List of selected credible studies outlining the harm from microwave radiation

***RFR** = **Radio Frequency Radiation**, also known as **microwave radiation**, **EMF-RF(R)** or **Non-Ionising Electromagnetic Radiation**

1.0 GENERAL ISSUES RE MICROWAVE RADIATION

Limiting liability with positioning to minimize negative health effects of cellular phone towers:

This JD PEARCE paper states “There is a large and growing body of evidence that human exposure to RFR from cellular phone base stations causes negative health effects, including both i) neuropsychiatric complaints such as headache, concentration difficulties, memory changes, dizziness, tremors, depressive symptoms, fatigue and sleep disturbance, and ii) increased incidence of cancer and living in proximity to a cell-phone transmitter station.

https://www.researchgate.net/publication/337624982_Limiting_liability_with_positioning_to_minimize_negative_health_effects_of_cellular_phone_towers

A vast amount of research on pulsed polarised non-ionising radiation shows there are biological effects:

This recent evaluation of 2266 studies (including in-vitro and in-vivo studies in human, animal, and plant experimental systems and population studies) found that most studies (n=1546, 68·2%) have demonstrated significant biological or health effects associated with exposure to anthropogenic electromagnetic fields.

Priyanka Bandara, David O Carpenter, Planetary electromagnetic pollution: it is time to assess its impact, (The Lancet Planetary Health, Volume 2, Issue 12) 2018

Major new (Jan 2021) evaluation from BERENIS, the Swiss expert group on electromagnetic fields and non-ionising radiation, finds that the majority of research studies demonstrate effects on oxidative

This review confirms there is scientific evidence showing adverse impacts from RFR as the “majority of the animal and more than half of the cell studies provided evidence of increased oxidative stress caused by RF-EMF or ELF-MF.” Despite some methodological issues in the body of research “EMF exposure, even in the low dose range, can lead to changes in oxidative balance.” Furthermore, as pre-existing conditions, such as immune deficiencies or diseases (diabetes, neurodegenerative diseases), compromise the body’s defence

mechanisms, “it is therefore possible that individuals with these conditions experience more severe health effects.”

BERENIS group https://ehtrust.org/wireless-and-power-frequency-emfs-impact-oxidative-balance-says-swiss-expert-group/?fbclid=IwAR047V_OkzQnxv3LwRuFw4RNupG74VIUBNOP3iCbuQzp-AVpSrCs8XPk-4Y Jan 2021

2020 UK Medical Consensus statement signed by over 3500 experts asserts to harm rom human health from the cocktail of electrosmog:

1. RFR has been proven to damage biological systems at intensities below ICNIRP guidelines.
2. Public exposure to RFR is already harmful and will rise with the deployment of 5G.
3. Exposure is unavoidable, contravening the Human Rights Act for those who do not consent.
4.Multiple international governmental health advisory groups are biased by conflicts of interest.

Dr Erica Mallery-Blythe Phire Medical Consensus Report December 2020

Biological Effects not caused by heating are not being recognized and effectively included in safety standards:

Exposure to low frequency and radiofrequency electromagnetic fields at low intensities poses a significant health hazard that has not been adequately addressed by national and international organizations such as the World Health Organization. This is a particular concern in children.

Belpomme et al Thermal and non-thermal health effects of low intensity non-ionizing radiation: An international perspective 2018

The mechanism of harm may well be through oxidative stress, ICNIRP who set the guidelines fail to recognise this mechanism:

Analysis of the currently available peer-reviewed scientific literature reveals molecular effects induced by low-intensity RFR in living cells. Among 100 currently available peer-reviewed studies dealing with oxidative effects of low-intensity RFR, in general, 93 confirmed that RFR induces oxidative effects in biological systems. The oxidative stress induced by RFR exposure should be recognized as one of the primary mechanisms of the biological activity of this kind of radiation.

Yakymenko, Igor, et al. “Oxidative mechanisms of biological activity of low-intensity radiofrequency radiation.”2016

Extensive review of the science supporting lowering the safety standards can be found in this report:

A report prepared by 29 authors from ten countries, ten holding medical degrees (MDs), 21 PhDs, and three an MsC, MA or MPH. The conclusion from the report is that bioeffects are clearly established to occur with very low exposure levels (non-thermal levels) to electromagnetic fields and radiofrequency radiation exposures. In the eight years since the BioInitiative 2012 Report was posted there has been a substantial amount 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 ELF-EMF/Static Fields and RFR at levels allowable under current public safety limits poses health risks.

