\text{W}/\text{cm}^2$ with a frequency of 925 MHz. Students were exposed to EMFR for 6 hr a day, 5 days a week for a total period of 2 years. The Narda Safety Test Solution device SRM-3006 was used to measure RF-EMF in both schools, and cognitive functions tasks were measured by the Cambridge Neuropsychological Test Automated Battery (CANTAB). Significant impairment in Motor Screening Task (MOT; $p = .03$) and Spatial Working Memory (SWM) task ($p = .04$) was identified among the group of students who were exposed to high RF-EMF produced by MPBSTs. High exposure to RF-EMF produced by MPBSTs was associated with delayed fine and gross motor skills, spatial working memory, and attention in school adolescents compared to students who were exposed to low RF-EMF.

[Biological Effects from Exposure to Electromagnetic Radiation Emitted by Cell Tower Base Stations and Other Antenna Arrays](#), Levitt & Lai, Environmental Reviews, 2010

- This review of 100 studies found approximately 80% showed biological effects near towers. “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.”

[Mortality by neoplasia and cellular telephone base stations](#). Dode et al. (Brazil), Science of the Total Environment, Volume 409, Issue 19, 1 September 2011, Pages 3649–3665

- This 10 year study on cell phone antennas by the Municipal Health Department in Belo Horizonte and several universities in Brazil found a clearly elevated relative risk of cancer mortality at residential distances of 500 meters or less from cell phone transmission towers. Shortly after this study was published, the city prosecutor sued several cell phone companies and requested that almost half of the cities antennas be removed. Many antennas were dismantled.

[Epidemiological Evidence for a Health Risk from Mobile Phone Base Stations](#) Khurana, Hardell et al., International Journal of Occupational Environmental Health, Vol 16(3):263-267, 2010

- A review of 10 epidemiological studies that assessed for negative health effects of mobile phone base stations (4 studies were from Germany, and 1 each from Austria, Egypt, France, Israel, Poland, Spain) found that seven showed altered neurobehavioral effects near cell tower and three showed increased cancer incidence. The review also found that eight of the 10 studies reported increased prevalence of adverse neurobehavioral symptoms or cancer in populations living at distances < 500 meters from base stations. Lower cognitive performance was found in individuals living ≤ 10 meters from base stations. None of the studies reported exposure above accepted international guidelines, suggesting that current guidelines may be inadequate in protecting the health of human populations.

[Health effects of living near mobile phone base transceiver station \(BTS\) antennae: a report from Isfahan, Iran.](#) Shahbazi-Gahrouei et al, Electromagnetic Biology Medicine, 2013.

- This cross-sectional study found the symptoms of nausea, headache, dizziness, irritability, discomfort, nervousness, depression, sleep disturbance, memory loss and lowering of libido were statistically increased in people living closer than 300 m from cell antennas as compared to those living farther away. The study concludes that “antennas should not be sited closer than 300 m to people to minimize exposure.”

[How does long term exposure to base stations and mobile phones affect human hormone profiles?](#) Eskander EF et al, (2011), Clin Biochem

- RFR exposures significantly impacted ACTH, cortisol, thyroid hormones, prolactin for females, and testosterone levels for males.

[Investigation on the health of people living near mobile telephone relay stations: Incidence according to distance and sex](#) Santini et al, 2002 , Pathol Bio

- People living near mobile phone masts reported more symptoms of headache, sleep disturbance, discomfort, irritability, depression, memory loss and concentration problems

the closer they lived to the installation. Study authors recommend that the minimal distance of people from cellular phone base stations should not be < 300 m.

Navarro EA, Segura J, Portoles M, Gomez-Perretta C, [The Microwave Syndrome: A preliminary Study](#). 2003 (Spain) Electromagnetic Biology and Medicine, Volume 22, Issue 2, (2003): 161 – 169

- Statistically significant positive exposure-response associations between RFR intensity and fatigue, irritability, headaches, nausea, loss of appetite, sleeping disorder, depressive tendency, feeling of discomfort, difficulty in concentration, loss of memory, visual disorder, dizziness and cardiovascular problems.

Two Important Animal Studies on Radiofrequency Radiation

These studies indicate that government limits are non protective. Government limits are based on the assumption that radiofrequency radiation is only harmful at thermal levels. However, the cancers developed in animals in these studies at radiation levels that were non thermal.

