

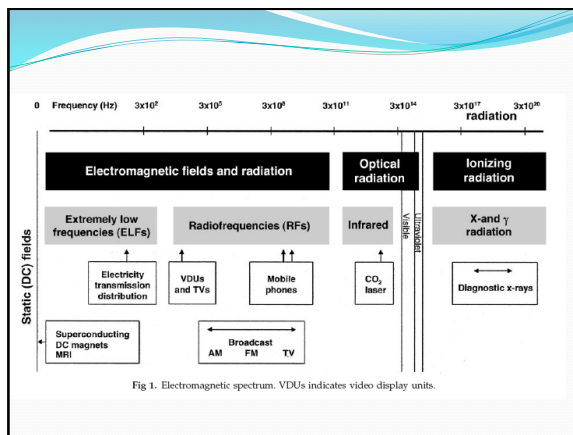
The Precautionary Principle in the Wireless Age

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RIO DECLARATION - 1992



Principle 15: In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.



Hazardous Effects of EMFs

High Energy Breaks chemical bonds;
Causes ionizations,
Birth Defects, and Cancer

Low Energy ? Causes Cancer,
? Neurodegenerative Disease,
? Electrohypersensitivity
? Reduced male fertility

Power-line Magnetic Fields

- The strongest evidence for human hazards from the non-ionizing portion of the electromagnetic spectrum comes from studies of 50 or 60 Hz magnetic field exposures and risk of childhood leukemia.
- These are at the lower end of the EMF spectrum. If 60 Hz magnetic fields cause cancer, RF fields should be worse.

Power-line Magnetic Fields and Cancer

- Three meta-analyses have shown significant elevation in rates of childhood leukemia in relation to residential exposure to EMFs (Wartenburg, 1998; Ahlbom et al., 2000; Greenberg et al., 2000).
- NRC (1997) states "The link between wire-code rating and childhood leukemia is statistically significant (unlikely to have arisen from chance) and is robust in the sense that eliminating any single study from the group does not alter the conclusion that the associations exist."
- WHO (2007) states "epidemiological data...show an association between ELF magnetic field exposure and an increased risk of childhood leukemia."

Occupational plus Residential Exposure and Adult Leukemia (Feychting et al., 1997)

	Residential	Occupational	Both
• Leukemia:	0.9 (0.4-1.8)	1.3 (0.9-2.0)	3.7 (1.5-9.4)
• AML	1.3 (0.4-5.0)	1.5 (0.6-3.6)	6.3 (1.5-26.0)
• CML	0.5 (0.1-3.9)	1.0 (0.4-2.8)	6.3 (1.5-26.7)
• CLL	0.8 (0.3-2.3)	1.5 (0.8-2.7)	2.1 (0.4-10.4)

EMFs and Cancer in Quebec

- Two Quebec studies have shown that prenatal exposure to magnetic fields increases risk of childhood cancer:
 - Infante-Rivard and Deadman (2003) found that occupational exposure of pregnant women increased risk of leukemia in their offspring by 2.5 fold (1.2-5.0)
 - Li et al. (2009) found that prenatal magnetic field exposure increased risk of brain cancer in the child by 1.5-fold (1.0-2.4), while in occupational-exposed women the risk was increased by 2.3-fold (1.0-5.4).

Radiofrequency (RF) EMFs

- These are the communications frequencies, ranging from AM and FM radio, TV, cell phones, and radar.
- WiFi, smart meters and wireless anything use RF fields to communicate between a generator and a receiver.
- Microwave ovens use RF. The fact that you can cook your potato in a microwave oven is proof that communication frequencies can have biological effects.

RF in the Ambient Environment

- It used to be that the urban RF environment was dominated by radio and television transmission RF.
- In the past few years we have increased the RF in the ambient environment enormously, coming from use of cell phones, cell phone towers, WiFi and smart meters, often using higher energy RF.
- What does this sudden increase in RF exposure suggest regarding human health?

Residential Exposure to RF from Radio Transmitters

- Michelozzi et al. (2002) reported elevations in leukemia in children living near to a radio transmitter tower in Italy (OR 2.2, 1.0-4.1).
- Ha et al. (2007) reported elevated leukemia in Korean children living near to a radio transmitter tower (OR 2.15, 1.00-4.67).
- These results indicate that while localized RF radiation may cause local cancer, leukemia is the cancer of greatest concern with whole body exposure. This is the same cancer seen with power-line ELF exposure.

