

Why Australia Should Not Allow Mobile Phone Base Stations and Similar Radiofrequency Transmitters near Schools, Homes and Other Sensitive Locations

A report presenting a fraction of the scientific evidence of potential adverse health effects from long-term exposure, in support of the objection by the P&C Association of Castle Hill High School to the Telstra mobile phone base station (MPBS) next to the school on Castle Hill RSL Club, proposed to soon be co-hosting Optus and Vodafone.

An appeal to the state and federal governments of Australia to legislate the NSW Department of Education & Communities (DEC) guideline of 500 m clearance from a school for telecommunications towers a mandatory requirement

This report was prepared in 2013 and updated in November 2016

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Abbreviations used

MPBS	mobile phone base station
EMR	electromagnetic radiation
MW/RF	microwave/radiofrequency
ARPANSA	Australian Radiation Protection and Nuclear Safety Agency
ICNIRP	International Commission on Non-Ionizing Radiation Protection
WHO	World Health Organization

1. Introduction

Mobile phone base stations (MPBS) emit microwave electromagnetic radiation (MW-EMR) - high frequency and high energy radiofrequency or RF-EMR, a man-made environmental pollutant that has rapidly increased in human exposure over the last few decades due to mobile and wireless communication and surveillance technologies.

There is a strong body of scientific evidence showing a wide range of biological effects and health effects induced by currently permitted so-called “low levels” of RF-EMR. Based on credible evidence on cancer alone, RF-EMR has been classified as a Class 2B possible human carcinogen (cancer causing agent) by the World Health Organization’s (WHO) International Agency for Research on Cancer (IARC). This classification was made by a panel of 30 international experts including Australia’s renowned physician epidemiologist Prof. Bruce Armstrong who evaluated the scientific evidence from several hundred studies ([IARC monographs](#) volume 102 of 2013).

It appears that the scientific uncertainty about long-term health risks outlined in the Australian government commissioned 1994 CSIRO report prompted the NSW Department of Education to introduce a precautionary guideline of 500m clearance from schools for transmitters in 1997. Although the scientific evidence of biological and health effects increased rapidly in quantity and quality since, there has been no action on the part of state and federal governments to prevent telecommunication companies ignoring this important guideline. There has been countless public protests against MPBS near sensitive locations such as homes and children’s facilities in Australia (<http://www.notowersnearschools.com/>), but they have not been heard.

2. Warnings from credible scientific bodies

Many health bodies overseas recommend the Precautionary Principle in general and Prudent Avoidance with regards to children and RF-EMR due to potential health risks. Over 220 international scientists have made a special appeal to the WHO and the UN for urgent measures to protect public health from wireless radiation (<https://emfscientist.org/>).

The American Academy of Pediatrics cautioned against “the potential dangers of RF energy exposure” on children in 2012 stating “*Children are disproportionately affected by environmental exposures, including cell phone radiation. The differences in bone density and the amount of fluid in a child’s brain compared to an adult’s brain could allow children to absorb greater quantities of RF energy deeper into their brains than adults*”. AAP has stated that “*The current exposure limits may not reflect the latest research on RF energy*”.

The American Academy of Environmental Medicine in 2009 urged for precautionary actions and recommended banning cell phone use by children and keeping microwave towers away from schools. In 2013, the AAEM reaffirmed its concerns about RF-EMR health effects and recommended only wired internet (no WiFi) in schools:
<https://www.aaemonline.org/pdf/WiredSchools.pdf>

In May 2016, at the annual meeting of the Pediatric Academic Societies in the USA, a session was held titled **“Wireless and Children: Why and How to Protect Infants, Toddlers, and Young Children from Avoidable Exposures to Wireless Transmitting Devices”**. Leading scientists including senior clinicians from Yale and Harvard gave warnings on the risk to children and the foetuses from mobile phone and other wireless transmitting device. See the [Press Conference](#) on this event. Listen to [Prof. Hugh Taylor](#), chair of reproductive medicine at Yale whose research team found evidence linking RF-EMR exposure and neuro-behavioural disorders such as ADHD.

The European Academy for Environmental Medicine (EUROPAEM) in its [2016 guidelines](#) for treatment of EMR-related illnesses states: *“Studies, empirical observations, and patient reports clearly indicate interactions between EMF exposure and health problems. Individual susceptibility and environmental factors are frequently neglected. New wireless technologies and applications have been introduced without any certainty about their health effects, raising new challenges for medicine and society.”*

It further states: *“On the one hand, there is strong evidence that long-term exposure to certain EMFs is a risk factor for diseases such as certain cancers, Alzheimer’s disease, and male infertility. On the other hand, the emerging electromagnetic hypersensitivity (EHS) is more and more recognized by health authorities, disability administrators and case workers, politicians, as well*

The California Medical Association (CMA) adopted a resolution ([Resolution 107- 14](#)) in December 2014 on mobile and wireless safety titled: Wireless Communications Public Safety Standards Re-evaluation. It states *“CMA understands that existing public safety limits for microwave EMF devices are outdated and inadequate to protect public health thus endorses efforts of the Federal Communications Commission to re-evaluate its safety standards to include consideration of adverse non thermal biologic and health effects from non-ionizing electromagnetic radiation used in wireless communications”* Note that the American public safety limits (exposure standards) are the same as Australian.

The [Vienna Medical Association](#) has issued new warnings on mobile & wireless radiation the English translation of which can be found [here](#). They have advised against wireless device use by children under 16 years of age, and in general for minimization of wireless use for anyone (by using safer wired connections).

Dr. Annie Sasco MD has been with the WHO for 22 years, and has served as its Chief of Epidemiology for Cancer Prevention and Acting Chief of the Cancer Control program. Dr. Sasco’s comments on mobile and wireless devices: *“As a physician and epidemiologist with decades of experience working with the World Health Organization, I am deeply concerned with what the data are showing. We have to take precautions with these devices now – especially to protect our children”*. She co-authored a [recent publication](#) that demands upgrading the current IARC cancer classification.

A group of German medical doctors in the Bamberg Doctor's Report (signed by 175 doctors) appealed to the government of Bavaria in 2005 for urgent measures to protect public health from RF-EMR from MPBS and internal sources. Their investigation of 356 patients and their home RF-EMR exposure levels revealed a striking association of symptoms people commonly suffered from with their EMR exposure levels ([English translation](#)).

Therefore, outright dismissal of public safety concerns should not happen.

We have seen some governments responding to the evidence of harm. For example, it is now illegal in France to market mobile phones to children or have wireless devices like WiFi in small children's facilities. Israeli [Ministry of Health](#) has cautioned on limiting mobile phone and other wireless device usage. This year, the National Committee on Environment and Children's Health of Cyprus released [this 5min video](#) aimed at reducing children's exposure to wireless radiation, and the message is very clear about the adverse health effects.

There is a clear need to take action to protect our Australian children from this environmental pollutant now scientifically demonstrated to be toxic to humans, animals and plants. It is appalling that telecommunication providers are allowed to completely ignore a large body of scientific evidence of interference with biological processes risking public health. This is a matter requiring urgent attention of politicians and health authorities of Australia.

3. Current regulation of public exposure with ARPANSA standard is flawed

The existing public exposure standards (RPS3) of the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) are based on the 1998 guidelines of the International Commission on Non-Ionizing Radiation Protection (ICNIRP), a professional body of 14 self-appointed individuals aligned with industry interests as per statements even made in [the European Parliament](#).

The ICNIRP guidelines and Australia's RPS3 standards have **ONLY** taken into account **short-term thermal (heating) effects, and as such, they cannot protect against long-term effects or non-thermal effects (without tissue heating)**. This is a fact clearly stated by credible scientific bodies such as the [Environmental Protection Agency](#) of USA and the [National Toxicology Program of USA](#), despite the false assurances of safety against all effects by proponents of wireless technology. In fact, this is what a US Air Force medical intelligence report states about nonthermal effects that our ARPANSA is completely denying:

suggests that the human body may be more sensitive to the nonthermal effects of RF/MW radiation [3].

(Radiofrequency Microwave Radiation Biological Effects and Safety Standards: A Review. US Air Force Materiel Command, New York, 1994. Page 2).

Sir (Prof) William Stewart, the former Chairman of the Health Protection Agency UK who led the UK government's inquiry into EMR health effects (Stewart Commission 2000) was outspoken against mobile masts (MPBS) near schools. In [a BBC TV interview](#) he clearly recommend the

precautionary approach and even stated that he thinks that the ICNIRP and WHO International EMF Project are wrong to say there are no health effects. Following industry complaints, the BBC later retracted this program though some parts are still available on YouTube. Unfortunately, similar censorship took place in Australia recently against the ABC Catalyst program titled “WiFried?” that investigated scientific evidence of adverse effects microwave RF-EMR following industry complaints.

A wide range of non-thermal biological effects of microwave RF-EMR, occurring at levels well below our current public exposure standards have been established in scientific research. These biological effects include potentially very serious effects such as genotoxicity (DNA damage) that can lead to cancer. The long-term health consequences have not been studied enough, but some studies clearly show harm. The BioInitiative Report 2012 by an international panel of scientists and clinicians is available free on the web (www.bioinitiative.org) is the most extensive compilation of the peer-reviewed scientific evidence.

ARPANSA has failed to employ appropriately qualified multi-disciplinary experts, particularly those with medical and biological sciences expertise. It is intriguing to find that only four individuals have been assigned the task of [evaluating the health effects research](#) and their academic qualifications were limited to physical sciences, psychology and epidemiology. It is questionable how this extremely small panel lacking the vitally important medical and biological sciences expertise could assess the health risks of RF-EMR. Such improper handling could jeopardise the health of the entire Australian population. It is disturbing that when Australians are reported to be suffering from microwave irradiation from wireless towers, their claims are rejected by so-called experts without the appropriate scientific or medical qualifications, [as in this example](#), by Professor Rodney Croft, a psychologist (qualified to study the mind) who heads Australia’s RF biological effects research despite not being a qualified biological scientist. This ABC report falsely claims that “*Professor Rodney Croft's research shows wi-fi does not affect human health*” when no such assurances can be given by his limited studies that found RF-EMR exposure changed brain waves (natural electrical activity of the brain). The apparent conflict of interest affecting Australian research and public exposure regulation are addressed later in this document.

4. Telstra MPBS has highly increased the microwave RF-EMR levels at the Castle Hill High school and the proposed upgrade will make the levels unacceptably hazardous

Prior to the erection of the Telstra MPBS, the ambient RF-EMR levels at the school were low even with an excellent mobile reception. The Telstra mast drastically changed the microwave RF-EMR landscape at the school as per periodic measurements undertaken by the P&C.

The increase in microwave RF-EMR exposure at the school (as per power flux density measured) has been 83,333 times so far, and will be 653,333 times higher after the proposed installation as per [industry information](#) for site 2154020 .

Whilst the increase so far against the school’s vehement objection is risky, the proposed increase is a potential health hazard which would be illegal in many parts of the world.

Extremely low RF-EMR levels well below $0.000001 \mu\text{W}/\text{cm}^2$ are capable of maintaining mobile coverage. In Salzburg, Austria with the most stringent standards ($0.1 \mu\text{W}/\text{cm}^2$) that are aimed to prevent serious biological effects rather than thermal effects, in line with the recommended exposure standard adopted in by the [European Parliament resolution 1815](#) of 2011, even the current level at CHHS would not be permitted. The proposed level exceeds the current exposure standards (thresholds) in several countries (Switzerland, Russia, China, Italy, Hungary, Bulgaria for example), although Australia (similar to USA, UK, Canada, NZ) allows 450 and 900 $\mu\text{W}/\text{cm}^2$ for the 700 and 1800 MHz frequencies used at this MPBS. Such wide variation of allowable limits in different parts of the world clearly indicates that there is no scientific consensus on safety regulation of RF-EMR.

RF-EMR levels at CHHS	Before Telstra MPBS	Current	Proposed Optus & Vodafone addition	Max in Salzburg	Max in Switzerland
Electric field (V/m)	0.01	3.10	8.67	0.60	5.00
Exposure level (power density $\mu\text{W}/\text{cm}^2$)	0.00003	2.5	19.9	0.10	6.60

Direct communication was made with the Swiss Federal Office for the Environment and verification has been received from the Department of the Environment, Transport, Energy and Communication (DETEC) that the proposed RF-EMR levels for CHHS would not be permitted in Switzerland. Direct communications were also made with the Department of Public Health, Government of Land Salzburg, Austria and a number of eminent scientists and public health physicians with direct research experience in EMR health effects. They all supported the school’s campaign to reduce RF-EMR exposure at the school and several letters of support are supplied separately.

