



Cellular Operators Association of India

**EMF Radiations and
Alleged Health Hazards**

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A. INTRODUCTION

“The mobile phone has moved beyond being a mere device to become a key “social object” present in every aspect of our daily lives”

International Telecommunications Union. ITU

1. Telecommunications is no longer viewed as a luxury service, but recognized as an important infrastructure service that should be available, to all at affordable prices. It is now a well accepted fact that the telecom delivers manifold economic and social benefits. Many studies have established the direct multiplier effect of increase in tele-density on economic growth.
2. **It is well established from various international studies that there exists a causative relationship between increase in telecommunication penetration and GDP growth.**
3. Research has also shows that having access to telecommunications substantially improves the social and economic conditions of people living in rural areas by improving access to family, education, health & financial services & by enabling development of non-agricultural economic activity.
4. Within telecom, it is the **mobile infrastructure that has demonstrated itself to be the most conducive medium to rapidly deliver the benefits of connectivity in developing economies.** In fact mobile has been identified as the missing link for
 - Improved connectivity,
 - Social empowerment,
 - Higher productivity,
 - Increased employment opportunities,
5. Further, with the growth of mobile communications population is being exposure to the **low-level Electromagnetic Fields** produced by the base station antennas normally mounted on cellular mobile towers and by handheld mobile telephone sets/radio terminals.
6. It is most important to note that the RF radiations emitted by Mobile Communication Systems lie in the **non-ionizing part of the electromagnetic spectrum and thus do not have enough energy to cause any genetic damage.** And, the RF emissions from mobile phones and base stations are some **50,000 times lower than the levels at which the first health effects begin to be established.** Also, the output power of mobile phones is **less than 1 Watt (typically is in the range of 0.2 to 0.6 watts),** which is **far lower than the emission levels that emanate from the microwave or even the radio.**
7. However, it is very disappointing to know that **due to lack of awareness and proper communication about various national and international studies and reviews,**

there exists a general misconception that Electromagnetic Radiations emitted from Mobile Systems are a potential source of health hazards.

8. It is relevant to mention that **for several decades extensive RF research has been undertaken by researchers of the highest integrity** at organizations like World Health Organization, British Medical Association, Royal Society of Canada, International Commission on Non-Ionizing Radiation Protection, U.K. Independent Expert Group on Mobile Phones, Swedish Radiation Protection Institute, Food And Drug Administration (USA), Australian Radiation Protection and Nuclear Safety Agency, Indian Council for Medical Research etc. **and general consensus of these studies does not demonstrate any substantive link between human health risks and the use of digital mobile phones or living near a base station.**
9. Further, many expert panels have reviewed the large body of existing scientific literature and have **consistently concluded that compliance with the existing science based standards is sufficient to protect public health.** These reviews have concluded that for exposures to radiofrequency energy up to levels below the safety limits prescribed by **International Commission on Non-ionizing Radiation Protection (ICNIRP) and endorsed by WHO**, there is **no substantive or convincing evidence of biological effects that could harm a person's health.**
10. It is evident that **this concern on alleged health hazards is a misplaced concern** as extensive research studies done both nationally as well as internationally, have opined that **there is no conclusive evidence of any health hazard due to electromagnetic radiations emitted from mobile base stations or mobile handsets.**
11. It is felt that that there is pressing need to establish an effective system of health information and communication, designed by scientists, government, industry and public, to raise the level of general understanding about mobile phone technology and reduce any mistrust and fears both real and perceived. **The information transmitted should be accurate, based on scientific evidence and at the same time be understandable to the intended audience.**