Belpoggi et al. 2018, "[Report of final results regarding brain and heart tumors in Sprague-Dawley rats exposed from prenatal life until natural death to mobile phone radiofrequency field representative of a 1.8 GHz base station environmental emission](#)" Environmental Research Journal

- Researchers with the renowned Ramazzini Institute (RI) in Italy performed a large-scale lifetime [study](#) of lab animals exposed to environmental levels (comparable to allowable limits from cell towers) of RFR radiation and found the rats developed increased cancers- schwannoma of the heart in male rats. This study confirms the \$25 million [US National Toxicology Program](#) study which used much higher levels of cell phone radiofrequency (RF) radiation, but also reported finding the same unusual cancers as the Ramazzini- schwannoma of the heart in male rats. In addition, the RI study of cell tower radiation also found increases in malignant brain (glial) tumors in female rats and precancerous conditions including Schwann cells hyperplasia in both male and female rats.
- "Our findings of cancerous tumors in rats exposed to environmental levels of RF are consistent with and reinforce the results of the US NTP studies on cell phone radiation, as both reported increases in the same types of tumors of the brain and heart in Sprague-Dawley rats. Together, these studies provide sufficient evidence to call for the International Agency for Research on Cancer (IARC) to re-evaluate and re-classify their conclusions regarding the carcinogenic potential of RFR in humans," said Fiorella Belpoggi PhD, study author and RI Director of Research.
- The Ramazzini study exposed 2448 Sprague-Dawley rats from prenatal life until their natural death to "environmental" cell tower radiation for 19 hours per day (1.8 GHz GSM radiofrequency radiation (RFR) of 5, 25 and 50 V/m). RI exposures mimicked base

station emissions like those from cell tower antennas, and exposure levels were far less than those used in the NTP studies of cell phone radiation.

- [Watch Press Conference](#)

Wyde, Michael, et al. “National Toxicology Program Carcinogenesis Studies of Cell Phone Radiofrequency Radiation in Hsd: Sprague Dawley® SD rats (Whole Body Exposure). [Statement on conclusions of the peer review meeting by NIEHS, released after external peer review meeting](#) and the [DNA damage presentation](#).

- This 25 million dollar study is the most complex study completed by the NTP and the world’s largest rodent study on radiofrequency radiation exposure to date which found long term exposure at non thermal levels associated with brain cancer and schwannomas of the heart in male rats. In addition damage to heart was found in all exposure levels. The full report is expected to be released in Fall 2018.

More Important Studies on Cell Tower Radiation

Cindy L. Russell, [5 G wireless telecommunications expansion: Public health and environmental implications](#), Environmental Research, 2018, ISSN 0013-9351

- Radiofrequency radiation (RF) is increasingly being recognized as a new form of [environmental pollution](#). This article reviews relevant [electromagnetic](#) frequencies, exposure standards and current scientific literature on the health implications of 2G, 3G, 4G and 5G.
- Effects can also be non-linear. Because this is the first generation to have cradle-to-grave lifespan exposure to this level of man-made microwave (RF EMR) radiofrequencies, it will be years or decades before the true health consequences are known. Precaution in the roll out of this new technology is strongly indicated.

Noa Betzalel, Paul Ben Ishai, Yuri Feldman, [The human skin as a sub-THz receiver – Does 5G pose a danger to it or not?](#), Environmental Research, Volume 163, 2018, Pages 208-216, ISSN 0013-9351,

- Researchers have developed a unique simulation tool of human skin, taking into account the skin [multi-layer structure](#) together with the helical segment of the sweat duct embedded in it. They found that the presence of the sweat duct led to a high specific absorption rate (SAR) of the skin in [extremely high frequency](#) band that will be used in 5G. “One must consider the implications of human immersion in the electromagnetic noise, caused by devices working at the very same frequencies as those, to which the sweat duct (as a helical antenna) is most attuned. We are raising a warning flag against the unrestricted use of sub-THz technologies for communication, before the possible consequences for public health are explored.”

[Mobile phone infrastructure regulation in Europe: Scientific challenges and human rights protection](#) Claudia Roda, Susan Perry, Environmental Science & Policy, Volume 37, March 2014, Pages 204-214.