The Bioinitiative Report 2012 (updated 2020)

Many biological effects of RFR known about even in the 1970s:

This document records over 2300 references on the biological responses to radio frequency and microwave radiation published up to April 1972. It lists around 140 biological responses to microwave radiation, including anxiety, poor concentration, depression, headaches, insomnia, restlessness, seizures, decreased fertility, altered foetal development, changes in oxidative processes.

Zorach R Glaser PhD, 1972 US Naval Medical Research Institute (NMRI) report

EUROPAEM EMF Guideline 2016 for the prevention, diagnosis and treatment of EMF-related health problems and illnesses

This seminal report states that "**there is strong evidence** that long-term exposure to certain EMF's is a risk factor for such diseases as certain cancers, Alzheimer's disease and male infertility. Common EHS (electromagnetic hypersensitivity) symptoms include headaches, concentration difficulties, sleep problems, depression, lack of energy, fatigue and flu-like symptoms.

https://pubmed.ncbi.nlm.nih.gov/27454111/

Evidence for a connection between coronavirus disease-19 and exposure to radiofrequency radiation from wireless communications including 5G

This study is very comprehensive (1hr read), it is not citing 5G as the cause of CV19 symptoms. It correlates a very close match in symptomology between chronic RFR exposure and CV19 and recognises that the Triad of disease conditions includes environmental factors as well as personal terrain and pathogenic markers.

It is quite clear that RFR toxicity would exacerbate vulnerability to other acute toxins and allergens.

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8580522/

**Low intensity microwave radiation induced oxidative stress, inflammatory response and DNA damage in rat brain*

A significant increase in levels of pro-inflammatory cytokines (IL-2, IL-6, TNF-α, and IFN-γ) was observed in microwave exposed animals. The study also suggests that low intensity microwave radiation induces oxidative stress, inflammatory response and DNA damage in brain by exerting a frequency dependent effect. The study also indicates that increased oxidative stress and inflammatory response might be the factors involved in DNA damage following low intensity microwave exposure.

https://pubmed.ncbi.nlm.nih.gov/26511840/

2.0 ISSUES WITH 5G

The roll out of 5G should be halted – the precautionary principle is justified given current science and epidemiological data

This essay identifies four relevant sources of scientific uncertainty and concern, including the almost total lack (as yet) of high quality epidemiological studies of adverse human health effects from 5G EMF exposure, but epidemiological evidence of such effects from past generations of RF-EMF is becoming better understood.

Prof Frank J W (physician-epidemiologist, University of Edinburgh) Electromagnetic fields, 5G and health: what about the precautionary principle? Oct 2020

What is the radiation before 5G?

A correlation study between measurements in situ and in real time and epidemiological indicators in Vallecas, Madrid. People who are exposed to higher radiation values present more severe headaches, dizziness and nightmares. Moreover, they sleep fewer hours. Exposure of the general population to electromagnetic radiation emitted by mobile phone base stations is one of the greater concerns of residents affected by the proximity of these structures due to the possible relationship between radiated levels and health indicators.

Lopez https://pubmed.ncbi.nlm.nih.gov/33434609/

Many biological systems are affected by RFR, including 5G; this is being ignored by flawed processes of assessment.

This explores the existing research on the health risks posed by 5G. It demonstrates that the overwhelming body of scientific evidence on RFR appears to have been ignored by relevant government departments and agencies in arriving at decisions about the introduction of 5G. This is due to over-reliance on the International Commission on Non-Ionizing Radiation Protection (ICNIRP), an NGO whose members have traditionally had close ties to industry.

Prof Tom Butler – Submission on 5G for the Action Against 5G Judicial Review Case 2020

Potential toxicity of 5G in the real world is not adequately considered by the regulatory bodies and governments.

Identifies adverse effects of wireless radiation reported in the premier biomedical literature. It emphasizes that most of the lab experiments conducted to date are not designed to identify the more severe adverse effects reflective of the real-life operating environment in which wireless radiation systems operate. Many experiments do not include pulsing and modulation of the carrier signal and the vast majority do not account for synergistic adverse effects of other toxic stimuli (such as chemical and biological) acting in concert with the wireless radiation. This article also presents evidence that the newly emerging 5G mobile networking technology will affect not only the skin and eyes, as commonly believed, but will have adverse effects as well.