B. Role of Cellular Mobile Telephony

1. Universal access to modern telecommunications is a common vision shared by the countries, especially the developing countries of the Asia Pacific region. The Indian Cellular industry has made an indelible mark in the global telecom arena, as it delivered far beyond all expectations on its promise and potential Cellular mobile telephony is thus uniquely suited bridge the digital divide and bring modern telecommunications services to chronically underserved communities.
2. It is a well accepted fact that the cellular mobile industry delivers manifold economic and social benefits. Access to telecom facilities in rural areas:
 - Allows dispersed families to stay in touch on a regular basis without the need for expensive and time consuming visits
 - Gives villages much better access to education, health and financial services
 - Enables villagers to initiate and monitor payments from urban family members more effectively
 - Enables the development of non-agricultural economic activity.
 - Improves significantly the bargaining power of farmers as they will no longer have to rely on middlemen
3. Research shows that having access to telecommunications substantially improves the social and economic conditions of people living in rural areas by improving access to family, education, health & financial services & by enabling development of non-agricultural economic activity.
4. Cellular mobile telephony is thus uniquely suited to bridge the digital divide and bring modern telecommunications services to chronically underserved communities. Setting up a fixed line infrastructure is a costly and time-consuming task, cellular networks are cheaper to set up and faster to deploy and thus represent the optimal solution to expeditiously reaching the power and benefits of telecommunications to remote and rural areas.
5. However for cellular mobile services to proliferate and grow and there is a need for mobile infrastructure to be continually augmented to keep pace with the rate of growth. If the growth of infrastructure did not keep pace with subscriber growth it would lead to network congestion, poor quality of service, call drops, and maybe even stagnate the growth of service.
6. In this regard, cellular towers are a key infrastructure element used to propagate radio frequency signals and in a cellular infrastructure, cellular towers played the key role of handing over the call from cell to cell to locate the mobile subscriber and terminate the call.
7. The mesh configuration forms the very foundation of a cellular mobile network and the network needs to be set up in a contiguous mesh so as to ensure seamless transfer of signals and delivery of service.

8. If an operator is not able to maintain a contiguous mesh of cellsites, it could lead to dark spots within the network, from where the subscriber would neither be able to make or receive a call. In any cellular mobile network dark spots are undesirable as they would prevent the industry from delivering on its motto of 'anytime, anywhere access'

C. EMF Radiations and Alleged Health Hazards

1. There is a widespread misconception, especially in developing countries that cellular towers and mobile phones are potential health hazards. This concern has often led to cases / instances where cellular mobile operators are not allowed to put up towers thus impacting service quality, growth, etc.
2. There are several widespread myths on the alleged health hazards that have no underlying basis in reality.
 - For example, it is often alleged that the use of mobile phones increases the cause of Brain Cancer, despite there being absolutely no evidence of such adverse health impact.
 - It has also been alleged that mobile phones are powerful enough to cook your brain. There is lack of awareness that the output of mobile phones is less than 1 Watt and is in fact far lower than the emission levels that emanate from the microwave or even the radio.
 - There is also a lack of awareness that the RF radiations emitted by Mobile Base Station lie in the non-ionising part of the electromagnetic spectrum and thus do not have enough energy to cause any genetic damage.
 - It is also not known to most people that the average level of **RF exposure from the base station is only 0.002% i.e. 50,000 times lower than the levels laid down in the recommended guidelines,**.
3. There is therefore a requirement to understand the underlying facts in order to address / allay the concerns that are voiced by various communities of stakeholders.

D. The Electromagnetic Spectrum

1. Electromagnetic Fields (EMF) occur in nature and thus have always been present on earth. Further, with the growth of mobile communications population is being exposed to the **low-level Electromagnetic Fields** produced by the base station antennas normally mounted on cellular mobile towers and by handheld mobile telephone sets/radio terminals
2. Electromagnetic energy or EME is a natural form of energy. EME occurs in many different forms as shown in the electromagnetic (EM) spectrum of Figure 1. EME is composed of oscillating electric and magnetic fields. EME at different frequencies within the spectrum behaves differently in its interactions with matter. The largest natural source of EME is the sun and this generates energy from many parts of the spectrum, including radio signals.

