Doppler Radar Tower Update

Greater Pine Island Civic Association

December 1, 2020 - Update #2

Presentation by Jeffrey Waller, Bokeelia jmwaller333@gmail.com

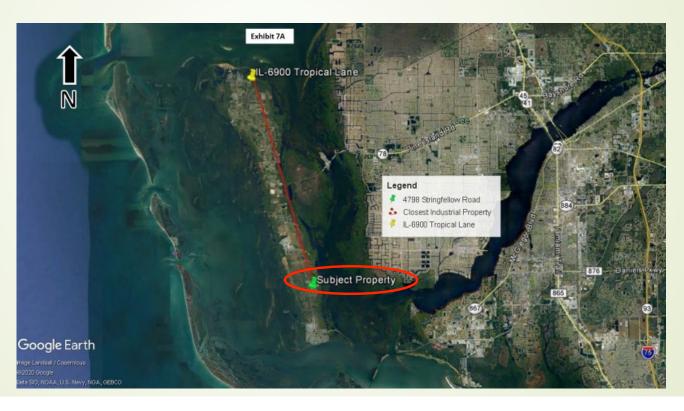
Doppler Radar Tower Meeting Agenda

- WINK Proposal
- Variance/Exception Application
- WINK Submissions & Responses
- Opposition Rationale
 - 1. Health Concerns
 - 2. Does Not Fit Coastal, Rural Character
 - 3. Negative Wildlife/Environmental Impact
 - 4. Does Not Conform to Review Criteria of Hearing Examiner
 - Variance Enforcement
 - 6. Other Legitimate Sites
 - 7. Weather Wars with NBC2
- Next Steps

Fort Myers Broadcasting (WINK) Proposal: Build a Doppler Radar Tower on Pine Island



Location of Doppler Radar Tower - 4798 Stringfellow Road



Doppler Radar Tower Plat – Satellite View KOA Campground to North, Eagle Lake Estates to South



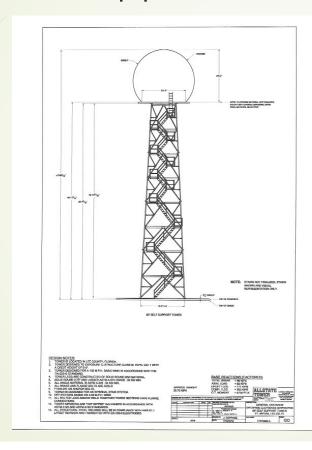
Doppler Radar Tower on WINK Parcel Location of Proposed Tower



Simulated Doppler Radar Tower View From Stringfellow Road



Doppler Radar Tower Elevation

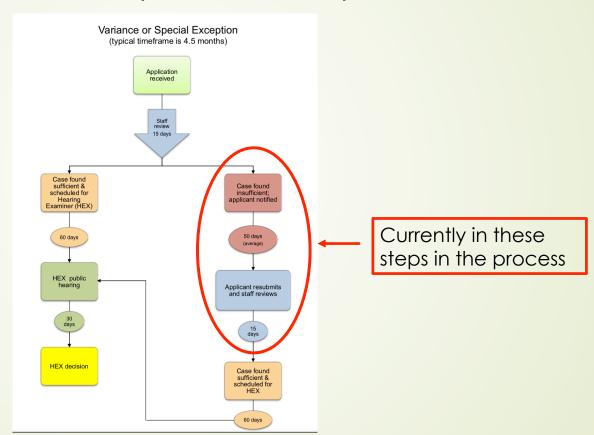


- 110 foot tower height
- 25 foot dome diameter
- Lattice support structure

Doppler Radar Tower Specs

- Defender C1000 C-Band Radar System
- 1 million watts of power
- Operating 24 hours/day, 7 days/week, 365 days/year
- 360 degrees of coverage
- 125 mile range (almost 50 thousand square miles)
- Equivalent to 5-25 times the power of a full capacity cell tower
- Dual polarization horizontal and vertical transmission
- Operates within 5.5 to 5.7 GHz frequency, same range as cell phones

Variance or Special Exception Process



Variance or Special Exception Process

- Statutory limit no more questions can be asked beyond scope of original letter
- Three legged stool
 - Applicant presentation
 - Staff presentation/recommendation
 - Public comment competent/substantial evidence (relevant to how Hearing Examiner (HE) can make decision)
 - Can provide academic research
 - More relevant to have expert witness if debatable topic
 - No time limit
- Legitimate questions surface
- Applicant able to rebut public response
- If changes to project proposed or defense opens new issues, then HE can reopen to public comments

WINK Doppler Tower Submission #1

(July 21, 2020)

- Request a Special Exception in accordance with LDC Sec 34-1447, which limits antenna height to 90 feet, to allow construction of a 110 foot Doppler Radar Tower
- Two Variance Requests on Pine Island:
 - (1) Variance request from LDC Section 33-1087 which limits the overall height of wireless communication facilities to a maximum height of 45 feet above mean sea level, to allow for a maximum height of 110 feet; and
 - (2) Variance request from LDC Sec. 34-1447(d)(2) which requires
 a monopole design, to allow for a lattice antenna-supporting
 structure.

