Radiation Hazards from Cell Phones/Cell Towers

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OUTLINE OF PRESENTATION

- RF sources
- Radiation Pattern of Cell tower Antenna
- EMF exposure Safety norms
- Radiation measurements near cell towers
- Review Biological effects
- Case Studies
Electromagnetic Radiations

Radiation emitted from Cell Phones, Cell phone towers, Wi-Fi, TV and FM towers, microwave ovens, etc. are called Electromagnetic radiations (EMR).

EMR causes significant health hazards (biological effects) on human, animals, birds, plants and environment.
RF Sources in India

- **FM Tower (88-108MHz)**: PT=10KW, 503 towers
- **TV Tower (180-220MHz)**: PT=40KW, 1044 towers
- **AM Tower (540-1600KHz)**: PT=100KW, 197 towers
- **Wi-Fi (2.4 - 2.5 GHz)**: PT=10-100mW, Wi-Fi hot spots
- **Cell Tower (800, 900, 1800 MHz)**: PT=20W, 4.3 lakhs towers
- **Mobile Phones**: GSM-1800 - 1 W, GSM-900 - 2 W, 600+ million
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.
Microwave Heating Concept

4.2 KW (4200 W) of microwave power raises temperature of 1 Litre of water by 10°C in 1 second.

In energy absorption term, 4.2 KW-sec microwave energy will increase the temperature of 1 Litre by 10°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 10°C in 500 seconds.

Temp. of ear lobes increases by approx. 1°C when cell phone is used for approx. 20 minutes.
Cell Phone and Tower Statistics in India

**Worldwide:**
4.6 billion mobile subscriptions

**India:**
Population - 1.15 billion

Mobile subscriber base - 65crores. Growing at 1.5 crore/month, highest in the world (TRAI, June 2010).

Mobile Towers - Nearly 4.5 lakhs to meet the communication demand.
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 units of watts per kg (W/kg) of tissue.

In USA, SAR limit for cell phones is **1.6W/Kg** which is actually 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 commonly known to people in India.
### SAR Values for Mobile Phones

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Model</th>
<th>SAR Output (W/Kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motorola</td>
<td>V195</td>
<td>1.6</td>
</tr>
<tr>
<td>Motorola</td>
<td>Rival</td>
<td>1.59</td>
</tr>
<tr>
<td>Sony Ericsson</td>
<td>Satio (Idou)</td>
<td>1.56</td>
</tr>
<tr>
<td>BlackBerry</td>
<td>Curve 8330</td>
<td>1.54</td>
</tr>
<tr>
<td>Nokia</td>
<td>E71x &amp; X6</td>
<td>1.53</td>
</tr>
<tr>
<td>LG</td>
<td>Rumor</td>
<td>1.51</td>
</tr>
<tr>
<td>BlackBerry</td>
<td>Bold</td>
<td>1.51</td>
</tr>
<tr>
<td>Samsung</td>
<td>S3650 Corby</td>
<td>0.75</td>
</tr>
<tr>
<td>Samsung</td>
<td>SGH-G800</td>
<td>0.23</td>
</tr>
<tr>
<td>Samsung</td>
<td>Blue Earth</td>
<td>0.196</td>
</tr>
</tbody>
</table>

SAR is expressed in Watts per Kilogram

Current UK Standard = 1.0W/Kg  
Current US Standard = 1.6W/Kg

San Francisco Govt. has made it mandatory for the industry to display SAR value for each phone. (USA Today 14 July, 2010)
Antennas on Cell tower transmit in the frequency range of:

- **869 - 890 MHz (CDMA)**
- **935 - 960 MHz (GSM900)**
- **1805 – 1880 MHz (GSM1800)**
- **2110 – 2170 MHz (3G)**

*Note: Some frequencies may vary depending on country or service provider.*
Radiation Pattern of Antenna

Horizontal plane

Vertical plane
Radiation Pattern of a Cell Tower Antenna

Propagation of "main beam" from antenna mounted on a tower or roof top

People living within 50 to 300 meter radius are in the high radiation zone (dark blue) and are more prone to ill-effects of electromagnetic radiation.
CASE STUDY