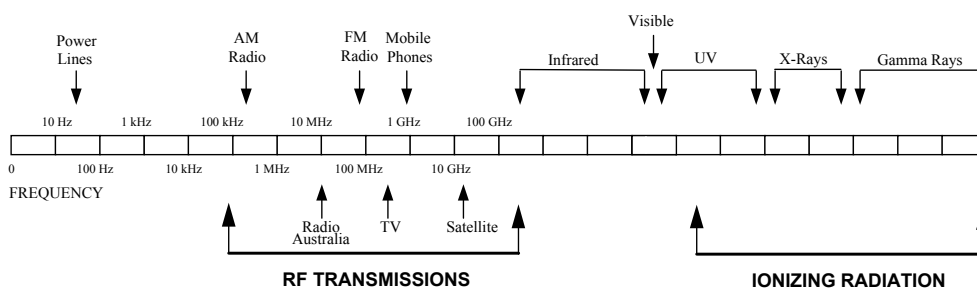


Figure 1: The Electromagnetic (EM) Spectrum

3. EM fields are characterised by frequency (in units of Hertz or cycles per second) and wavelength (in units of metre). The frequency and wavelength are interrelated by the velocity of light in free space, which has a value of $3 \times 10^8 \text{ ms}^{-1}$ (metres per second). This relationship is shown in equation 1. For example the domestic microwave oven uses a frequency of 2.45 GHz, which corresponds to a wavelength of about 0.12 m (12 cm).

$$\text{velocity} = \text{frequency} \times \text{wavelength}$$

Equation 1: Relationship between frequency and wavelength in free space

4. At the high frequency (and high energy) end of the spectrum there are highly penetrating forms of EME such as X-rays. This is the ionising part of the EM spectrum where there is sufficient energy in a single photon (packet of energy) to break molecular bonds. If these bonds form part of genetic material, ionising energy may be able to cause direct genetic damage, thus initiating cancer.
5. Below about halfway through the ultra-violet (UV) part of the spectrum there is insufficient photon energy to cause ionisation. Energies below this frequency are termed non-ionising.
6. The range of frequencies used for radio transmissions, radio frequency (RF) signals lie in the non-ionizing part of the electro magnetic spectrum and do not have enough energy to cause any genetic damage.

E. Radio Frequency Safety Guidelines

1. The primary mechanism of interaction by RF fields with biological bodies is heating. The body is largely composed of water and water is a polar molecule, this means that it has a positive and a negative end. Water molecules are randomly orientated in the body due to the heat of biological reactions. In the presence of an RF field some of these molecules will try to align themselves with the field and follow its changes, much as a compass needle would follow a magnet. This produces friction and heat within biological tissues. The amount of energy absorbed in this manner is dependent on a number of factors including the frequency and intensity of the RF signals as well as the size of the exposed body. The generally accepted measure of the rate of RF energy absorption is the Specific Absorption Rate (SAR) with a unit of watts per kilogram (W/kg).
2. There is a large body of scientific evidence on the subject of health effects of RF transmissions. Present international guidelines draw on research dating from the 1930s, though there are studies on 'animal electricity' going back to Galvani in 1780 and an important series of experiments by D'Arsonval in the 1890s. Much of the work done in the 1940s and 1950s investigated military use of radio signals at much higher powers than those used for telecommunications purposes. Through these studies the physical basis for biological interactions was established and from that understanding modern human exposure standards have been developed.
3. A range of studies using various mammalian species and human volunteers has established that for RF exposures, the threshold SAR at which reproducible behavioural effects occur is in the range 2 to 4 W/kg. Standards for human exposure to RF fields generally reduce the allowable SAR by a safety factor of 10 for occupational exposures and a further reduction of 5 (total safety factor of 50) for the general public to account for uncertainties in the existing scientific database. These limits are designed to ensure that any temperature rise as a result of RF exposure would be less than the normal daily variation in human body core temperature. The levels are intended to be protective of all members of the population from all known adverse health effects.
4. As measurement of SAR is a complex process, human exposure standards provide derived electric (V/m – volts per metre) or magnetic field (A/m – amperes per metre) strength or power flux density (W/m² - watts per square metre) limits. In establishing these derived field strength limits, conditions for maximum coupling to the body are generally assumed. Variations between western RF exposure standards are largely due to differences in the models used to determine the equivalent fields required to induce the fundamental SAR limits.
5. International guidelines for RF exposure were developed by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) and published in 1998. These guidelines form the basis for the recommended human RF exposure standards in the European Union, Australia, much of Asia and Africa. ICNIRP is a non-governmental organisation formally recognised by the WHO. The guidelines were developed following reviews of all the peer-reviewed scientific literature, including thermal and non-thermal effects. The standards are based on evaluations of biological effects that have been established to have health consequences. The

main conclusion from the WHO reviews is that EMF exposures below the limits recommended in the ICNIRP international guidelines do not appear to have any known consequence on health.