WINK Submission #1 – Additional Info Requested by County Planning

(Aug 19, 2020)

- Department of Community Development Zoning Section request for additional information (Abbreviated list)
 - Evidence of Community Planning Meeting
 - How information collected by this tower will be shared with benefitting organizations?
 - Natural Resources Review will any work occur within the bald eagle nests located on this property which will require a bald eagle management plan?
 - Provide species assessment geared toward the Migratory Bird Treaty Act

Wink Submission #2 – Major Updates

(October 13, 2020)

- Expanded public safety benefits and explanations for same
- More specific public safety benefits to Pine Island
- Expanded explanation as to why radar tower won't work in other locations
- Explanation of why old WINK Doppler Radar Tower was dismantled
- Migratory and Listed Bird Species Assessment
- Documented Community Planning Meeting questions (but no answers)
- Description of how data will reach benefitting organizations:
 - Data > WINK meteorologists > Translated and disseminated to public
 & EM agencies > Through broadcast tv, radio and website access
 - Enable National Weather Service forecasts in cooperation with WINK

WINK Submission #2 – Additional Info Requested by County Planning

(Nov 15, 2020)

- Department of Community Development Zoning Section request for additional information
 - Further clarification on how and when information will be formally provided to larger community resources such as National Weather Center, National Weather Service or Emergency Management
 - LDC Section 33-1087(e) states height variances must also be found to maintain the health, safety and welfare of the general public (not just the health, safety, or welfare of the customers or residents of the property in question) concerned only customers of WINK news would be the primary beneficiaries
 - Staff is still concerned about consistency with:
 - ► Lee Plan Policy 2.1.3 Public uses/utilities vs. commercial benefit
 - ► Lee Plan Policy 24.4.4 reflect the Coastal Rural character and unique culture of Greater Pine Island

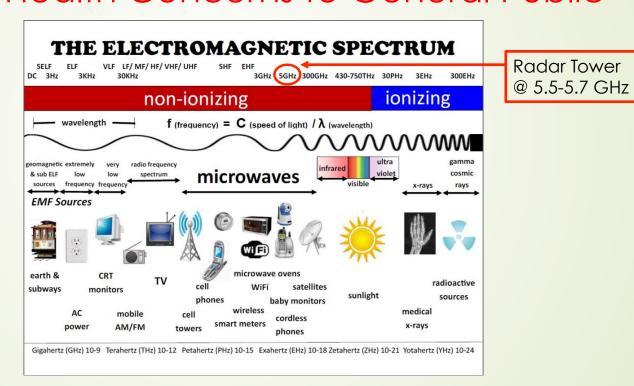
WINK Submission #2 – Additional Info Requested by County Planning

POLICY 2.1.3: All land use categories and Planning Community Map areas permit the consideration of churches and schools (except in Wetlands and Airport Noise Zones), public uses and buildings, public utilities and resource recovery facilities, public recreational uses (including franchised quasi-commercial uses in conjunction with a public use), and sites for compatible public facilities when consistent with the goals, objectives, policies, and standards in this plan and applicable zoning and development regulations.

WINK Submission #2 – Additional Info Requested by County Planning

- POLICY 24.4.4: In the Coastal Rural future land use category, non-residential development is restricted to minor commercial development. All zoning requests for commercial projects must utilize the planned development rezoning process and be consistent with the following:
- Total building floor area is limited to 5,000 square feet, unless the development can demonstrate compatibility with adjacent uses, and a positive impact on traffic patterns within Greater Pine Island.
- Development must not exceed two acres of impervious area.
- Uses are limited to those that reflect the Coastal Rural character and unique culture of Greater Pine Island, such as animal clinics, bait and tackle shops, ecotourism, farm and feed supply stores, food stores, lawn and garden supply stores, restaurants (excluding fast food), roadside/produce stands, specialty retail, and plant nurseries.
- Buildings exceeding 5,000 square feet that are lawfully existing or approved as of October 1, 2009 will be deemed vested for the approved and existing square footage for the life of the structure despite a change in use.

Opposition to Doppler Radar Tower: 1. Health Concerns to General Public



Opposition to Doppler Radar Tower: 1. Health Concerns to General Public

- 2007 BioInitiative Report (updated in 2012, 2014, 2017) has determined that electromagnetic fields are linked to cancers, neurological problems and DNA damage (https://bioinitiative.org)
 - Most comprehensive scientific research on the biological effects of nonionizing (microwave) radiation
- U.S. International Electromagnetic Field Scientist Appeal signed by 225 scientists concluded that the agencies setting safety standards have failed to impose sufficient guidelines to protect the general public
 - Press Release:
 https://www.emfscientist.org/images/docs/EMF Scientist Press Release 5-1-2015.pdf
 - ► Appeal: https://www.emfscientist.org/index.php/emf-scientist-appeal

Opposition to Doppler Radar Tower: 1. Health Concerns to General Public

BioInitiative Report

(See Appendix for webpage summary and detailed list of research)

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

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

Opposition to Doppler Radar Tower – 1. Health Concerns to General Public

- Arthur Firstenberg tells of the Freiburger Appeal where 1000 German doctors in 2002 signed an appeal calling for a moratorium on antennas and towers, claiming electromagnetic radiation was causing a drastic rise in both acute and chronic disease including:
 - Extreme fluctuations in blood pressure
 - Heart rhythm disorders
 - Heart attacks
 - Strokes
 - (http://freiburger-appell-2012.info/media/International Doctors Appeal 2012 Nov.pdf)
- It's also occurring among an increasingly younger population
- Arthur Firstenberg is the author of "The Invisible Rainbow" which tells an amazing history of the introduction of electrical currents into the human environment and the ramifications to our health and that of every living creature (https://www.cellphonetaskforce.org)

Opposition to Doppler Radar Tower – 1. Health Concerns to General Public

- Cities and Counties throughout the world have taken action to put a moratorium on microwave generation
 - Belgium halted 5G due to adverse health effects
 - Ireland counties have halted 5G due to adverse health effects
 - Italy 14 municipalities (including Rome) stopped 5G
 - France banned WIFI in nursery schools
 - Switzerland adopted moratorium/blocked 320 of 326 antennas
 - Santa Barbara, CA halted licensing agreement with Verizon due to health concerns

Source: Stop5GBlacktown.org

Opposition to Doppler Radar Tower – 2. Does Not Fit Coastal, Rural, Character

The Lee Plan – Vision #16 for Pine Island:

- Pine Island will continue to be a haven between urban sprawl approaching from the mainland and the wealth of the outer islands; a quiet place of family businesses, school children, farmers, and retirees enjoying the bounties of nature; a place devoid of high-rises, strip malls, and gated communities.
- Wildlife and native vegetation will be protected; loss of wildlife habitat will be reversed:
- Pine Island will continue to be a place where people, nature and agriculture exist in harmony, a place not very different from what it is today, an island as state-of-mind as much as a physical entity, its best features preserved and enhanced.