Kostoff et al. Adverse health effects of 5G mobile networking technology under real-life conditions Toxicology Letters, Volume 323, 2020, Pages 35-40

The scale of increase of exposure to RFR radiation with 5G, via a new millimetre wave beam formed technology, potentially has serious health implications.

After considering the science and safety guidelines of 2G, 3G, 4G. It questions whether adding high frequency 5G radiation to the complex mix of lower frequencies is advisable. It addresses the synergistic toxic effects. Precaution is strongly indicated.

Cindy L Russell. 5G wireless telecommunications expansion:Public health and environmental implications. Environmental Research. April 2018. Environmental Research. 2018.

Despite the ubiquity of RF radiation and the rush to roll out 5G, health effects are still under investigation, especially in relation to 5G, which has been little investigated. It's clear that RF-EMF causes health effects. Preliminary observations show that 5G millimetre waves increase skin temperature, alter gene expression, promote cellular proliferation and synthesis of proteins linked with oxidative stress, inflammatory and metabolic processes, could damage the eyes and affect neuro-muscular dynamics. Further studies are needed.

Di Ciaula, Towards 5G communication systems: Are there health implications? Int J Hyg Environ Health. 2018

3.0 HEALTH ISSUES FOR PEOPLE IN CLOSE PROXIMITY TO PHONE MASTS

Epidemiological evidence for a health risk from mobile phone base stations

The study identified 10 epidemiological studies that assessed for putative health effects of mobile phone base stations. 8 of the 10 studies reported increased prevalence of adverse neurobehavioral symptoms or cancer in populations living at distances < 500 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.

Khurana et al 2010 https://pubmed.ncbi.nlm.nih.gov/20662418/

**Mortality by neoplasia and cellular telephone base stations in the Belo Horizonte municipality, Minas Gerais state, Brazil*

Between 1996 and 2006, 7191 deaths by neoplasia occurred and within an area of 500 m from the base station, the mortality rate was 34.76 per 10,000 inhabitants. Outside of this area, a decrease in the number of deaths by neoplasia occurred. There were high rates of prostate, breast, lung, kidney and liver cancer among the victims living closest to masts.

Dode et al. 2011 https://pubmed.ncbi.nlm.nih.gov/21741680/

There is enough medical and scientific evidence for liability of telecoms companies to be an issue

As use of mobile phones increases, both the density of base stations and their power output is expected to increase the global human RFR exposure. Although direct causation of negative human health effects from RFR from cellular phone base stations has not been finalized, there is already enough medical and scientific evidence to warrant long-term liability concerns for companies deploying cellular phone towers.

Pearce, J 2019 Limiting liability with positioning to minimize negative health effects of cellular phone towers

**Association of Exposure to Radio-Frequency Electromagnetic Field Radiation (RF-EMFR) Generated by Mobile Phone Base Stations with Glycated Hemoglobin (HbA1c) and Risk of Type 2 Diabetes Mellitus*

The mean HbA1c for the students who were exposed to high RF-EMFR was significantly higher than the mean HbA1c for the students who were exposed to low RF-EMFR. Moreover, 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 low RF-EMFR.

Meo, Almutawa, Almubarak, Hasanato 2015 https://pubmed.ncbi.nlm.nih.gov/26580639/

Residents living under rooftop antennas suffer illnesses which improve when antennas are removed.

This Japanese study showed statistically significant adverse health effects from electromagnetic radiation from mobile phone antennas. 107 out of 122 residents of a building with cell phone antennas on the rooftop for 11 years were medically examined before and after the antennas were removed. *(The residents had no prior knowledge about possible effects.)* In several cases, significant effects on the inhabitants' health could be proven. The health of these inhabitants was shown to improve after the removal of the antennas, and the researchers could identify no other factors that could explain this health improvement.

Shiniyo et al. Significant Decrease of Clinical Symptoms after Mobile Phone Base Station Removal –An Intervention Study 2014

Research shows headaches in people living near mobile phone masts at radiation levels well below PHE/ICNIRP safety standards

A cross-sectional study of 365 randomly selected inhabitants living in urban and rural areas for more than one year near to 10 selected base stations. Total HF-EMF and exposure related to mobile telecommunication were far below recommended levels. Distance from antennae was 24-600 m in the rural area and 20-250 m in the urban area. Despite the influence of confounding variables, including fear of adverse effects from exposure to the base stations, there was a significant relation of some symptoms, especially for headaches.