6. Biological effects are measurable responses to a stimulus or to a change in the environment. These changes are not necessarily harmful to health. For example, moving from inside to outside on a warm day will produce a range of biological effects. Looking at light from a distant star causes a response in the eye due to the very weak visible light (a form of electromagnetic energy). The body has sophisticated mechanisms to adjust to the many and varied influences encountered in the environment. Changes that are irreversible and stress the system for long periods of time may constitute a health hazard. The WHO states:

“An adverse health effect causes detectable impairment of the health of the exposed individual or of his or her offspring; a biological effect, on the other hand, may or may not result in an adverse health effect”

7. Some people believe that there possible *athermal* or *non-thermal* effects of exposure to RF fields. This refers to alleged effects at levels of exposure too low to cause detectable heating. Reports of such effects have been considered, however, the effects have not been substantiated and therefore, the heating or *thermal* effects are regarded as the only scientifically acceptable basis for RF exposure safety standards setting.
8. In commenting on reports of ‘athermal’ effects ICNIRP concludes in the 1998 guidelines that:

“Overall, the literature on athermal effects of AM [Amplitude Modulated] electromagnetic fields is so complex, the validity of reported effects so poorly established, and the relevance of the effects to human health so uncertain, that it is impossible to use this body of information as a basis for setting limits on human exposure to these fields.”

9. RF exposure standards and guidelines are the subject of regular review to consider evidence from new scientific research. In 1995, Dr Michael Repacholi commented in a report prepared by him as the then Chairman of ICNIRP:

*“All learned reviews have concluded that the **RF fields emitted from base stations do not have any known impact on health.** While research is continuing to determine if there are any health effects from very low levels, it is only possible to make decisions based on our present knowledge. Regulators are well aware of the fact that physical agents such as X-Rays, asbestos and smoking were once considered safe but later studies revealed they were not. In the case of radio frequency, studies have continued for some 40 years and laboratory techniques are extremely sensitive. While it cannot be dismissed that subtle effects will be found in the future, it is comforting to know that a **large amount of research has been conducted and international standards have not had to be lowered for more than fifteen years.** Another point that needs to be remembered is that **RF emissions from base stations are some 50,000 times lower than the levels at which the first health effects begin to be established.**”*

F. Independent and Expert Reviews

1. Many expert panels have reviewed the large body of existing scientific literature and have **consistently concluded that compliance with the existing science based standards is sufficient to protect public health**. These reviews have concluded that for exposures to radiofrequency energy up to levels below the safety limits prescribed by **International Commission on Non-Ionizing Radiation Protection (ICNIRP) and endorsed by WHO**, there is **no substantive or convincing evidence of biological effects that could harm a person's health**
2. World Health Organization (WHO) after studying the various research papers presented on the alleged harmful effect of electromagnetic effect on human health has concluded that **'...current evidence does not confirm the existence of any health consequences from exposure to low level electromagnetic fields. However, some gaps in knowledge about biological effects exist and need further research. While research continues the WHO has recommended:**
 - *Strict adherence to existing national or international safety standards.*
 - *Simple protective measures, such as barriers around strong electromagnetic field sources where exposure levels may be exceeded.*
 - *Consultation with local authorities and the public in siting new power lines or mobile phone base stations.*
 - *An effective system of health information and communication among scientists, governments, industry and the public to help raise general awareness of programmes dealing with exposure to electromagnetic fields and reduce any mistrust and fears.*
3. Further, the WHO recommends adoption of the International Commission on Non-Ionizing Radiation Protection (ICNIRP) 1998 guidelines and states that these guidelines **'...offer protection against all identified hazards of RF energy with large safety margins'**
4. The UK Mobile Telecommunications Health Research (MTHR) program has recently issued a progress report covering 23 studies that have been completed with many already published in peer reviewed scientific journals. The report states:

'None of the research supported by the Programme and published so far demonstrates that biological or adverse health effects are produced by radiofrequency exposure from mobile phones.'
5. **A view has also been taken by the DoT** in its technical opinion dated 25.8.2004, wherein it has been stated :

"As far as DOT is concerned, we do not have any authentic information from any study or report about any health hazard of mobile phones or from towers installed for the purpose of providing Mobile Telephone Service."
6. Even the **Telecom Regulatory Authority of India**, which is the expert Regulator, has, in its letter dated 15.9.2004 addressed to the Finance Secretary, UT Chandigarh, stated that :

“Regarding Health Hazard: As per the information available with TRAI, there is no definite conclusive study, which confirms that health is adversely affected by radiation emitted by mobile phones.”

7. Further, the Committee formed by the Government of India under the Chairmanship of Dr. N.K. Ganguly, Director General, Indian Council on Medical Research which included representatives from PGIMER, Chandigarh & AIIMS New Delhi, has also opined as under :-

*“Taking the above mentioned into account, the Committee opined that overall **there is not enough evidence to show direct health hazards** of RF exposures from Mobile Base Stations.”*

8. **As stated above, several studies have been carried out internationally** with respect to the effect of Electro Magnetic radiation (EMR) on the environment as also the health concerns. However, **till date there is no conclusive evidence of any health ailment caused due to electromagnetic radiations emitted from mobile base stations.**

A bird eye view of the conclusions of a few of these studies is reproduced below:

i. **WORLD HEALTH ORGANIZATION, 2004**

*“Based on a recent in-depth review of the scientific literature, the WHO concluded that **current evidence does not confirm the existence of any health consequences** from exposure to low level electromagnetic fields. However, some gaps in knowledge about biological effects exist and need further research.”*

ii. **WORLD HEALTH ORGANIZATION, 2005**

*“To date, all expert reviews on the health effects of exposure to RF fields have reached the same conclusion: There have been **no adverse health consequences established** from exposure to RF fields at levels below the international guidelines on exposure limits published by the International Commission on Non-Ionizing Radiation Protection”.*

iii. **WORLD HEALTH ORGANIZATION, 2006**

“Recent surveys have shown that the RF exposures from base stations range from 0.002% to 2% of the levels of international exposure guidelines, depending on a variety of factors such as the proximity to the antenna and the surrounding environment. This is lower or comparable to RF exposures from radio or television broadcast transmitters”.

iv. **EUROPEAN COMMISSION EXPERT GROUP**

*“Overall, the **existing scientific literature** encompassing toxicology, epidemiology and other data relevant to health risk assessment, while providing*

useful information, **provides no convincing evidence** that the use of radiotelephones or other radio systems, whether analogue or digital, poses a **long-term public health hazard.**”

v. **BRITISH MEDICAL ASSOCIATION**

“There are **no definite adverse health effects from mobile phones or their base stations.**”

vi. **THE BRITISH MEDICAL ASSOCIATION – (JANUARY – 2005)**

“Current evidence suggests that it is **unlikely** that the special features of the signals from TETRA mobile terminals and repeaters **pose a hazard to health**”.

vii. **THE HEALTH COUNCIL OF THE NETHERLANDS**

“The **chance of health problems** occurring among people living and working below base stations as a result of exposure to electromagnetic fields **originating from the antennas is, in the Committee’s opinion, negligible.** The field strengths are always considerably less than the exposure limits.”

“On the basis of the present data, the Committee concludes that the **occurrence of health problems** at exposure levels associated with the use of mobile phones **is unlikely.** It is considered virtually impossible that the low field strengths in the vicinity of base stations give rise to changes in cognitive functions.”

viii. **THE HEALTH COUNCIL OF THE NETHERLANDS, 2004**

“In conclusion, **there is no convincing scientific data** to assume a difference in the absorption of electromagnetic energy in heads of children and adults, nor is it likely that the electromagnetic sensitivity of children’s head changes significantly after the second year of life. Because of this, the Health Council of Netherlands sees no reason for recommending limiting the use of mobile phones by children.”

ix. **SWEDISH RADIATION PROTECTION INSTITUTE**

“In many cases where the general public has shown concern, **radiation intensity has proved to be less than a thousandth of the permitted level**”.