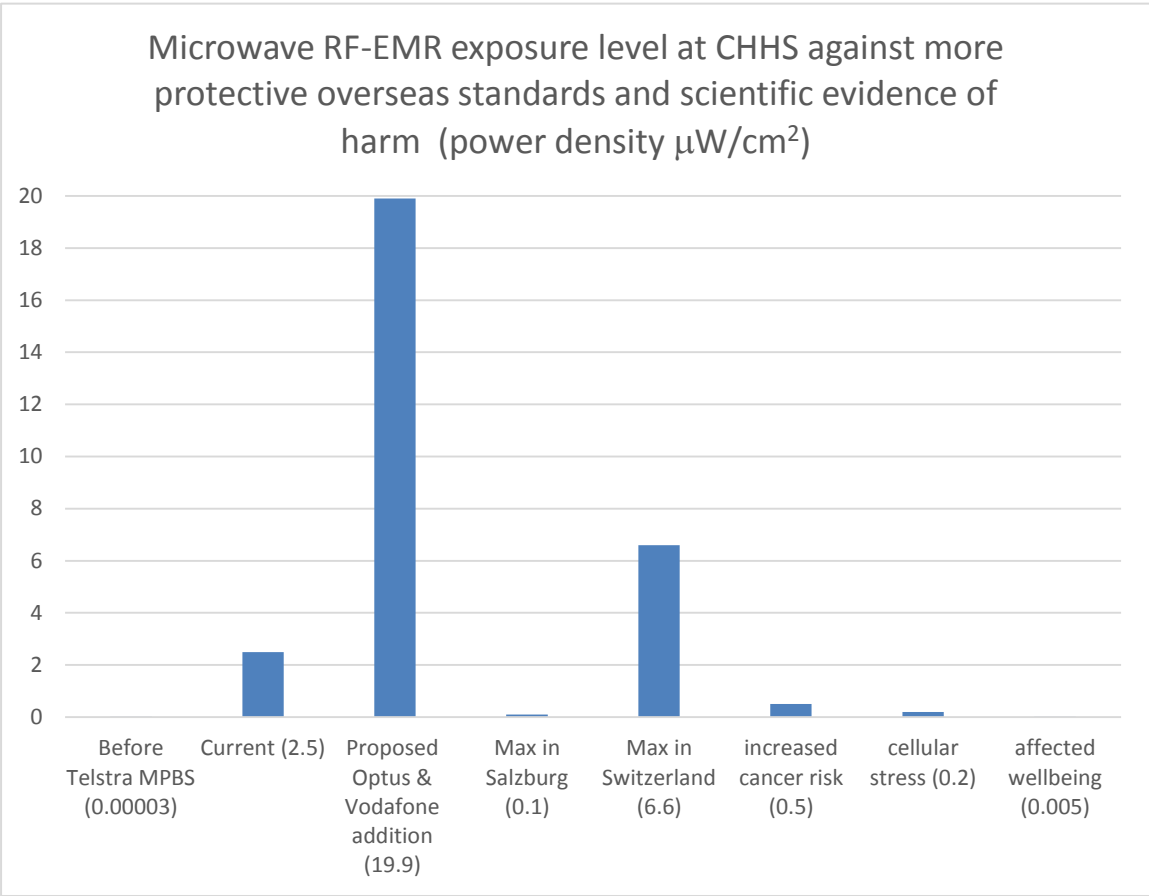
When the microwave RF-EMR levels at CHHS are compared with available scientific studies that found adverse health effects, even the current levels clearly indicate a health risk. Comparison with adverse health effects reported in a few peer-reviewed studies are illustrated in the graph on next page (Augner et al., 2010; Hutter et al., 2006; Ha et al., 2007; Wolf and Wolf 2004; Navarro et al 2003 – details and links in Sections 5 and 8). A list of human and animal studies showing significant biological and health effects demonstrated to occur at below proposed RF-EMR levels at CHHS (extracted from a compilation by Prof. Henry Lai at Washington University which is included in Appendix). This is only a minuscule amount of the existing scientific evidence because studies with exposure level determined as the Specific Absorption Rate (SAR) have been excluded for ease of reference. Only studies with exposure level indicated as the strength of the electrical field or power density have been included for easy comparison with the levels at CHHS tabulated above.

Research on microwave RF-EMR began in the 1940s, primarily within the military following anecdotal observations of people exposed to RF-EMR through radar systems and medical diathermy equipment suffering from unusually high levels of adverse health effects, including

cancer ([Cook H.J. et al.](#), Annals of Science, 1980. 37(3): p. 323-51). The [WHO held an international conference](#) titled “Biologic Effects and Health Hazards of Microwave Radiation” in 1973 and it is clear that health authorities were well aware of the hazardous nature of RF-EME exposure because detailed studies were available even that time. In 2004, there was another [WHO symposium held in 2004](#) to discuss the condition termed electro-hypersensitivity experienced by some people who associate their symptoms to EMR exposure. Dr. Bruce Hocking, former long-serving Chief Medical Officer of Telecom/Telstra presented clear evidence of neurological effects induced by mobile phone use suffered by people he investigated at this international workshop.

The knowledge on biological and health effects has grown rapidly with advances in scientific research over the last couple of decades, particularly with high-tech molecular biology techniques. The scientific evidence of effects at low level exposures comes from all three areas of research:

- Cell culture studies – human and animal cells grown in culture (*in vitro* studies)
- Animal studies – live lab animals (*in vivo* studies)
- Epidemiologic studies – study of human populations



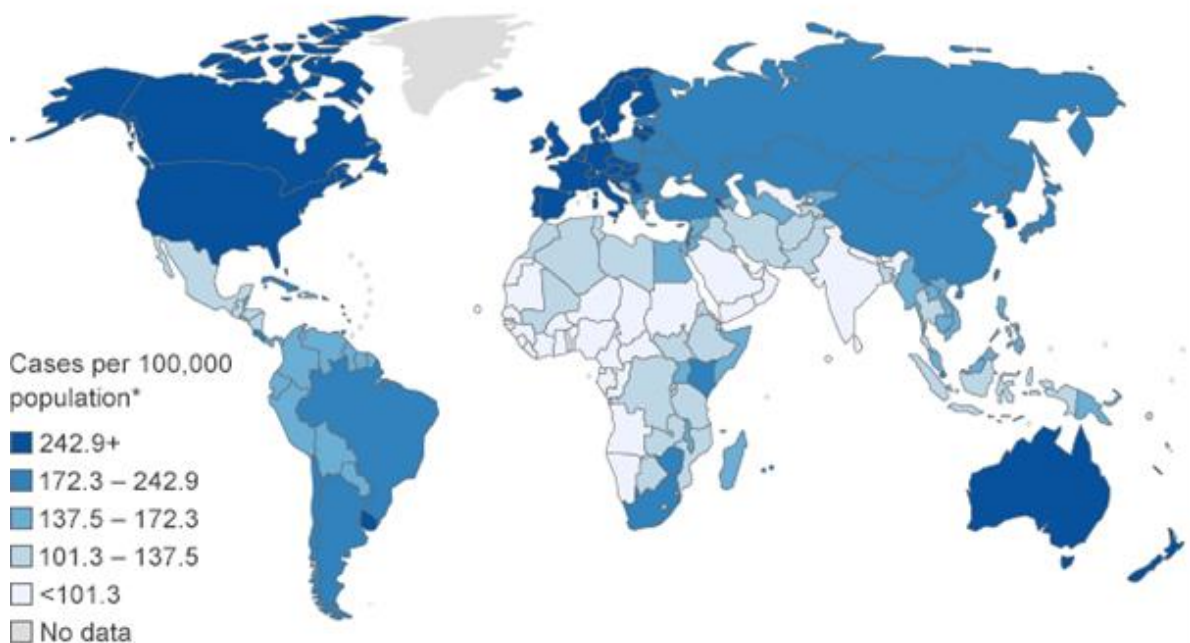
5. Human population studies on cancer around MPBS and other RF-EMR transmitters.

Cancer is a major health concern and incidence rate (rate of new cases diagnosed per 100,000 people) is rising in Australia similar to most parts of the world. In fact, the WHO admits that there is a [tidal wave](#) of cancer coming up globally, with underdeveloped parts of the world traditionally low in cancer prevalence showing rapid increases. It is clear that these increases follow as societies become more Westernised and industrialised. According to data from the Australian Institute for Health and Welfare (AIHW), some cancers have shown large increases in incidence rates. These include thyroid (known to be very sensitive to radiation), prostate, testicular and breast cancers. AIHW still has not released Australia's latest cancer data (after 2012).

As clearly seen in the figure below, Western industrialized countries are the cancer hot-spots of the world. Australia has world's second highest cancer incidence rate (new diagnosis rate) which proves that our country has a very poor control over causes of cancer. Many studies indicate that these causes are largely environmental, not internal genetic causes. It should be noted that environmental toxic damage to DNA would invariably lead to more genetic mutations leading to more "genetic causes" of diseases like cancer. It is unfortunate that most of our cancer funds are going towards diagnosis and therapies rather than prevention.

Western-style industrialized societies are the cancer hot-spots of the world

World cancer cases 2012



*All cancers except non-melanoma skin cancer

Source: WHO GloboCan

<http://globocan.iarc.fr/Pages/Map.aspx>

The scientific literature contains several studies that examined cancer rates around RF-EMR transmitters

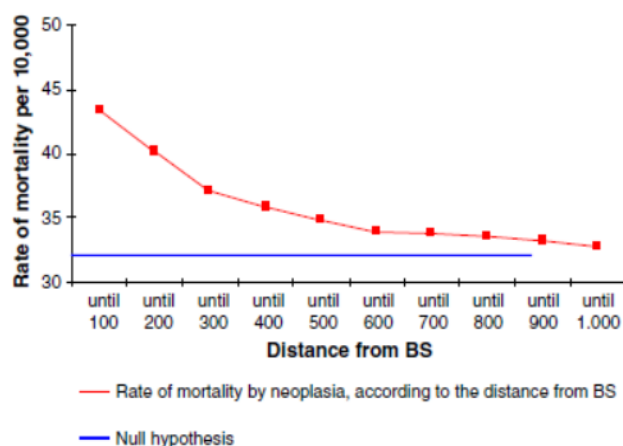
5.1 Increased Cancer near mobile phone base stations (MPBS)

Six out of eight studies that investigated cancer in populations have found increased cancer risk near MPBS in this review.

- I. A German study undertaken by independent GPs in Naila investigating nearly 1000 newly diagnosed cancer cases during 1994-2004 found cancer risk to be increased by three times if patients lived within 400 m of the city's MPBS compared to the outer area, after five years of its operation. In addition, those who lived within 400m of the MPBS developed cancer at a younger age – by an average 8.5 years. The average age of females in inner area who developed breast cancer was 50.8 y as opposed to 69.9 y in the outer area – nearly 20 years younger. The German national average age for breast cancer at the time was 63 y. ([Eger et al.](#), Umwelt Medizin Gesellschaft 2004;17(4) 1-7).
- II. An Israeli study conducted by independent clinicians in Netanya on 622 people who had lived close to a MPBS compared with a second cohort of 1222 people from a nearby area as well as the wider population in Netanya city. The control group individuals were matched including for environment, workplace and occupational characteristics. The study found a more than a 4-fold increase in the overall cancer risk, notably increased breast cancer within 350m of MPBS (emitting 850 MHz microwaves) compared to the wider population. An increase in cancer risk was associated with an RF-EMR exposure level even less than 0.5 $\mu\text{W}/\text{cm}^2$ at homes ([Wolf R. and Wolf D.](#), International Journal of Cancer Prevention 2004; 1(2):123-128).
- III. A German study assessed cancer rates in Bavarian municipalities with different levels of MPBS coverage between 2002-2003. They classified 48 small municipalities into three exposure groups: 1) no base station coverage (the distance of all base stations was more than 400 m to the municipality area, or the operating time of the base station was less than 5 years) ; 2) moderate base station coverage (operating time at least 8 years and at least 15 % of the municipality area was in the distance of 400m or less to the next base station or, the operating time lasted 5 to 7 years and at least 30 % of the municipality area in the distance of 400m or less to the next base station); 3). low base station coverage (municipalities that could not be assigned to the above two categories). This study did not find a statistically significant difference in cancer rates in the grouped municipalities. Their complex exposure categorisation without any scientific basis, instead of a simple 400m radius employed in the Naila study may have prevented an effect being seen (type 2 statistical error of failing to identify an existing effect or a false negative). For example, inclusion of people living very close to MPBS up to five years in the “no base station coverage” group, essentially labelling exposures up to five years as “no exposure”, effects could have been masked. Moreover, it seems disingenuous to exclude Naila that had previously reported an increased cancer rate near its MPBS (Meyer M. et al., Umweltmed Forsch Prax. 2006;11:89-97).

Above peer-reviewed and published studies are discussed by Australian neurosurgeon [Dr. Vini Khurana](#) (ANU/Canberra Hospital) in Int. Journal of Occupational and Environmental Health 2010; 16: 263-277.

- IV. A pilot scale study was conducted to monitor a residential population (627 participants) living within 400m of a MPBS in Hennen in Westfalia, Germany following the findings in Naila. The MPBS started operating in 1999, and the researchers compared the cancer incidences over two periods (1 Jan 2000 – 31 Dec 2004 and 1 Jan 2005 – 30 Jun 2007) and compared to the wider population in the region according to the Cancer Registry Saarland. The observed cancer incidence was compared to the expected cancer incidence. They observed 9 cancer cases in the first five-year period (2000 – 2004) and 14 cases in the second 2.5 year period. The mean age of disease onset was 59.2 years in the first period and 59.3 years in the second period in comparison to the expected value of 66.4 years evaluated from the Saarland Cancer Registry. There was a statistically significant increase of cancer incidence 5 years after the base station started operating (Eger H and Neppe F., Umwelt Medizin Gesellschaft 2009; 22 (1): 55-60).
- V. A study in Sandwell, West Midlands done by academic health researchers at Staffordshire University UK focused on a single street near a mobile phone base station where residents complained of a cancer cluster (19 cancers). They found significantly higher death rate from cancer on this street compared to the West Midlands wider population and this was particularly higher for females ([Stewart A et al.](#), Perspectives in Public Health, 2012;132(6):299-304).
- VI. A large study with a long observation period (1996-2006) in Brazil found a marked increase in cancer death rate near 300+ MPBS. University academics and local government authorities studied 7191 cancer deaths. As the below graph shows, it took a good 1 km for the observed cancer death rate to come down to the expected cancer death rate. Based on their findings, the investigators claimed current ICNIRP public exposure standards not protective and urged immediate changes. The EMR levels varied between 0.4 – 12.4 V/m ($4.2 \times 10^{-4} - 0.4 \text{ W/m}^2$) in this study, only a small fraction of the allowed levels by the ICNIRP standards. The city prosecutor took legal action against some mobile operators following this study. ([Dode A.C. et al.](#), Science of the Total Environment 2011; 409:3649–3665).