Usha Kiran Building, Worli, Mumbai

Four cancer cases in 3 consecutive floors (6th, 7th and 8th) directly facing and at similar height as the mobile phone towers of four telecom companies placed on the roof of opposite building.
Power density $P_d$ at a distance $R$ is given by

$$P_d = \left( \frac{P_t \times G_t}{4\pi R^2} \right) \text{ Watt/m}^2$$

- $P_t$ = Transmitter power in Watts
- $G_t$ = Gain of transmitting antenna
- $R$ = Distance from the antenna in meters
Power Density at distance $R$ from cell tower

<table>
<thead>
<tr>
<th>Distance $R$ (m)</th>
<th>$P_d$ (W/m$^2$)</th>
<th>$P_d$ (µW/m$^2$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>79.6</td>
<td>79,600,000</td>
</tr>
<tr>
<td>3</td>
<td>8.84</td>
<td>8,840,000</td>
</tr>
<tr>
<td>5</td>
<td>3.18</td>
<td>3,180,000</td>
</tr>
<tr>
<td>10</td>
<td>0.796</td>
<td>796,000</td>
</tr>
<tr>
<td>50</td>
<td>0.0318</td>
<td>31,800</td>
</tr>
<tr>
<td>100</td>
<td>0.008</td>
<td>7,960</td>
</tr>
<tr>
<td>500</td>
<td>0.000318</td>
<td>318</td>
</tr>
</tbody>
</table>

The above values are for a **single carrier and a single operator**. For multiple carriers and **multiple operators** on the same roof top or tower, then the above values will **increase manifold**.
### Power Density for multiple carriers and operators

For $P_t = 20$ W, $G_t = 17$ dB = 50  
No. of carriers = 5, No. of operators = 3

<table>
<thead>
<tr>
<th>Distance R (m)</th>
<th>$P_d$ (W/m²)</th>
<th>$P_d$ (µW/m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1194.0</td>
<td>1194,000,000</td>
</tr>
<tr>
<td>3</td>
<td>126.0</td>
<td>126,000,000</td>
</tr>
<tr>
<td>5</td>
<td>47.7</td>
<td>47,700,000</td>
</tr>
<tr>
<td>10</td>
<td>11.94</td>
<td>11,940,000</td>
</tr>
<tr>
<td>50</td>
<td>0.477</td>
<td>477,000</td>
</tr>
<tr>
<td>100</td>
<td>0.1194</td>
<td>119,400</td>
</tr>
<tr>
<td>500</td>
<td>0.00477</td>
<td>4,770</td>
</tr>
</tbody>
</table>

For **5 carriers** and **3 operators** on the same roof top or tower, the radiation level is extremely high.
<table>
<thead>
<tr>
<th>International Exposure limits for RF fields (1800MHz)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>9.2 W/m²</strong></td>
</tr>
<tr>
<td><strong>3 W/m²</strong></td>
</tr>
<tr>
<td><strong>2 W/m²</strong></td>
</tr>
<tr>
<td><strong>1.2 W/m²</strong></td>
</tr>
<tr>
<td><strong>0.5 W/m²</strong></td>
</tr>
<tr>
<td><strong>0.24 W/m²</strong></td>
</tr>
<tr>
<td><strong>0.1 W/m²</strong></td>
</tr>
<tr>
<td><strong>0.095 W/m²</strong></td>
</tr>
<tr>
<td><strong>0.09 W/m²</strong></td>
</tr>
<tr>
<td><strong>0.025 W/m²</strong></td>
</tr>
<tr>
<td><strong>0.02 W/m²</strong></td>
</tr>
<tr>
<td><strong>0.001 W/m²</strong></td>
</tr>
<tr>
<td><strong>0.0009 W/m²</strong></td>
</tr>
<tr>
<td><strong>0.00001 W/m²</strong></td>
</tr>
<tr>
<td>Standards, GSM1800/GSM1900/UMTS/DECT (e.g.)</td>
</tr>
<tr>
<td>---------------------------------------------</td>
</tr>
<tr>
<td>FCC/ANSI – USA</td>
</tr>
<tr>
<td>Germany, England, Finland and Japan</td>
</tr>
<tr>
<td>Belgium</td>
</tr>
<tr>
<td>Switzerland and Italy</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Recommendations / References (e.g.)</th>
<th>Total Power Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ecolog Study, Germany (ECOLOG 2000)</td>
<td>10,000 μW/m²</td>
</tr>
<tr>
<td>Cellular tower radiation – significant exposure level, 95(^{th}) percentile (this study)</td>
<td>6,300 μW/m²</td>
</tr>
<tr>
<td>Salzburg, Austria (RESOLUTION 2000)</td>
<td>1,000 μW/m²</td>
</tr>
<tr>
<td>Cellular tower radiation – median level, 50(^{th}) percentile (this study)</td>
<td>200 μW/m²</td>
</tr>
<tr>
<td>High exposure, Oeko-Test (OEKOTEST 2001)</td>
<td>100 μW/m²</td>
</tr>
<tr>
<td>EU Parliament (STOA 2001)</td>
<td>100 μW/m²</td>
</tr>
<tr>
<td>Cellular tower radiation – background level, 20(^{th}) percentile (this study)</td>
<td>10 μW/m²</td>
</tr>
<tr>
<td>Low exposure, Oeko-Test (OEKO TEST 2001)</td>
<td>10 μW/m²</td>
</tr>
<tr>
<td>Nighttime exposure, Baubiology Standard (SBM 2000)</td>
<td>0.1 μW/m²</td>
</tr>
<tr>
<td>Successful communication with GSM mobile phone, system coverage requirements</td>
<td>0.001 μW/m²</td>
</tr>
<tr>
<td>Natural cosmic microwave radiation (MAES 2000)</td>
<td>0.000001 μW/m²</td>
</tr>
</tbody>
</table>
GSM cell tower power density levels – percentiles