“To summarize, **mobile telecommunications base stations do not constitute a risk** regarding radiation protection.”

x. **NORDIC COUNTRIES: DENMARK, FINLAND, ICELAND, NORWAY, SWEDEN, 2004**

“The Nordic authorities agree that **there is no scientific evidence for any adverse health effects** from mobile telecommunication systems, neither from the base stations nor from the handsets, below the basic restrictions and reference values recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). However, certain knowledge gaps exist that

justifies more research in this field. There are a number of published reports suggesting that biological effects may occur at exposure levels below the ICNIRP guidelines. These studies need to be reproduced and the scientific progress in these fields of research should be followed carefully. In this context, however, it is important to note that biological effects do not necessarily imply health hazard”.

xi. FRENCH ENVIRONMENT HEALTH AND SAFETY AGENCY (AFSEE)

*“The **strength of radiation received from base stations** beyond a few meters from the base stations is **considerably lower than the strength of radiation from radio and television transmitters.**”*

xii. AFSSE STATEMENT ON MOBILE PHONES & HEALTH, 2003

*“The AFSSE notes that the **general analysis of current scientific data** on exposure to base station waves **show no health risk linked to mobile phone base stations**. Given this, the recommendations made are based on the principle of responsiveness in order to take into account the public worries about the siting of macro-cellular base stations”.*

xiii. INTERNATIONAL COMMISSION IN NON IONIZING RADIATION PROTECTION (ICNIRP)

*“Epidemiological studies on exposed workers and the general public have shown **no major health effects associated with typical exposure environments.**”*

xiv. ICNIRP GUIDELINES

*“There is **no substantive evidence that adverse health effects**, including cancer, can occur in people exposed to levels at or below the limits on whole body average SAR recommended by INIRC (IRPA / INIRC 1988) or at or below the ICNIRP limits for localized SAR set out in this document”.*

xv. GSMA WEBSITE

*GSM Association recognizes the fact that, apprehensions have been raised by the public / communities on siting of cellular antennas. However, these antennas are low powered, with typical signal levels in the community similar to those from broadcast services, such as radio and TV. In light of all the research / documents on record by various international agencies, GSMA is of the opinion that “To date expert groups have consistently found **no convincing evidence of a public health hazard from mobile communication services**. However, further research has been recommended”.*

xvi. GSM ASSOCIATION, MMF AND THE EUROPEAN COMMISSION, 2006

*A study of mice exposed to GSM900 and GSM1800 type signals has been published on-line in the journal Bioelectromagnetics and **overall finds no evidence that radio signals increase cancer risk**. The authors state ‘In*

conclusion, the **present study produced no evidence** that the exposure of male and female B6C3F1 mice to wireless GSM and DCS radio frequency signals at a whole body absorption rate of up to 4.0 W/kg **resulted in any adverse health effect** or had any cumulative influence on the incidence or severity of neoplastic and non-neoplastic background lesions, and thus the **study did not provide any evidence of RF possessing a carcinogenic potential.**'

This study was co-funded by GSMA, the MMF and the European Commission and will make an important contribution to future health risk assessments by the WHO. It is the first whole of life animal study of radiofrequency (RF) exposures using standard toxicological procedures.

xvii. **UNITED STATES GENERAL ACCOUNTING OFFICE**

*Scientific research to date does not demonstrate that the radio frequency energy emitted from mobile phones has **adverse health effects**, but the findings of some studies have raised questions indicating the need for further investigation.*

xviii. **USA: FOOD AND DRUG ADMINISTRATION, 2005**

*"FDA agrees with the NRPB on its conclusions that **there is no hard evidence of adverse health effects** to the general public from exposure to radio frequency energy while using wireless communications devices. A few studies have suggested low level of radio-frequency energy exposure could accelerate the development of cancer in laboratory animals, however, these studies have failed to be replicated, and the vast majority of studied reports in the scientific literature show no adverse health effect associated with low level of radio frequency energy exposure. With regards to the safety and use of cell phones by children, the scientific evidence does not show a danger to users of wireless communication devices including children".*