Opposition to Doppler Radar Tower – 2. Does Not Fit Coastal, Rural, Character

- The Lee Plan Objective #24 in Future Land Use Element:
- GREATER PINE ISLAND COMMUNITY PLAN. Manage future growth on and around Greater Pine Island so as to: maintain the island's unique natural resources, rural character, and coastal environment; support the viable and productive agricultural community and other local businesses; and to protect the public health, safety and welfare of island residents and visitors when a hurricane strike is imminent.

Opposition to Doppler Radar Tower – 2. Does Not Fit Coastal, Rural, Character

- The Lee Plan Policy #24.4.4 in Future Land Use Element
- In the Coastal Rural future land use category, non-residential development is restricted to minor commercial development.
- Uses are limited to those that reflect the Coastal Rural character and unique culture of Greater Pine Island, such as animal clinics, bait and tackle shops, ecotourism, farm and feed supply stores, food stores, lawn and garden supply stores, restaurants (excluding fast food), roadside/produce stands, specialty retail, and plant nurseries.
- A 110 Foot Doppler Radar Tower does NOT meet this criteria

- WINK stated in response #1 to staff questions:
 - This project meets the US Fish and Wildlife's (FWS) criteria to qualify for the Clearance to Proceed with Construction of Communication Towers and Related Activities so that further coordination with FWS is not necessary
 - The tower will be located in a undeveloped, cleared pasture which does not provide potential habitat for federally listed species – only State species
 - The tower will be located at least 1,850' from any active or inactive documented bald eagle nests.
 - The two bald eagle nests documented onsite (LE-018 and LE-018a) or their nest trees were not observed during the Migratory and Listed Bird Species Assessment. In fact, there do not appear to be any trees capable of supporting a bald eagle's nest within 200' of either nest location. It is likely that both nest trees were blown over during Hurricane Irma on September 10, 2017. The applicant will seek to have these nests declared lost by the Lee County Eagle Technical Advisory Committee and the FWS.

- WINK stated in response #1 to staff questions:
 - The tower will be located well over the 1 mile requirement from any wood stork or wading bird nesting colonies.
 - The closest wood stork nesting colony is approximately 19 miles to the east of the proposed tower.
 - The closest water bird nesting colony is on Master's Island which is 2.17 miles to the northeast of the proposed tower.

Migratory Bird & Listed Species Assessment



Eagle and Migratory Bird Nests



County Question on Flight Paths of Migratory Birds – was that addressed, especially for a 125 mile radius?

- "...University of Southern California professor Travis Longcore discusses his study finding that communication towers kill 6.8 million birds annually...Longcore's research attributed these bird deaths to the disorienting lights used on communication towers...
- "People have observed for a very long time that nocturnally migrating birds are attracted to lights at night and it's exacerbated during periods of bad weather," he told NPR in 2012. "It leaves them circling these towers that they encounter and running into either the guide wires on the towers, each other, ending up on the ground and taken by predators..."

(Source: Audubon Magazine, January 14, 2020)

AVIAN MORTALITY AT COMMUNICATION TOWERS: A REVIEW OF RECENT LITERATURE, RESEARCH, AND METHODOLOGY-MARCH 2000

Prepared for: United States Fish and Wildlife Service

Office of Migratory Bird Management

Prepared by:

Paul Kerlinger, Ph.D. Curry & Kerlinger, L.L.C. P.O. Box 453 Cape May Point, NJ 08212 609-884-2842, fax: 884-4569 pkerlinger@aol.com

"...Our knowledge regarding tower kills is rudimentary, despite more than 50 years of history documenting the problem (first reported by Aronoff in 1949; for reviews see Avery et al. 1978, 1980; Banks 1979; Hebert et al. 1995; Kerlinger in press; Trapp 1998; and Manville 2000). Basically, we know that birds collide with tall towers and that on some occasions–particularly, but not necessarily always, during inclement weather – these towers kill large numbers of birds. The species impacted most seem to be night migrating songbirds (warblers, thrushes, vireos, tanagers, cuckoos, sparrows, etc.), although smaller numbers of waterfowl, shorebirds, and other species have also been documented. Current estimates of the numbers of birds killed annually by communication towers range between 4 and 10 million..."

- Highlights:
 - The growth of wireless telecommunication technologies causes increased electrosmog.
 - Radio frequency fields in the MHz range disrupt insect and bird orientation.
 - Radio frequency noise interferes with the primary process of magnetoreception.
 - Existing guidelines do not adequately protect wildlife.
 - ► Further research in this area is urgent.

(Source: ScienceDirect Abstract on "Anthropogenic radio/frequency electromagnetic fields as an emerging threat to wildlife orientation", June 15, 2015)

Radiation From Cellphones, Wi-Fi Is Hurting the Birds and the Bees; 5G May Make It Worse

- Technology is quite literally destroying nature, with a new report further confirming that electromagnetic radiation from power lines and cell towers can disorientate birds and insects and destroy plant health. The paper warns that as nations switch to 5G this threat could increase.
- In the new analysis, <u>EKLIPSE</u>, an EU-funded review body dedicated to policy that may impact biodiversity and the ecosystem, looked over 97 studies on how electromagnetic radiation may affect the environment. It concluded this radiation could indeed pose a potential risk to bird and insect orientation and plant health, <u>The Telegraph</u> reported.
- This is not a new finding, as studies dating back for years have come to the same conclusion. In fact, one study from 2010 even suggested that this electromagnetic radiation may be playing a role in the decline of certain animal and insect populations. The radio waves can disrupt the magnetic "compass" that many migrating birds and insects use. The creatures may become disorientated, AFP reported.