(Haumann T. et al, Germany)
Other Standards and Guidelines

- **BioInitiative Report 2007** - 1000 μW/m² for outdoor, cumulative RF exposure

- Building Biology Institute, Germany, provided following guidelines for exposure:
  a. <0.1 μW/m² (0.00001 μW/cm²) - no concern
  b. 0.1 - 10 μW/m² (0.00001 to 0.001 μW/cm²) - slight concern
  c. 10 - 1000 μW/m² (0.001 to 0.1 μW/cm²) - severe concern
  d. > 1000 μW/m² (> 0.1 μW/cm²) - extreme concern

- We recommend safe power limit up to 50 μW/m² with upper limit as 100 μW/m².
India adopts ICNIRP guideline for Power density ($P_d$) 

\[ P_d = \frac{\text{Frequency}}{200}, \text{frequency is in MHz}. \]

For GSM900 (935-960 MHz), $P_d = 4.7\text{W/m}^2$ and 
GSM1800 (1810-1880 MHz), $P_d = 9.2\text{W/m}^2$.

ICNIRP has considered only thermal effects of radiation and has given following disclosure:

ICNIRP is only intended to protect the public against short term gross heating effects and NOT against 'biological' effects such as cancer and genetic damage from long term low level microwave exposure from mobile phones, masts and many other wireless devices.- [http://ww.icnirp.de/documents/emfgdl.pdf](http://ww.icnirp.de/documents/emfgdl.pdf)
Power Absorbed by Human Body

How much microwave power will be absorbed by human body if exposed to the so called safe radiation level adopted in India, which is f/200, where f is in MHz?

At 940 MHz, Power density ($P_d$) is 4.7 W/m²

Area = 1.43 m²

Power received ($P_r$) by human body will be $[P_r = P_d \times \text{Area}] = 6.75$ Watts in one sec.

Microwave oven: 700 to 1000 W. With say 60% efficiency, microwave power output is say 500 W.