xix. **NETWORK AND ACADEMIC COMPUTING SERVICE, UNIVERSITY OF CALIFORNIA,**

*"There is **no reason to believe that such towers could constitute a potential health hazard** to nearby residents or students."*

xx. **NETWORK & ACADEMIC COMPUTING SERVICES, UNIVERSITY OF CALIFORNIA, 2005**

*"Measurements made near typical cellular and PCS installations, especially those with tower-mounted antennas, have shown that **ground-level power densities are thousands of times less than the FCC's limits for the safe exposure**. In fact, in order to be exposed to levels at or near the FCC limits for cellular or PCS frequencies an individual would essentially have to remain in the main transmitting beam (at the height of the antenna)".*

xxi. **THE ROYAL SOCIETY OF CANADA**

Therefore at this point, the **epidemiological evidence to date** is inadequate for a comprehensive evaluation of risk, **and does not support a hypothesis of an association between exposure to radio frequency fields and risk of cancer, reproductive problems, or congenital anomalies.**

To date, no convincing, reproducible data exist to demonstrate the ability of MW/RF field exposure to induce seizures or to worsen an existing seizure disorder in human patients.

Headache and fatigue are non specific complaints. For example, many factors can cause headache. Headache is not an indicator of “brain activity” and in general headaches occur in the absence of structural abnormalities of either the brain or the blood brain barrier. Given the high variability of headache as a symptom, correlating headache with some MW –induced neuro chemical alteration is very difficult. Although there is need to consider the possibility of MW induced symptoms such as headache and fatigue, existing data to do not support the conclusion that MW can induce headaches.

xxii. ROYAL SOCIETY OF CANADA

All of the authoritative reviews completed within the last two years have concluded that there is **no clear evidence of adverse health effects associated with RF fields.**

The British Medical Association (2001), for example, concluded that “whilst there are small physiological effects within the existing guidelines, **there are not definite adverse health effects from mobile phones or their base stations.**”

xxiii. AUSTRALIAN RADIATION PROTECTION AND NUCLEAR SAFETY AGENCY

“It can be seen that **exposure levels are less than those from FM radio stations (100 MHz) and significantly less than levels from AM radio stations (1 MHz).**”

xxiv. AUSTRALIAN RADIATION PROTECTION AND NUCLEAR SAFETY AGENCY

No adverse health effects are expected from continuous exposure to the RF radiation emitted by the antennas on mobile telephone base station towers.

xxv. AUSTRALIA: COMMITTEE ON ELECTROMAGNETIC ENERGY PUBLIC HEALTH ISSUES, 2003

“The weight of national & international scientific opinion is that **there is no substantiated evidence that exposure to low level RF EME cause adverse health effects.** The view is **backed by every major review panel on the subject** including the Royal Society of Canada (1999), the International Expert Group on Mobile Phones (2000), the French Health General Directorate (2001) and ARPANSA’s RF standard Working Group (2002)”.

xxvi. **MALAYSIA: COMMUNICATIONS & MULTIMEDIA COMMISSION (2001)**

“For now, we can conclude that there is no consistent and convincing scientific evidence of adverse health effects caused by RF radiation. Meanwhile further ongoing research based on established scientific methods will continue to shed light on our understanding of this important health issue.”

xxvii. **MALAYSIAN INSTITUTE FOR NUCLEAR TECHNOLOGY RESEARCH (MINT), 2003**

“The findings of this study confirms that the presence of the radio frequency and microwave radiation in public accessible areas around the base stations was indeed very low and comparable to the radiation levels found in places away from the facilities. The levels were generally below 11% of the exposure limit for members of the public. The actual contribution made by the base stations themselves was often less than 0.2% of the limit”.

xxviii. **INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS**

Present scientific evidence, as reviewed by standards setting organizations and other expert groups, does not demonstrate health or safety risks from cellular and other communications transmitters.