If the mobile phone base stations had no association on cancer deaths, the researchers expected the flat blue line (null hypothesis), but what they saw was a highly increased cancer death rates near MPBS.

- VII. A large case-control study was conducted by public health researchers at National Cheng Kung University in Taiwan investigating if there was an association between cancer in children and their RF-EMR exposure. A total of 2606 children with cancer (939 leukaemia and 394 brain cancer cases) treated between 2003 -2007 were included with 78,180 controls – 30 control children of the same age for each cancer patient. RF-EMR emission levels from 71,185 MPBS in operation between 1998-2007 were used for the study as Annual Summarized Power (ASP, in watt-year). For each of the 367 townships under study, Annual Power Density (APD in watt-year/km²) was computed as a ratio of the total ASP of all MPBS in that township to the area of it. RF-EMR exposure of each test cancer case (or control) was calculated as average APD for 5 years before the diagnosis. Data analysis showed that a higher than median averaged APD (approximately 168 WYs/km²) was significantly associated with an increased risk for all cancers. i.e. in townships with higher than 168 WYs/km² there was a significantly increased risk of childhood cancer. This is a well conducted study that well estimated residential exposure and also allowed a reasonable duration of exposure which should be taken into serious consideration by health researchers and policy makers. ([Li C.Y. et. al.](#), Science of the Total Environ 2012; 435-436:472-8).
- VIII. A British study sponsored by UK's Mobile Telecommunications and Health Research (MTHR) program (with industry funding involved) investigated if distance to a MPBS from the residential address provided by the mother during pregnancy was significantly associated with cancer in children aged 0-4 years. 1397 cases from national cancer registry (diagnosed between 1999 to 2001) and 5588 birth controls (matched for sex and date of birth) were included. The researchers claimed no association and this large study has been widely used by the proponents of wireless technology as evidence of safety of MPBS ([Elliott P et al.](#), BMJ. 2010;340:c3077 doi: 10.1136/bmj.c3077). However, factors in the study design such as excluding microcell MPBS, common in cities exposing people to more RF-EMR than macrocells due to lower height and closer proximity, choosing a 700 m distance from base stations for exposure modelling may have prevented identifying effects that may exist closer to the MPBS (failing to identify an existing effect introducing a type 2 error). Their claim *"power density at ground level typically peaks at a distance of 200-500 m from the base station and then falls off rapidly with distance"* to justify their 700 m selection, fails to do that. It is questionable why they did not take 500 m as the cut off which would be justified by the above claim. 500 m would have been also closer to the 350 m or 400 m distances identified by previous studies as important cut off to see effects on cancer (Wolf & Wolf; Eger et al., respectively). This British study also only presented mean distance from the nearest MPBS which was 1107m (SD 1131 m) for cancer cases Vs. 1073 m (SD 1130 m) for controls. The large standard deviations show highly variable data. There is no data presented on vital information such as how many cases were included from, say within 400 m from MPBS, which is a critical distance as per power density variation from MPBS and also found in other studies presented above. Further, the address provided by the mother to the health service during pregnancy does not necessarily relate to the child's residential address, let alone RF-EMR exposure. Many factors could have resulted in a false negative outcome and it

is therefore imprudent to rely on this study – the lack of scientific merit also detailed by [UK Powerwatch](#). Moreover, their claim of peak power at a distance of 200-500 m referring to two publications from the year 2000, is not correct for modern Australian MPBS for which project peak power density at ground usually 100 -250 m away. Older style taller towers had longer spans of the microwave beam due to higher elevation but modern ones closer to ground are different. In the case of the Castle [Hill RSL MPBS](#) objected by CHHS, the peak power density (current 7.21, proposed 19.9 $\mu\text{W}/\text{cm}^2$) is at 110.48 m away, exactly at the school at 0-7 m from the ground. There is a large drop after 300m from the MPBS (current 1.37, proposed 3.9 $\mu\text{W}/\text{cm}^2$) and 400 m (current 0.7, proposed 2.2 $\mu\text{W}/\text{cm}^2$). Levels at 700m is not even provided due to the rapid fall after 500 m. The fact that only 11% of the proposed peak levels at CHHS would be at 400-500m away, clearly justifies the DEC NSW requested clearance of 500m.

So, six out of eight studies reported increased cancer rates near Mobile Phone Base Stations, methodological errors may have prevented such observations in the other two!

Absence of evidence is not evidence of absence, but presence of evidence is evidence.

It should be noted that a study not finding evidence of harm does not mean that evidence does not exist. However, on the contrary, when the evidence is found that really exists. There should be stronger emphasis on the positive findings than negative findings.

In a fine example of this very important point, the researchers at the National Institutes of Health, USA investigated occupational exposure of various chemicals, ionizing radiation and RF-EMR in 33,509 breast cancer cases and 117,794 controls. They did not find a statistically significant association between breast cancer and most of the occupational exposures they investigated, some of which are well-established carcinogens. Interestingly, the exposure to RF-EMR showed a similar risk to ionizing radiation (both showing a weak positive association which failed to reach statistical significance). Exposure to ionizing radiation is a well-established cancer cause. Despite not seeing an effect, these researchers were prudent to admit the possibility of not being able to find an effect due to limitations in the methodology of their study: *“If a link truly exists with one or more of the factors that we evaluated, the association might easily have been missed. We therefore do not place much emphasis on our negative findings”* (Cantor K.P. et al., J Occupational and Environmental Medicine 1995;37(3):336-48).

On the contrary, we have found that the proponents of mobile and wireless technology who are imposing RF-EMR on us and our children against our wish, always emphasise on negative findings. This has been the approach of the representatives of Telstra whom we have had

meetings with previously – blatantly ignoring the positive studies and over-emphasizing the negative.

5.2 Increased cancer around radio/TV/radar transmitters that emit RF-EMR

- I. The only Australian population study on RF-EMR and cancer focused on cancer incidence and mortality rates between 1972-1990 with relation to three TV transmitters in North Sydney. The researchers compared this “inner area” with a 12 km radius from the towers as the exposed area against the outer local government areas. This landmark study investigating 1206 leukaemia cases and 740 brain cancer cases found a statistically significant association between both leukaemia incidence (diagnosis) rate as well as death rate and proximity to the transmission towers. In particular, childhood leukaemia risk was increased in the inner area: rate ratio was 1.58 (95% CI, 1.07-2.34) for incidence and 2.32 (95% CI, 1.35-4.01) for mortality, indicating approximately 2-fold increase. RF-EMR TV signals under study were composed of 100 kW video amplitude modulated (AM) and 10 kW audio frequency modulated (FM) signals, on carrier frequencies ranged from 63 to 215 MHz. The calculated power density ranged from 8.0 $\mu\text{W}/\text{cm}^2$ near the towers to 0.2 $\mu\text{W}/\text{cm}^2$ at 4 km away (radius from tower) and 0.02 $\mu\text{W}/\text{cm}^2$ at 12 km (TV towers transmit with much higher power compared to MPBS, hence a substantially longer spread of RF-EMR). ([Hocking et al.](#), Medical Journal of Australia 1996;165(11-12):601-5). The lead researcher of this study is former Chief Medical Officer of Telecom/Telstra Dr. Bruce Hocking who was allegedly made redundant following his pursuits to properly investigate adverse health effects of mobile phone radiation of staff (according to the report “*Hear No Evil: Mobile phones and health effects*” by Garry Linnell in the Good Weekend, in the Age and The Sydney Morning Herald, 16 December 2000). Attempts have been made to discredit this study. Ray McKenzie (Australian Mobile Telephone Association, AMTA) et. al., re-analysed the original data and published another paper ([Aust N Z J Public Health](#). 1998;22(3 Suppl):360-7), after separating data from the Lane Cove local government area (LGA) with the strongest effect . Exclusion of a data set from one LGA with high incidence of cancer *post hoc* when there is no other known explanation to the higher cancer rate is a very poor scientific approach and should have been rejected by the reviewers of the journal. The original researchers objected to this baffling reanalysis in a rebuttal ([Aust N Z J Public Health](#). 1999;23(1):104-5.). It is possible, that this geographic area could possibly be receiving more RF-EMR exposure from the transmitters under investigation due to differences in the terrain. Further, the subsequent re-analysis included new LGAs as control groups which may have been influenced by RF-EMR from other sources such as radar towers. This second analysis appears to have been done to dilute the previously observed positive effect on cancer. In our own experience, Mr. Michael Bangay, a technical specialist rather than a health specialist, brought to Castle Hill Scouts Hall on 1 Aug 2013 by Telstra to counter our claims of adverse health effects tried to discredit Dr. Hocking’s study claiming that the increased cancer in Lower North Sydney was because cancer patients had moved close to the Royal North Shore hospital (RNSH) for

treatment. Two facts clearly refute his claim: 1. existence of an increase in the incidence (diagnosis) rate as well as an increase in the death rate (patients would not move to the area anticipating treatment before diagnosis!), and 2. indication that most children were treated at separate children's hospitals away from the area as there was no paediatric oncology service at RNSH.

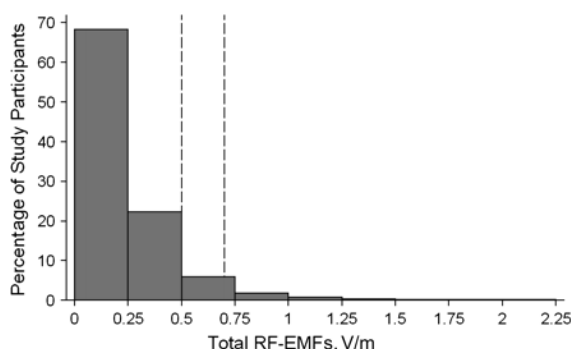
- II. Another study by British academic public health researchers that investigated an alleged cancer cluster around Sutton Coldfield TV and FM radio station in West Midlands found an increased risk of leukaemia and skin cancer near the tower. Cancer incidence between 1974-1986 was investigated in an area defined by a 10 km radius from the tower, with 10 bands assigned with increasing distance defined for testing for a decline in risk with distance, and an inner circular area of a 2 km radius. The significantly elevated risk of adult leukaemia within 2 km (1.83, 95% CI: 1.22-2.74) was further supported by a dose-response effect suggested by a significant decline in risk with distance from the transmitter ($p = 0.001$). The findings were consistent over the periods 1974-1980, 1981-1986, and appeared to be independent of the initially reported cancer cluster which was a later concern. This indicates that increased cancer risk around this RF-EMR transmitter had been there for a long time. In addition to leukaemia, there was a similar distance-dependent significantly increased risk of skin cancer and bladder cancer ([Dolk et al.](#), American Journal of Epidemiology 1997;145(1):1-9).
- III. An extension study conducted by researchers of the above study collectively looking at 20 radio and TV transmitters and found similar statistically significant effects of increased risk of cancer near transmitters, but a little diluted compared to the original study. It appears that the authors tried to distance from their original findings possibly under pressure to dismiss public concerns ([Dolk et al.](#), Am J Epidemiol, 1997;145(1):10-17).
- IV. A South Korean study conducted by academic researchers investigated cancer 42 AM radio transmission towers. They compared cancer incidence rates for 1993-5 within a 2 km radius of transmitters which they categorized as high power sites (100-1500 kW) and low-power sites (50 kW) and also had control areas further than 2 km from high power sites. They found increased incidence of total cancer (all different types together) and brain cancer in women near high power sites compared to the low power sites. Among the 11 high-power sites, there were significantly higher incidence rates of leukaemia in two areas and of brain cancer in one area ([Ha M. et al.](#), Archives of Environmental Health, 2003; 58(12) 756-62).
- V. Another academic study on cancer in relation to AM radio transmitters done in S. Korea found a significantly increased cancer mortality (death) rates for all cancers near transmitters. They also noticed a significantly increased cancer death rate from leukaemia for young people. Standardized mortality rate ratio (MRR) for the 0-14 years age group was 2.29 (95% CI = 1.05-5.98) and for the 15-29 years age group 2.44 (95% CI = 1.07-5.24) showing a 2.3 times and 2.4 times increase respectively within 2 km of the transmitters ([Park S.K. et al.](#), Int Arch Occup Environ Health. 2004;77(6):387-94).

