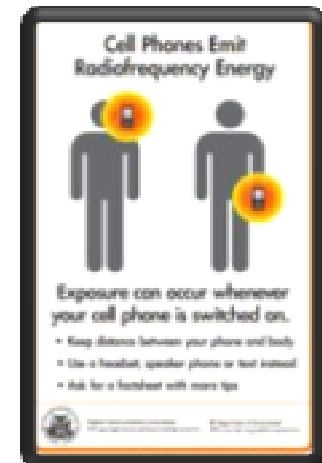
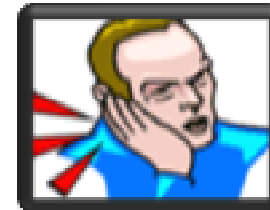
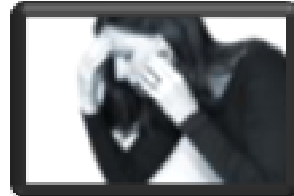
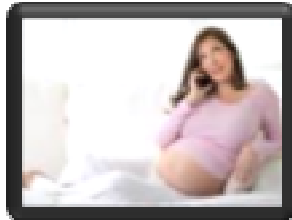
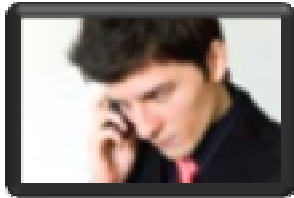


CELL PHONE RADIATION HAZARDS AND SOLUTIONS

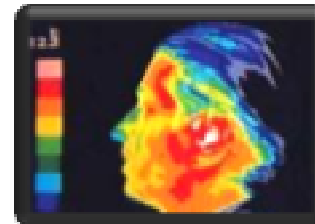
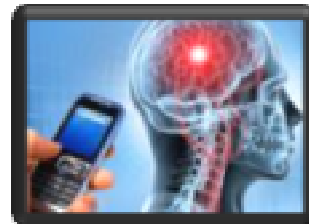
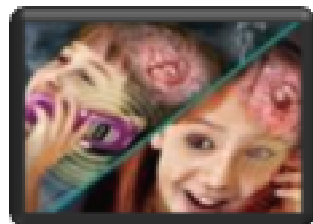
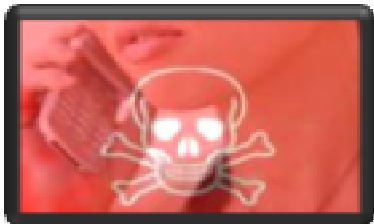


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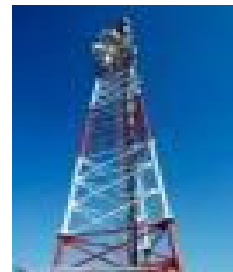
Outline of Presentation

- **Cell Phone Advantages**
- **Microwave Heating Principle**
- **Cell Phone – Specific Absorption Rate (SAR)**
- **International Findings**
- **Biological effects**
- **Newspaper Coverage**
- **Solutions**