In one day, microwave energy absorbed will be $[6.75 \text{ Watts} \times 60 \times 60 \times 24 \text{ sec}] = 583.2 \text{ KW-sec.}$

This implies that human body can be safely kept in a microwave oven for 1166 secs = 19 minutes per day.
Power Received by an Antenna

Power Received $P_r$ by an antenna at a distance $R$ is given by:

$$P_r = \frac{P_t \times G_t \times Area}{4\pi R^2} = P_t \times G_t \times G_r \times \left(\frac{\lambda}{4\pi R}\right)^2$$

- For a transmitter power, $P_t = 20$ W
- Transmitting antenna gain, $G_t = 17.0$ dB = 50
- Receiving monopole antenna gain, $G_r = 2$ dB = 1.6
- Received power at $R = 50$ m is:
  - At 940 MHz, $P_r = 0.413$ mW = -3.8 dBm
  - At 1840 MHz, $P_r = 0.108$ mW = -9.7 dBm

Power density is equal to $31.8$ mW/m$^2 = 31,800$ µW/m$^2$. 
**EXPERIMENT:** Radiation level measurements near several Cell Tower sites

Broadband monopole antenna of gain = 2 dB was used to measure radiated power from cell towers (CDMA, GSM900 and GSM1800)

Measured Power (in dBm)
For each frequency bands

- 50m: -20 to -30 dBm
- 100m: -30 to -50 dBm
• Measured power is less than theoretically calculated power as the concrete wall provides some attenuation and also these buildings were not directly in the direction of maximum radiation of transmitting antenna.

• A mobile phone requires -80 to -100 dBm power for its proper operation. Thus power level at 50m is 50 to 60 dBm (100,000 to 1,000,000 times) more than required by mobile phone.
50m from cell tower (IIT-B)

10m from cell tower (IIT-B)

Power level measured using a hand-held radiation monitor was: -6dBm and 5dBm (max. limit of instrument) at 50m and 10m, respectively.
# Radiation Measurement at various locations

Cumulative Readings including following:
CDMA , GSM 900 , GSM 1800 , Bluetooth, Wireless LAN (0.8-4GHz)

<table>
<thead>
<tr>
<th>Location</th>
<th>Reading in dBm</th>
<th>Readings in W/m²</th>
<th>Readings in microW/m²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delhi-Gurgaon Highway - near Toll (3 towers)</td>
<td>0</td>
<td>0.121</td>
<td>121000</td>
</tr>
<tr>
<td>Vashi Bridge - after Railway Station</td>
<td>-4</td>
<td>0.0481</td>
<td>48100</td>
</tr>
<tr>
<td>Resident 1, 4th Fl: Sergeant House Lady w/cancer</td>
<td>-6</td>
<td>0.0304</td>
<td>30400</td>
</tr>
<tr>
<td>Resident 2, Opposite roof, Rane Society, Powai</td>
<td>-10</td>
<td>0.012</td>
<td>12000</td>
</tr>
<tr>
<td>Near Hub mall, Goregaon</td>
<td>-10</td>
<td>0.012</td>
<td>12000</td>
</tr>
<tr>
<td>Gandhi Nagar Over railway bridge-near building</td>
<td>-12</td>
<td>0.00763</td>
<td>7630</td>
</tr>
<tr>
<td>Ustav Chowk, Kharghar</td>
<td>-12</td>
<td>0.00763</td>
<td>7630</td>
</tr>
<tr>
<td>Vikroli - before Godrej</td>
<td>-14</td>
<td>0.00481</td>
<td>4810</td>
</tr>
<tr>
<td>Govandi- Residential towers - near Indian Oil</td>
<td>-14</td>
<td>0.00481</td>
<td>4810</td>
</tr>
<tr>
<td>Belapur Flyover, near RBI- CIDCO</td>
<td>-16</td>
<td>0.00304</td>
<td>3040</td>
</tr>
<tr>
<td>Vashi Highway – near Turbhe</td>
<td>-18</td>
<td>0.00192</td>
<td>1920</td>
</tr>
<tr>
<td>Nerul Bridge</td>
<td>-20</td>
<td>0.00121</td>
<td>1210</td>
</tr>
<tr>
<td>Vivero pre School (opposite powai lake)</td>
<td>-22</td>
<td>0.000763</td>
<td>763</td>
</tr>
<tr>
<td>Powai police station</td>
<td>-22</td>
<td>0.000763</td>
<td>763</td>
</tr>
<tr>
<td>Rajeev Gandhi nagar</td>
<td>-26</td>
<td>0.000304</td>
<td>304</td>
</tr>
<tr>
<td>On road near Evita (Hiranandani Building)</td>
<td>-28</td>
<td>0.000192</td>
<td>192</td>
</tr>
<tr>
<td>D-Mart, Hiranandani, Powai</td>
<td>-34</td>
<td>0.0000481</td>
<td>48.1</td>
</tr>
<tr>
<td>IIT Bombay School of Management - Entrance</td>
<td>-46</td>
<td>0.00000304</td>
<td>3.04</td>
</tr>
</tbody>
</table>
CASE STUDY:

SERGEANT HOUSE Residence (4th Floor) - Lady has been diagnosed with cancer - Cell phone towers few 10 meters away close to window in main beam. Measured Power levels using Radiation Monitor (in the room layout above) are given in dBm, which are very high.
Studies in Spain, the Netherlands, Israel, Germany, Egypt and Austria all document adverse health effects below the FCC guideline. Based on symptoms experiences: Cellular phone base stations should not be sited closer than 300 m to populations.

(Santini R 2002)
Serious health concerns regarding current Safety Guidelines

Power Density ($\mu$W/cm$^2$)

Guidelines for various countries

- Canada, Germany, Japan, NZL, USA
- Australia
- Auckland, NZL
- China
- Italy
- Bulgaria, Hungary, Russia, Switzerland
- Salzburg, Austria, pulsed
- New South Wales, Australia

Data from Firstenberg 2001
RF Spectrum near cell tower
TV Tower Radiated Power Density at Different Height at a distance of 800 m

<table>
<thead>
<tr>
<th>H(m)</th>
<th>R (m)</th>
<th>Power density (mW/cm²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>230</td>
<td>803</td>
<td>0.00147</td>
</tr>
<tr>
<td>200</td>
<td>806</td>
<td>0.00145</td>
</tr>
<tr>
<td>150</td>
<td>814</td>
<td>0.00139</td>
</tr>
<tr>
<td>100</td>
<td>825</td>
<td>0.00132</td>
</tr>
<tr>
<td>50</td>
<td>838</td>
<td>0.00124</td>
</tr>
<tr>
<td>0</td>
<td>854</td>
<td>0.00115</td>
</tr>
</tbody>
</table>
TV Tower radiation measurement with shield

Without shield  
With shield
BIOLOGICAL EFFECTS
Multiple Resonances - localized heating - This results in boils, drying up the fluids around eyes, brain, joints, heart, abdomen, etc - leg/foot pain, muscle and joint pain.
Most common complaints:

Cognitive functions - Concentration, memory, behavior, etc

Epidemiological studies - Sleep disruption, Headache, Depression, discomfort, irritability, nausea, dizziness, appetite loss, muscle spasms, numbness, tingling, altered reflexes

Subjects reported buzzing in the head, palpitations of the heart, light-headedness, heat, visual disorders, cardiovascular problems, respiratory problems, nervousness, agitation. More severe reactions include seizures, paralysis, psychosis and stroke.

All these are related to changes in the electrical activity of the brain.
**Blood Brain Barrier** - selectively lets nutrients pass through from the blood to the brain, but keeps toxic substances out.

- Albumin in brain tissue - Damaged blood vessels & lost brain protection
- Neuron - Grouped & shrunken with loss of internal cell structures.

**NOTE**: BBB in is the same in a rat and a human being.
Alzheimer’s, Motor neuron, Parkinson's disease

• 4 times incidence of Alzheimer’s disease (Hakansson et al 2003)
• 3 times amyotrophic lateral sclerosis (ALS) (Savitz et al 1998)

Cells concerning learning, memory, movement damaged
(Salford et al 2003)

↓ Melatonin production
(Protects from brain damage)
(Burch 1999a, Wood et al 1998)
1. Ca2+ release:

- ELF release Ca2+ bound to membranes
- Loss of Ca2+ causes leaks in the membranes of lysosomes releasing DNAase that causes DNA damage.

2. Interfere with natural processes:

- DNA replication & repair - altering molecular conformation
- This could result in chromosome aberrations, micronuclei formation & increased DNA fragmentation
3) **Free radical formation inside cells:**

- ↑ free radical activity in cells from EMF via Fenton rxn.
- Free radicals kill cells by damaging macromolecules, such as DNA, protein and membrane.

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

Normal Cell (Human/Animal)

Over-expression of (HSPs)

Inhibit natural programmed cell death (apoptosis)

cells that should have ‘committed suicide’ continue to live.