Hutter et al Subjective symptoms, sleeping problems, and cognitive performance in subjects living near mobile phone base stations 2006

Residents living near mobile phone masts report poor concentration, stress and headaches.

This Swiss survey study reported that out of 429 questionnaires returned, 394 people reported symptoms from mobile phone tower exposure. 58% percent of these symptomatic people suffered headaches, 19% nervous stress, and 18% fatigue, while concentration difficulties were the most common complaint.

Röösli Symptoms of ill health ascribed to electromagnetic field exposure--a questionnaire survey 2004

Research conducted on people living near masts show increase in headaches, sleep problems, depression, memory loss, irritability, concentration, discomfort, headaches, dizziness, tremors, blurred vision, nausea, lack of appetite, circulatory complaints

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 < 300m.

Santini et al. Investigation on the health of people living near mobile telephone relay stations: Incidence according to distance and sex 2002

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.

Abdel-Rassoul et al Neurobehavioral effects among inhabitants around mobile phone base stations 2007

This study (involving a questionnaire survey) confirmed that residents living close to mobile phone masts reported “Various complaints mostly of the circulatory system, but also of sleep disturbances, irritability, depression, blurred vision, concentration difficulties, nausea, lack of appetite, headache and vertigo. The study shows relationships between the incidence of individual symptoms, the level of exposure, and the distance between a residential area and a base station. This association was observed both in persons who linked their complaints with the presence of the base station and those who did not notice such a relation.”

Bortkiewicz et al. Subjective symptoms reported by people living in the vicinity of cellular phone base stations: review 2004

Increased risk of cancer has been observed near mobile phone masts

This study, commissioned by the German Federal Agency for Radiation Protection, compiled medical histories between 1994–2004 of people living in Naila, Bavaria. The study found a threefold increase in malignant tumours for people exposed for five years or more to cell phone masts within 400 metres, compared with people living further away.

Eger et al. The Influence of Being Physically Near to a Cell PhoneTransmission Mast on the Incidence of Cancer 2004

A pilot study was conducted in Hennen, Germany, to investigate the cancer incidence adjacent to a mobile phone base station. The authors concluded that a statistically significant increase of cancer incidence was observed 5 years after the base station had started operating.

Eger H, Neppe F., Incidence of cancer adjacent to a mobile telephone basis station in Westfalia 2009

A Tel Aviv University study of 622 people living in Netanya, Israel, revealed an overall fourfold increase in the incidence of cancer among residents living within 350 metres of a cell phone mast for a period of between three and seven years.

Wolf and Wolf Increased Incidence of Cancer Near a Cell-phone Transmitter Station 2004

**Exposure to non-ionizing electromagnetic fields emitted from mobile phones induced DNA damage in human ear canal hair follicle cells*

Akdag, Canturk, Dasdag 2018 https://pubmed.ncbi.nlm.nih.gov/29667447/

**Exposure to global system for mobile communication (GSM) cellular phone radiofrequency alters gene expression, proliferation, and morphology of human skin fibroblasts*

Pacini, Gulisano, Aterini 2002 https://pubmed.ncbi.nlm.nih.gov/12201670/

4.0 MAST PROXIMITY CONSEQUENCES ESPECIALLY FOR CHILDREN

Mobile Phone Base Station Tower Settings Adjacent to School Buildings: Impact on Students' Cognitive Health

Evidence of harm to children and teens living close to mobile phone masts includes higher exposure to cell tower RFR was associated with delayed fine and gross motor skills, spatial working memory, and attention among adolescents compared to students exposed to lower levels of cell tower RFR. (13-16 years of age)

Meo et al 2019 https://pubmed.ncbi.nlm.nih.gov/30526242/

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Meo, Almutawa, Almubarak, Hasanato 2015 https://pubmed.ncbi.nlm.nih.gov/26580639/

5.0 CHILDREN & RFR

Children are more vulnerable to RFR radiation

Children's health is at risk from everyday wireless digital technologies. Why? The past 15 years witnessed the proliferation of near-field microwave non-ionizing Radio Frequency Radiation (RFR) devices in the home, school and society. However, near field RFR from WiFi access points (AP) and routers, and at a wider level far-field, 2G - 5G cellular telecommunications antennae, also pose significant risks, as existing scientific research indicates.