Cell Phone and Tower Statistics in India



India Population –
1.2 billion



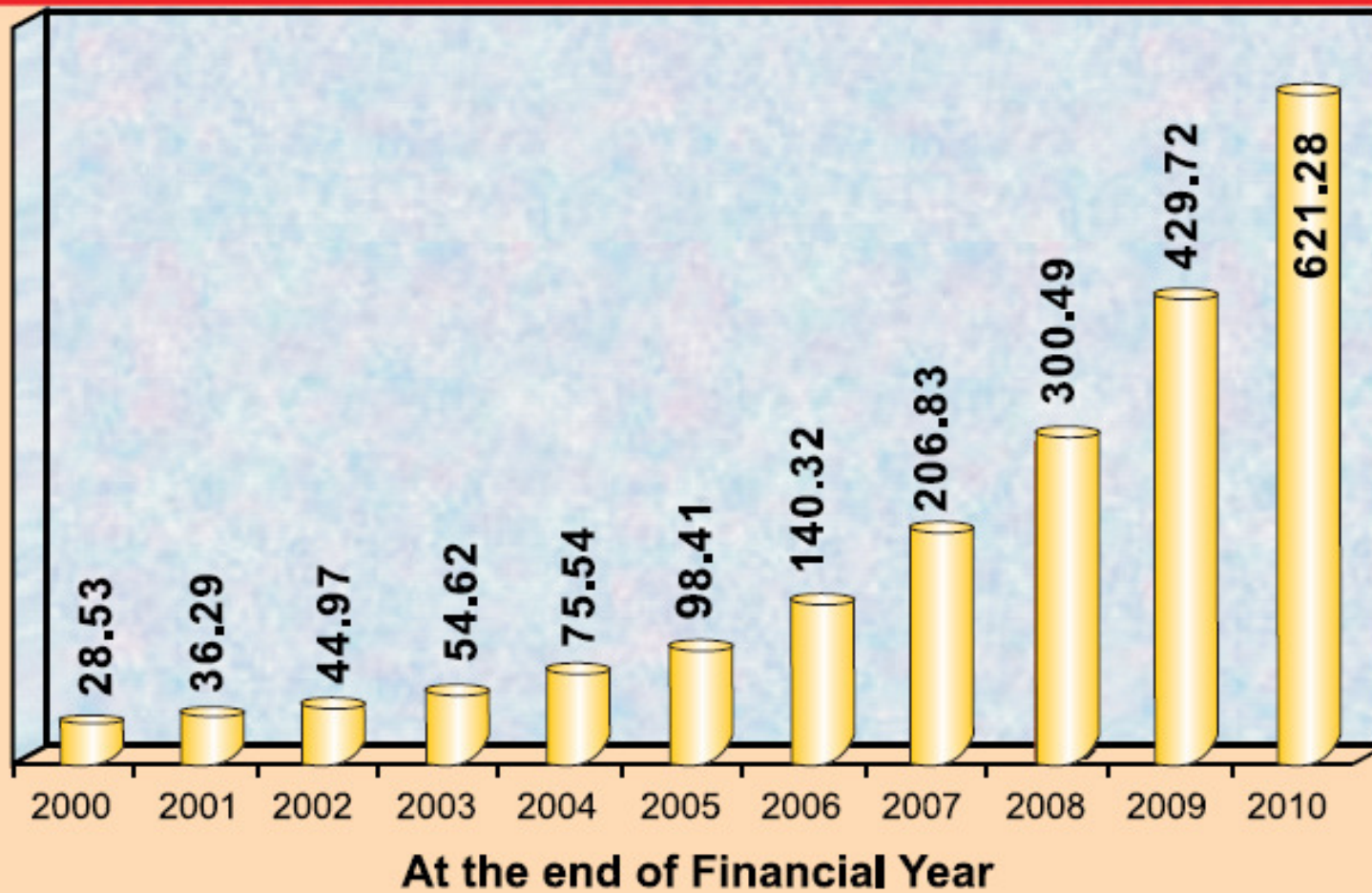
Mobile Towers –
4.5 lakh



Mobile subscribers –
800+ Million

Growth of Subscriber Base

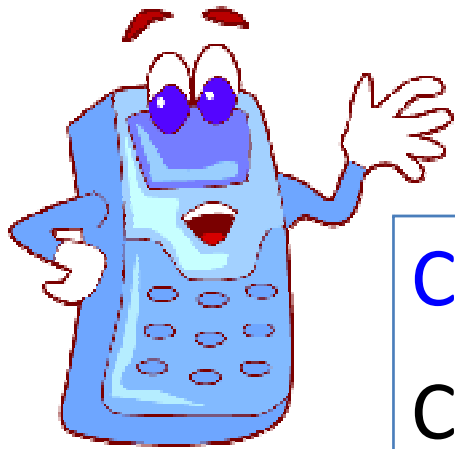
Growth of Subscriber base (in million) from 2000 to 2010



Subscriber Base in August 2011

Particulars	Wireless	Wireline	Total
Total subscribers	865.71	34.07	899.78
Total Net addition	7.34	-0.11	7.23
% of monthly growth	0.86%	-0.33%	0.81%
Urban subscribers	570.54	25.73	596.27
Rural subscribers	295.17	8.34	303.51
Tele density	72.12%	2.84%	74.96%
Urban teledensity	157.76%	7.11%	164.87%
Rural teledensity	34.10%	24.48%	33.73%

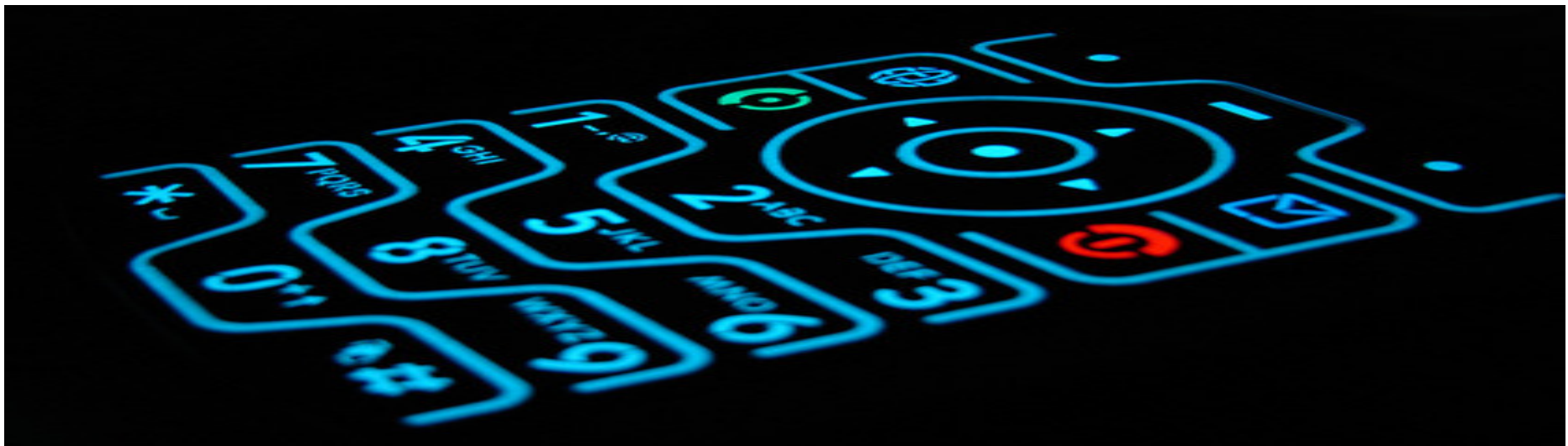
August 2011 – subscribers in millions



Cell Phones- Bane or Boon?

Cell phones have several advantages.

Cell phones and cell towers have several disadvantages including microwave radiation, which has **several harmful effects**.



Microwave Radiation

Microwave radiation effects are classified as:

- Thermal
- **Non-thermal**

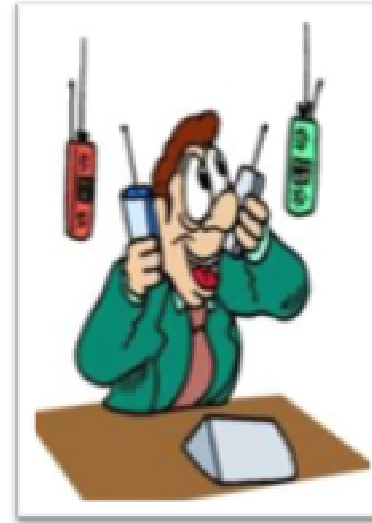
The current exposure safety standards are mainly based on the thermal effects, which are inadequate.