Consistent with the 2-3-fold ↑ in incidence of a rare forms of cancer

Sleep Disorders

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

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

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

Fetus &Mother - RF can pass placental barrier & continuously react with the developing embryo and increasing cells
Effect on Skin

✓ Rashes / sores – redness of skin
✓ Crawling, biting and stinging sensations
✓ Granules, threads or black speck-like materials on or beneath the skin.

☐ Alters protein expression in endothelial cell lines and affect skin structure, (↑ed transtyrretin protein conc.)
☐ May enhance development of skin tumours.
Tinnitus and Ear Damage

Tinnitus or “Ringxiety” - sensation of cell phone ring – in millions of cell phone users. People with severe tinnitus may have trouble hearing, working or even sleeping.

Warm sensation/pain > tinnitus > irreversible hearing loss

- Damage the delicate workings of the inner ear.
- Patients, 18-25 yrs of age - damaged hair cells by RFR from phones. Hearing problems occur because these cells do not regenerate.
Effect on Eye/ Uveal Melanoma

(A) Macroscopic Damage

Good quality lens

Exposed lens - ability to focus the laser beam at the various locations is altered.

(B) Microscopic Damage

Tiny "bubbles" created due to microscopic friction between particular cells exposed to EMR. Contrary to macroscopic damage, the microscopic damage does not heal and accumulates with time.

Right frame - Control lens with no damage.
Bottom frame - demonstrates the effect of microwave radiation on bovine lens sutures.
Melatonin Reduction

Powerful antioxidant, antidepressant and immune system enhancer that regulates circadian rhythm.

> 25 min/day – Prolonged use → ↓ Melatonin production


- arthritis
- increased eye stress
- chronic fatigue, depression
- ↑ cancer
- renal impairment
- ↑ childhood leukemia
- miscarriage
- ↑ DNA damage
- sleep disturbance
- cardiac, reproductive and neurological diseases
Increase in Cancer risk

- Mobile phone use >10 years doubles risk of brain cancer. Risk is highest for ipsilateral (on the same side of the head where the instrument is held) exposure.

- Cell phone use also increases risk of glioma, acoustic neuroma, salivary gland tumors, uveal melanoma, non-Hodgkin lymphoma, facial nerve tumors, skin, blood, testicular and breast cancer.

- Children and teenagers, before age of 20 - Five times more likely to get brain cancer if they use cell phones.
Live Blood Cells and Electrosmog
Symptoms

- Headache, fatigue
- Difficulty concentrating
- Numbness, tingling, cold extremeties
- Heart and blood pressure problems

Consequences

- Poor Circulation
- Reduces waste removal
- Lower Oxygen transport
Effect on Environment

**Farm animals** -
- Dairy cows – Decreased milk production, spontaneous abortions, reproductive and developmental problems, and general declines in overall health.
- Sheep, dogs, cats, rabbits living near base stations affected.

**Birds** –
- Interfere with navigation, reproduction, thin shells.
- London - 75% fall sparrow population.
- **Sparrow - 'Red List’** of endangered avian species.
- Fall in Pigeons, swans, white stork, rock dove

- Biological indicators to detect alterations in our ecosystem
Honey Bees -

Colony Collapse Disorder (CCD):
• Abrupt disappearance of bees.
• Cannot find their way back to hive due disruption in intercellular communication.

CCD has hit – US (up to 70 %), England (54% fall), Germany, Spain, Italy, Switzerland, Greece, Scotland, Wales, Kerala etc

Abrupt disappearance of bees in US
• 1/4th (about 2.4 million colonies) lost to CCD.
• Loss projected to $8-12 billion on US agricultural economy.
• US now regularly imports bees from Australia and China.