Prof Tom Butler, On the Clear Evidence of the Risks to Children From Non-Ionizing Radio-frequency Radiation

Children absorb more MWR than adults because their brain tissues are more absorbent, their skulls are thinner and their relative size is smaller. The foetus is particularly vulnerable to MWR. Responsible governments are passing laws and/or issuing warnings about children's use of wireless devices

Morgan et al, Why children absorb more microwave radiation than adults: The consequences 2014

Growing evidence to concern us about the threats of RFR on children

Children are involuntarily exposed to various kind of non-ionizing radiation in their daily lives and are more sensitive to the effects. It is not easy to conduct a study investigating the effects of EMFs on a foetus or child due to ethical issues. Hence, the studies are usually performed on virtual models or animals. Although the results are conflicting and cannot be totally matched with humans; there is growing evidence to distress us about the threats of EMF on children.

Sangun et al The Effects of Electromagnetic Field on the Endocrine System in Children and Adolescents 2015

Exposure in utero to high levels of RFR associated with increased risk of ADHD

Consistent with the emerging literature, this study suggests that in utero exposure to high levels of RF nonionizing radiation was associated with an increased risk of ADHD, especially ADHD with immune-related comorbidity. The findings should spur more research to examine the biological association of in utero MF exposure with risk of ADHD in offspring, given that almost everyone is exposed to it.

De-Kun Li et al Association Between Maternal Exposure to Magnetic Field Nonionizing Radiation During Pregnancy and Risk of Attention-Deficit/Hyperactivity Disorder in Offspring in a Longitudinal Birth Cohorthttps://pubmed.ncbi.nlm.nih.gov/32207831/ 2020

6.0 FERTILITY AND RFR

Fertility rates have been falling at an alarming rate in western countries, causing huge concern, and there is good evidence that RFR is a significant factor in contributing to this.

Around 14% of couples in high- and middle-income countries have difficulty conceiving, and there are unexplained declines in semen quality reported in several countries. We conclude that pooled results from in vitro and in vivo studies suggest that mobile phone exposure negatively affects sperm quality."

Adams et al Effect of mobile telephones on sperm quality: a systematic review and meta-analysis 2014
Houston, B.J., et al. "The effects of radiofrequency electromagnetic radiation on sperm function." 2016

Documented impacts of RF-EMR on the male reproductive system include decreased sperm motility, elevated levels of reactive oxygen species, increased DNA damage, and decreased antioxidant levels.

Houston, B.J., et al. "The effects of radiofrequency electromagnetic radiation on sperm function." 2016

This review covered various health effects of RFR, including reproductive health. Several studies reported a link between cell phone use and changes in sperm count, motility, normal morphology and viability. Two studies on foetal and neonatal cardiac output and heart rate following exposure to RFR noted significant changes.

Singh et al Effect of radiofrequency radiation on reproductive health 2018

An alarming aspect of RFR radiation is the research showing detrimental effects to fertility

The results show that the reproductive capacity decreases almost linearly with increasing exposure duration to both GSM 900 and DCS 1800 radiation, suggesting that short-term exposures to these radiations have cumulative effects on living organisms.

Panagopoulos et al The effect of exposure duration on the biological activity of mobile telephony radiation (reproductive capacity of the insect Drosophila melanogaster) 2010

**Radiation and male fertility*

From currently available studies it is clear that radiofrequency electromagnetic fields (RF-EMF) have deleterious effects on sperm parameters (like sperm count, morphology, motility), affects the role of kinases in cellular metabolism and the endocrine system, and produces genotoxicity, genomic instability and oxidative stress.

Kesari https://pubmed.ncbi.nlm.nih.gov/30445985/

7.0 NERVOUS SYSTEM AND RFR

RFR can adversely affect nerve cells

The neuronal effects of 835 MHz RF-EMF on the cerebral cortex of the mouse brain at 4.0 W/kg for 5 hours/day for 12 weeks included induction of autophagy genes, production of proteins, accumulation of autolysosome, demyelination in cortical neurons and hyperactivity-like behaviour.

Kim, Ju Hwan, et al. "Long-term exposure to 835 MHz RF-EMF induces hyperactivity, autophagy and demyelination in the cortical neurons of mice." , 2017

RFR can reduce total pyramidal cell number in the brain

It was found that 900 megahertz of electromagnetic field significantly reduced the total pyramidal cell number in the hippocampus of subjects in the electromagnetic field group ($P < 0.001$).