Non-thermal effects are several times more harmful than thermal effects.

Sun Heating vs Microwave Heating



- ❑ Outside to inside heating
- ❑ Skin heating
- ❑ Sweating happens



- ❑ Inside to outside heating
- ❑ Internal heating
- ❑ Heat trapped

Microwave Heating Equation

The dependence between the microwave power applied in heating and the increase of temperature can be described by the equation:

$$\Delta T = \frac{P \times t}{V \times c_p \times \rho} \quad (1)$$

where: ΔT – the increase of the mean temperature of the heated body (K)

P – microwave power used for heating (W)

V, c_p, ρ – volume, heat capacity, density ($\text{m}^3, \text{J/kg.K}, \text{kg/m}^3$)

t – time of heating (s)

Microwave Radiation Standards vs. time in different countries in 1977

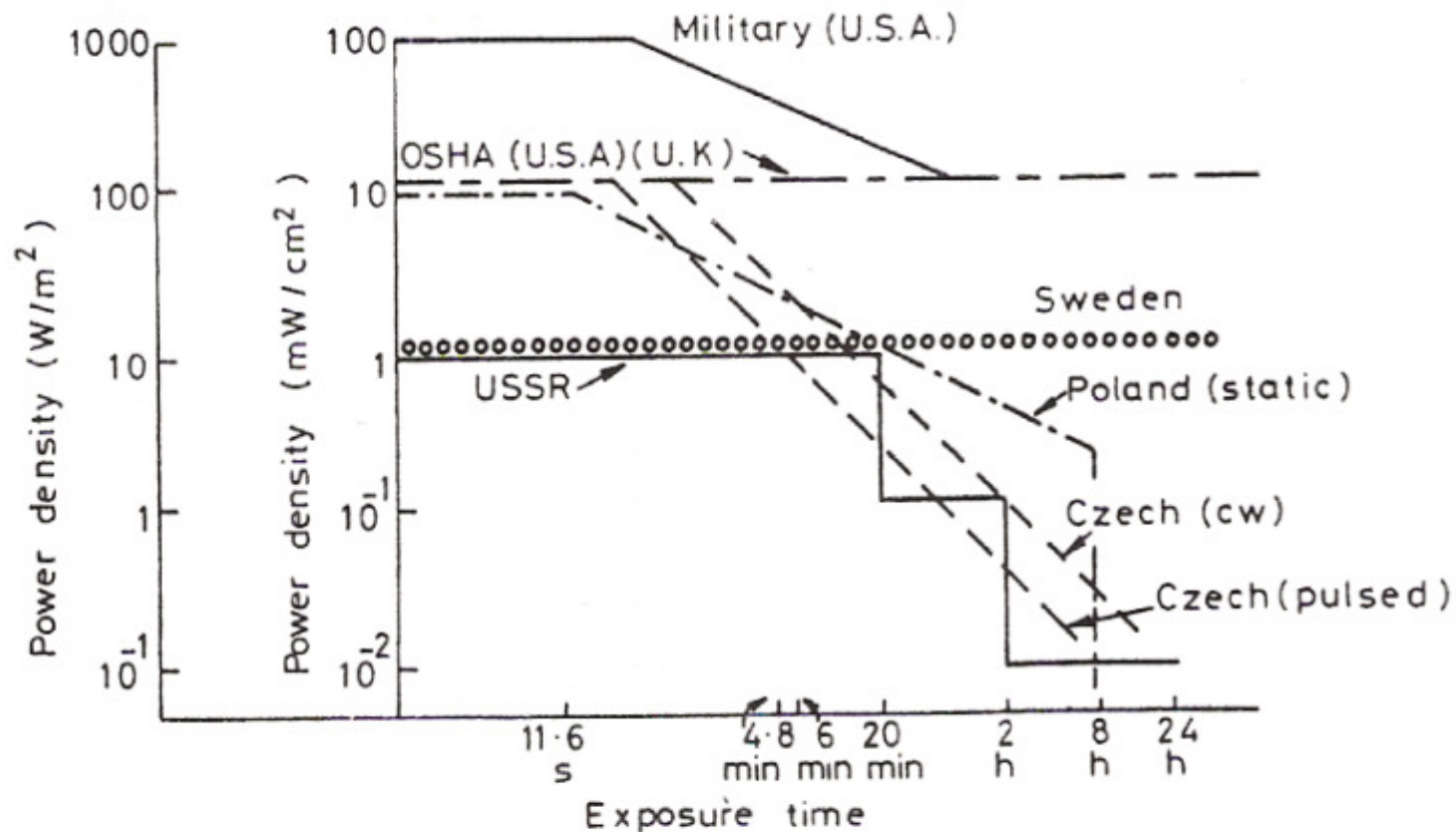


Fig. 10.2 Microwave personnel exposure standards
(Simplified from Dodge and Glaser, *The Journal of Microwave Power*, 1977.)

Figure from the book entitled "Industrial Microwave Heating" by Metaxas and Meredith, Peter Peregrinus, 1983, page 280.

Microwave Heating Concept

4.2 KW (4200 W) of microwave power raises temperature of 1 Litre of water by 1°C in 1 second.



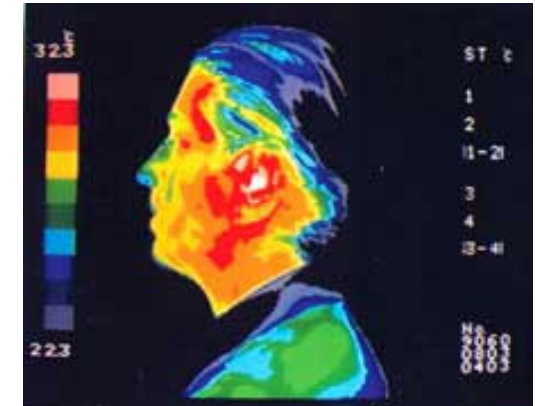
In energy absorption term, 4.2 KW-sec microwave energy will increase the temperature of 1 Litre by 1°C .