- VI. A separate study on children's cancer was done in S. Korea with 1,928 leukemia patients, 956 brain cancer patients and 3,082 control children with respiratory disease (diagnosed in the same year as the cancer cases and matched for age and sex). The researchers used a computer-based program incorporating a geographic information system that was modified by the results of actual measurements to estimate RF-EMR exposure from 31 AM radio transmitters at each cases residential address. This study found a significantly increased leukaemia risk in children who live within 2 km of AM radio transmitters compared to those who lived more than 20 km away. Moreover, the risk of lymphocytic leukemia was associated with the estimated RF-EMR exposure but other cancers did not show such association. This increased risk of leukaemia was associated with exposure more than 6 $\mu\text{W}/\text{cm}^2$ which is much lower than what is proposed for CHHS ([Ha M. et al.](#), American Journal of Epidemiology, 2007; 166(3):270-279).
- VII. An Italian study by public health researchers at the Rome area health service investigated anecdotal complaints of people living close to the very powerful Vatican Radio transmitter located North of Rome. Data from 1987-1998 were used in a population within 10 km of the radio tower (population size 49,656 in 1991). They found more than doubled the risk of childhood leukemia within 6 km of this RF-EMR source. There was a significant decline in risk with increasing distance from the transmitter both for childhood leukemia and also for male mortality (death rate of men) indicating a dose-response relationship supporting a causal relationship ([Michelozzi P. et al.](#), American Journal of Epidemiology, 2002;155(12):1096-103).
- VIII. A study done by researchers at Hawaii State Department of Health investigated a cluster of childhood leukemia diagnosed between 1979 to 1990 in Waianae Coast. Risk of childhood leukemia near RF-EMR transmitters was found to be increased two-fold (100%) within 2.6 miles of radio transmitters. Although this study involved relatively a small number of individuals (12 cases, 48 matched controls), this was a thorough study investigating various parameters with full medical and family histories, X-ray exposure, occupation of parents, domestic smoking etc., making this a very reliable study. It is of particular interest because this was done at a time RF-EMR exposure from other sources was extremely low to non-existent (unlike today when people are exposed to RF-EMR transmitters of various personal devices) and residential exposure was very reliably from the radio transmitters. The same strength is in the Australian study by Hocking et al. discussed above ([Maskarinec G. et al.](#), Journal of Environmental Pathology Toxicology and Oncology, 1994;13(1):33-7).
- IX. A researcher study done at Karolinksa Institute, Sweden examined skin cancer (melanoma) data from four countries in (Sweden, Norway, Denmark and USA) in relation to FM radio broadcasting (RF-EMR source). This study found a correlation between melanoma incidence and the number of FM transmitters. It also showed that melanoma incidence is a function of the exposure time to FM broadcasting and a function of the number of active FM stations available at each location. The researchers concluded that melanoma is

associated with exposure to RF-EMR from FM broadcasting ([Hallberg O. and Johansson O.](#) Archives of Environ Health, 2002;57(1):32-40).

- X. A German study investigated childhood leukaemia (diagnosed between 1984 and 2003, studied between 2005-2007) in municipalities near several AM and FM radio transmitters. 1,959 cases and 5,848 controls aged under 15 years of age were analysed with an estimation of individual exposure to RF-EMFs one year before diagnosis made with a field strength prediction program (computer model). The authors did not report an association between childhood leukaemia and RF-EMR from radio transmitters. However, they found an increased risk of lymphoid leukaemia associated with AM transmitters (OR 1.56; 95% CI 0.77, 3.16) similar to the above Korean study by Ha et al. (OR 1.60; 95% CI 0.69, 3.72). This increase in the German study failed to meet statistical significance due to lower case numbers, unlike in the Korean study. When scrutinising the German data, they included only 25 cancer cases (0.3% of the study population of 7807 children) and 67 controls (0.9%) who had lived within 2 km of an AM or an FM transmitter. The Korean study had 36 leukaemia patients, 0.6% out of the study population living within 2 km of a transmitter. The 127 cases of children with leukaemia excluded from the analysis in the German study due to reported lack of information about residential address may have changed the final results of this analysis. With 95% of the study population having an estimation of exposure to 0.7 V/m or less (Fig. 2 below), their null finding on estimated residential exposure and leukaemia is hardly surprising. This study population did not have enough cases of high exposure to RF-EMR. To explain in simple terms, if you are to find association of cancer with cigarette smoking, you have to compare heavy smokers with no smokers. If you compare moderate smokers with low-level smokers, your study will not be able to find statistically significant effects due to dilution of effects (i.e. not being able to see an effect that really exists, a false null finding). **The RF-EMR fields used in this German study are much lower than typical exposures around Castle Hill CBD.** For example, the comparable electric field strength at CHHS increased from 0.011 V/m to over 3.1 V/m after the Telstra MPBS was installed. The proposed increase is a staggering 8.67 V/m (788 fold). Our measurements find that 1 – 6 V/m range is very common around MPBS and radio/TV transmitters and in public transport (concentration of personal EMR transmitters such as mobile phones in metal cages) around Sydney, and in fact, levels around 10 V/m are not too uncommon. In order to see effects, it is necessary to compare high exposures with low exposures. This German study appear to have falsely concluded on no effect, hence cannot be used to give assurances on health risks. Their conclusion is not surprising considering that the lead author is highly influential [Dr. Joachim Schuz](#), a prominent member of the “No Effect” campaign aligned with the ICNIRP, and headed the IARC’s section on the environment. It is intriguing that his 2008 publication claimed no conflict of interest only declaring funding from the Federal Office for Radiation Protection, Munich when Dr. Schuz had received [private funding](#) from the industry (Electric Power Research Institute) to “*study electromagnetic fields (EMF) and risk and survival of childhood leukemia*” from 2006 to

2012. He played a major part in the Danish Cohort Study and the Interphone study (both assessing mobile phone use and brain cancer) which are highly criticised for the methodical errors leading to false negative results (discussed in section 9).



Distribution of total radio frequency electromagnetic fields (RF-EMFs) in the study population, Germany, 1984–2003. Dashed lines: 90% quantile and 95% quantile

(Figure 2 of Merzenich H. et al., American Journal of Epidemiology 2008,15;168(10):1169-78).

- XI. A Swiss study investigating residential RF-EMR levels from broadcasting towers (estimated by computer modelling rather than taking measurements) over the period of 2000-2008 found mixed results between estimated exposure category and childhood cancer risk. Based on 997 cancer cases studied, adjusted hazard ratios (with in the time-to-event analysis for the highest exposure category (>0.2 V/m) as compared with the reference category (<0.05 V/m) were: for central nervous system (CNS) tumours 1.68 (95% CI: 0.98, 2.91); for all cancers 1.03 (95% confidence interval 0.74, 1.43) and for leukaemia 0.55 (95% CI: 0.26, 1.19). Although the researchers down-played the results, certainly the increased risk of CNS tumours (brain and spinal cord tumours) should not be ignored. There is a major problem with this study design that would dilute effects and mask positive effects: The “highest” exposure category is set too low! The value they chose; 0.2 V/m is too low as a cut-off to see an effect. Instead, this should have been made at least 1V/m. Therefore, this study assigning a cut-off of 0.2V/m is flawed methodology pushing the study towards not finding an effect, although even with that they found an effect on CNS tumours which is concerning (Hauri DD et al Am J Epidemiol. 2014 Apr 1;179(7):843-51. doi: 10.1093/aje/kwt442).

Above 11 peer-reviewed scientific studies on radio/TV transmitters and cancer, 10 out of which were clear positive findings, and the remaining also indicating a positive effect make 16 out of 18 above studies on fixed MW/RF-EMR transmitters positive for increased cancer risk. This evidence adds considerable scientific weight to the suspected causal link between RF-EMR transmitters and cancer. Though every study has limitations, such as lack of detail of actual exposures, lack of details on all other relevant factors (confounders such as dietary and lifestyle variations) and short follow-up periods, when separate multiple large human studies have found statistically significant associations between cancer and RF-EMR sources, and experimental evidence also prove that RF-EMR can cause cellular damage such as DNA damage, a causal link is likely and therefore precautionary approach must be taken.

5.3 Increased cancer in military personnel and civilians exposed to radars, another source of microwave RF-EMR.

Note: radar uses the same MW/RF carrier waves as WiFi (2.45 GHz) and our review of scientific literature has led the P&C to take measures to minimize exposure to RF-EMR from the school's WiFi system.

- US researchers found that counties with an Air Force Bases with radar towers have higher cancer rates than counties without radar facilities (Lester J.R. and Moore D.F., 1982: Journal of Bioelectricity, 1(1):77-82).
- In a separate study they found that there was more cancer in the population exposed to two airport radar towers in Kansas compared to the population that was shielded from the same towers by the hilly landscape (Lester J.R. and Moore D.F., 1982; Journal of Bioelectricity, 1(1):59-7)
- A study of over 40,000 US Navy personnel aboard ships in Korean war found an increased mortality rate (from all causes) and cancer rate in those who had exposure to RF-EMR from radar ([Robinette C.D. et al.](#), Effects upon health of occupational exposure to microwave radiation (radar),1980, American Journal of Epidemiology; 112(1): 39-53).
- [A US military medical intelligence report](#) states that an investigation completed by the WHO in 1976 found clear evidence of increased cancer and heart disease in a Finnish population exposed to a radar transmitter (Radiofrequency Microwave Radiation Biological Effects and Safety Standards: A Review. US Air Force Materiel Command, New York, 1994, page 8)

radar units adjacent to nearby Lake Ladoga. The operation of these units exposes the residents of North Karelia to large doses of ground and scatter radiation. The WHO investigation found evidence linking exposure of RF/MW radiation to cardiovascular disease and cancer. The North Karelian population suffered from an unusually high number of heart attacks and cases of cancer. In addition, it was found that the affliction rate of these diseases was much higher among residents living closest to the radar site [8].

Interestingly, the WHO did a dietary intervention program promoting fruit & vegetables in this region (full of antioxidants to counter cell damage by microwave radiation induced oxygen and nitrogen free radicals) and had some improvement in health statistics.

- [Israeli researchers found RF-EMR exposure from radar to be associated with cancers in young defence personnel](#) who had developed cancer in a relatively short periods of time ([Richter E et al.](#), 2000. International journal of occupational and environmental health; 6(3): 187-93).
- Another [large study](#) conducted at the Military Institute of Hygiene and Epidemiology in Poland that investigated radar-exposed military personnel between 1971-1985 found

significantly increased incidence of cancer – mostly gastrointestinal, brain cancers and leukaemias in exposed personnel aged 20-59 years of age ([Szmigielski S. et al.](#), Science of the Total Environment. 1996;180(1):9-17).

- A meticulously conducted [Canadian-French study](#) found a highly increased risk of lung cancer in electrical workers exposed to RF-EMR which had a clear dose related effect, but the financial sponsor (industry partner) prevented further study of this cohort. This study is particularly important because it involved wearable personal dosimeters that quantified exposure rather than estimating. Cancer risk increased with increasing exposure demonstrating a dose-dependent response which suggests the agent under investigation (RF-EMR) is likely to be the true cause of cancer (Armstrong B. et al., American Journal of Epidemiology.1994;140(9):805-20).
- [Dr. Samuel Milham MD](#), former head of epidemiology at Washington State Department of health studied causes of death among 67,829 amateur radio operators and reported an increased cancer mortality rate for acute myeloid leukemia and collectively for multiple myeloma and non-Hodgkin's lymphomas (Milham S., [Lancet](#). 1985 Apr 6;1(8432):812; [Am J Epidemiol](#). 1988 Jan;127(1):50-4. Further study showed mortality from these types of cancer to be associated with license class senior classes (with longer duration of exposure) having the highest risk ([Am J Epidemiol](#).1988;128(5):1175-6.).
- The late Prof. Neil Cherry ONZM, an EMR health effects researcher from Lincoln University, New Zealand has presented a substantial amount of [scientific evidence](#), giving dire warnings even at an [Australian senate inquiry in 2001](#), linking RF-EMR to cancer and other human diseases. This report on brain cancer linked to [police radar](#):

A recent meta-analysis of 56 peer-reviewed studies by academic health researchers in Israel has found a significantly increased cancer risk associated with long-term exposure to microwave RF-EMR. The researchers have called for review of exposure standards and reduction of children's exposure to RF-EMR ([Atzmon I et al.](#), International Journal of Cancer and Clinical Research, 2016, 3 (1):040)

Apart from above, we should also consider these Australian cancer clusters near RF-EMR transmitters:

- A breast cancer cluster amongst female staff at [ABC's Toowong studio](#) in Brisbane where the expert [investigation](#) despite confirming the 6-fold increase in risk in this group compared to Queensland female population, failed to find a cause. There are many gaps in this investigation that have been [questioned](#). RF-EMR could potentially be involved in this case as the levels even exceeded the current Australian standards at least at one location. "*The Panel noted that the highest strength electric field (121.3V/m) was at chest height in proximity to the external, security gate card reader and exceeded the ARPANSA time averaged and instantaneous reference levels for general public exposure. Exposure to this card reader, as compared with exposure to those at doors leading to the TV building and newsroom, however, would generally be infrequent and distant*" (page 21 of the expert panel report). It is questionable how this expert panel simply assumed the levels of RF-

EMR exceeding current ARPANSA exposure standards to be safe. Instead, they should have questioned the protective adequacy of the current ARPANSA standards and called for an ACMA investigation into non-compliance with the standards.

With this clear noncompliance revealed at the above ABC studio, how can the Australian public be assured that 18,000 MPBS planted amongst populations are even meeting the current standards when most of them are reported to be not even checked? (“In 13 years, only 99 mobile towers radiation tested” By Natasha Bita, Consumer editor, The Australian April 30, 2012).

- A [brain tumour cluster at Atherton Fire Station](#) where the rate of brain cancer among staff was 21 -62 times higher than for the general Queensland population. Again, the questionable [expert investigation](#) dismissed a link to the fire station only citing family history and ionizing radiation (such as X-ray) as causes of brain cancer. This investigation failed to do a proper scientific literature review on studies linking RF-EMR exposure and cancer.
- A brain tumour cluster in the top two floors of the Bourke Street building at the RMIT University in Melbourne with rooftop mobile base station installations. Five individuals were diagnosed with brain tumours within a month as reported in 2006 and two previously. Two of the seven tumours were malignant cancers. However, the expert investigation denying a possible link to RF-EMR exposure from MPBS is not convincing: “*Environmental assessments show no evidence of exposures at or above levels of concern for known or suspected occupational or environmental risk factors for brain cancer*”, the mobile phone industry refers to the [investigation](#). This suggests to us that they only checked for compliance with the current exposure standards (only protecting against short term thermal effects) and falsely concluded those levels were safe. This is disingenuous when the exposure standards themselves are deemed not protective enough because they are not based on non-thermal long-term effects. The RMIT cancer cluster report also claimed “*The diversity of tumour types indicates that there is no single cause. There is, therefore, no evidence for a work-related brain cancer or other cancer cluster on levels 16 and 17*”. This refers to a flawed opinion that unless the tumours are of identical tissue origin, they are irrelevant in relation to a suspected environmental carcinogen. Though some carcinogens may have tissue specific effects, it is not reliable to expect tissue specific action with every carcinogen, and certainly not with microwave RF-EMR that is absorbed by different tissues and demonstrated in animal experiments to increase cancers in many different body locations (details later in report). Considering the common cellular mechanisms of tumour initiation and promotion in any tissue type, this false assumption needs to be discarded. It seems common sense even to a high school student that if something causes tumours in one human tissue type, it could potentially cause the same effect in another.