Bas, O., et al. "Chronic prenatal exposure to the 900 megahertz electromagnetic field induces pyramidal cell loss in the hippocampus of newborn rats." 2009

Decline in cognitive function with exposure to RFR

Rats exposed to low-intensity microwave radiation showed declined cognitive function, elevated HSP70 level, and DNA damage within the brain, compared to control animals.

Deshmukh, Pravin Suryakantrao, et al. "Cognitive impairment and neurogenotoxic effects in rats exposed to low-intensity microwave radiation." 2015

RFR may adversely affect memory

Results demonstrate that exposure to 900 MHz EMF radiation for 28 days can significantly impair spatial memory and damage blood brain barrier permeability in rats by activating the mkp-1/ERK pathway.

Tang, Jun, et al. "Exposure to 900MHz electromagnetic fields activates the mkp-1/ERK pathway and causes blood-brain barrier damage and cognitive impairment in rats." 2015

RFR could play a role in autism spectrum behaviours

Authors document how behaviours in autism spectrum conditions may emerge from alterations of electrophysiological oscillatory synchronization, how EMF/RFR could contribute to these by de-tuning the organism, and policy implications of these vulnerabilities.

Herbert, Martha R., and Cindy Sage. "Autism and EMF? Plausibility of a pathophysiological link part II." 2013

8.0 CANCER AND RFR

An increased risk of certain tumours with mobile phone use – researchers call for upgrade of RFR from a Group 2b possible human carcinogen to a Group 1 known carcinogen

This review demonstrates an increased risk of brain, vestibular nerve and salivary gland tumours associated with mobile phone use. The conclusion of the researchers was that, based on the evidence reviewed, IARC's current categorization of RFR as a possible human carcinogen (Group 2B) should be upgraded to Carcinogenic to Humans (Group 1).

Anthony B. Miller, L. Lloyd Morgan, Iris Udasin and Devra Lee Davis. "Cancer Epidemiology Update, following the 2011 IARC Evaluation of Radiofrequency Electromagnetic Fields (Monograph 102)" Environmental Research, 2011

Clear evidence of tumours – malignant schwannomas and gliomas - in the hearts of male rats from near-field RFR (eg mobile phones)

The very important findings of the 10 year $30 million NTP studies found that high exposure to RFR used by cell phones was associated with:

1) Clear evidence of tumours in the hearts of male rats. The tumours were malignant schwannomas.
2) Some evidence of tumours in the brains of male rats. The tumours were malignant gliomas.
3) Some evidence of tumours in the adrenal glands of male rats. The tumours were benign, malignant, or complex combined pheochromocytoma.

National Toxicology Program (NTP) Carcinogenesis Studies of Cell Phone Radiofrequency Radiation, Final Reports 2018

The prestigious Ramazzini Institute findings, of tumours in rats exposed to far-field RFR (ie from masts), support the findings of the NTP study

"Our findings of cancerous tumours 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 tumours 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"

Belpoggi et al. (Ramazzini Institute), "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" 2018

Meningioma and glioma in the temporal lobe can be considered to be caused by cumulative RF exposure

When considered vis a vis deductive public health principles, the combined evidence from epidemiology and laboratory studies indicates that meningioma and glioma in the temporal lobe can be considered to be caused by cumulative RF radiation exposure. Experimental

findings that RF increases production of reactive oxygen species suggest a potential mechanism.

Carlberg, Michael and Hardell, Lennart "Evaluation of Mobile Phone and Cordless Phone Use and Glioma Risk Using the Bradford Hill Viewpoints from 1965 on Association or Causation." 2017

Tumours in lungs and liver, and lymphomas, elevated by exposure to RFR

Numbers of tumours of the lungs and livers in exposed animals were significantly higher than in sham-exposed controls. In addition, lymphomas were also found to be significantly elevated by exposure.

Lerchl, Alexander, et al. "Tumor promotion by exposure to radiofrequency electromagnetic fields below exposure limits for humans." 2015

9.0 ECOLOGICAL ISSUES AND RFR

How Green is 5G ?

All encompassing article by Sally Beare bringing attention to the tremendous environmental impact of unrestrained Telco rollout and operation. This conflicts with ALL stated sustainable objectives.

https://envirotecmagazine.com/2021/11/08/how-green-is-5g/

EMF could have a serious impact on the vitality of insect populations.