For example, in a microwave oven, temperature of one cup of water increases from 30°C to 100°C in approx. 70 seconds with 500W of microwave power.

With 1W power (same as output power of cell phones), temp. will increase by 1°C in 500 seconds.

Cell Phone - Ear Warming?

Have you ever noticed warm sensation in ear after using mobile phone for a long time?



Temp. of ear lobes increases by 1°C when cell phone is used for approx. 20 minutes.

Warm sensation/pain > tinnitus > irreversible hearing loss



All these effects lead to Ear Tumor

Tinnitus or "Ringxiety"- sensation of cell phone ring

SAR and Cell phone use time limit



6 minutes/day usage.

A Cell phone transmits
1 to 2 Watts of power

SAR (Specific absorption rate) - Rate at which radiation is absorbed by human body, measured in watts per kg (W/kg).

In USA, max. SAR limit for cell phones is **1.6W/Kg** which is for **6 minutes.** It has a safety margin of 3 to 4, so a person should not use cell phone for more than **18 to 24 minutes per day.**

This information is not given to people in India.

SAR value



Check SAR Values:
Search on Internet
SAR mobile phone

San Francisco Govt. has made it mandatory for the industry to display SAR value for each phone. (USA Today 14 July, 2010)

Warning from Blackberry

BlackBerry device keep the BlackBerry device at least 0.98 in. (25 mm) from your body when the BlackBerry device is transmitting. When using any data feature of the BlackBerry device, with or without a USB cable, hold the BlackBerry device at least 0.98 in. (25 mm) from your body. If you use a body-worn accessory not supplied by RIM when you carry the BlackBerry device, verify that the accessory does not contain metal and keep the BlackBerry device at least 0.98 in. (25 mm) from your body when the BlackBerry device is transmitting.

To reduce radio frequency (RF) exposure consider these safety guidelines:

- Use the BlackBerry device in areas where there is a strong wireless signal. The indicator that provides information about the strength of the wireless signal is located in the upper-right corner of the Home screen and displays five ascending bars. Three or more bars indicate a strong signal. A reduced signal display, which might occur in areas such as an underground parking structure or if you are traveling by train or car, might indicate increased power output from your BlackBerry device as it attempts to connect to a weak signal.
- Use hands-free operation if it is available and keep the BlackBerry device at least 0.98 in. (25 mm) from your body (including the abdomen of pregnant women and the lower abdomen of teenagers) when the BlackBerry device is turned on and connected to the wireless network. For more information about carrying your BlackBerry device, see the holster information in the "Additional safety guidelines" section of this document.
- Reduce the amount of time spent on calls.

Results of Re-evaluation of Interphone Study

INTERPHONE – WHO -10 years, 13 countries, largest (5,117 brain tumor cases), \$25 million dollars to evaluate risk on brain tumors.

Conclusion - no overall ↑ risk, but suggestions of ↑ glioma - heavy users & ipsilateral exposures

Re-evaluation - Risk underestimated by at least 25%

- For every 100 hours of use -26% ↑ risk of meningioma
- Initial 24% risk of glioma ↑ to 55% over 10 years- regular users are taken as people who use it for **2hrs/month**.
- Doubled - quadrupled brain tumor risk - heavy users **(1/2 hour/day)** over 8 to 10 years.
- Children, young adults– excluded. New study - Mobi-kids

WHO: Cell phone use can increase cancer risk

International Agency for Research on Cancer (IARC), a part of **WHO designates cell phones as "possible human carcinogen" [Class 2B]**



World Health Organization

Found evidence of increase in glioma and acoustic neuroma brain cancer for mobile phone

International Agency for Research on Cancer



World Health
Organization

PRESS RELEASE
N° 208

31 May 2011

IARC CLASSIFIES RADIOFREQUENCY ELECTROMAGNETIC FIELDS AS
POSSIBLY CARCINOGENIC TO HUMANS

BIOLOGICAL EFFECTS



Most common complaints:



Fatigue



Headaches



Loss of sleep



Memory loss



Ringing ears

BIOLOGICAL EFFECTS

Neurodegenerative Disorders –Alzheimer, Parkinson's

Immune System Degradation

Tinnitus and Ear Damage

Irreversible infertility

Effect on Skin

DNA Damage

Increase in Cancer risk



Breakdown of Blood Brain Barrier

Increased Risk of Eye Cancers

Increased Risk of Ear Tumors

Increased Risk of Other Cancers

Sleep Disorders



Use of mobile phones before bed disturbs Stage 4 sleep, the stage important for full recuperation of brain and body.

Keeping mobile phone next to head or below pillow while sleeping

NOT ADVISABLE



Risk to Children



Children are more vulnerable as:

- Skulls are smaller & thinner - ↑'s radiation absorption
- ↑rate of Cell division - more susceptible to genetic damage
- Myelin sheath not developed - Electrical brain-wave activity
- Immune system not well developed -less effective against fighting cancer growth



RF penetration in the skull of an adult (25%), 10 year (50%) and a 5 year old (75%).