Unusual breast cancers have been reported in young American women directly under the mobile phones stored inside bras and their clinicians are warning against the cancer risk from RF-EMR ([West J.G et al.](#), Case Reports in Medicine. 2013;2013:354682).

Cancer is a complex multi-step process often with long latency periods. Mesothelioma deaths in Australia are projected to peak in 2018 though asbestos was phased out since 1989 and fully banned by 2003. The fact that above-mentioned studies found increased risk of cancer or increased cancer death rates associated with proximity to mobile base stations within short periods of time is unexpected and very concerning indeed.

6. Affected hormone levels in people living near mobile base stations

One study appears to have investigated effects on hormones and found affected hormone levels in people living near a mobile base station. This Egyptian study checked people's hormone levels over a 6-year observation period. It found significant changes on ACTH, cortisol, thyroid hormones, prolactin, and testosterone levels indicating effects on the pituitary-adrenal axis (Eskander et al., *Clinical Biochemistry* 2012; 45:157-61).

7. Affected immune functions and neurological effects near RF-EMR transmitters

One study done in Italy conducted by academic researchers investigated the immune system of those exposed to long-term RF-EMR from broadcast towers. This was a long-term case-controlled study on a group of healthy young women. A range of immune markers were found to be significantly different in women with the higher RF-EMR exposures. Higher RF-EMR exposure group (with mean domestic fields $4.3 + 1.4$ V/m in the year 2000 and $3.7 + 1.3$ V/m in 2005) showed a statistically significant reduction the cytotoxic activity in peripheral blood compared to the control group of women in nearby area with mean less than 2.0 V/m. This effect in healthy young women could compromise their immune functions which could increase their risk of infectious diseases as well as cancer. This study accounted for age, smoking habits, atopy and social level. It should be noted that the control group in this study also had substantially high RF-EMR exposures that could potentially underestimate effects. This study also found high RF-EMR group to have increased anxiety further supporting the other studies that found increased neuro-behavioural effects near RF-EMR sources. (Boscolo, P., et al., *International Journal of Immunopathology Pharmacology*, 2006. 19(4 Suppl): p. 43-8).

8. Increased neuro-behavioural symptoms in people living near MPBS and other RF sources and impact on mental health

Twelve studies in 10 countries have investigated neuro-behavioural effects on people living near MPBS and all of them reported increased symptoms such as headaches, sleep disturbance, stress, dizziness, irritability, lethargy, impaired concentration, decreased cognitive performance close to MPBS.

These studies originating from different countries from peer-reviewed scientific journals are:

1. Navarro et al., *Electromag Biol Med* 2003; 22:161-169 (Spain).
2. Santini et al., *Electromag Biol Med*. 2003; 22:41-49 (France).
3. Gadzicka E et al, *Biuletyn PTZE Warszawa* 2006; 14:23-26 (Poland).
4. Hutter et al., *Occup Environ Med* 2006; 63:307-313 (Austria).

5. Abdel-Rassoul et al., *Neurotoxicology* 2007; 28:434-440 (Egypt).
6. Blettner et al., *Occup Environ Med* 2009; 66:118-123 (Germany).
7. Berg-Beckhoff et al., *Occup Environ Med* 2009; 66:124-130 (Germany).
8. Augner C, Hacker GW. *Indian J Occup Environ Med.* 2009; 13(3):141-145, (India).
9. Bortkiewicz et al., *Int J Occup Med Environ Health* 2012; 25(1):31-40 (Poland).
10. Shahbazi-Gahrouei et al., *Electromagn Biol Med* 2014;33(3):206-10 (Iran).
11. Gómez-Perretta C et al., *British Med J Open.* 2013; 3(12):1-7 (Spain).
12. Gandhi G et al., *Electromag Biol Med.* 2015;34(4):344-54 (India).

The 13th comparable study is a Japanese study done by independent medical professionals that found significant reduction of neurological symptoms in people near a MPBS after removal of it following nine years of operation from 1998 to 2009. This study was published in Germany in a peer-reviewed medical journal ([Shinryo, T. & Shinryo, A.](#) *Umwelt-Medizin-Gesellschaft*, 2014, 27(4), S. 294-301.

The 14th was done in Cyprus found a highly significant associations of neurological symptoms such as migraine, headache and dizziness with proximity (1-3 km) to MW/RF-EMR emitting military radar. However, even after observing that these symptoms to share a gradient with EMR exposure levels (a dose-response) the authors strangely concluded possible psychosomatic effect from antenna visibility (nocebo effect) or aircraft noise to be the possible cause of these symptoms rather than EMR exposure. They even suggested making antennas less conspicuous! ([Preece A.W. et al.](#), *Occup Environ Med* 2007;64:402–408)

The 15th is the above Italian study on women living near broadcasting towers having more anxiety disorders discussed in the previous section.

The 16th is a recent study undertaken in Spain investigated ambient RF-EMR levels near residential addresses (measured) and neuro-behavioural characteristics and cognitive functions of 10 year-old boys. There was clear evidence of harm with higher prevalence of emotional problems such as anxiety, obsessive compulsive disorder (OCD) and post-traumatic stress disorder (PTSD) while having lower scores for cognitive functions in children who lived at high RF-EMR surroundings near transmitter towers ([Calvente I. et al.](#), *Bioelectromagnetics* 2016;37(1):25-36).

A field study done in Austria biochemically assessed stress markers in saliva of people exposed to a real mobile phone base station (900 MHz RF-EMR). The researchers found that just a 50-minute exposure could induce significant measurable biochemical effects in some individuals, particularly when going from low exposure to high exposure. Such studies are very important because of the objective assessment of measurable biological markers, in this case alpha-amylase, immunoglobulin A (IgA), and cortisol, well-established biological stress markers. Intriguingly, the “High” exposure used in this study (0.2 $\mu\text{W}/\text{cm}^2$) where clear evidence of biological interference was observed, is well below the microwave RF-EMR levels already projected at the CHHS (2.5 $\mu\text{W}/\text{cm}^2$). The proposed levels for CHHS (19.9 $\mu\text{W}/\text{cm}^2$) is 99.5 times higher than the “High” exposure in this study ([Augner C. et al.](#), *Biomedical and Environmental Science.* 2010 Jun;23(3):199-207).

Some of these studies above have been done controlling well for many confounding factors, including potential nocebo effects from fear of the MPBS and they still found effects on wellbeing. For example, headaches, cold hands or feet, difficulties in concentrating, and to a lesser degree, tremor, loss of appetite, and feelings of exhaustion showed increased prevalence near MPBS and increased with residential RF-EMR levels ([Hutter HP. et al.](#), *Occup Environ Med* 2006; 63:307-313).

Above 16 peer-reviewed studies showing increased anxiety, stress and other neuro-behavioural problems around RF-EMR transmitters is clear evidence of harm.

Given that Australians are commonly suffering from neuro-behavioural problems and the mental health issues are affecting one in seven children as per [2015 data](#), above presented scientific evidence should be taken into immediate consideration by the health authorities and measures must be taken to reduce children’s exposure to RF-EMR. [Latest data](#) from the Australian Institute for Health & Welfare shows, as per the figure below, that mental health disorders (neuro-psychiatric and neuro-behavioural) are the leading cause of health burden on in young Australians. Anxiety disorders is the leading cause of health burden in females aged 5 – 44 years, followed by depressive disorder in those aged 15-44 years. Suicide and self-inflicted injuries is the leading cause of health burden in males aged 15-44 years. As suicide arises out of mental ill health, it is clear that Australian children, adolescents and young adults are mostly burdened with neuro-psychiatric/neuro-behavioural disorders.

Mental health problems of neuro-behavioural nature (purple boxes) are mainly affecting the young. It should be noted that suicide/self-inflicted injuries, despite in separate green boxes are directly related to mental ill health. Further dementia affecting the elderly is of the same class.

		Age group							
		Under 5	5-14	15-24	25-44	45-64	65-74	75-84	85+
Males	1	Pre-term/lbw complications	Asthma	Suicide/self-inflicted injuries	Suicide/self-inflicted injuries	Coronary heart disease	Coronary heart disease	Coronary heart disease	Coronary heart disease
	2	Birth trauma/asphyxia	Anxiety disorders	Alcohol use disorders	Back pain and problems	Lung cancer	Lung cancer	COPD	Dementia
	3	Other disorders of infancy	Autism spectrum disorders	RTI/motor vehicle occupant	Alcohol use disorders	Other musculoskeletal	COPD	Dementia	Stroke
	4	SIDS	Conduct disorder	Depressive disorders	Poisoning	Back pain and problems	Diabetes	Stroke	COPD
	5	Other congenital conditions	Depressive disorders	Asthma	Depressive disorders	Suicide/self-inflicted injuries	Bowel cancer	Lung cancer	Prostate cancer

		Under 5	5-14	15-24	25-44	45-64	65-74	75-84	85+
Females	1	Birth trauma/ asphyxia	Anxiety disorders	Anxiety disorders	Anxiety disorders	Other musculoskeletal	Coronary heart disease	Coronary heart disease	Dementia
	2	Pre-term/lbw complications	Asthma	Depressive disorders	Depressive disorders	Breast cancer	Lung cancer	Dementia	Coronary heart disease
	3	Other disorders of infancy	Depressive disorders	Asthma	Back pain and problems	Back pain and problems	COPD	COPD	Stroke
	4	SIDS	Dental caries	Suicide/self-inflicted injuries	Other musculoskeletal	Anxiety disorders	Other musculoskeletal	Stroke	COPD
	5	Cardiovascular defects	Upper respiratory conditions	Bipolar affective disorder	Asthma	Lung cancer	Breast cancer	Lung cancer	Diabetes

[Martin Pall](#), Emeritus Professor of Biochemistry and Basic Medical Sciences at the Washington State University (also with a degree in physics) describes wireless radiation exposure as one of the biggest threats to public health and he has reviewed (in his retirement) the scientific literature to show how neuro-psychiatric diseases can be caused by exposure to artificial EMR ([Pall M.](#), J Chem Neuroanat. 2016 Sep;75(Pt B):43-51). His testimony to the Heath Committee of the Oregon House of Representatives in 2014 is [here](#).

The scientific evidence of RF-EMR effects on behaviour is not new. For example, a review of biological effects of microwaves by the US Air Force stated ***“Assessing the biological effects, it was found that behavior was the most sensitive biological component to RF/MW irradiation”***. (Radiofrequency Microwave Radiation Biological Effects and Safety Standards: A Review. US Air Force Materiel Command, New York, 1994, page 20). Veteran EMR researcher, late Prof. Ross Adey, an Australian Navy physician who later pursued academic research in the USA pioneering physiology research on EMR, even served as the Chair of the committee of the US National Council on Radiation Protection and Measurements (NCRP) was [reportedly](#) funded by the military to utilise EMR to control mind: *“While at the Brain Research Institute at the University of California, Los Angeles, he worked with the Department of Defense on Project Pandora, the super-secret program that sought a way to use electromagnetic radiation for mind control”*. Adey’s research in the 1970s first found RF-EMR to affect cellular calcium channels (Adey, R. [Nature](#). 1988;333(6172):401).

Some studies also had shown a link between RF-EMR exposure and early childhood development and behavioural disorders (such as ADHD and autism spectrum) that have been on the rise. For example, a large Danish study on 13,000 mothers and children found that pre/post-natal exposure to cell phones was associated with a higher risk of behavioural problems and hyperactivity in children ([Divan, et al.](#), Epidemiology 2008;19:523-529). A laboratory study was undertaken at Yale University, USA to further test this finding and the researchers found prenatal exposure to RF-EMR to change the brain structure and function of young mice causing ADHD-like behaviour ([Aldad T.S. et al.](#), Scientific Reports 2012, Article number: 312 doi:10.1038/srep00312). Many experts such as Dr Martha Herbert MD, a paediatric neurologist and brain researcher at Harvard University, presents EMR as a plausible contributing factor for autism (Herbert M. and Sage C. [Pathophysiology](#). 2013;20(3):191-209).

Very clearly demonstrated effects on brain physiology by electroencephalogram (EEG) studies prove that levels well below currently permitted levels of microwave RF-EMR used for mobile telephony affect human brains. These academic researchers from Netherlands, UK and Switzerland have published these irrefutable effects in recent years ([Roggeveen S. et al.](#), 2015; PLoS One. 2015 Jun 8;10(6):e0129496; [Schmid M.R., et al.](#), J Sleep Res. 2012 Feb;21(1):50-8; [Lustenberger C. et al.](#), Bioelectromagnetics. 2015 Apr;36(3):169-77).