(Source: Newsweek May 9, 2018)

- 4. Adverse Effects of Radiation on Birds...Ornithologists assert that one would never see a sparrow, pigeon, or any bird flying or staying near the cell tower, the reason being increased absorption of radiation owing to large surface area of bird in comparison to human body (power = power density x area).
- Since fluid content is small due to less weight, it gets heated up very fast and also the magnetic field disturbs their navigational skills. When birds are exposed to weak electromagnetic fields, they disorient and begin to fly in all directions, which explain migratory birds undermining navigational abilities.
- Millions of migratory birds die each year from collisions with telecommunication masts.
- Birds are believed to be using earth's magnetic field for navigation, and get severely disoriented by the microwave radiation from telecommunication masts.

(Source: Trends In Veterinary And Animal Sciences 2016)

Work in Process - Need Updates/Conclusions on Wildlife Section

Opposition to Doppler Radar Tower – 4. Does Not Conform to Review Criteria of Hearing Examiner

- Hearing Examiner must find the following review criteria are satisfied with respect to variances:
 - The property has inherent exceptional conditions that cause the application of the regulation to create a hardship (as defined in Sec 34-2) on the property owner
 - Sec 34-2 defines hardship as an unreasonable burden that is unique to a parcel of property
- The height limitation is NOT unique to this parcel it applies to all parcels on the island

Opposition to Doppler Radar Tower – 4. Does Not Conform to Review Criteria of Hearing Examiner

- Hearing Examiner must find the following review criteria are satisfied with respect to variances:
 - The exceptional conditions are not the result of actions of the property owner taken subsequent to the adoption of the ordinance
- WINK dismantled their Fort Myers Doppler Radar around 2014

Opposition to Doppler Radar Tower – 4. Does Not Conform to Review Criteria of Hearing Examiner

- Hearing Examiner must find the following review criteria are satisfied with respect to variances:
 - The granting of the variance will not be injurious to the neighborhood or detrimental to the public welfare
- Health issues noted above ARE injurious to residents and detrimental to the public welfare!

Opposition to Doppler Radar Tower – 5. Variance Enforcement

- Greater Pine Island has a long history of enforcing development height restrictions, dating back to 1977 (Source: Greater Pine Island Community Plan Update September 30, 2001)
- It's ironic that WINK is seeking a variance to the height restrictions when:
 - It will benefit from the prior historical enforcement of same, and...
 - It is assuming protection with enforcement of future height restrictions
- And yet, it is the only deserving recipient of the height variance??
- Let's not open up pandora's box on who does and who does not deserve a variance from height restrictions.

Opposition to Doppler Radar Tower 6. Other Legitimate Sites



Purported Gap in Coverage

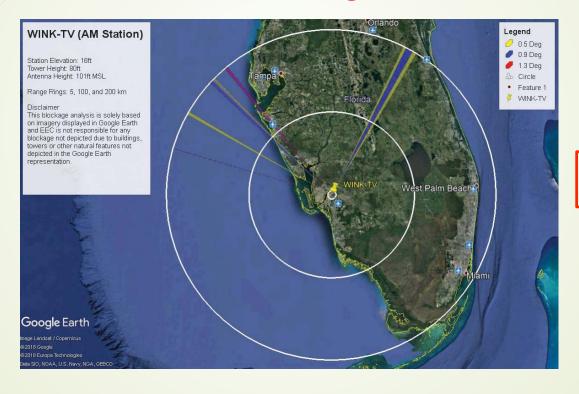
Opposition to Doppler Radar Tower 6. Other Legitimate Sites



What Does the Gap Look Like When NBC2's Doppler Radar is Superimposed on This Chart?

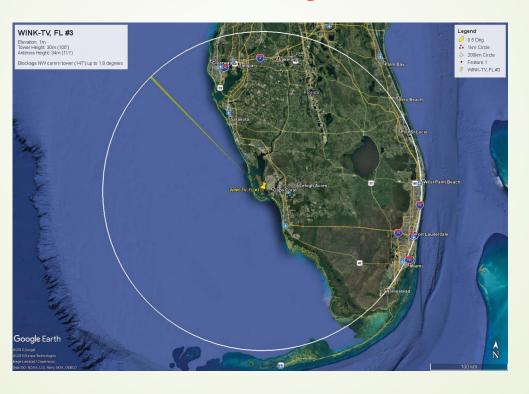
Is This Chart Really an Accurate Depiction of a Gap in Coverage?

Opposition to Doppler Radar Tower – 6. Other Legitimate Sites



Potential Fort Myers Site

Opposition to Doppler Radar Tower – 6. Other Legitimate Sites



Proposed Pine Island Site

Opposition to Doppler Radar Tower – 6. Other Legitimate Sites

- Is the marginal benefit of an approximately 5% reduction in coverage (due to building/tree blockage) with a Fort Myers site (or some other alternative site) worth the violation of Pine Island's unique culture, beauty and character AND impairing the health of the island residents?
- How do Tampa and Miami deal with any blockages in coverage, or is the coverage sufficient to provide adequate radar coverage benefits for public safety and emergency management?
- How does NBC2 deal with any blockage issues?

Opposition to Doppler Radar Tower – 7. Weather Wars with NBC2

- Per market research, local weather forecasts are the prime reason residents tune in to local TV stations (Source: News-Press, Oct 29, 2016)
- As such, having the #1 weather forecasting audience is tantamount to being the #1 local TV station, driving up advertising revenue
- Aren't the pleadings for the Doppler Radar Tower really a business strategy to counter NBC2's Doppler Radar Tower?
- Potentially driving increased revenue/profit to the detriment of the health, beauty and unique character of Pine Island? The business strategy is OK, but the location is NOT.