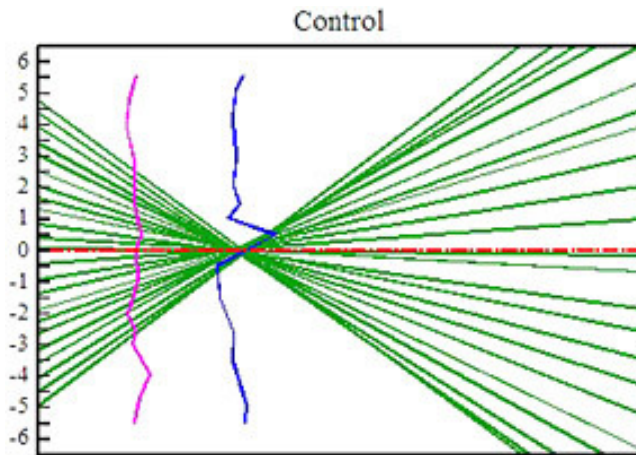
Risk to Pregnant Women



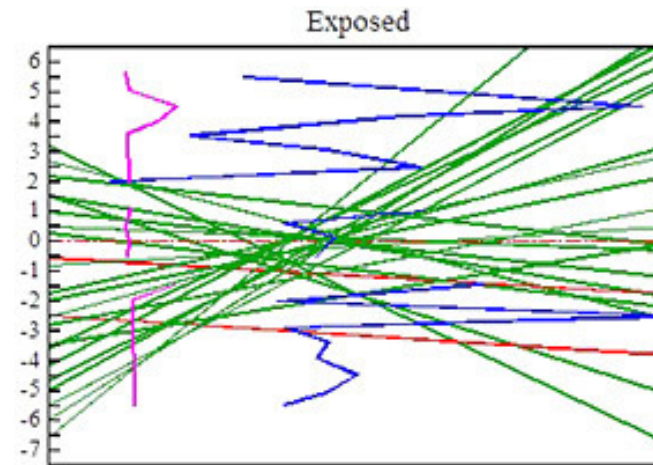
A pregnant woman and the fetus both are vulnerable as RF radiations can pass placental barrier & continuously react with the developing embryo and increasing cells.



Effect on Eye/ Uveal Melanoma



Good quality lens



Ability to focus the laser beam at the various locations is altered.

Prolonged exposure to microwave radiation can lead to macroscopic and microscopic damage to the lens and part of this damage does not heal and accumulates with time.

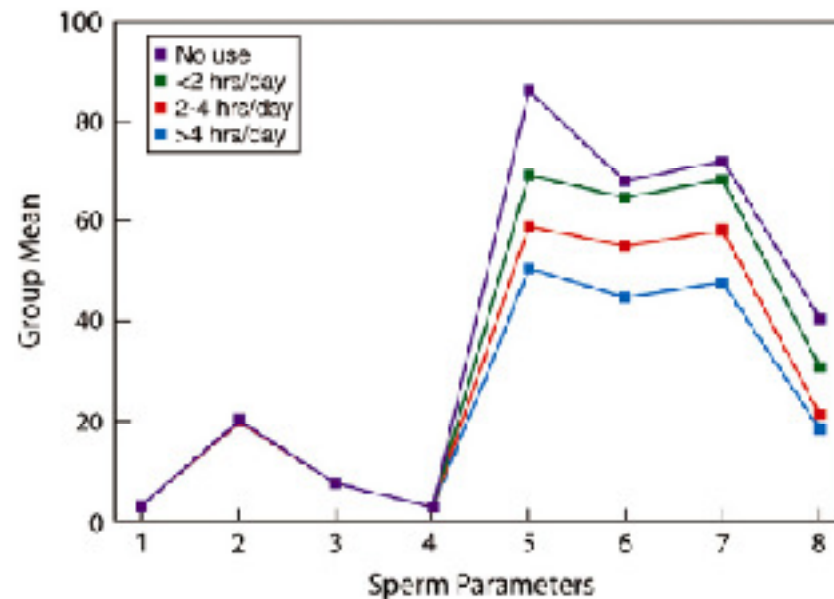
Irreversible infertility

Continuous exposure



30% sperm decrease in intensive mobile users, in addition to damage of sperms

Sperm parameter profile for cell phone use groups. The x-axis lists eight sperm parameters: 1 = volume; 2 = liquefaction time; 3 = pH; 4 = viscosity; 5 = sperm count; 6 = motility; 7 = viability; and 8 = percent normal morphology. The y-axis depicts the mean value of the corresponding sperm parameters for each cell phone use group.

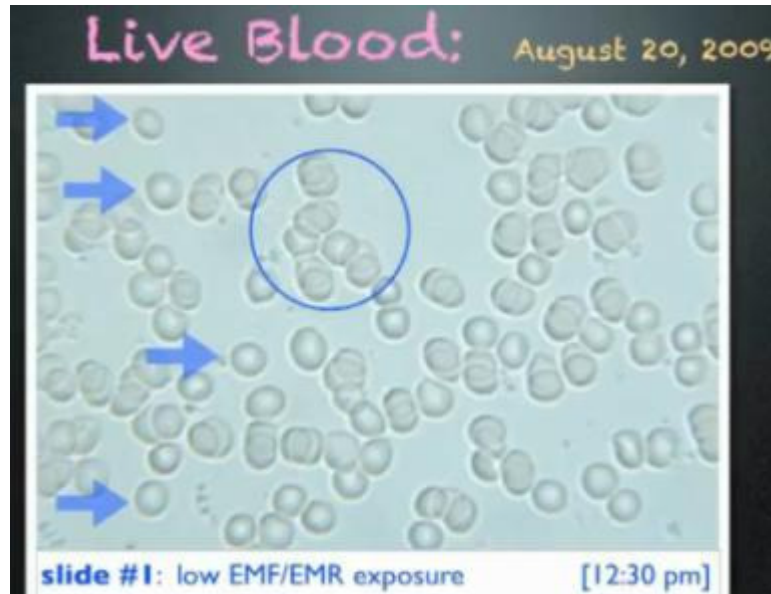


Agarwal. Cell phone usage and male infertility. Fertil Steril 2008.