It is however intriguing that Australian research studies under psychologist Prof. Rodney Croft at the ACEBR at Wollongong University (and also at Monash), despite finding clear effects on brain physiology and cognitive functions, are dismissive of potential adverse health effects. Mobile phone radiation (RF-EMR) was found to interfere with brain's electrical activity (delayed ERD/ERS responses of the alpha power) and to cause performance with less accuracy in adolescents, young and older adults ([Leung S et al.](#), Clin Neurophysiol. 2011;122(11):2203-16; [Croft R.J. et al.](#), Bioelectromagnetics. 2010;31(6):434-44). Moreover, in a study done on 317 seventh grade students from 20 Melbourne schools, mobile phone use was associated with faster but less accurate responses to cognitive tasks. The researchers reported ***“the accuracy of working memory was poorer, reaction time for a simple learning task shorter, associative learning response time shorter and accuracy poorer in children reporting more mobile phone voice calls”***. However, the following comment of the researchers is questionable: *“the findings were similar for total short message service (SMS, also known as text) messages per week, suggesting these cognitive changes were unlikely due to radiofrequency (RF) exposure”* ([Abramson MJ et al.](#), Bioelectromagnetics. 2009 Dec;30(8):678-86). It is strange that the authors simply assumed RF-EMR exposure through text messaging (SMS) to be negligible to cause direct effects. Considering that mobile phones emit similar RF-EMR signals for both voice and text (though for shorter duration for texting), and particularly noting effects on the brain by extremely low exposures as seen in other studies conducted overseas, it can be argued that the authors' assumption was wrong. The observed effects in this study were likely to be caused by RF-EMR. Another study derived from the students of the same Melbourne cohort ([Thomas S. et al.](#), Occup Environ Med. 2010;67(12):861-6), found changes in cognitive functions, particularly in response time when 238 students were retested after 1 year. Some changes were associated with increased exposure to mobile phones, particularly in those who had smaller number of voice calls and SMS at baseline. Again, the authors dismissed the effect of RF-EMR because texting also gave the same significant results as voice calls. Their statement *“As opposed to the voice calls, very little EMF is emitted during text messaging”* can easily be demonstrated as a fallacy with EMR measurements. Whilst exposure is less due to quicker data transmission in texting, emitted EMR is comparable to voice calls and also one's exposure at the head could increase by over thousand fold during texting. If texting is frequent, RF-EMR exposure can be very high.

Confirming the above Australian studies, a previous British randomized cross-over study also found a significant reduction of reaction time to cognitive tasks in children exposed to RF-EMR from mobile phones ([Preece A.W. et al.](#), Bioelectromagnetics, 2005;Suppl 7:S138-43). However, these authors also downplayed the implications of their statistically significant finding ($p=0.02$)

after re-adjusting for multiple comparisons. It is worth noting that Dr. Preece also authored the 13th study on neuro-behavioural effects near military radar in Cyprus discussed above where clear positive effects were dismissed as unlikely to be caused by EMR without evidence to substantiate that claim. His early work with EMR found reduced reaction time to cognitive tasks in adults when exposed to mobile phone radiation. This was a highly significant (p=0.007) effect and in an interview Dr. Preece stated “*When my colleague Stuart Butler, who is a neurophysiologist, saw the results, he said immediately: ‘You’re getting this effect because the antenna is right above the angular gyrus.’*” He was referring to physiological effects arising out of stimulation of the angular gyrus that acts as an interface between the visual and speech centres of the brain. This effect of reduced reaction time (or faster response time) had a clear dose dependence and was independent of alcohol, caffeine and other intakes of study participants that would influence performance as well as amount of sleep the previous night (Preece A.W. et al., International Journal of Radiation Biology, 1999 Apr;75(4):447-56). Cognitive impairment of RF-EMR exposed animals have been demonstrated in laboratory studies (Nittby H. et al., 2008) supporting above human data.

Overall, above studies indicate mobile phone radiation (RF-EMR) can change brain physiology and predispose children to impulsive and error-prone behaviour which should be noted by Australian educators. Prof. Abramson’s group stated this in their discussion “***children who used mobile phones more were faster but less accurate on a number of tasks, suggesting that they may be more impulsive than other children, favouring a quick, and not accurate, solution***”. The wider social implications of even a small effect of this nature could be serious.

An older meta-analysis of 10 studies investigating effects of mobile phone exposure on cognitive functions (Barth A. et al., Occup Environ Med. 2008;65(5):342-6) found an impact on memory and attention and above later studies affirm this.

Headache is a neurological symptom commonly reported by adults as associated with their mobile phone use (Hocking B. Occup Med (Lond) 1998; 48: 357-60; Oftedal G, et al. Occup Med (Lond) 2000; 50:237-45; Frey AH. Environ Health Perspect 1998; 106:101-3). A large Danish study that investigated cell phone use of 52,680 seven-year-old children found children with cell phone exposure to have more migraines and headache-related symptoms than children with no exposure (Sudan M. et al., The Open Pediatric Medicine Journal, 2012, 6, 46-52).

These scientific findings should be considered in policy making with relation to RF-EMR exposure of children. Researchers at Victoria University, New Zealand found high school students using mobile/cordless phones and wireless devices at increased risk of a range of neuro-behavioural adverse effects. Considering their findings as well as increased brain cancer risk found in other studies, Dr. Mary Redmayne and colleagues caution parents to control EMR exposure in children and limit time on mobile or cordless phones to 15 min per day (Environmental Health 2013, 12:5 ; doi:10.1186/1476-069X-12-5).

A review done on health effects of MPBS for the controversial WHO International EMF Project in 2009 excluded some positive studies (that showed effects) without giving reasons for the

omissions but included similarly conducted negative studies (no effect). Although the authors identified 134 studies relevant publications, they excluded 117 (87.3%) claiming “*they did not meet our inclusion criteria*”. For example, three studies (Eger et al 2004; Wolf & Wolf 2004; Eger and Neppe 2009) that found increased cancer within 400m of MPBS were excluded without explanation, but a study the reviewers themselves referred to as “classified on a crude three-level exposure scale” (Meyer et al., 2006) that didn’t find an effect on cancer was included. Classification of people living close to MPBS for up to 5 years in the no exposure group is one reason that would make that “crude” exposure scale completely unreliable. This review is biased in favour of the “No Effect” notion of the WHO International EMF Project. Unfortunately, this arm of the WHO that was set up to assess health effects has been dominated by industry-friendly individuals (overlapping with ICNIRP) without bio-medical expertise (currently headed by an electrical engineer). This [complaint of Prof. Dariusz Leszczynski](#) (former head of Finnish EMR bioeffects research) gives insights.

9. Studies investigating mobile phone use and brain cancer

Several large studies have investigated if mobile phone usage was associated with increased risk of brain cancer. Three found an association.

- **Interphone Study (largest study- 13 countries, coordinated by the WHO, partly industry funded)**

After spending some \$25 million dollars and a whole decade, the largest-ever study done (investigating 5,117 brain tumor cases in a case-controlled study) to study the effects of mobile phone usage on brain cancer has been inconclusive. Whilst the final conclusion was no increased risk of brain cancer associated with mobile phone usage, interestingly there are the two main final findings their study data indicate:

- Short-term use of cell phones provides protection against brain tumors
- Long-term use increases the risk of gliomas (the most aggressive type of brain cancer)

This is very confusing indeed. The authors attributed both of these findings to study biases and error! ([Cardis E. et al.](#), Int J Epidemiol 2010;39:675–694; Occup Environ Med. 2011 Sep;68(9):631-40; INTERPHONE Study Group. Cancer Epidemiol. 2011 Oct;35(5):453-64)

The study was done between 2000 and 2004. However, the data on past mobile phone usage as participants recalled go back to 1990s and even late 1980s. Some data (as in Appendix 2) indicate doubling of risk of gliomas in the heavy users (those who used mobile phones for more than 10 years, averaging 27 min per day call time). However, the Interphone study groups concluded there was no overall increased risk. They took several years to decide on how to publish the results (6 yr gap between end of study and final publication) and it is reported there have been disagreements amongst the investigators. The formal conclusion of “no effect” is now not aligned with the chief investigator of the project Dr. Elizabeth Cardis who cautions people to reduce exposure, particularly of young people. In a recent interview she had stated “I think we have a number of elements that suggest a possible increased risk among the

heaviest users, and because the heaviest users in our study are considered the low users today, I think that's something of concern"

[\(http://newsletters.environmentalhealthnews.org/t/40560/1038/49945/0/\)](http://newsletters.environmentalhealthnews.org/t/40560/1038/49945/0/)

The Australian head of the Interphone, renowned Prof. Bruce Armstrong has also clearly stated on [national TV](#) that there is evidence linking mobile phones to brain tumours saying *"I would not want to be a heavy user of a mobile phone"*. This year, he again stood by this finding of increased brain cancer risk by heavy mobile phone use when interviewed by the ABC Catalyst program.

Many experts have criticized the Interphone study of poor experimental design which would invariably lead to inconclusive and unreliable results. For example, Dr. Magda Havas of Trent University Canada says *"A regular cell phone user was defined as anyone who made at least one call on their cell phone each week for at least 6 months! Would you expect a person to develop lung cancer if s/he smoked at least one cigarette a week for at least 6 months? By setting the number of calls so low (at least 24 calls on a cell phone) it dilutes the effect and favors a "no-effect" result"*.

Participants were chosen within ages of 30 to 59 years. Younger, more vulnerable and the most concerning cases were excluded from this study and this is another reason why we can't really rely on the Interphone data to assure safety to children. This study also failed to take into account people's cordless phone usage. It is really like a doctor assessing a patient's alcohol intake by only asking about, say, beer drinking – ignoring the alcohol intake through all other types of alcoholic beverages.

Dr. Havas continues *"These experimental flaws and the obvious bias in the experimental design should have been caught early and corrected. But it wasn't. Why? How could so many of the leading scientists in this field allow this to happen? Were they lured by the funding, which came-in part-from the very industry whose product was being studied?"* (www.magdahavas.com).

A Japanese team within the Interphone study group found that those who used mobile phones for more than 20 minutes /day for at least five years had three times the risk of acoustic neuromas (a rare benign tumour in the hearing nerve) than expected ([Sato Y, et al. 2011. Bioelectromagnetics;32 \(2\):85–93](#)). So far, four research groups have found a similar increased risk of acoustic neuroma with mobile phone usage although the pooled Interphone data did not report a significant effect on [acoustic neuroma](#). The Million Women Study of UK found more than doubling of the risk after 10 years of use (10+ years: RR = 2.46, 95% CI = 1.07-5.64, P = 0.03), and this risk increased with duration of use ([Benson V.S. et al., Int J Epidemiol. 2013 Jun;42\(3\):792-802](#)). It is remarkable that the conclusion in the abstract of this publication completely ignored this positive finding on acoustic neuroma and only commented on the negative findings *"In this large prospective study, mobile phone use was not associated with increased incidence of glioma, meningioma or non-CNS cancers"*.

Dr. Samuel Milham, former Head of Epidemiology at Washington State Department of Health criticized some of the acoustic neuroma data analyses of the Interphone study ([Milham S.](#)

British J Cancer,2006;94:1351) and concluded “*I think the pattern of these results suggests that we may be at the beginning of an epidemic of cell phone induced tumors, rather than the authors’ claim of “....no substantial risk”.*

The final report of the Interphone study is at:

http://interphone.iarc.fr/UICC_Report_Final_03102011.pdf

- **Hardell Group Study (Sweden) – independently done by researchers led by neurosurgeon Lennart Hardell MD at Örebro University Hospital.**

This is a case controlled study that showed mobile phone usage over 10 years at just 30 min per day to be associated with a doubled brain cancer risk. The data indicate even worse outcomes for those who started mobile phone usage as teenagers with more than 5 times the risk! (Hardell et al., Occup Environ Med. 2007 Sep;64(9):626-32; Int Arch Occup Environ Health. 2006 Sep;79(8):630-9 ; Int J Oncol. 2008 May;32(5):1097-103; Int J Oncol. 2009 Jul;35(1):5-17 Söderqvist et al., Eur J Cancer Prev. 2012).

Interestingly, when the Hardell group re-did the statistical analysis excluding the data from patients aged under 30 years, their results look more like Interphone data, diluting the effects!

Using the latest data from brain cancers diagnosed during 2007-9, a new Hardell study confirms previous results of a significant association between mobile and cordless phone use and brain cancer. (Hardell L et.al., Int J Oncol. 2013 Sep 24. doi: 10.3892/ijo.2013.2111).

Hardell group included for glioma 1498 cases, 3530 controls, for Meningioma 1,625 cases and 3,530 controls. For Acoustic neuroma 316 participating cases and 3,530 controls

This is what Australian EMR researcher Dr. Don Maisch says comparing Hardell and Interphone studies “What has been shown is that the Hardell group used more thorough criteria than that stipulated in the Interphone methodology. For example, the Interphone study included only persons diagnosed with brain tumour at the age of 30-59 years, whereas the Örebro studies included brain tumour patients aged 20-80 years. Interphone did not assess the use of cordless DECT phones while the Hardell group did. Interphone restricted the highest exposure group to people who had used a mobile phone for 1,640 hours or more in total, corresponding to a mere 30 minutes per day over a time period of 10 years. In comparison, Hardell’s group included people who had used a mobile phone 2000 hours or more. So, I would suggest that, rather than ruling out further epidemiological research as a waste of time and resources, Hardell and his team have shown how it should be done – and independent of industry influence” (www.emfacts.com).

- **CERENAT Study (France - 2014) – the latest and 3rd case-controlled human study showing an increased risk of brain cancer associated with mobile phone use.**

This was a multi-centre study carried out in four areas in France in 2004–2006. Information on mobile phone use was collected through a detailed questionnaire. A total of 447 brain tumour patients with 253 gliomas, 194 meningiomas as well as 892 matched controls selected from the local electoral rolls were subjected to this study. There was a statistically significant association between brain tumours and mobile phone use in the heaviest users when considering life-long cumulative duration of mobile use of 896 hours or more (OR=2.89; 95% CI 1.41 to 5.93 for

gliomas; OR=2.57; 95% CI 1.02 to 6.44 for meningiomas) and number of calls for gliomas (18 360 or more calls, OR=2.10, 95% CI 1.03 to 4.31). These indicate a doubling of risk of brain tumours or more. Risks were higher for gliomas, temporal tumours (on the side of the head), occupational and urban mobile phone use ([Coureau G. et al.](#), Mobile phone use and brain tumours in the CERENAT case-control study. *Occup Environ Med.* 2014;71(7):514-22).