- Form a residents ad hoc committee (RADR Residents Against Doppler Radar!) to:
- Leaders to address five suggested key focus areas:
 - Zoning/Variance objections (Jeff Waller)
 - Health impact awareness (Lisa Waller)
 - Influence "court of public opinion" (Open)
 - Fact checking and hearing process support (Deborah Swisher Hicks)
 - Wildlife impact (Catherine Greenleaf)

- Presentations to other Pine Island organizations (and solicit support)
- St. James City Civic Association (Cindy Bickford)
- ROAR (Rise Up/Organize/Agitate/Resist) (Susan McGuire)
- GPICA (Shari Perkins has offered assistance) will update periodically
- Pine Island Garden Club (John & Marty Kendall)
- Others?

- Continue to monitor WINK/Morris Depew communication with the Lee County Zoning Department
- Waiting for responses to 19 questions sent to Morris Depew on Sept 29, 2020 following the Public Informational Meeting
- Continue to liaise with Noel Andress (land developer and zoning expertise)
- Establish contact Greg Stuart (real estate development planning)

Jeff Waller contact info:

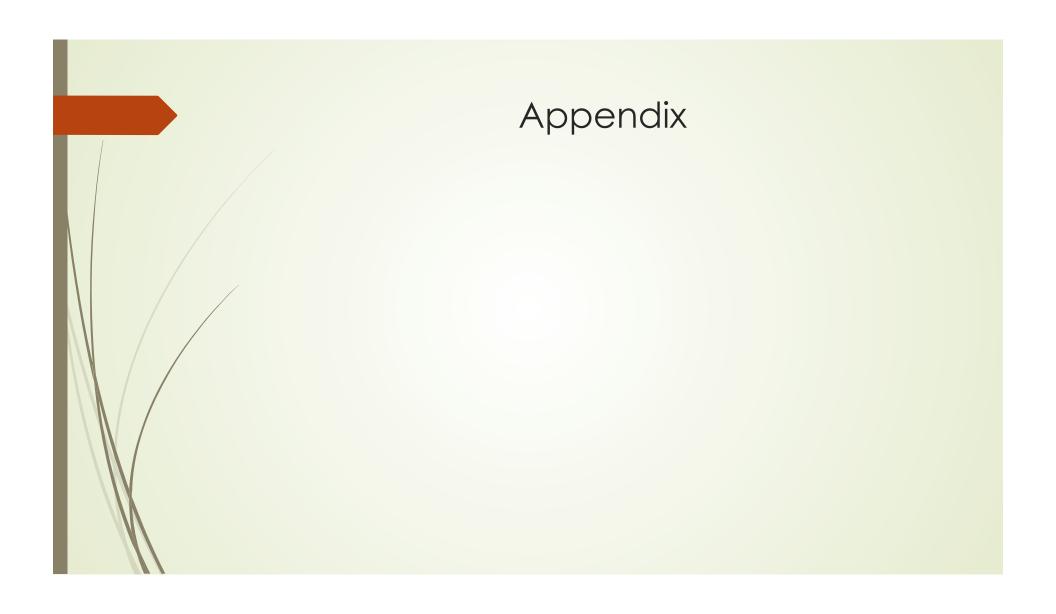
■ Cell: 262-639-1234

► Email: <u>imwaller333@gmail.com</u>

Deborah Swisher-Hicks contact info:

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■ Email: <u>debs.wish2@gmail.com</u>



- "The argument I made in these articles is not that EMF is proven to cause autism, but rather, that EMF can certainly contribute to degrading the physiological integrity of the system at the cellular level and molecular level and this in turn appears to contribute to the pathogenesis/causation not only of autism but of many highly common chronic illnesses, including cancer, obesity, diabetes and heart disease..."
- "In fact, there are thousands of papers that have accumulated over decades and are now accumulating at an accelerating pace, as our ability to measure impacts become more sensitive – that document adverse health and neurological impacts of EMF/RFR"
- "Powerful industrial entities have a vested interest in leading the public to believe that EMF/RFR, which we cannot see, taste or touch, is harmless, but this is not true.
- Radiofrequency electromagnetic radiation from WiFi and cell towers can exert a disorganizing effect on the ability to learn and remember, and can also be destabilizing to immune and metabolic function.

(Source: Letter dated Sept 9, 2016 to Petaluma City School District from Martha R. Herbert, PhD, MD, pediatric neurologist and neuroscientist on the faculty of Harvard Medical School and on staff at the Massachusetts General Hospital)

Physicians for Safe Technology with the European Journal of Preventative Cardiology point out the strong and growing evidence that radiofrequency radiation from wireless devices can negatively affect normal functioning of cellular processes throughout the body via oxidation/inflammation pathways

- In the Swiss Alps, an existing radio tower boosted its power level to 450,000 watts and surrounding residents complained it was damaging their health, that of animals and the nearby forests
- In response, an extensive health study was conducted by scientists from the University of Berne in 1992 and the results confirmed the complaints of the residents
 - Difficulty sleeping, limb and joint pain, weakness and tiredness, constipation, inability to focus, stomach pains, heart palpitations, shortness of breath, headaches, abnormal blood pressure
 - Reduction in cow melatonin levels
 - Damage to trees

- In Latvia, residents were concerned about exposure to an early warning radar station near the border of Russia
- Their concerns were confirmed in a conference called "The Effect of Radio Frequency Electromagnetic Radiation on Organisms"
 - School children who lived as far away as 12 miles from the station suffered from impaired motor function, memory loss and attention deficiencies
 - Lower lung capacity, more headaches
 - Chromosome damage in cows, fewer birds
 - Trees aged prematurely, plants grew abnormally, thinner growth rings in trees

