Electromagnetic hypersensitivity

Public Hearing – EESC



European Economic and Social Committee

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Changing perspectives – improving lives

Views on the topic: why the EU should deal with electromagnetic hypersensitivity, and what should be the approach

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Electromagnetic hypersensitivity (EHS)

EHS can cause ill health, distress, social exclusion & loss of quality of life to a growing number of people. Reducing its occurrence will greatly benefit nations.

3-5% of Europeans (22.3-37.1 million individuals) may be affected by EHS.

This number is growing.

By proactively addressing EHS & its causes the EU could make huge saving in healthcare costs whilst significantly increasing wellbeing & productivity.

Symptoms observed in those who are EHS include:

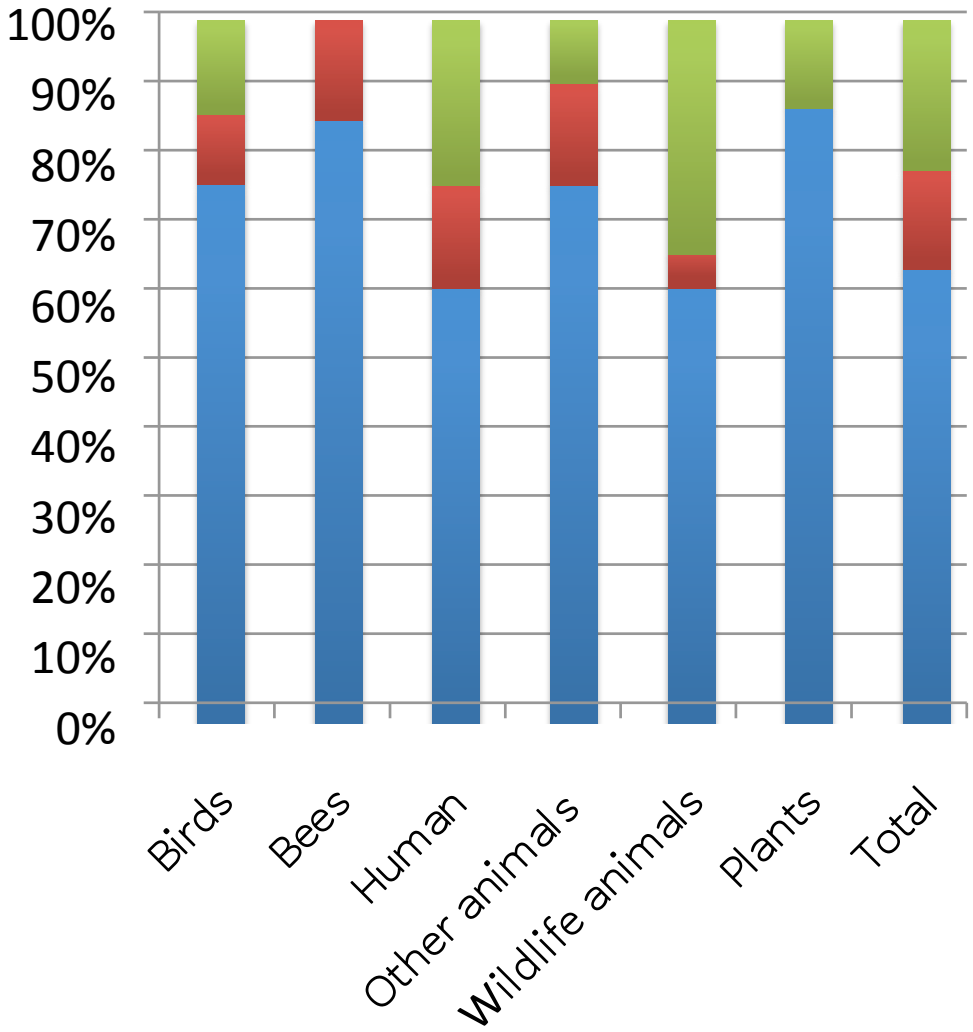
Headaches; visual disturbance; hearing disturbance; **sleep problems**; dizziness; poor blood circulation; capillary fragility; cold hands & feet; fatigue; heart problems; irritability; dermatological symptoms; disorientation, reduced libido; altered liver enzymes; **recurring infections**; **memory deficits**; general malaise; muscle pain; nausea; nasal congestion; night sweats; increased need to urinate; restless legs; tinnitus; **depression**; anxiety.

It is officially recognised as a functional impairment in Sweden. The Canadian Human Rights Commission also acknowledges environmental sensitivity attributed to EMFs (Johansson 2010, Wilkie & Baker 2007).

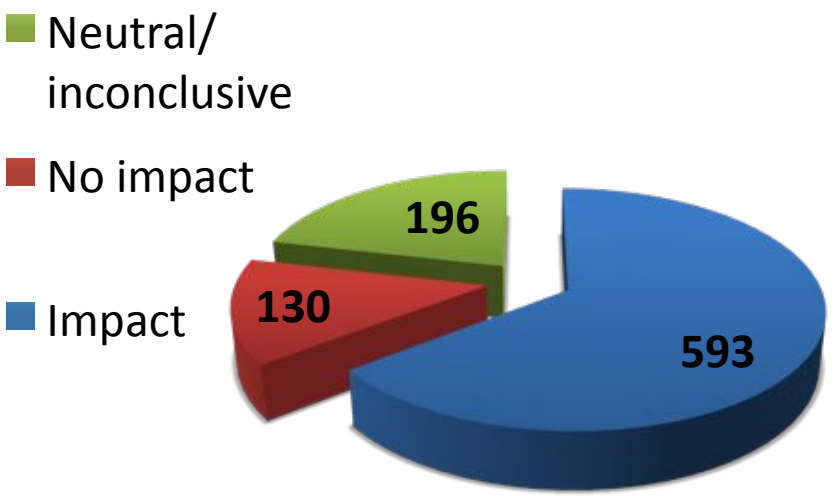
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Many studies indicate risk from over exposure

"EMF hypersensitivity can occur as a bona fide environmentally-inducible neurological syndrome," McCarty et al. (2011).