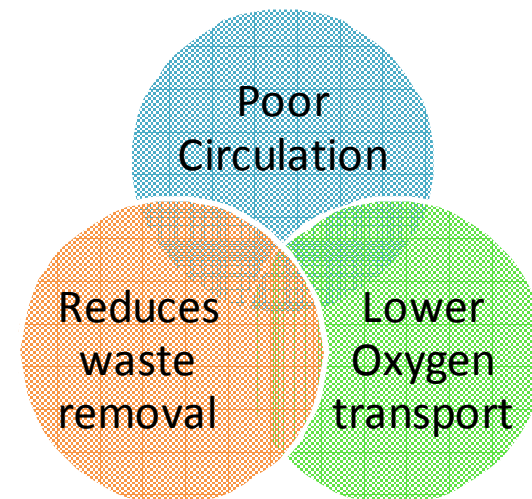
Live Blood Cells and Electromog



Dr. Magda Havas
Trent University, Canada



Consequences



DNA Damage

Single and double strand breaks observed in DNA from microwave exposure at levels below the current FCC exposure standard.



Prof. Henry Lai

University of Washington
1995, Diem *et al.* 2005

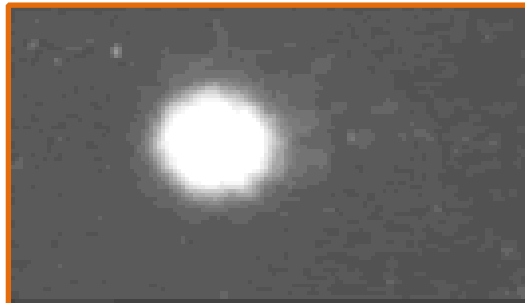


Fig.1 Unexposed control. Bundle of DNA (No-Tail)

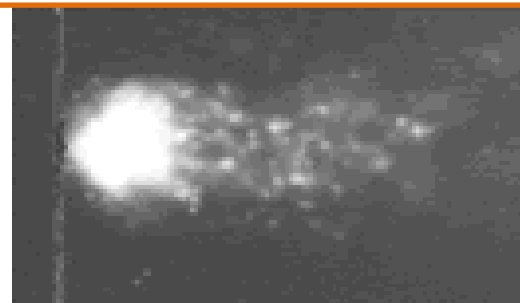


Fig.2 X-ray calibration 25.6 rads. DNA breaks are very obvious

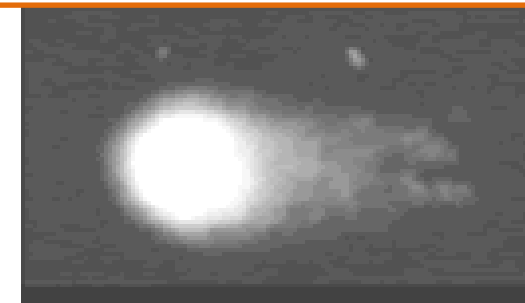


Fig.3 Cell Phone level microwave exposure 2hrs 2.45GHz reaching so called safe SAR levels
Comet Tail = DNA Damage

When Damage to DNA $>$ Rate of DNA repaired, there is the possibility of retaining mutations and initiating cancer

NEWS COVERAGE



Cell Phone Radiation? Text, Don't Talk, advises FCC

May 9 2011 - 4:36 pm | 1,586 views | 1 recommendation | 3 comments

How dangerous is your cell phone? The unfortunate reality is that you can't really know. Even so, only one year ago, progressive San Francisco Mayor Gavin Newsome proposed an ordinance that would have required that all retailers inform consumers about the amount of radiation that cell phones emit. Material printed in 11pt. type would have been posted next to phones disclosing their specific absorption rate ("SAR"), which is a measure of radio frequency energy (radiation) absorbed by the body. Last



HALF AN HOUR OF CELLPHONE USE A DAY INCREASES BRAIN CANCER RISK

A landmark 10-year study undertaken by the World Health Organisation has found that people who speak on their handset for more than half an hour a day for over 10 years are at risk of brain cancer...

Cellphone users worried about getting cancer aren't off the hook yet. A major international study into the link between cell phone use and two types of brain cancer has proved inconclusive, according to a report due to be published in the *International Journal of Epidemiology* today.

A 10-year survey of almost 13,000 participants found that phone use didn't increase the risk of developing meningiomas — a common and frequently benign tumour — or gliomas — cancer but deadliest form of cancer.

LONGER CALL TIMES INCREASE CANCER RISK

It found no increased risk of glioma or meningioma tumours after 10 years of using a mobile phone, although it found "suggestive of higher risk" for the heaviest users.

Given that the heaviest users in the study talked an average of half an hour per day on their phones, a figure which is not heavy by today's standards.

The heaviest users who reported using their phones on the side-side of their heads had a 40 per cent higher risk for gliomas and 15 per cent for meningiomas, but the researchers said "cases" prevent making a causal link.

"The study doesn't reveal an increased risk, but we can't conclude that there is no risk because there are enough findings that suggest a possible risk," the study's chief author, Elizabeth Cardis.

Among the factors that weren't examined were the effects of using handheld devices during calls or the risk of having phones directly while not making calls — such as in a pocket, or near or in the bed at night.

The authors acknowledged possible inaccuracies in the survey tools due to the fact that participants were asked to remember how much and on which ear they used their mobiles over the past decade.

The authors said further investigation is necessary before they can conclude with certainty that there is no link between phone radiation and brain cancer, partly because people's usage has changed considerably since the start of the study in 2000.

FUTURE STUDIES WILL LOOK AT RISK IN CHILDREN

Scientists are also planning to examine whether phone use increases the risk of tumours in the ear's acoustic nerve and the parotid gland, where saliva is produced. A separate study will look into the effects of cellphone use on children,

who are believed to be more susceptible to the effects of radiation. The 120 million study was completed by researchers in 13 countries whose estimates encompassed 12,846 participants, of which 3,150 had either meningiomas or glioma tumours.

Network operators and handset companies had heavily anticipated the results, which could have dented the development of their business. There was an estimated 4.1 billion phone subscriptions at the end of last year, according to the International Telecommunications Union.