Cell Phones

- As of 2007 there were 3.3 billion cell phone subscriptions, equal to half the world's population.
- The greatest concerns are brain cancer and leukemia.
- The latency for brain cancer from environmental exposures is usually thought to be 20-30 years.
- If cell phone use causes brain cancer we have a major problem, and it will get worse over time.

How a cell phone works:

- Cell phones use microwaves to transmit and receive information.
- Your cell phone communicates with the nearest cell phone tower.
- When you call someone farther away the microwaves go from one tower to another, and finally to the person you call.
- The further you are from the nearest cell phone tower the greatest the exposure to RF.

MICROWAVES:

- The microwaves used by a cell phone are very similar to those in your microwave oven, where food is heated.
- Cell phones are designed to use an intensity of microwaves that does not cause tissue heating.
- Microwaves travel at the speed of light, which allows signals to travel over long distances with very little latency.

Cell Phone Use for 10+ Years and Ipsilateral Glioma: Results from Meta-Analyses and Reviews

- From Individual Studies:
 - Lonn et al., 2005; OR = 1.60 (0.80-3.40)
 - Hepworth et al. 2006; OR = 1.60 (0.92-2.76)
 - Lahkola et al., 2007; OR = 1.39 (1.01-1.92)
 - Hardell et al., 2008; OR = 4.40 (2.50-7.60)
 - Interphone, 2010; OR = 1.57 (1.13-2.30)
- From Meta-Analyses:
 - Hardell et al., 2008; OR = 2.0 (1.2-3.4)
 - Kundi, 2008; OR = 1.9 (1.4-2.4)
 - Khurana et al., 2009; OR = 1.9 (1.4-2.4)
 - Myung et al. 2009; OR = 1.18 (1.04-1.34)
 - Levis et al., 2011; OR = 1.58 (1.21-2.00)

The INTERPHONE Study by the World Health Organization

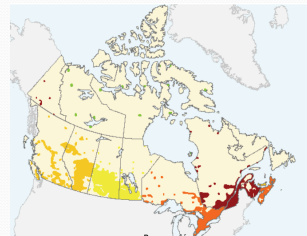
- This was a 13-country study of cell phone use and brain cancer, including Canada but not the US.
- Use of a cell phone for 10+ years resulted in a 2.18-fold increase in risk of glioma, use for 1640+ hours resulted in a 1.82-fold increased risk and making more than 270 calls resulted in a 1.31-fold increased risk of glioma.
- These positive results were hidden in an Appendix! The report abstract stated “No increase in risk of glioma or meningioma was observed with use of mobile phones”.

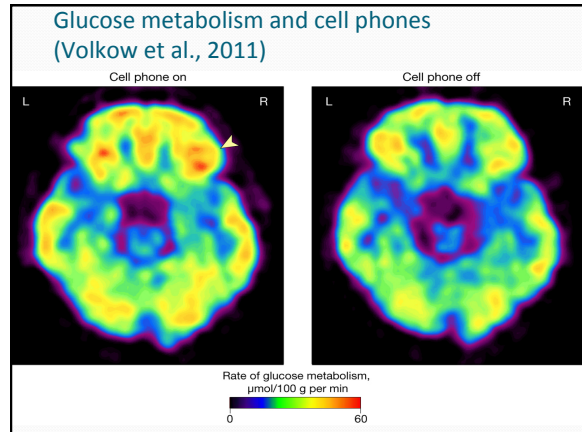
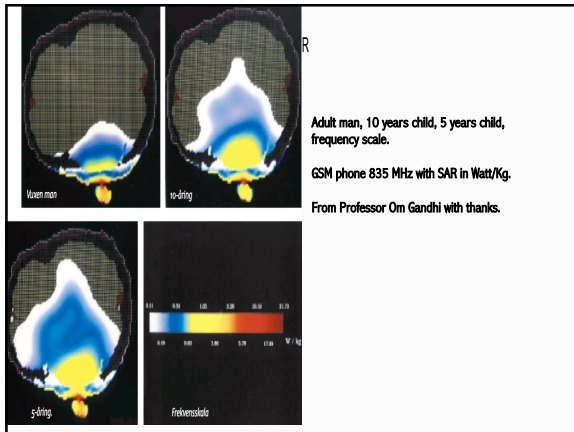
Susceptibility of Children