The review found that despite low levels of exposure to transmitters, harmful effects occurred after several months. Field strengths 100 times below the ICNIRP limits could already have effects. Against the background of the rapid decline of insects and the further expansion of high-frequency electromagnetic field sources, there is an urgent need for further research

Thill https://ehtrust.org/wp-content/uploads/Thill_Review_Insects_2020_Engl.pdf 2020

RFR disrupts insect and bird orientation - UK guidelines do not set safety limits for wildlife

Radio frequency fields in the MHz range disrupt insect and bird orientation. Radio frequency noise interferes with the primary process of magnetoreception. Further research in this area is urgent.

Balmori. "Anthropogenic radiofrequency electromagnetic fields as an emerging threatto wildlife orientation." Science of The Total Environment, vol. 518–519, 2015, pp. 58–60

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

The biodiversity of insects is threatened worldwide. Numerous studies have reported the serious decline in insects that has occurred in recent decades. The same is happening with the important group of pollinators, with an essential utility for pollination of crops. The extent that anthropogenic electromagnetic radiation represents a significant threat to insect pollinators is unresolved and plausible. For these reasons, and taking into account the benefits they provide to nature and humankind, the precautionary principle should be applied before any new deployment (such 5G) is considered.

Balmori 2021 https://www.sciencedirect.com/science/article/abs/pii/S0048969720384461

Significant effects to birds, insects, bees and other vertebrates are seen in scientific research

65% of 113 published studies (50% of the animal studies and about 75% of the plant studies) RF-EMF had a significant effect on birds, insects, other vertebrates, other organisms and plants. The review paper cites development and reproduction in birds and insects as the most strongly affected endpoints.

Cucurachi, C., et al. "A review of the ecological effects of radiofrequency electromagnetic fields (RF-EMF)." Environment International, vol. 51, 2013, pp. 116–40

DNA damage at low exposures seen in birds and other wildlife

This memorandum concludes that: "an increasing body of published lab research finds DNA damage at low intensity exposures - well below levels of thermal heating - which may be comparable to far field exposures from cell antennas. This body of work would apply to all species, including migratory birds"

Manville, A, former U.S. Fish and Wildlife Service agency lead on avian-structural impacts, "A BRIEFING MEMORANDUM: What We Know, Can Infer, and Don't Yet Know about Impacts from Thermal and Non-thermal Non-ionizing Radiation to Birds and Other Wildlife"

89.9% of studies on the effect of RFR on plants show effects

This analysis of 45 peer-reviewed scientific publications (1996-2016) on changes in plants due to the non-thermal RF-EMF effects from mobile phone radiation demonstrates that the data from a substantial amount of the studies show physiological and/or morphological effects (89.9%, $p < 0.001$).

Halgamuge, Weak radiofrequency radiation exposure from mobile phone radiation on plants 2020

Increases in absorbed power between 3% and 370% in insects when exposed to 2 GHz to 120 GHz frequencies

This is the first study to investigate how insects (including the Western honeybee) absorb the higher frequencies (2 GHz to 120 GHz) to be used in the 4G/5G rollout. The scientific simulations showed increases in absorbed power between 3% to 370% when the insects were exposed to the frequencies. Researchers concluded, "This could lead to changes in insect behaviour, physiology, and morphology over time…."

Thielens et al., "Exposure of Insects to Radio-Frequency Electromagnetic Fields from 2 to 120 GHz" Scientific Reports volume 8, Article number: 3924 (2018)

Frogs: adverse health effects on eggs and tadpoles when exposed to RFR

This study exposed eggs and tadpoles to electromagnetic radiation from cell phone antennas for two months, from the egg phase until an advanced phase of tadpole and found low coordination of movements, an asynchronous growth, resulting in both big and small tadpoles, and a high mortality rate. The authors conclude, "these results indicate that radiation emitted by phone masts in a real situation may affect the development and may cause an increase in mortality of exposed tadpoles."

Balmori, A Mobile phone mast effects on common frog (Rana temporaria) tadpoles 2010

Trees sustain significantly more damage on the side of the tree facing the antenna

A field monitoring study spanning 9 years involving over 100 trees found trees sustained significantly more damage on the side of the tree facing the antenna, leaving the entire tree system prone to degradation over time.

Waldmann-Selsam et al, Radiofrequency radiation injures trees around mobile phone base stations2016

Trees: ambient RF levels adversely affect aspen seedlings

This study on aspen seedlings found ambient RF levels in a Colorado setting were high enough to cause necrotic lesions on the leaves, decrease leader length and leaf area, and suppress fall anthocyanin production. These effects suggest that exposure to the RF background may be an underlying factor in the recent rapid decline of aspen populations. Further studies are underway to test this hypothesis in a more rigorous way."