- In Poland, residents northwest of Warsaw complained about health issues related to a Warsaw Central Radio tower.
- A 1991 government study found
 - 68% of people near the tower had abnormally high levels of cortisol (a stress hormone)
 - 42% had hypoglycemia (low blood sugar)
 - 30% had elevated thyroid hormones
 - 32% had high cholesterol
 - 32% had high blood cell counts
 - 58% had disturbed electrolytes

- Italy's Supreme Court convicted the former President of the Vatican radio management committee for public nuisance by polluting the environment with radio waves with their numerous broadcast towers.
- Public prosecutor considered negligent homicide and the National Cancer Institute of Milan performed an official investigation and found from 1997-2003:
 - Children from 1-14 years old who lived from 3.7 to 7.5 miles from the towers developed leukemia, lymphoma or myeloma at 8 times the rate of children who lived further away
 - Adults died of leukemia at almost 7 times the rate of those that lived further away

Appendix – Additional Health Issues Support: BioInitiative Report Website/Summary



Appendix – Additional Health Issues Support: BioInitiative Report Website/Summary

A Rationale for Biologically-based Public Exposure Standards for Electromagnetic Fields (ELF and RF)

READ THE REPORT

□ DOWNLOAD THE REPORT

WHO WE ARE



Ine Bioliniative 2012
Report has been prepared by 29 authors from ten countries, ten holding medical degrees (Mbs), 21 PhDs, and three MsC, MA or MPHs. Among the authors are three former presidents of the Bioelectromagnetics Society, and five full members of BEMS.

READ MORE

CONCLUSIONS



Bioeffects are clearly established to occur with very low exposure levels (non-thermal levels) to electromagnetic fields and radiofrequency radiation exposures.

READ MORE

Reported Biological Effects

Henry Lai's Research Summaries

These are invaluable resources that can are searchable by key words. These abstracts cover the relevant peer-reviewed, published literature documenting biological effects of non-ionizing radiation (ELF-EMF, Static Fields and RFR).

In the eight years since the BioInitiative 2012
Report was posted, there have been a
substantial number of new research. The large
majority of studies report biological effects as
opposed to 'no effect'. The trend continues to
show that exposure to low-intensity ELFEMF/Static Fields and RFR at levels allowable
under current federal public safety limits pose
health risks. The updated files in the Research
Summaries section detail the number of studies
showing 'effect vs no effect' for free radical
(oxidative damage), comet assay studies,
genetic and neurological studies and
electrohypersensitivity.

Appendix – Additional Health Issues Support: BioInitiative Report Website/Summary



WHY WE CARE



The stakes are very high. Human beings are bioelectrical systems. Our hearts and brains are regulated by internal bioelectrical signals. Environmental exposures to artificial EMFs can interact with fundamental biological processes in the human body.

READ MORE



DO WE KNOW ENOUGH?

There is more evidence than we need. The last five years worth of new scientific studies tell us the situation is much worse than in 2007 and yet people around the world have so much more daily exposure than even five years ago.

READ MORE

M DOWNLOAD SUMMARIES

RF Color Charts

The RF Color Charts summarize many studies that report biological effects and adverse health effects relevant for cell towers, WI-FI, 'smart' wireless utility meters, wireless laptops, baby monitors, cell phones and cordless phones.

DOWNLOAD RF CHARTS

DOWNLOAD DISRUPTED IMMUNE FUNCTION CHARTS

Appendix – Additional Health Issues Support: BioInitiative Report Table of Contents



Appendix – Additional Health Issues Support: BioInitiative Report Table of Contents



- SECTION 15: EVIDENCE FOR DISRUPTION BY THE MODULATING SIGNAL
- SECTION 16: PLAUSIBLE GENETIC AND METABOLIC MECHANISMS FOR BIOEFFECTS OF VERY WEAK ELF MAGNETIC FIELDS ON LIVING TISSUE
- SECTION 17 EVIDENCE BASED ON EMF MEDICAL THERAPEUTICS
- SECTION 18: FERTILITY AND REPRODUCTION EFFECTS OF EMF
- SECTION 19: FETAL AND NEONATAL EFFECTS OF EMF
- SECTION 20: FINDINGS IN AUTISM CONSISTENT WITH EMF AND RFR
- SECTION 21: NO CONTENT
- SECTION 22: PRECAUTION IN ACTION GLOBAL PUBLIC HEALTH EXAMPLES SINCE BIOINITIATIVE 2007
- SECTION 23: THE PRECAUTIONARY PRINCIPLE
- SECTION 24: KEY SCIENTIFIC EVIDENCE AND PUBLIC HEALTH POLICY RECOMMENDATIONS
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- **SECTION 27: APPENDIX**
- SECTION 28: ACKNOWLEDGEMENTS

Power Density (Microwatts/centimeter2 - uW/cm2)		Reference	
As low as (10 ⁻¹³) or 100 femtowatts/cm2	Super-low intensity RFR effects at MW reasonant frequencies resulted in changes in genes; problems with chromatin conformation (DNA)	Belyaev, 1997	
5 picowatts/cm2 (10-	Changed growth rates in yeast cells	Grundler, 1992	
0.1 nanowatt/cm2 (10-10) or 100 picowatts/cm2	Super-low intensity RFR effects at MW reasonant frequencies resulted in changes in genes; problems with chromatin condensation (DNA) intensities comparable to base stations	Belyaev, 1997	
0.00034 uW/cm2	Chronic exposure to mobile phone pulsed RF significantly reduced sperm count,	Behari, 2006	
0.0005 uW/cm2	RFR decreased cell proliferation at 960 MHz GSM 217 Hz for 30-min exposure	Velizarov, 199	
0.0006 - 0.0128 uW/cm2	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/cm2	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/cm2	In children and adolescents (8-17 yrs) short-term exposure caused conduct problems in school (behavioral problems)	Thomas, 2010	
0.005 uW/cm2	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/cm2	Adults exposed to short-term cell phone radiation reported headaches, concentration difficulties (differences not significant, but elevated)	Thomas, 2008	
0.006 - 0.01 uW/cm2	Chronic exposure to base station RF (whole-body) in humans showed increased stress hormones; dopamine levels substantially decreased; higher levels of adrenaline and non-adrenaline; dose-response seen; produced chronic physiological stress in cells even after 1.5 years.	Buchner, 2012	
0.01 - 0.11 uW/cm2	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