- Hardell and Carlberg reported on risk of glioma as a function of age of beginning use of a cell phone. The following is after > 1 year of cell phone use:
 - All ages: OR = 1.4 (1.1-1.7)
 - <20 years: OR = 5.2 (2.2-12.0)
 - 20-49 years: OR = 1.5 (1.1-2.0)
 - 50-80 years: OR = 1.3 (0.97-1.7)

Taux standardisé d'incidence par âge pour 100 000 habitants (Canada 1991)

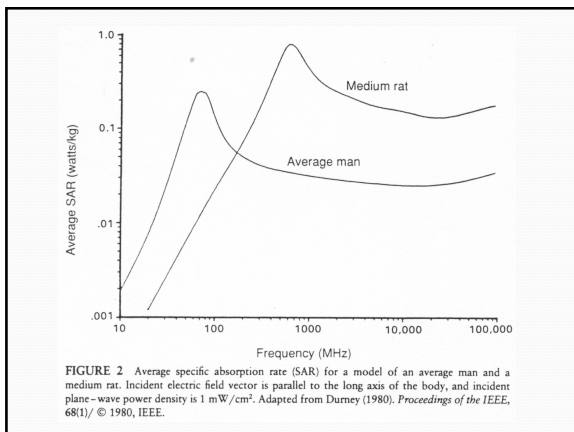
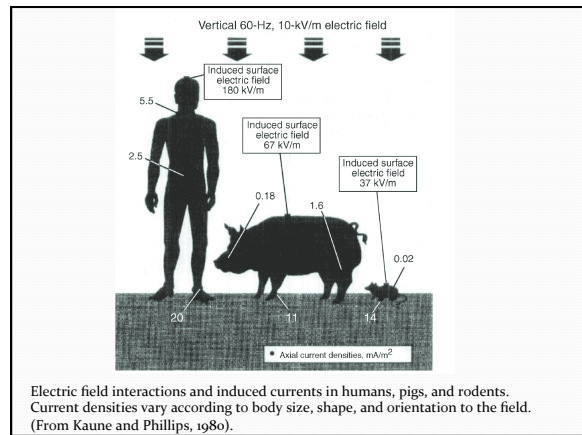
0.00 - < 5.74 5.74 - < 5.76 5.76 - < 6.37 6.37 - < 6.72 6.72 - 7.03





If the Evidence is so Strong, Why are There Not Tighter Standards?

- Four fallacious excuses are used to justify why governments have not done more to reduce exposure from EMFs:
 - A. There is no good animal model showing disease.
 - B. We don't know a specific mechanism whereby magnetic fields and RF can cause cancer and other diseases.
 - C. Non-ionizing radiation does not have sufficient energy to cause mutations.
 - D. The evidence for hazard is inconsistent.



Possible Mechanisms of EMF Effects

- We don't know the mechanism behind most cancers, so this should not be an issue.
- Examples of known human carcinogens that do not directly damage DNA include arsenic and dioxin.
- Several effects are known that may lead to cancer and other diseases:
 - Gene induction
 - DNA damage
 - Reactive oxygen species formation
 - Perturbation of calcium regulation

Microwaves and Tissue Heating

- Current national and international standards are based on the assumption that there are no adverse effects of RF that are not mediated by tissue heating.
- This assumption is wrong, as clearly documented by cellular, animal and human research.
- It is hard to understand why more steps are not taken to protect the health of the public, but conflicts of interest and opposition from the engineering and physics community are factors.

How Strong is the Evidence of Harm?

- On subjects like this one must look at the “weight of the evidence”, as is done in meta-analyses.
- Every meta-analysis done to date has confirmed elevated risk of brain cancer and acoustic neuroma with excessive cell phone use.
- Evidence for elevated risk of electrical hypersensitivity, neurodegenerative diseases and male infertility is less strong but building.

How Serious is this Problem?