10. Lastly, it is most relevant to mention that all of the reviews over the last ten years by expert panels and government agencies looking into the health and safety of mobile communications have agreed that the scientific evidence **does not demonstrate any health risks from the use of mobile phones for children**. These include agencies like WHO, ICNIRP, The Health Council of the Netherlands, Food and Drugs Associations, IEEE and many other international bodies

- *“In conclusion, there is no convincing scientific data to assume a difference in the absorption of electromagnetic energy in heads of children and adults, nor is it likely that the electromagnetic sensitivity of children’s head changes significantly after the second year of life. Because of this, the Health Council of Netherlands sees no reason for recommending limiting the use of mobile phones by children”*

The Health Council of the Netherlands

- *“Selvin et al. (1992) reported no increase in cancer risk among children chronically exposed to radiation from a large microwave transmitter near their homes.”*

ICNIRP 1998 Guidelines

- *“The protection system using basic restrictions and reference levels makes the ICNIRP guidelines flexible and applicable to virtually any exposure condition, and any group of population. Therefore, there is no need, or justification, for a special approach to the protection of children.”*

Dr Paolo Vecchia, Chairman ICNIRP (2004)

- *"From the scientific point of view, there is no evidence to support the need for a special precautionary approach for children or adults"*

IEEE (revised Standard C95.1-2005)

- *'Present scientific evidence does not indicate the need for any special precautions for the use of mobile phones. If individuals are concerned, they might choose to limit their own or their children's RF exposure by limiting the length of calls, or by using "hands-free" devices to keep mobile phones away from the head and body'*

World Health Organisation

- *"The scientific evidence does not show a danger to users of wireless phones, including children and teenagers"*

Food and Drug Administration (FDA)

- *"The current World Health Organization view is that international safety guidelines protect everyone in the population with a large safety factor and so there is no scientific basis to restrict children's use of phones or the locations of base stations. Mobile communications do provide important safety benefits for parents and children. The GSM Association supports parents making up their own mind about when and if their children should use mobile communication technologies."*

GSM Association

G. Conclusion

1. Mobile phone base stations operate at low RF powers in order to minimize adjacent site interference that could affect call quality and capacity. There is a widespread reliance on mobile communications for business and personal safety.
2. For several decades extensive RF research has been undertaken by researchers of the highest integrity at various international organizations and **general consensus of these studies does not demonstrate any substantive link between human health risks and the use of digital mobile phones or living near a base station.**

3. Many expert panels have reviewed the large body of existing scientific literature and have consistently concluded that compliance with the existing science based standards is sufficient to protect public health. These reviews have concluded that for exposures to radiofrequency energy up to levels, below the safety limits prescribed by International Commission on Non-Ionizing Radiation Protection (ICNIRP) and endorsed by WHO, **there is no substantive or convincing evidence of biological effects that could harm a person's health, that is, ICNIRP guidelines are reliable safeguards for all segments of the population, including children.**
4. Mobile phone base stations operate on low powers with typical maximum field strengths at ground level which are less than 1% of the international guidelines for public exposures. Expert reviews have consistently concluded there is no convincing scientific evidence of adverse human health effects for exposures to radio frequency electromagnetic fields up to the levels allowed by the ICNIRP human exposure guidelines.
5. All of the reviews over the last ten years by expert panels and government agencies looking into the health and safety of mobile communications have agreed that the scientific evidence **does not demonstrate any health risks from the use of mobile phones for children**. These include agencies like WHO, ICNIRP, The Health Council of the Netherlands, Food and Drugs Associations, IEEE and many other international bodies

H. Recommendations

An effective system of health information and communication, designed by scientists, government, industry and public, should be developed to raise the level of general understanding about mobile phone technology and reduce any mistrust and fears both real and perceived. The information should be accurate and at the same time be appropriate in its level of discussion as well as understandable to the intended audience. In this regard, the WHO has produced guidance, which should be taken into consideration.

Following are recommended:

- i. Ministry of Health & Ministry of Communications and Ministry of Environment in close collaboration with service providers, manufacturers, medical fraternity, consumer advocacy groups should hold awareness programmes for the general public educating them about the benefits of mobile communications, base stations and phones and the scientific debate around alleged health hazards.
- ii. The public should be made aware that the general consensus of all scientific studies till date is that there is no conclusive and definitive evidence of established effects on health at exposure levels below the safety limits recommended by ICNIRP and endorsed by WHO.