We need to compare the cumulative exposure of 896 hours of use that this study found significant with our current usage patterns. If occurred within 10 years, this is only 89.6 hours per year or a bit less than 15 min per day. This study data weren't available at the time of the IARC classification of RF-EMR in 2011.

- What would be the risk of youngsters who are using mobile phones and other wireless devices for many hours per day?
- What would be the risk of people who are living close to RF-EMR transmitters 24/7 for years?

There is no simple answer due to complex individual sensitivities, but above scientific data clearly show a significantly increased risk.

Using the well-established Bradford Hill criteria for assessing causality, it has been shown that microwave radiofrequency EMR should now be classified as the IARC Class1 (established) carcinogen instead of a class 2B possible carcinogen ([Hardell L. and Carlberg M.](#), *Reviews of Environmental Health* 2013;28(2-3):97-106)

It is important to mention a large study that investigated mobile phone usage and brain cancer that did not find an association. This fundamentally flawed Danish study is used repeatedly by the mobile phone industry and health authorities to assure the public on safety of RF-EMR.

- **The Danish Cohort Study** – Compared brain cancer risk in 420,095 people who had signed a mobile phone contract from 1982 till 1995, with the corresponding risk in the rest of the adult population (over 30 yr) with follow-up to 1996 and then 2002. The study reported slightly decreased risk of brain tumours among mobile phone subscribers. This bizarre protective role of mobile phone indicated by this study is not surprising when the study design is analysed ([Schüz J et al.](#), *Natl Cancer Inst.* 2006 Dec 6;98(23):1707-13; Frei P et al., *BMJ* 2011; 343 doi: <http://dx.doi.org/10.1136/bmj.d6387>).

This study attracted heavy criticism from many international experts for the poor experimental design that would introduce substantial bias ([Söderqvist F et al.](#), *Rev Environ Health.* 2012;27(1):51-8) and from Dr. Louis Slesis of [Microwave News](#). For example, they excluded 200,507 corporate mobile subscribers from the study “user” group, most likely the heaviest users at the early years of this technology and placed them in the control group with the rest of the population. Referring to this, the Dr. Robert Baan of the International Agency for Research

on Cancer (IARC) had said "*could have resulted in considerable misclassification in exposure assessment*". One doesn't need to be an expert to see that classifying the heaviest users as non-users would lead to unreliable results. Another major error introducing error was the "user" population only including those who had a mobile phone up until 1995 — about 20% of the population at that time. The Danish Cancer Society labelled everyone who subscribed to mobile phones after 1995 as if they were non-users, putting them in the control group. Though this may sound hard to believe, here's a direct quote from their paper: "*individuals with a subscription in 1996 or later were classified as non-users*". The number of Danish mobile phone users had more than doubled within a couple of years from 1995 (to about 44% of the population by 1997). Imagine the effect on the results of this study when considering all those people who started using mobile phones around 1996-7. These labelled "non-users" could have had more than 10 years of heavy use by the end of 2007, the cut-off date for data analysis for this study. This allowed people with potentially very high mobile phone usage in the non-user group. It is not surprising that they had the results showing less cancer risk in the non-user group! That's not all, they also did not consider people's cordless phone usage which gives equal or more exposure (as people tend to talk on them for longer) to the same type of EMR. This study got the deserving comment "*It's garbage in, garbage out*" by EMR expert engineer Alasdair Philips of UK PowerWatch according to Microwave News. [Prof. Dariusz Leszczynski former Head of RF-EMR biological effects research at the Radiation and Nuclear Safety Authority in Finland had publicly urged the editors of the British Medical Journal to withdraw the publication of this study saying "The conclusions of this flawed-design study are not supportable by the obtained flawed data and the study's conclusions are misleading. They are leading the public to believe that the cell phones are safe, when no such claim can be made based on the Danish Cohort study"](#) This study was partly funded by the mobile phone industry.

It should be also noted here that [a large study done in Israel found parotid gland cancers to be associated with mobile phone use](#) ([Czerninski R.](#) et al., Epidemiology, 2011. 22(1): p. 130-1).

The current level of evidence on increased risk of cancer alone is strong and clearly demands urgent attention of the health authorities of Australia. The prevailing scientific evidence urgently warrants the precautionary approach and discarding ICNIRP-based Australian exposure standards. As a mere professional body ICNIRP has no accountability towards the public but government regulators ARPANSA and ACMA have to be accountable to the Australian public.

Many diseases other than cancer are steadily on the rise in Australia including various disorders of the immune system such as allergies, asthma, arthritis, autoimmune disorders and neurodegenerative disorders such as Alzheimer's disease. There is mounting evidence that EMR may be a causal factor a wide range of chronic diseases by inducing cellular damage.

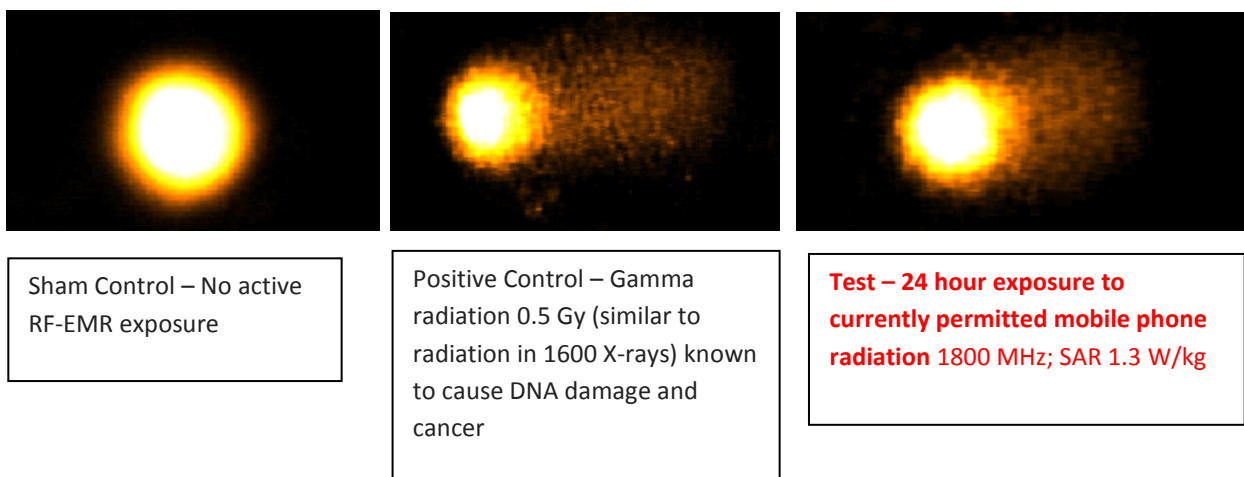
10. Biological effects of serious concern include damage to DNA

It is often claimed by the proponents of wireless technology that health effects such as cancer are biologically plausible because there is no mechanism to explain such effects. This is a false

and misleading claim because a wide range of biological effects have been clearly demonstrated in laboratory studies.

Researchers at Washington University clearly demonstrated that short-term non-thermal exposure to RF-EMR could induce DNA damage in exposed rats brains in the form of single strand breaks ([Lai H and Singh N.P](#) Bioelectromagnetics. 1995;16(3):207-10) and both single and double strand breaks ([Lai H and Singh N.P](#). International Journal of Radiation Biology. 1996 Apr;69(4):513-21). A Meta-analysis of 101 studies published in 2009 ([Ruediger, H.](#), Genotoxic effects of radiofrequency electromagnetic fields. Pathophysiology, 2009;16:2–3) investigating DNA damage found 49 studies – demonstrating genotoxic effects (DNA damage). Now there are a little over 100 studies showing DNA damage in the scientific literature. DNA damage is fundamental to development of cancer.

The image below presents the undeniable evidence of physical breakage of DNA induced by currently permitted levels of RF-EMR shown in what is termed a “comet assay”. Basically, if there is no DNA damage to the cells, a clear circle would be seen, but if there is DNA damage, something like a tail of a comet is formed by fragmented DNA. The study presented here was done at the Medical University of Vienna with European Union funding ([Diem E. et al.](#), Mutation Research, 2005;583(2):178-83). Image provided by Prof. Franz Adlkofer.



In fact, it had been demonstrated a long time ago that RF-EMR could damage DNA in living cells similar to ionizing radiation without causing heating effects (non-thermal). Just 5 minute exposure caused induction of chromosomal aberrations in garlic root cells when observed 24 hrs later after exposure (Heller J.H. and Teixeira-Pinto A.A. [Nature](#) 1959; 28;183(4665):905-6). A study on military personnel exposed to RF-EMR from radar found increased chromosomal aberration and formation of micronuclei (evidence of DNA damage) in blood lymphocytes demonstrating genotoxicity (Garaj-Vrhovac V. et al., Periodicum Biol., 1990;92, 411–416A). Furthermore, microwave RF-EMR occupational exposure when compared to X-ray and vinyl chloride exposure, clearly showed genotoxic and mutagenic effects in human lymphocytes. RF-EMR effects on DNA were similar to X-ray effects while showing differences to the chemical mutagen vinyl chloride ([Fucić A et al.](#), Mutat Res. 1992;282(4):265-71). A Belgian study that compared lymphocyte DNA of RF-EMR exposed field engineers of mobile phone industry to

that of admin workers (moderately exposed) and control subjects (low exposure) found an increased level (nearly doubled) chromatid breaks in the exposed field engineers blood, but the authors emphasized their other negative findings rendering it a negative study (Maes A. et al., *Mutagenesis* 2006; 21: 139-42).

The National Toxicology Programme (NTP) of the US National Institutes of Health in May 2016 released some data from their large animal study to investigate if non-thermal levels of RF-EMR could cause cancer. Overall, **46 out of 540 male rats exposed to cell phone radiation developed cancer or pre-cancerous cells.** In contrast, **none of the 90** unexposed control rats did. These tumours in mice were similar in nature to the tumours found to be associated with mobile phone use in human studies. The NTP also found significantly increased DNA damage in the exposed animals. The details in simplified terms can be found on [Prof. Joel M. Moskowitz's website](#) (Director, Center for Family & Community Health at University of California, Berkeley)

Wireless radiation can damage DNA – Experimentally Proven!

Highly increased DNA damage in people living within 300m of a MPBS have been found compared to matched control cases away from MPBS ([Gandhi G et al.](#), *Electromagnetic Biology and Medicine*. 2015;34(4):344-54.

This human evidence is in line with over 100 laboratory studies demonstrating that RF-EMR exposure can cause genotoxicity by damaging DNA and several animal studies confirming cancer initiation and promotion – including the latest data from the 25 million-dollar study undertaken by the [US National Toxicology Program](#)

Animal experiments are routinely employed to assess toxicology of drugs and environmental agents due practical limitations in human experiments. Safety of chemical agents are typically assessed by animal studies of much smaller scale than what has been done at the NTP etc. Hundreds of animal studies clearly demonstrate biological effects by RF-EMR at low non-thermal exposure levels. For example, animal experiments have demonstrated that RF-EMR can initiate and promote cancer (Chou, C.K., et al., *Bioelectromagnetics*, 1992. 13(6): p. 469-96; Repacholi M.H. et al., [Radiat Res.](#)1997 May;147(5):631-40; Lerchl, A., et al., *Biochem Biophys Res Commun*, 2015. 459(4): p. 585-90; Tillmann, T., et al., *Int J Radiat Biol*, 2010. 86(7): p. 529-41). It would be unscientific and imprudent to ignore or downplay a substantial body of credible evidence of harm from animal studies.

Oxidative stress is implicated in the pathology of a wide range of diseases such as cancer and currently there are a little over 100 peer-reviewed studies showing that low level RF-EMR can cause oxidative stress, out of which 93 are highlighted in a recent review (Yakymenko I. et al., [Electromagn Biol Med](#). 2016;35(2):186-202.). In a recent publication, high-profile American researchers of the Institute of Electrical and Electronic Engineers (IEEE) explained with experimental and theoretical data how extremely low levels of RF-EMR can generate oxidative stress and

potentially cause diseases like cancer and Alzheimer's' ([Barnes F. and Greenebaum B.](#), IEEE Power Electronics Magazine, vol. 3, no. 1, pp. 60-68, March 2016. doi: 10.1109/MPEL.2015.2508699). Furthermore, disruption of voltage-gated ion channels embedded in vitally important cell membranes (e.g. plasma membrane and membranes covering cellular organelles such as mitochondria) by RF-EMR exposure would lead to biochemical and physiological malfunction causing disease. There is evidence of significant biological effects induced by low levels of microwave RF-EMR causing:

- Altering gene expression. In one study, American academic researchers found 759 human genes in cultured cells to be affected by exposure of RF-EMR for just six hours ([Lee S et al.](#) FEBS Lett., 2005;579(21):4829-36). Researchers at the Finnish Radiation and Nuclear Safety Authority (STUK) also found just one hour exposure could change gene expression in human endothelial cell ([Nylund R. and Leszczynski D.](#) Proteomics. 2006 Sep;6(17):4769-80). How these changes in gene expression translating to protein synthesis and cellular processes dependent on them in the long term is not known. There is evidence that vital immune and metabolic functions are affected.
- Sperm damage –demonstrated in Australia by Prof. John Aitken's Group at the University of New Castle as well as other researcher groups overseas including at the Cleveland Clinic. Aitken group had high quality evidence of oxidative stress in irradiated sperm ([De Iuliis G.N. et al.](#), PLoS One. 2009 Jul 31;4(7):e6446. doi: 10.1371/journal.pone.0006446). In a recent review, it has been shown that out of 27 studies investigating the effects of RF-EMR on the male reproductive system, 21 studies have reported adverse effects of exposure (Houston B. et al., [Reproduction](#).2016 Sep 6. pii: REP-16-0126). Some animal studies have also demonstrated adverse effects on eggs contained in ovaries. Given that sub-fertility is affecting a large proportion of Australians, health authorities need to advise people to reduce their exposure to RF-EMR. Damage to reproductive cells (sperm and ova) is likely to have detrimental effects on future generations.
- Making the critical blood brain barrier leaky potentially making the brain more vulnerable to environmental toxins ([Nittby H. et al.](#), Pathophysiology. 2009 Aug;16(2-3):103-12). It has been experimentally demonstrated in rats that as a result of RF-EMR irradiation GSM mobile phones nerve cell damage occurs in the brain ([Eberhardt J.L.](#), Electromagn Biol Med. 2008;27(3):215-29). [French P.W.](#) et al., Differentiation. 2001 Jun;67(4-5):93-7.
- Inducing cellular stress responses ([Augner C. et al.](#), Biomedical and Environmental Science. 2010 Jun;23(3):199-207;. [Harvey C. and French P.W.](#) Cell Biol Int. 2000;23(11):739-48).