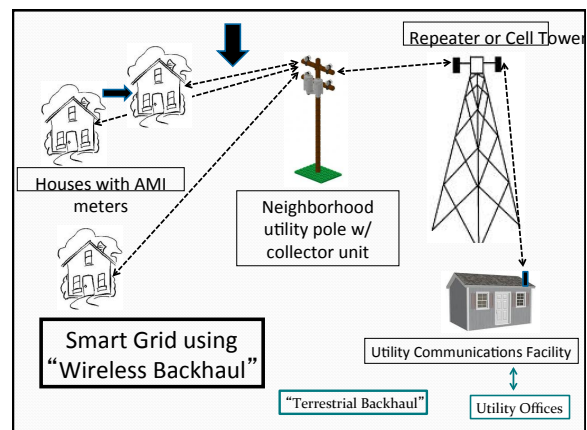
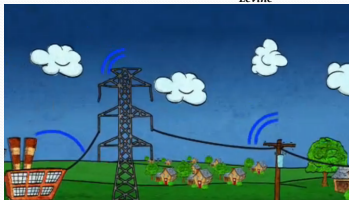
- Exposure assessment is very poor, often relating risk to only one component of EMF exposure.
- Under these circumstances it is almost certain that the true risk is grossly underestimated.
- Of particular concern is the intense use of cell phones by young children, and placement of wireless devices in schools and day-care centers.

What About Other Sources of RF?

- The RF exposure from a cell phone held to the head is intense, but most people do not use it for long periods of time.
- Other sources are usually at much lower intensity, but may result in exposure 24/7. This includes WiFi and smart meters.
- Total RF exposure (and therefore risk to health) from these sources of lower intensity may be greater than that from cell phone use.

“Your electric company is going to swap your old meter with a smart meter, equipped with wireless communication. **All your appliances will be also be smart**, they’ll be able to communicate with your meter, which in turn will be in **constant contact with the grid.**”

PBS’ s NOVA, “Smart Grid” 2/23/11 Thanks to Matt Levine





Smart Meters

- Smart meters benefit the utility, since they can then fire all the people that read meters.
- They will increase human exposure to anyone near the meter, although exposure falls off with distance.
- In the future, when chips are put in every electrical appliance, exposure will be even greater.

Are Smart Meters and WiFi Dangerous?

- To date there has not been specific study of these sources of RF exposure and adverse health effects.
- Exposure assessment for only these sources would be very difficult.
- However one does not need to have results from these specific exposures, given what we know about other RF exposures.

How Certain Are We That RF Causes Human Disease?

- The evidence that RF causes at least some kinds of cancer is strong, but many questions remain.
- The level of evidence for other diseases than cancer is weaker, and even more questions remain.
- However, the worst case scenario is that we will see an epidemic of cancers, especially leukemia and brain cancer.
- This is a perfect example of where the precautionary principle should be applied.

Summary of Available Policy Response for Dealing with the Possible Public Health Risks Posed by Exposure to Radio-Frequency Fields

Level	Specific Response
Minimal	Denial Passive information supply Active information supply
Prudent avoidance	Limited response for new facilities Reduction of radiofrequency field exposures to the degree possible
Major response	Major limitations imposed on radiofrequency transmission

Steps to Reduce Exposure to RF Fields from Mobile Phones

1. Use a landline whenever possible.
2. Send text messages whenever possible.
3. If you must use a mobile phone, use an headset rather than holding the phone close.
4. Don't allow children to use a mobile phone except in an emergency.
5. Don't keep an active phone in your belt pocket, which only exposes other body parts.
6. Don't sleep with the phone on next to your body.

Steps to Reduce Exposure to Other RF Sources

- Don't place AM, FM, TV or cell phone towers close to homes, schools or businesses.
- Don't put wireless networks in schools - use wired connections.
- Resist the general movement to make everything wireless without consideration of negative consequences. This includes things like "smart meters".

Conclusions

- There is already very convincing evidence for an elevation in risk of cancer from EMF/RF exposure. Evidence for other diseases is growing.
- Because of the long latency for these diseases and the limits of current exposure assessment, we almost certainly underestimate that real risk.
- The precautionary principle (and common sense) requires that we take action now to reduce exposure.