

Electromagnetic Pollution in our Environment

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Electromagnetic fields, sometimes described as "electrosmog", have been intensifying for the past ten years. In addition to ELF (Extremely Low Frequency, e.g. 50 Hz), magnetic and electric fields from electric power lines and electric devices especially radio frequency and microwave radiation from mobile phone base stations, mobiles, cordless phones and wireless internet antennas (WIFI), have increased substantially.

Extremely Low Frequency Magnetic Fields (ELF)

ELF Magnetic Fields



High-voltage power lines obviously create a very strong magnetic field. The surrounding areas are unequally exposed. The major issue is the distance at which people can consider themselves safe. The reply to that question depends on the extent to which the line is used and the threshold limit laid down. In the case of 380,000 volt power lines, which are increasingly frequent in Europe, a distance of about 70 metres should be maintained if – as in Switzerland – a level of 1 microtesla is stipulated, and about 240 metres if the level of 0.1 microtesla recommended by the Bioinitiative working group (2007) is stipulated.

Examples of local magnetic fields are those created by a television set or some refrigerators. Televisions can be found in children's bedrooms, sometimes even next

to the bed, or the television may be in another room but is in reality, just the other side of the wall from the child's bed. In some of these cases, the magnetic fields can reach high levels. Depending on where people sleep, they could also be affected by their own or even their neighbour's refrigerator. Mention should also be made of the small devices, such as CD players or clock radios, often found just a few centimetres from the sleeping person's head. These should be placed at least 50 centimetres to 1 metre away from the bed.

In 2002, the Lyon-based International Agency for Research on Cancer (IARC) published a report showing that extremely low frequency magnetic fields may be possibly related to leukaemia in children. Studies conducted in California in 2002 produced similar findings and also concluded that there was a possible risk of brain tumours, miscarriages, amyotrophic lateral sclerosis and other conditions.

ELF Magnetic Fields California EMF-Program 2002

Health Outcome	Hazard
Leukaemia in Children	possible - definitiv
Leukaemia in Adults	possible - definitiv
Braintumor in Adults	possible
Miscarriage	possible
Motoneuron Disease (MND)	possible
Braintumor in Children, Breast Cancer, Alzheimer's Disease, Suicide, Sudden Heart Attack	inadequate

In 2007 the Bioinitiative Report (www.bioinitiative.org) added breast cancer and Alzheimer diseases associated with ELF magnetic fields exposure and recommended a limit of 0.1 μ T for residential areas.



- While new ELF limits are being developed and implemented, a reasonable approach would be a 1 mG planning limit for habitable space adjacent to all new or upgraded power lines and a 2 mG limit for all other new construction. It is also recommended for that a 1 mG limit be established for existing habitable space for children and/or women who are pregnant. This recommendation

$$1\text{mG} = 1 \text{ Milligauss} = 100 \text{ nT} = 0,1 \mu\text{T}$$

Electromagnetic Waves – Radiofrequency Radiation (RF) and Microwave Radiation (MW)

Radiofrequency and Microwave Radiation



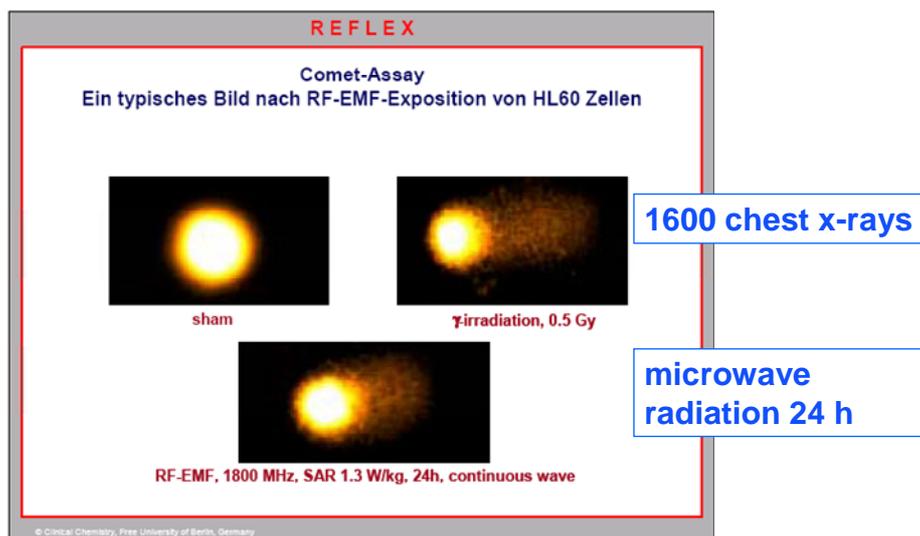
In contrast to ELF, with RF and MW radiation the electric and magnetic field become coupled: the electric field causes the magnetic one and vice versa. The resulting electromagnetic waves propagate through space, adopting increasingly quasioptical properties from the MHz range and up. These include, for example, reflection at conductive surfaces and refraction at edges of buildings.