- This article was published in Environmental Science & Policy by human rights experts. It argues that cell tower placement is a human rights issue for children.
- “We argue that (1) because protection of children is a high threshold norm in Human Right law and (2) the binding language of the Convention on the Rights of the Child obliges States Parties to provide a higher standard of protection for children than adults, any widespread or systematic form of environmental pollution that poses a long-term threat to a child’s rights to life, development or health may constitute an international human rights violation.
- In particular we have explained how the dearth of legislation to regulate the installation of base stations (cell towers) in close proximity to children’s facilities and schools clearly constitutes a human rights concern according to the language of the Convention on the Rights of the Child, a treaty that has been ratified by all European States.

[SAFETY ZONE DETERMINATION FOR WIRELESS CELLULAR TOWER](#) Nyakyi et al, Tanzania (2013)

- This research looked at the radiation that cell towers emit and states a safety zone is needed around the towers to ensure safe sleeping areas. The authors state that “respective authorities should ensure that people reside far from the tower by 120m or more depending on the power transmitted to avoid severe health effect.”

[A cross-sectional case control study on genetic damage in individuals residing in the vicinity of a mobile phone base station.](#) Ghandi et al, 2014 (India):

- This cross-sectional case control study on genetic damage in individuals living near cell towers found genetic damage parameters of DNA were significantly elevated. The authors state, “The genetic damage evident in the participants of this study needs to be addressed against future disease-risk, which in addition to neurodegenerative disorders, may lead to cancer.”

[Human disease resulting from exposure to electromagnetic fields,](#) Carpenter, D. O. Reviews on Environmental Health, Volume 28, Issue 4, Pages 159172.

- This review summarizes the evidence stating that excessive exposure to magnetic fields from power lines and other sources of electric current increases the risk of development of some cancers and neurodegenerative diseases, and that excessive exposure to RF radiation increases risk of cancer, male infertility, and neurobehavioral abnormalities.

[Signifikanter Rückgang klinischer Symptome nach Senderabbau – eine Interventionsstudie. \(English-Significant Decrease of Clinical Symptoms after Mobile Phone Base Station Removal – An Intervention Study\)](#) Tetsuharu Shinjyo and Akemi Shinjyo, 2014 Umwelt-Medizin-Gesellschaft, 27(4), S. 294-301.

- Japanese study Showed Statistically Significant Adverse Health Effects from electromagnetic radiation from mobile phone base stations. Residents of a condominium building that had cell tower antennas on the rooftop were examined before and after cell tower antennas were removed. In 1998, 800MHz cell antennas were installed, then later in 2008 a second set of antennas (2GHz) were installed. Medical exams and interviews were conducted before and after the antennas were removed in 2009 on 107 residents of the building who had no prior knowledge about possible. These results lead researchers to question the construction of mobile phone base stations on top of buildings such as condominiums or houses.

[Effect of GSTM1 and GSTT1 Polymorphisms on Genetic Damage in Humans Populations Exposed to Radiation From Mobile Towers.](#) Gulati S, Yadav A, Kumar N, Kanupriya, Aggarwal NK, Kumar R, Gupta R., Arch Environ Contam Toxicol. 2015 Aug 5. [Epub ahead of print]

- In our study, 116 persons exposed to radiation from mobile towers and 106 control subjects were genotyped for polymorphisms in the GSTM1 and GSTT1 genes by multiplex polymerase chain reaction method. DNA damage in peripheral blood lymphocytes was determined using alkaline comet assay in terms of tail moment (TM) value and micronucleus assay in buccal cells (BMN). Our results indicated that TM value and BMN frequency were higher in an exposed population compared with a control group and the difference is significant. In our study, we found that different health symptoms, such as depression, memory status, insomnia, and hair loss, were significantly associated with exposure to EMR. Damaging effects of nonionizing radiation result from the generation of reactive oxygen species (ROS) and subsequent radical formation and from direct damage to cellular macromolecules including DNA.

[Subjective symptoms, sleeping problems, and cognitive performance in subjects living near mobile phone base stations,](#) Hutter HP et al, (May 2006), Occup Environ Med. 2006 May;63(5):307-13

- Found a significant relationship between some cognitive symptoms and measured power density in 365 subjects; highest for headaches. Perceptual speed increased, while accuracy decreased insignificantly with increasing exposure levels.

Oberfeld, A.E. Navarro, M. Portoles, C. Maestu, C. Gomez-Perretta, [The microwave syndrome: further aspects of a Spanish study,](#)

- A health survey was carried out in La Ñora, Murcia, Spain, in the vicinity of two GSM 900/1800 MHz cellular phone base stations. The adjusted (sex, age, distance) logistic regression model showed statistically significant positive exposure-response associations between the E-field and the following variables: fatigue, irritability, headaches, nausea, loss of appetite, sleeping disorder, depressive tendency, feeling of discomfort, difficulty in concentration, loss of memory, visual disorder, dizziness and cardiovascular problems.