(Microwatts/centim	eter2 - uW/cm2)	Reference
0.01 - 0.05 uW/cm2	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/cm2	Adults exposed to short-term cell phone radiation reported headaches, concentration difficulties (differences not significant, but elevated)	Thomas, 2008
0.015 - 0.21 uW/cm2	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/cm2	RFR linked to adverse neurological, cardio symptoms and cancer risk	
0.05 - 0.1 uW/cm2	RFR related to headache, concentration and sleeping problems, fatigue	Khurana, 2010
0.07 - 0.1 uW/cm2	Sperm head abnormalities in mice exposed for 6-months to base station level RF/MW. Sperm head abnormalities occurred in 39% to 45% 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 donormalities on the reproductive health of humans living in close proximity to GSM base stations were discussed."	Otitoloju, 2010
0.38 uW/cm2	RFR affected calcium metabolism in heart cells	
0.8 - 10 uW/cm2	RFR caused emotional behavior changes, free-radical damage by super-weak MWs	Schwartz, 1990
0.13 uW/cm2	RFR from 3G cell towers decreased cognition, well-being	Akoev, 2002
0.16 uW/cm2	Motor function, memory and attention of school children affected (Latvia)	Zwamborn, 200
0.168 - 1.053		Kolodynski, 199
iW/cm2	Irreversible infertility in mice after 5 generations of exposure to RFR from an 'antenna park'	Magras & Zenos
1.2 - 8 uW/cm2	RFR caused a two-fold increase in leukemia in children	
.2 - 8 uW/cm2	RFR decreased survival in children with leukemla	Hocking, 1996
.21 - 1.28 uW/cm2	Adolescents and adults exposed only 45 min to UMTS cell phone radiation reported increases in headaches.	Hocking, 2000

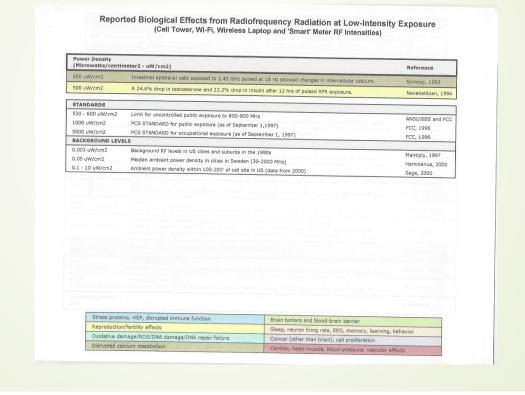
Stress proteins, HSP, disrupted immune function	
	Brain tumors and blood-brain barrier
Reproduction/fertility effects	Sleep peurop ficing rate 550
Oxidative damage/ROS/DNA damage/DNA repair failure	Sleep, neuron firing rate, EEG, memory, learning, behavior
	Cancer (other than brain), cell proliferation
Disrupted calcium metabolism	Cardiac, heart muscle, blood-pressure, vascular effects

(Microwatts/centil	meter2 - uW/cm2)	Reference
0.5 uW/cm2	Significant degeneration of seminiferous epithelium in mice at 2.45 GHz, 30-40 min.	Saunders, 1981
0.5 - 1.0 uW/cm2	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/cm2	RFR induced pathological leakage of the blood-brain barrier	Persson, 1997
1.0 uW/cm2	RFR caused significant effect on immune function in mice	Fesenko, 1999
1.0 uW/cm2	RFR affected function of the immune system	Novoselova, 199
1.0 uW/cm2	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/cm2	RFR associated with a doubling of leukemia in adults	Dolk, 1997
1.25 uW/cm2	RFR exposure affected kidney development in rats (in-utero exposure)	Pyrpasopoulou, 2004
1.5 uW/cm2	RFR reduced memory function in rats	Nittby, 2007
2 uW/cm2	RFR induced double-strand DNA damage in rat brain cells	Kesari, 2008
2.5 uW/cm2	RFR affected calcium concentrations in heart muscle cells	Wolke, 1996
2 - 4 uW/cm2	Altered cell membranes; acetycholine-induced ion channel disruption	D'Inzeo, 1988
4 uW/cm2	RFR caused changes in hippocampus (brain memory and learning)	Tattersall, 2001
4 - 15 uW/cm2	Memory impairment, slowed motor skills and retarded learning in children	
5 uW/cm2	RFR caused drop in NK lymphocytes (immune function decreased)	Chiang, 1989
5.25 uW/cm2	20 minutes of RFR at cell tower frequencies induced cell stress response	Boscolo, 2001
5 - 10 uW/cm2	RFR caused impaired nervous system activity	Kwee, 2001
6 uW/cm2	RFR induced DNA damage in cells	Dumansky, 1974 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