Sources of RF and MW include transmitters such as broadcasting, television, mobile phone base stations for GSM, UMTS, etc, mobile phone handsets, cordless phones (CT1, DECT/GAP), trunked radio systems (TETRA, Tetrapol), digital data communications, Bluetooth, wireless local area networks (WLAN), radar stations, directional radio systems, microwave ovens, baby monitors and cameras, wireless keyboards and ordering systems, high-speed computers.

There should be a clear distinction between a short-term exposure, like from speaking on a mobile phone close to the head, and long-term exposure from mobile phone base stations or DECT base stations.

A recent study on cell cultures, the EU co-financed REFLEX study “Risk Evaluation of Potential Environmental Hazards From Low Energy Electromagnetic Field Exposure Using Sensitive in vitro Methods” (REFLEX 2004), observed chromosome damage due to exposure from electromagnetic waves. Both the comet assay and the micronucleus test consistently showed DNA damage after e.g. 4 hours exposure. The damage to the genetic material (DNA) in the chromosomes is a serious finding, which usually leads to legal rulings to reduce such risks.

DNA–Damage: Comet-Assay Microwave Radiation Mobile Phone

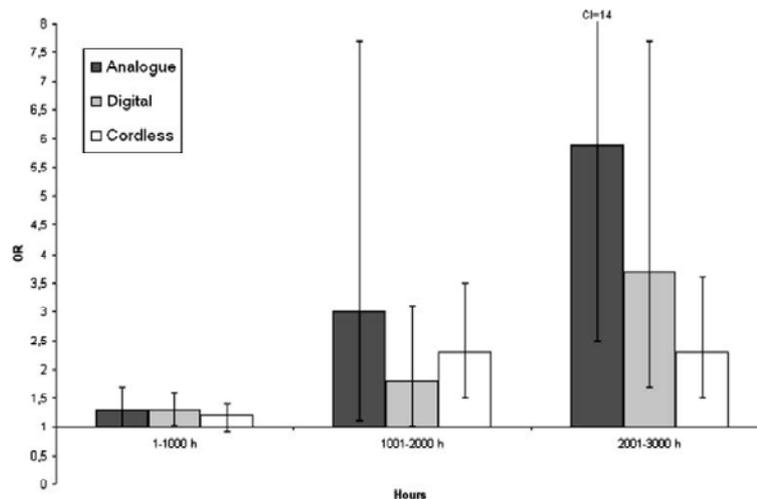


With respect to mobile phone exposure the health risk depends on the age of the subject and the duration of the exposure, for example the time spent using a mobile telephone. One of my slides showed the comparative effect on the brain of a child of five, a child of ten and an adult. At the age of five, a considerably greater amount of radiation was absorbed compared to the adult.

A Swedish study by Hardell et al. (2006) stressed the dangers of mobile phones for young people and that mobile telephone use increased the risk of a brain tumour

threefold over a period of 2,000 to 3,000 hours, which corresponded to about an hour a day over ten years. Given the number of mobile telephone subscribers, it could reasonably be assumed that the frequency of brain tumours would rise considerably. And it is certain that children are not being sufficiently protected.

Malignant Brain Tumours Mobile Telephone Users [Hardell 2006]

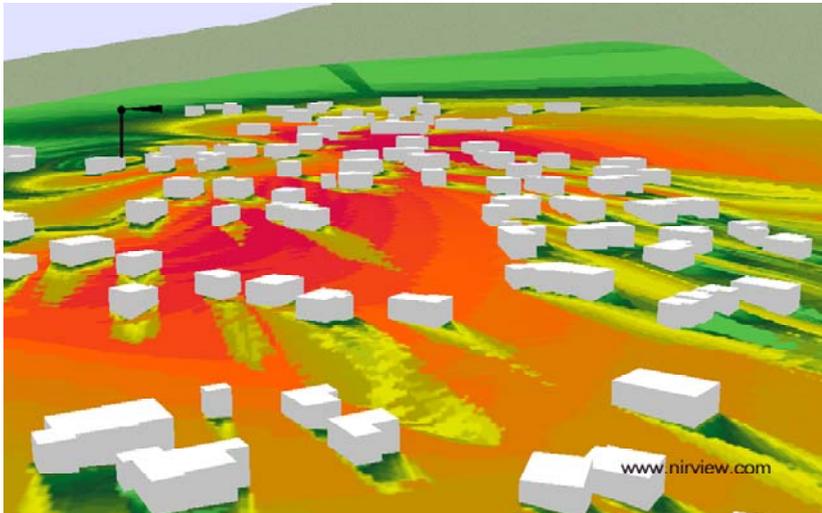


With regard to an association between mobile phone base stations and direct health effects, the first study published 2002 by Santini et al. (France) showed that the number of non-specific symptoms increased as the self-determined distance from mobile phone base stations decreased. In the symptom category “very frequently,” a significant increase in such symptoms as fatigue, irritability, headaches, sleep disruptions, depressive tendencies, concentration difficulties, memory loss, and dizziness could be observed in comparison to the reference group (> 300 m distance).