[Bortkiewicz et al, 2004 \(Poland\), Subjective symptoms reported by people living in the vicinity of cellular phone base stations: review, Med Pr.2004;55\(4\):345-51.](#)

- Residents close to mobile phone masts reported: more incidences of circulatory problems, sleep disturbances, irritability, depression, blurred vision and concentration difficulties the nearer they lived to the mast.
- The performed studies showed the relationship between the incidence of individual symptoms, the level of exposure, and the distance between a residential area and a base station.

Wolf R and Wolf D, [Increased Incidence of Cancer Near a Cell-phone Transmitter Station](#), International Journal of Cancer Prevention, (Israel) VOLUME 1, NUMBER 2, APRIL 2004

- A significant higher rate of cancer (300% increase) among all residents living within 300m radius of a mobile phone mast for between three and seven years was detected.
- 900% cancer increase among women alone
- In the area of exposure (area A) eight cases of different kinds of cancer were diagnosed in a period of only one year. This rate of cancers was compared both with the rate of 31 cases per 10,000 per year in the general population and the 2/1222 rate recorded in the nearby clinic (area B). The study indicates an association between increased incidence of cancer and living in proximity to a cell-phone transmitter station.

[Changes of Neurochemically Important Transmitters under the influence of modulated RF fields – A Long Term Study under Real Life Conditions](#)(Germany), Bucher and Eger, 2011

- German study showing elevated levels of stress hormones (adrenaline, noradrenaline), and lowered dopamine and PEA levels in urine in area residents during 1st 6 months of cell tower installation. Even after 1.5 years, the levels did not return to normal.

[The Influence of Being Physically Near to a Cell Phone Transmission Mast on the Incidence of Cancer](#) (Umwelt·Medizin·Gesellschaft 17,4 2004) [Eger et al, 2004 \(Germany\)](#)

- 200% increase in the incidence of malignant tumors was found after five years' exposure in people living within 400m radius of a mobile phone mast. The proportion of newly

developing cancer cases is significantly higher among patients who live within 400 meters of a cell phone transmitter. Early age of cancer diagnosis.

[Microwave electromagnetic fields act by activating voltage-gated calcium channels: why the current international safety standards do not predict biological hazard.](#) Martin L. Pall. Recent Res. Devel. Mol. Cell Biol. 7(2014).

- “It can be seen from the above that 10 different well-documented microwave EMF effects can be easily explained as being a consequence of EMF VGCC activation: oxidative stress, elevated single and double strand breaks in DNA, therapeutic responses to such EMFs, breakdown of the blood-brain barrier, cancer, melatonin loss, sleep dysfunction, male infertility and female infertility.”

Pall ML. 2015. [Microwave frequency electromagnetic fields \(EMFs\) produce widespread neuropsychiatric effects including depression.](#) J. Chem. Neuroanat. 2015 Aug 20.

- Non-thermal microwave/lower frequency electromagnetic fields (EMFs) act via voltage-gated calcium channel (VGCC) activation.
- Two U.S. government reports from the 1970s to 1980s provide evidence for many neuropsychiatric effects of non-thermal microwave EMFs, based on occupational exposure studies. 18 more recent epidemiological studies, provide substantial evidence that microwave EMFs from cell/mobile phone base stations, excessive cell/mobile phone usage and from wireless smart meters can each produce similar patterns of neuropsychiatric effects, with several of these studies showing clear dose–response relationships.
- Lesser evidence from 6 additional studies suggests that short wave, radio station, occupational and digital TV antenna exposures may produce similar neuropsychiatric effects. Among the more commonly reported changes are sleep disturbance/insomnia, headache, depression/depressive symptoms, fatigue/tiredness, dysesthesia, concentration/attention dysfunction, memory changes, dizziness, irritability, loss of appetite/body weight, restlessness/anxiety, nausea, skin burning/tingling/dermographism and EEG changes. In summary, then, the mechanism of action of microwave EMFs, the role of the VGCCs in the brain, the impact of non-thermal EMFs on the brain, extensive epidemiological studies performed over the past 50 years, and five criteria testing for causality, all collectively show that various non-thermal microwave EMF exposures produce diverse neuropsychiatric effects.