(Microwatts/centing	meter2 - uW/cm2)	Reference
8.75 uW/cm2	RFR at 900 MHz for 2-12 hours caused DNA breaks in leukemia cells	Marinelli, 2004
10 uW/cm2	Changes in behavior (avoidance) after 0.5 hour exposure to pulsed RFR	Navakatikian, 1994
10 - 100 uW/cm2	Increased risk in radar operators of cancer; very short latency period; dose response to exposure level of RFR reported.	Richter, 2000
12.5 uW/cm2	RFR caused calcium efflux in cells - can affect many critical cell functions	Dutta, 1989
13.5 uW/cm2	RFR affected human lymphocytes - induced stress response in cells	Sarimov, 2004
20 uW/cm2	Increase in serum cortisol (a stress hormone)	Mann, 1998
28.2 uW/cm2	RFR increased free radical production in rat cells	Yurekli, 2006
37.5 uW/cm2	Immune system effects - elevation of PFC count (antibody producing cells	Veyret, 1991
45 uW/cm2	Pulsed RFR affected serum testosterone levels in mice	Forgacs, 2006
50 uW/cm2	Cell phone RFR caused a pathological leakage of the blood-brain barrier in 1 hour	Salford, 2003
50 uW/cm2	An 18% reduction in REM sleep (important to memory and learning functions)	Mann, 1996
60 uW/cm2	RFR caused structural changes in cells of mouse embryos	Somozy, 1991
60 uW/cm2	Pulsed RFR affected immune function in white blood cells	Stanklewicz, 2006
60 uW/cm2	Cortex of the brain was activated by 15 minutes of 902 MHz cell phone	Lebedeva, 2000
65 uW/cm2	RFR affected genes related to cancer	Ivaschuk, 1999
92.5 uW/cm2	RFR caused genetic changes in human white blood cells	Belyaev, 2005
100 uW/cm2	Changes in immune function	Elekes, 1996
100 uW/cm2	A 24.3% drop in testosterone after 6 hours of CW RFR exposure	Navakatikian, 1994
120 uW/cm2	A pathological leakage in the blood-brain barrier with 915 MHz cell RF	Salford, 1994

Brain tumors and blood-brain barrier
Sleep, neuron firing rate, EEG, memory, learning, behavior
Cancer (other than brain), cell proliferation
Cardiac, heart muscle, blood-pressure, vascular effects



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 prefental 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 agressiveness.	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
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)

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 (e-0.02) 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 mln	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 fod, compared to healthy individuals; effects depend on carrier frequency (315 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 ayian brain cells	Beason, 2002

Stress proteins, HSP, disrupted immune function

Reproduction/fertility effects

Sleep, neuron firing rate, EEG, memory, learning, behavior

Oxidative damage/RSD/RNA damage/DNA repair failure

Cancer (other than brain), cell proliferation

Disrupted calcium metabolism

Cardiac, heart muscle, blood-prosure, vascular effects

(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	Altken, 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	
0.15 - 0.4 W/Kg	Statistically significant increase in malignant tumors in rats chronically exposed to RFR	Dasdag, 1999
0.26 W/Kg	Harmful effects to the eye/certain drugs sensitize the eye to RFR	Chou, 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)	Kues, 1992 Chia, 2000
0.3 - 0.44 W/Kg	Cell phone use results in changes in cognitive thinking/mental tasks related to memory retrieval	
0.3 - 0.44 W/Kg	Attention function of brain and brain responses are speeded up	Krause, 2000
0.3 - 0.46 W/Kg	Cell phone RFR doubles pathological leakage of blood-brain barrier permeability at two days (P= .002) and	Schirmacher, 200
0.43 W/Kg	Significant decrease in sperm mobility; drop in sperm concentration; and decrease in seminiferous tubules at	Salama, 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
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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)

Reference (Watts/Kilogram) 0.5 W/Kg 900 MHz pulsed RF affects firing rate of neurons (Lymnea stagnalis) but continuous wave had no effect 0.58 - 0.75 W/Kg Decrease in brain tumors after chronic exposure to RFR at 836 MHz Mouse embryos develop fragile cranial bones from in utero 900 MHz The authors say "(0)ur results clearly show that even modest exposure (e.g., 6 min daily for 21 days" is sufficient to interfere with the normal mouse Fragopoulou, 2009 0.6 - 0.9 W/Kg Increase in DNA single and double-strand DNA breaks in rat brain cells with exposure to 2450 MHz RFR Lal & Singh, 1996 Panagopoulous, 201 0.795 W/Ka premature cell death of nurse cells and follicles in ovaries (that nourish egg cells) Altered human mental performance after exposure to GSM cell phone radiation (900 MHz TDMA digital cell 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 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 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. < 1.0 W/Kg The authors conclude "the decreased number of follicles in pups exposed to mobile phone microwaves suggest that intrauterine exposure has toxic effects on ovaries." One 6-hr exposure to 1800 MHz cell phone radiation in human sperm cells caused a significant dose response Applyoner of Month of the Month De Iuliis, 2009 age, potentially affecting both their fertility and the health and wellbeing of their offspring." Human semen degraded by exposure to cell phone frequency RF increased free-radical damage De Iuliis, 2009 1.0 W/Ka Stress proteins, HSP, disrupted immune function Brain tumors and blood-brain barrier 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

SAR (Watts/Kilogram)		Reference
0.5 W/Kg	900 MHz pulsed RF affects firing rate of neurons (Lymnea stagnalis) 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, 201
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 implications 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

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

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
L.O 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
.0 W/Kg	Sleep patterns and brain wave activity are changed with 900 MHz cell phone radiation exposure during sleep	Borbely, 1999
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
.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
.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
.0 - 2.0 W/Kg	Significant elevation in micronuclei in peripheral blood cells at 2450 MHz (8 treatments of 2-hr each)	Trosic, 2002
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
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	ed immune function Brain tumors and blood-brain barrier	
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Outlief of the second	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	

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 B88 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 ganglaw with a 1-th 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 signaling pathway and leads to changes in cell sie and shape (shinking 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

IEEE Standard uncontrolled public environment (whole body)	IEEE
IEEE Standard controlled occupational environment (whole body)	IEEE
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ICNIRP SAR limit for 10 grams of tissue	FCC, 1996 ICNIRP, 1996
	IEEE Standard controlled occupational environment (whole body) FCC (IEEE) SAR limit for 1 gram of tissue in a partial body exposure

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