In a cross-sectional study from Spain, residents in the vicinity of two GSM mobile phone base stations were studied by Navarro et al. 2003. The study participants were recruited based on self-selection. The power density was measured as a broad spectrum across the bed (400 MHz – 3,000 MHz). The spectrum analysis showed the dominance of two GSM base stations at 900/1800 MHz. The participants were classified into two exposure groups: with an average RF exposure of 0.01 $\mu\text{W}/\text{cm}^2$ and with an average RF exposure of 0.11 $\mu\text{W}/\text{cm}^2$. The latter group with the higher exposure levels had a significantly higher score for irritability, headaches, nausea, loss of appetite, feeling of discomfort, sleep disruptions, depression and dizziness. This study was re-analyzed by the author (Oberfeld) with a logistic regression model revealing significant associations between measured power densities and 13 symptoms in an exposure-effects relationship independent from the self estimated distance to the GSM base stations. The distance between residence and mobile phone base stations as estimated by the study participants, was entered into the model as a measure for possible concerns and it hardly affected the statistic model. These data cannot be extrapolated to the general population because of self-selection. However,

the study results can be applied to an as-of-yet undefined subgroup within the general population, which suffers from significant disturbance to their general well-being and health due to the RF exposure from mobile phone base stations.

Radiation 3D



In a 2006 publication by Hutter et al. (Austria), individual symptoms were evaluated. Significant associations were observed for headaches, concentration problems as well as cold hands and feet. The symptoms occurred at exposure levels well below $0.1 \mu\text{W}/\text{cm}^2$ (former Salzburg Precautionary Exposure Limit outdoor). Furthermore, the selection of the study participants was representative; the selection was not based on any groups with higher susceptibility. This means that the study results are representative for the general population.

The widespread installation of mobile telephone antennas and the use of wireless internet (WiFi) and DECT base stations represents a worrying development. There is, or will be, no longer any place that is not affected, including schools and hospitals. It is hard for an individual to know the level of radiation to which they are exposed, as that really depends on their exact location. The symptoms experienced by sensitive people - fatigue, depression and concentration problems - vary considerably according to their distance from the source of the radiation.

The experts involved in the Bioinitiative Report agreed that the current threshold limits are obsolete and that urgent measures should be taken. As a precaution, they recommended not exceeding $0.1 \mu\text{W}/\text{cm}^2$ - or 0.614 volts per metre - outdoor cumulative RF exposure. Liechtenstein has passed legislation on the subject requiring a threshold limit of 0.6 volts per metre to be observed by the end of 2012.



- A precautionary limit of 0.1 ($\mu\text{W}/\text{cm}^2$ (which is also 0.614 Volts per meter) should be adopted for outdoor, cumulative RF exposure. This reflects the current RF science and prudent public health response that would reasonably be set for pulsed RF (ambient) exposures where people live, work and go to school. This level of RF is experienced as

$$0,1 \mu\text{W}/\text{cm}^2 = 1 \text{ mW}/\text{m}^2 = 0,6 \text{ V}/\text{m}$$

Based on empirical evidence, the Salzburg Public Health Office recommended in February 2002 for the sum total of the continuous exposure to GSM 900/1800 mobile phone base stations not to exceed 0.0001 $\mu\text{W}/\text{cm}^2$ (new Salzburg Precautionary Exposure Limit indoor) and 0.001 $\mu\text{W}/\text{cm}^2$ (new Salzburg Precautionary Exposure Limit outdoor).

Electromagnetic Standards and Recommendations General Public

Standards and Guideline Values for Mobile Phone Base Stations	V/m	$\mu\text{W}/\text{cm}^2$
ICNIRP /WHO / EU(all sources)	40 – 60	425-950
Switzerland (per Site)	4 – 6	4.2-9.5
Italy	6	9.5
South Tyrol	3	2.4
Bioinitiative 2007	0.6	0.1
Public Health Department Salzburg 2002 outdoor	0.06	0.001
indoor	0.02	0.0001

There is an urgent need to implement a Master Plan for EMF & Public Health. Both at European and national levels, advisory councils should be set up comprising scientists, environmental medicine specialists, epidemiologists, specialists in the biology of buildings, representatives of civil society, etc. More research is needed

and there needs to be more monitoring of these issues. Studies should be carried out for stress markers, such as cortisol, norepinephrine, epinephrine or serotonin to be monitored, as well as the oxidative stress markers and heart rate variability (HRV). People should be informed and educated about the risks associated with electromagnetic fields. Prevention plans are needed and finally, threshold limits based on health considerations should be laid down.

Further information may be obtained at: www.salzburg.gv.at/umweltmedizin

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