Haggarty, Adverse Influence of Radio Frequency Background on Trembling Aspen Seedlings: Preliminary Observations 2010

**Radiofrequency radiation injures trees around mobile phone base stations*

Statistical analysis demonstrated that electromagnetic radiation from mobile phone masts is harmful for trees. These results are consistent with the fact that damage afflicted on trees by mobile phone towers usually start on one side, extending to the whole tree over time.

https://www.sciencedirect.com/science/article/abs/pii/S0048969716317375

10.0 ISSUES WITH REGULATORY BODIES

Serious implications arising from differences in protection standards for ionising and non-ionising radiation are being raised by members IRPA, ICNIRP's parent organisation.

Although IARC (International Agency for Research on Cancer) has classified EMF as a possible carcinogen, the main reference organisation (ICNIRP) adopts a policy re non-ionising radiation that is closer to promotion than to protection. In contrast to ionising radiation protection policy, ICNIRP does not recommend the use of dose constraints. This policy means that the public is not adequately protected or even informed.

https://www.youtube.com/watch?v=-Oqct4yuLa0
"Protection Against Ionising Radiation vis-à-vis Protection Against Non-Ionising Radiation" Jan 16th 2021

https://www2.irpa.net/members/IRPA13-abstract-USB-FINAL.pdf 2012 (Page 187)

ICNIRP – ethical breaches are leading to significant health risks for the population

An important new draft study from top Irish analyst Professor Tom Butler providing a historical analysis of wireless radiation safety guidelines and tracing the serious ethical breaches in the development of safety standards since the 1950s, the consequence of which is a significant risk to the health and wellbeing of adults and children.

Wireless Technologies and the Risk of Adverse Health Effects in Society: A Retrospective Ethical Risk Analysis of Health and Safety Guidelines (Environmental Health Trust article leading to a report by Prof Tom Butler)

ICNIRP accused of 'playing with the truth'

A troubling report by two MEPs about ICNIRP, the powerful NGO based in Germany which issues the RFR guidelines for the UK and much of the world. They argue that ICNIRP has vested interests, plays with the truth and that EU and authorities close their eyes to scientific facts and early warnings.

Buchner K and Rivasi M https://klaus-buchner.eu/wp-content/uploads/2020/06/ICNIRP-report-FINAL-JUNE-2020.pdf 2020

AGNIR report accused of conflicts of interest, omission, inaccuracies and misleading statements

The Advisory Group on Non-ionising Radiation (AGNIR) 2012 report forms the basis of official advice on the safety of radiofrequency (RF) electromagnetic fields in the UK and has been relied upon by health protection agencies around the world. This review by Dr Sarah Starkey describes incorrect and misleading statements, omissions and conflict of interest, which do not reflect the scientific evidence available and make the report unsuitable for health risk assessment.

Starkey, S Inaccurate official assessment of radiofrequency safety by the Advisory Group on Non-ionising Radiation 2016

WHO Core EMF Group compromised – strong links to industry-loyal ICNIRP

In 2014 the WHO launched a draft of a Monograph on RF fields and health. Five of the six members of the Core Group in charge of the draft were affiliated with the International

Commission on Non-Ionising Radiation Protection (ICNIRP), an industry loyal NGO, and thus had a serious conflict of interest. Like the ICNIRP, the monograph dismisses non-thermal bio effects of RFR. Despite criticism the WHO has refused to change the makeup of the group.

Hardell, L World Health Organization, radiofrequency radiation and health - a hard nut to crack (Review 2017)

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*In 2010 University of Washington professor **Henry Lai** analysed **326 cellphone radiation studies**. He found that **72%** of industry-funded studies found no biological effect from cellphone radiation exposure — but that of the studies not funded by industry, **only 33%** found no biological effect.

https://www.pbs.org/newshour/science/what-you-need-to-know-about-the-new-study-on-cellphones-and-cancer

*In 2020 he updated his report and found that of **1000** studies on the adverse effects from chronic exposure to RFR.

- Neurological effects were reported in 75%
- Genetic effects reported in 65%
- Oxidative damage in **91%**

https://bioinitiative.org/wp-content/uploads/2020/10/13-Neurological-Effects-Studies-Percent-Comparison-2020.pdf