A large number of reference studies for above effects can be found in the [Bioinitiative Report](#).

11. Conflict of interest in Australia's EMR research and regulation

The Australian government authorities have been aware of the scientific evidence of potential harm from the evidence of biological effects reviewed in the government-commissioned [1994 CSIRO report](#) prepared by Dr. Stan Barnett of the biophysics division. Moreover, a special senate inquiry into health effects of electromagnetic radiation was held in 2001 which [detailed the knowledge](#) at the time.

It is noteworthy that credible scientific expert witnesses had pointed out the efforts to distort and down play the evidence on biological and health effects in the [2001 Senate Inquiry](#) on EMR:

“Witnesses suggested that since 1985 the Australian Standard has come under sustained industry pressure to revert to much higher levels of exposure; to delete references to fundamental principles of radiation safety; to minimise any explicit references to harmful effects; and to delete the previous acknowledgment of the existence of non-thermal effects on living organisms” (Executive Summary, page xxii).

The fundamental reason for attempts by Western authorities to downplay of health effects of EMR and promotion of lax exposure standards (only taking into account short-term thermal effects) appears to be indicated in the [1976 US Defense Intelligence Agency report](#) (prepared by U.S. Army medical Intelligence and Information Agency, Office of the Surgeon General). This report evaluated the biological effects of RF-EMR mainly through extensive health research conducted in Russia and other Eastern European countries. Despite details of evidence of harm reported, for example on heart disease: *“Comparison of a group of engineers and administrative officials who were exposed to microwaves for a period of years and an unexposed control group revealed a significantly higher incidence of coronary disease, hypertension, and disturbances of lipid metabolism among the exposed individuals. Hereditary predisposition to heart disease was approximately the same in both groups, but overt disorders developed much more frequently in the previously exposed group. It was concluded that microwaves act as a nonspecific factor which, under certain conditions, interferes with adaptation to unfavorable influences. Exposure may, therefore, promote an earlier onset of cardiovascular disease in susceptible individuals.”* (page 5); and on abnormalities observed in blood: *“One study involved the observation of several thousand persons working in microwave-irradiated workshops, as well as animal experiments. In the human subjects, three kinds of damage were found: (1) Lymphocytosis and monocytosis (2) Granulocytopenia, monocytosis, and eosinophilia frequently accompanied by absolute lymphocytosis (3) Moderate neutrophilia”* (page 3), this report states: **“If the more advanced nations of the West are strict in the enforcement of stringent exposure standards, there could be unfavorable effects on industrial output and military functions”** (Summary page vii).

This evidence of a clear Conflict of Interest (CoI) risking public health on the part of the Western governments which needs to be addressed, particularly in light of the current statistics on chronic disease burden of the West.

RF-EMR research on effects of mobile phones has been demonstrated to be affected by the funding source. A group of Swiss researchers statistically analysed available research studies and concluded that industry-funded studies are less likely to report statistically significant effects compared to industry-independent studies ([Huss et al.](#), Environ Health Perspective 2007: 115(1) 1-5). This bias introduced by industry funding appears to have sometimes caused

manipulation of research to produce more “No Effect” outcomes which can easily be achieved by study design. For instance, by not choosing parameters that clearly separate high exposure and low exposure which is needed to see statistically significant effects. An examples of this is defining someone who made at least one call per week from a mobile phone for at least six months as a “regular mobile phone user” and comparing with those who used less as “non users”, and also on focusing on mobile phone use excluding other key sources of RF-EMR exposure as occurred in the Interphone study.

Industry influence in the regulation of public exposure is also known and limited academic research has documented this. A 2015 Harvard University ethics publication examined the industry’s influence on the American regulatory agency Federal Communications Commission (FCC) which is currently headed by the former chief lobbyist of the mobile & wireless industry, Mr. Tom Wheeler ([Alster, N.](#), *Captured Agency: How the Federal Communications Commission is Dominated by the Industries it Presumably Regulates*” 2015, Edmond J. Safra Center for Ethics, Harvard University, Cambridge, MA 02138 USA). An academic investigation in Australia details how the industry influence on regulation has happened with wilful blindness on public health implications of chronic RF-EMR exposures ([Maisch D.](#), 2010. *The Procrustean Approach – Setting Exposure Standards for Telecommunications Frequency Electromagnetic Radiation. An examination of the manipulation of telecommunications standards by political, military, and industrial vested interests at the expense of public health protection.* 2010, PhD Thesis, The University of Wollongong).

Apart from the industry, governments also have conflict of interest as they highly depend on massive revenues generated by the industries such as communications and energy, as well as the military that heavily uses RF-EMR technologies.

The current Australian research on RF-EMR health effects conducted by the Australian Centre for Electromagnetic Bioeffects Research (ACEBR) largely funded by the mobile and wireless industry money administered through the National Health and Medical Research Council (NHMRC) is not industry-independent like the previous work by the CSIRO. Telstra is a major collaborator in ACEBR. It is not possible to expect good science without bias on health effects from this joint venture when **Telstra’s conflict of interest is clearly stated:**

“The establishment of a link between adverse health effects and electromagnetic energy (EME) could expose us to liability or negatively affect our operations.”

Telstra further stated: *“In our operations, we comply with the EME levels permitted by legislation and applicable standards. While to date we have been able to insure these risks, the level of insurance cover available is reducing and premiums are rising to a point where the risks may not be economically insurable. However, there is a risk that an actual or perceived health risk associated with mobile telecommunications equipment and facilities could:*

- *lead to litigation against us;*
- *adversely affect us by reducing the number or the growth rate of mobile telecommunications services or lowering usage per customer; or*

- *hinder us in installing new mobile telecommunications equipment and facilities.*

Any of these, or a combination of more than one, could have a negative effect on our results or financial position.” (Telstra Annual Report 2004, section on Risks, page 10-11).

See more of [Dr. Maisch’s commentary](#) on the subject. Previously other communities in NSW have complained about this conflict of interest on the part of government and industry. It appears that the telecommunications industry is protected by non-protective exposure standards of ARPANSA and this situation also protects the government’s multi-billion-dollar revenue from the same industry while Australian public health is at risk. It is questionable if the current privatisation of public health care programs, for example, the recent [\\$220 million contract given to Telstra Health](#) to establish a new national cancer screening register would serve public interests most.

It should be noted that the Repacholi et al. study mentioned earlier in which irradiation with mobile phone radiation was found to promote cancer development, was done in Australia as a multi-million research effort by Telstra (public funds as the national telecommunication carrier). Dr. Michael Repacholi, a radiation scientist formerly of Royal Adelaide Hospital became one of the most influential people in RF-EMR exposure regulation as the Head of WHO International EMF project as well as the ICNIRP. Even though his early comments on the mice study included *“I believe this is the first animal study showing a true non-thermal effect”* in an interview with the [Microwave News](#), he has subsequently distanced himself from possibility of non-thermal effects and instead been a leader of the “No Effect” campaign. His financial links with the industry has been criticized by many in the field and addressed in the BBC documentary referred to in section 3 (page 6). **It is a shame that after spending a few million dollars of public funds on research including this animal cancer study (through Telstra), the Australian authorities downplayed the concerning findings.**

Andrew Marino, retired professor and EMR researcher at Departments of Neurology, Orthopaedic Surgery, Anatomy and Cellular Biology at Louisiana State University Medical School has [heavily criticised Dr. Repacholi’s industry financial ties](#) that has risked public health in his opinion.

Further, the ACEBR’s Director, Prof. Rodney Croft’s suitability to lead research into EMR bioeffects is questionable when his professional expertise as a psychologist (not physiologist) is clearly outside the scientific expertise needed to study complex cell biology of cancer and other diseases. Prof. Croft’s position, evident by the [media statements](#) made by the ACEBR appears to support the theory (No Effect) favoured by the industry and also that those who are complaining of health effects from EMR are mentally affected from a nocebo effect.

The former Head of the mobile & wireless industry’s largest research program in the early 1990s, Dr. George Carlo accuses the industry of scientific misconduct and fraud in this book: [Cell Phones – Invisible Harzards in the Wireless Age](#). He also [condemns the efforts by the industry](#) to promote wireless technology to children. Highly reliable evidence of DNA damage

induced by currently permitted levels of wireless radiation exposure was generated at the University of Washington 20 years ago. This article by Dr. Louis Slesin about the bitter battles within the academic scientific EMR research arena to suppress the evidence of DNA damage alone is testament the [Col affecting science](#) on EMR. Further high quality evidence on DNA damage found in a study funded by the European Union was met with resistance by academics with strong links to the industry. This was addressed by Prof. Franz Adlkofer in a presentation [on institutional corruption](#) at this lecture at Harvard University

Unfortunately, loss of independence in scientific research and regulation is the reality in this area and it appears to be a massive blow to public health. Industry and government cover-ups occurred with tobacco, asbestos and many other environmental toxins of the past. Human society will continue to repeat history if lessons are not learnt from past mistakes.

12. Summary

The credible scientific evidence provided in this document clearly indicates that wireless radiation or man-made RF-EMR is a toxic environmental pollutant capable of eliciting biological and health effects at currently permitted levels. The peer-reviewed scientific evidence and other information presented herein should prompt the Australian authorities to urgently introduce measures to reduce the exposure of the population, particularly of children to RF-EMR. The evidence herein also warrants mandatory requirements to keep mobile phone base stations and other RF-EMR transmitters (NBN/radio/TV/ radar towers) at least 500 m away from community sensitive locations such as homes and schools.

The UK government's Stewart Commission's Report (2000) specifically recommended that most intense part of the microwave beam from a mast should not fall on a school without consent of the school and parents. Unfortunately, here in Castle Hill, the wireless industry (Telstra, Optus and Vodafone) is doing exactly the opposite of that recommendation, also ignoring the recommendation of 500m clearance specified by the Department of Education and Communities (DEC) NSW.

It should be emphasized that the recommendations of [the 2001 Senate Inquiry into EMR health effects](#) included the following:

Recommendation 2.3: The Committee recommends that based on a growing body of research that provides evidence of biological effects, the Commonwealth Government considers developing material to advise parents and children of the potential risks associated with mobile phone use.

Recommendation 2.5: The Committee Chair recommends that the Government review the Telecommunications (Low-impact Facilities) Determination 1997, and as a precautionary measure, amend it to enable community groups to have greater input into the siting of antenna towers and require their installation to go through normal local government planning processes.

The Australian Federal and State governments should no longer ignore these recommendations.

This document has been prepared by [Dr. Pri Bandara](#). Whilst every effort has been made to ensure accuracy, no liability is taken for the information compiled in this document in good faith as unpaid community service in support of a community effort to stop a mobile base station proposed to be built near Castle Hill High School, aimed at protecting students and staff from adverse health effects of long-term RF-EMR exposure. Those who wish to discuss any point raised in this document in detail may contact the author by email: ayubowan1234@gmail.com

Appendix:

A summary of scientific studies demonstrating biological or health effects in humans at currently permitted RF-EMR levels (below ARPANSA safety standards).

Table II Human studies with power density

	mW/cm ²	W/m ²	EMF considered	Effects reported
Abdel-Rassoul et al. (2007)	0.0054	0.054	Mobile phone base station	Neuropsychiatric problems and some changes in the performance of neurobehavioral functions either by facilitation or inhibition.
Augner et al. (2010)	0.00021	0.0021	900-MHz GSM antenna	Psychobiological stress markers
Boscol et al. (2001)	0.0005	0.005	500 KHz – 3 GHz	Reduce cytotoxic activity in the peripheral blood of women
Chiang et al. (1989)	0.01	0.1	Mainly AM radio	Central nervous and immune systems in man.
Ha et al. (2007)	0.006	0.06	AM radio	Childhood leukemia
Hutter et al. (2006)	Ave 0.000005 Max 4.1 mW/m ²	0.00005 0.004 {Hutter, 2006 #1584} 1	80 MHz – 2 GHz (73% mobile communication signals)	Wellbeing and performance
Navarro et al. (2003)	0.00011	0.0011	1 MHz – 3 GHz	“RF syndrome”
Wolf & Wolf (2004)	0.0005	0.005	850 MHz	An association between increased incidence of cancer and living in proximity to a cell-phone transmitter station.

mean = 0.0028 mW/cm², median = 0.0005 mW/cm²
(range 0.000005 – 0.01 mW/cm²)

Above table was extracted from a document kindly provided by [Professor Henry Lai](#) of Dept. Bioengineering at Washington University. A prolific EMR researcher with 491 peer-reviewed publications in PubMed, Prof. Lai has been serving as the Editor-in-Chief of the journal Electromagnetic Biology and Medicine since 2009.