In a statement Sunday, the Mobile Manufacturers Forum welcomed the study. "The phone industry takes all questions regarding the safety of phones seriously and has a strong commitment to supporting ongoing scientific research," the industry group said.

ARAC/3



MORE RESEARCH NEEDED

The older varieties of cell-phones were more likely to cause damage. However, the newer varieties are less likely to emit the tumour-causing radiation, though it is obvious that the cell-phones can cause damage. The extent of it is yet to be determined because most of the studies have been inconclusive.

A long-term study said that three to four hour of everyday cellphone use over a period of ten years will cause brain tumour. However, most of it has been speculation. The causes of most cases of tumour



and similar disorders are genetic, and hence pre-determined. For an outside stimulus to cause such damage, the brain would have to go in specific directions.

Nonetheless, it is advisable to use cellphones that can reduce the risk to almost zero. And the longer the usage, the longer you will be in touch with a harmful communication device, which is not a bad thing at all.

— Dr Nikil Patel,

Head of department of neuro-surgery, Sionby Hospital

26 Oct 2011

Study by KEM Hospital proves hearing problems

Heard this? Talking on phone makes you deaf

That indispensable gizmo, so much a part of your daily life, has caused hearing loss in the young, according to a study by KEM Hospital doctors; plugging in to listen to music is not a safe bet either

Lata Mishra
@lata@wip.com

Do you jabber on your mobile phone for at least 10 minutes every day? If so, that short span of time is long enough to give you a hearing problem. So says a study conducted recently by KEM Hospital, Pune.

This study, the first such to be carried out by a civic hospital, will be documented in the civic body's annual report.

The study, conducted over a three years, was carried out on 50 people - 16 of the subjects are women. All the subjects were between 18 and 40 years of age. A majority of them subjects (68 per cent) were in the 21 to 25 age group, said assistant professor Dr Neelam Sathe of the Ear, Nose and Throat Department who conducted the study along with resident doctor Ithanashee Chiplunkar.

Twenty-three of the subjects (that's 46 per cent) have already lost their hearing, the findings reveals.

DON'T HAVE A BLAST

The study reveals that people using cellphones to listen to music also showed trouble with their hearing.

"The majority of patients selected were those who complained of earache, especially the right ear," said Dr. Sathe. "The history of the patients revealed that they used to talking excessive on

DOSANDDON'TS

- » Limit use of cellphone for short duration
- » Buy your mobile from a genuine company with low SAR value
- » Talk on loud speaker mode or use earphones and headphones
- » Children and pregnant women should avoid using mobiles
- » Don't use defective mobiles
- » Avoid direct contact of mobile to ear
 - » if possible, use landline phone or text messaging instead of mobile phone
 - » Do not make a call when the signal strength is weak



the mobile phone."

While 20 patients (40 per cent) held the phone to their left ear, 19 of them (39 per cent) used the right ear during a phone conversation while the rest (22 per cent) used the phone to both ears.

The ear, which was most used during the phone conversation, was seen to be most commonly affected.

Those included in the study had been using cellphones for at least a year and for up to 12 years. On a daily basis, the average duration of exposure to the phone was between 20 minutes and up to a maximum of 5 hours.

While 13 patients (26 per cent) had the a history of pain in the ear, 11 patients (22 per cent) said they had a 'feeling of fullness' in the ear.

The feeling of fullness that patients referred to was a sensation that one's ear is blocked, like it happens when water enters the ear, for instance.

Also, 19 patients (38 per cent) complained of decreased hearing while seven patients (14 per cent) were found to have the complaint of tinnitus. In simple language, tinnitus is an imaginary sound that appears to ring in the ear.

AUDIGORAMS DON'T LIE

"As per patients' medical history we did an audiogram which revealed that 23 patients (46 per cent) suffer from perma-

nent hearing loss problem," said Dr Sathe.

An audiogram is a clinical test that indicates a person's hearing ability. Its unit measure is kilohertz, symbolised as KHz. An average person has hearing ability of between 500 KHz and 88 KHz. Advancing age makes a person lose up to 8 KHz of hearing loss.

"The study has shown that young people tend to lose about 8KHz of hearing due to cellphone use," said Dr Sathe.

Dr Chiplunkar said that plugging in to the cellphone regularly to hear music also causes hearing loss. "In the study, 24 persons (48 per cent) said they continuously heard music on earphones for over an hour daily. "The audiograms show that seven such patients have hearing loss."

Long-term usage apart, intensive use of the phone may also lead to ear damage. "The hearing loss is not only due to radiation but also depends on the volume.



● Constant exposure to loud noise, overuse of phones can cause high frequency hearing loss

Get off your mobile phone, now

Santosh Andhale

If you cannot hear the sounds of the consonants f, s, t, and z or high pitched sounds, chances are you are suffering from high frequency hearing loss.

"Most healthy people are not aware that they suffer from high frequency hearing loss, which is very common," said Dr Joyti Mohite, associate professor, audiology and speech therapy department at Nair Hospital.

Every year, medical students at Nair and JJ hospitals are screened for health problems. This year, the results were startling — around 50% of the 300 students were found suffering from the high hearing frequency loss. "We found that those with high hearing frequency loss would talk on their mobile phones for hours and listened to loud music on their ear-phones," said Dr Mohite.

"Currently, these students do not have any problem, but we have asked them not to use the mobile phone rigorously and avoid exposure to loud noise," she added.

People with high frequency hearing loss can hear vowels, but not consonants f, s, t, and z.

"People with high frequency hearing loss show symptoms like inability to hear consonants, failure to hear high pitched sounds, tinnitus (abnormally loud sounds in the ear canal for some duration), difficulty talking in groups and inability to hear when there noise in the background," explained Dr Mohan Jagde, head of ENT department, Sir JJ group of hospitals.