❖ Bees are vital pollinators for agriculture. With vanishing of bees, a major food crisis could ensue.
RESULT OF RE-EVALUATION OF INTERPHONE STUDY

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

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

**Re-evaluation - Risk underestimated by at least 25%**

- Flaws in the design
- 25% industry funded
- Correction factor - significant results.
- For every 100 hours of use - 26% ↑ risk of meningioma
- Initial 24% risk of glioma ↑ ed to 55% - regular users (2 hrs/month)?
- Doubled - quadrupled brain tumor risk - heavy users (1/2 hour/day)
- Children, young adults – excluded. New study - Mobi-kids
Dr. Carlos Sosa, M.D., physician and surgeon living in Medellin, Colombia - Had to move five different apartments all over the city, resign his position at the hospital due to nearby masts and high radiation inside the Emergency Service. He now lives in a Faraday cage that prevents radiations from entering inside.
CASE STUDY

250,000 Swedes allergic to mobile phone radiation

- Around 230,000 - 290,000 Swedish men and women - Out of a population of 9,000,000 are now electro hypersensitive and report a variety of symptoms when being in contact with electromagnetic field.

- One of the first countries where mobile technology was introduced (approx. 15 years ago).

- Sweden has now recognized EHS (Electrohypersensitivity) as a physical degradation and EHS sufferers are entitled to have metal shielding installed in their homes free of charge from the local government.
## CASE STUDY

Increased cancer cases with proximity to Towers

### Within 91 m from a mobile tower

<table>
<thead>
<tr>
<th>Name of deceased</th>
<th>Year of death</th>
<th>Cause of death</th>
<th>Age at time of death</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radhabai Sathe</td>
<td>2005</td>
<td>Breast cancer</td>
<td>66</td>
</tr>
<tr>
<td>Deshpande</td>
<td>2006</td>
<td>Oesophagus cancer</td>
<td>48</td>
</tr>
<tr>
<td>Shubhangee Deshpande</td>
<td>2007</td>
<td>Rectum cancer</td>
<td>66</td>
</tr>
<tr>
<td>Pujaree</td>
<td>2008</td>
<td>Cancer</td>
<td>46</td>
</tr>
<tr>
<td>Gawai</td>
<td>2008</td>
<td>Breast cancer</td>
<td>52</td>
</tr>
<tr>
<td>Shah</td>
<td>2009</td>
<td>Cancer</td>
<td>48</td>
</tr>
<tr>
<td>Vidyadhar Dev</td>
<td>2009</td>
<td>Liver cancer</td>
<td>52</td>
</tr>
<tr>
<td>Ransube</td>
<td>2009</td>
<td>Throat cancer</td>
<td>73</td>
</tr>
<tr>
<td>Archana Malvadkar</td>
<td>2009</td>
<td>Spinal cord cancer</td>
<td>17</td>
</tr>
</tbody>
</table>

*Source: L.B. Deshpande, who studied the deaths in his Solapur locality since two towers were installed four years ago*
Cell Phones - Cigarettes of 21st Century

What do they have in common?
✓ Produced by Multi-Billion $ Companies
✓ Products linked to illness
✓ Industries deny any health problem

✓ Warnings on cigarette packages, cell phone manufacturers are beginning to put warnings on user manual –

Blackberry warns: “...keep the device at least 0.98 inches (25 mm) from your body... and SHOULD NOT be worn or carried on the body.”

CELLPHONE USER’S MANUAL:
warns customers to keep cellphones away from body.
Until now, man has been absorbing the harmful, unseen EM radiations without even being aware of it, but now, with rapid advent in technology this RF Radiation pollution has started having ill effects on human health and health of animals.

Hence, there is an urgent need to take precautionary steps.

Example, when a glass is filled with water, it holds up to a certain level, but once it reaches the rim, it starts spilling. Similarly, our bodies can also absorb radiation up to a certain limit.
In addition to continuous radiation from cell towers, there is radiation from cell phones, computers, laptops, TV & FM towers, microwave ovens, etc. - additive in nature.

Stricter radiation norms must be enforced in India.

This does not mean that we have to stop living near these towers. We all know that automobiles create air pollution... Hence came up with unleaded petrol, CNG driven vehicle, hybrid vehicles, etc. Similarly, the solution to avoid excess radiation is to use radiation shields.

Mobile companies should not be in the denial mode and accept that radiation causes serious health problems. Only then people all over the world will carry out research to come out with solutions.
<table>
<thead>
<tr>
<th>Reference</th>
<th>Details</th>
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<tbody>
<tr>
<td>1</td>
<td>Haumann Thomas, et al, “HF-Radiation levels of GSM cellular phone towers in residential areas”</td>
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THANK YOU