He advised that before seeking treatment, people should visit an audiologist to find out what type of hearing loss they have and the extent of the damage. "If people with high frequency hearing loss people do not take proper precautions, they may need hearing aids soon," said Dr Neelam Sathe, lecturer in the ENT department, KEM Hospital.

Apart from loud noise, diabetes, neuropathy, genetics, and infections like cold, flu and meningitis can cause high frequency hearing loss.

ABOUT THE CONDITION

People with high frequency hearing loss can hear low frequencies and tones, but not high pitches and other noises that aren't on the normal tonal range

High frequency hearing loss is characterised by the loss of ability to hear consonants such as s, f, t, and z, even though vowels can be heard normally. Consequently, people hear sounds but cannot make out what is being said

Health experts warn users of mobile phones to look out for symptoms such as ear warmth, ear fullness, and ringing in the ears (tinnitus) as early warning signs that you may have an auditory abnormality



Picture for representation



JOIN [facebook.com/DNAWakamKar](https://www.facebook.com/DNAWakamKar)

Besides loud noise, diabetes, your genes and infections like cold, flu and meningitis can cause high frequency hearing loss

Gymkhana can host events with riders

DNA Correspondent

In a major relief to Dadar Parsi Gymkhana, the Bombay high court on Tuesday allowed them to use the ground for social functions and marriages, but asked them to adhere to the noise pollution control norms.

A division bench of justice PB Majumdar and Mridula Bhatkar asked the gymkhana management not to overlook comfort of the residents of the area who are disturbed by the noise during functions.

"There are so many communities and festivals in our country. We must learn to enjoy it without disturbing others," remarked justice Majumdar. "For enjoying your festival, you must

not disturb somebody's peace."

The judges observed that while marriages and social functions are a part of our society, a balance has to be struck.

EP Bharucha, advocate for gymkhana, said they were willing to keep a check on noise pollution.

The court was hearing a petition filed by Dadar Parsi Gymkhana challenging the order of the Lokayukta restraining them from using the ground any purpose other than sports.

On May 2, the Lokayukta had passed an order following a complaint lodged by a local, Jyotibhaskar Salgaonkar, alleging that these functions inconvenience those residing in the area.

In September, the high court had

stayed the Lokayukta's order questioning its jurisdiction to pass such an order.

On Tuesday, when assistant government pleader Jasbir Saluja informed the court that the ground was surrounded by many buildings and it was a 'silent colony', justice Majumdar replied: "To find silence one has to go 100km away from the city. This is the hazard of modern living."

The judges directed the gymkhana to ensure peace of citizens in area is not disturbed at the next function on November 19, and instructed the police to verify and monitor the decibel level and submit a compliance report.

The matter will be next heard on December 7.

The radiation figure for each handset model must also be displayed prominently at all retail outlets that sell mobile phones.

Radiation Norms Set for Mobiles, Towers

Guidelines close to ones followed in US; Telecom min asked to prepare implementation road map

JOJI THOMAS PHILIP
NEW DELHI

Concerned about impact on consumer health from excessive mobile usage, the government has finalised radiation emission guidelines for cellphones and towers. The guidelines are close to the norms followed in the US.

ET has a copy of the new rules that specify upper limit for radiation for handsets that can be sold in the country.

Radiation emitted by cellphones is measured in terms of specific absorption rate (SAR) — the amount of radio waves absorbed by the body tissue when a mobile phone is in use. It is different for different phones.

The new rules state that cellphones can be imported and sold in India only if the SAR level is below 1.6 watts per kg (W/kg). So far India had unofficially followed European norms which state the maximum SAR level must not exceed 2 W/kg.

The guidelines state that SAR value, or the radiation emitted by the handset, must be specified on the device, its manual, the box as well as the websites of both the company and the telecom department.

The radiation figure for each handset model must also be displayed prominent-

ly at all retail outlets that sell mobile phones. Radiation limits for towers have also been tightened to a tenth of the existing exposure level.

For consumers, the cost of acquiring a cellphone is set to go up by a minimum of ₹400. This is because, the new rules make it mandatory for all handsets to be sold with a hands free device, as the government believes this step will help reduce the exposure to radiation significantly.

The telecoms department had finalised the rules on November 14, according to documents reviewed by ET.

Leading handset makers did not comment, as the rules are not public yet. But an executive with a leading cellphone

The new rules state mobiles can be imported and sold in India only if the SAR level is below 1.6 watts per kg

company said most handsets, except some Chinese brands, were already adhering to the US specified radiation limits. For instance, the Apple iPhone 4, has a SAR value of 1.17, the Samsung Galaxy S2 has a SAR of 0.338, while for the BlackBerry Curve 8310, the corresponding value is at 0.72. A significant part of the new guidelines are based on the recommendations of the inter-ministerial group that was set up to study the health-related effects of radiation emitted by mobile phones and towers.

The communications ministry has accepted most of the recommendations and telecoms minister Kapil Sibal has directed his ministry to prepare the implementation road map, according to internal department documents reviewed by ET.

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'Are cell phones injurious'
Sep. 2011.



While the cell has become an additional appendage for most of us, all this, of course, does not mean that we have to stop using cell phones. Just ensure you take precautions:

- Limit your use
- Talk for short durations
- If possible, use SMS
- Use cell phone with lower SAR value
- Use the speakerphone or wired hands free or Bluetooth, but keep the cell phone at a distance of at least 12 inches from your body
- Use the land-line, when available
- Do not keep cell phones in your hand/pocket for long.
- At home/office, keep the phone away from you

A still life composition on a light blue background. A dark blue ribbon is draped across the upper left. In the center, there are three white daisies with yellow centers and a small bud. To the right, there is a bunch of green, feathery herbs. Several translucent blue and green pills are scattered on the surface. The scene is lit with soft, diffused light, creating gentle shadows.

Thank you