Number of studies on EMF impacts collected & collated based on study subjects & results (Rahmani et al. 2011).*



Total 919 studies

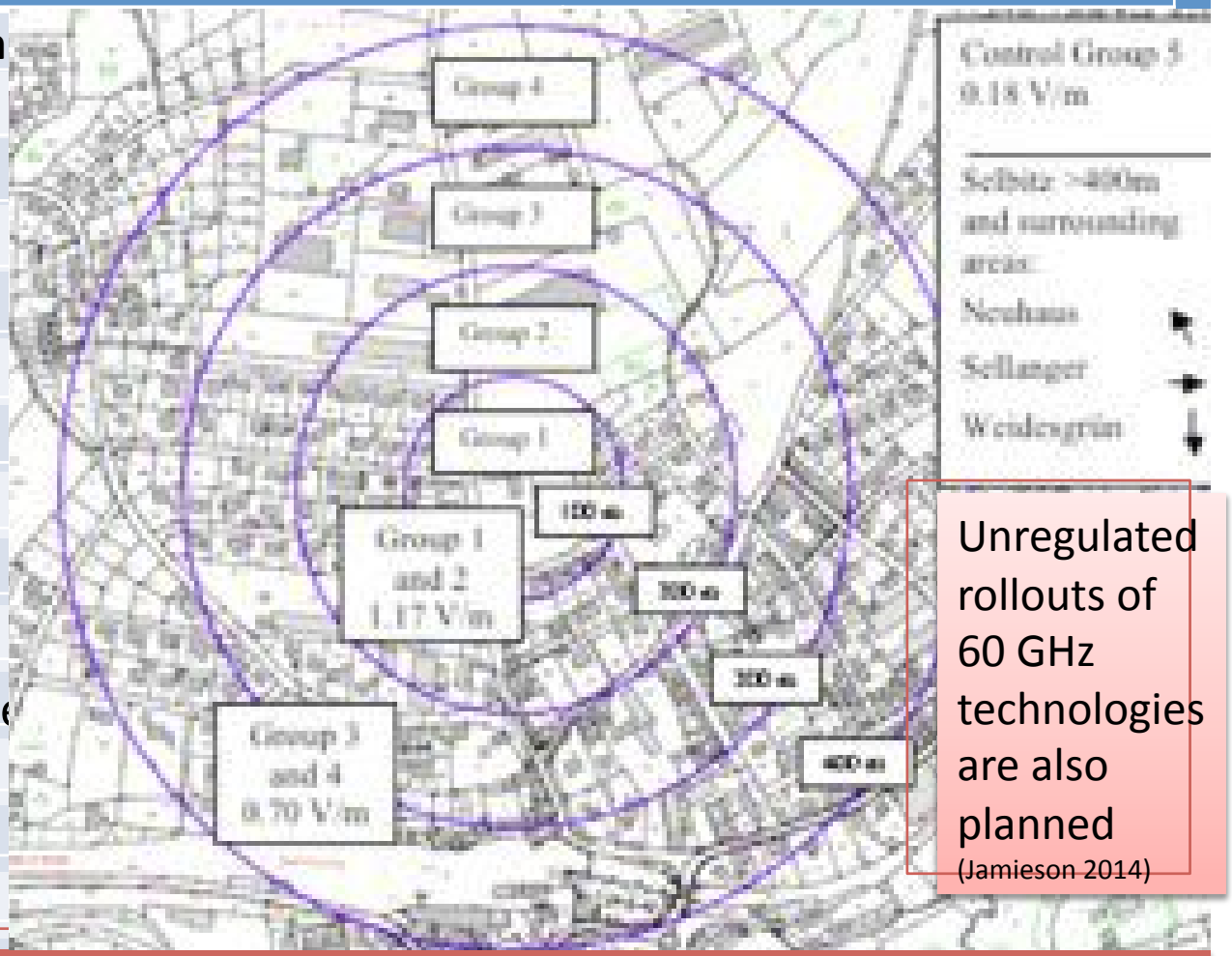
* Similar results were observed in Cucurachi et al. (2013)'s review of 113 studies.

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RF exposures & health problems

Specific Health Symptoms & RF radiation (n = 180) Eger & Jahn (2010, 2010a).

Comparison of 1.17 V/m & 0.7 V/m
Sleep problems
Symptoms of depression
Headaches
Cerebral affections
Concentration difficulties
Joint problems
Infections
Skin problems
Cardiovascular problems
Auditory system Disturbance of
Visual problems
Gastrointestinal problems
Dizziness



Unregulated rollouts of 60 GHz technologies are also planned (Jamieson 2014)

Similar levels of **0.72-1.31 V/m recorded 1m from single wireless laptop** (Peyman et al. 2009). Levels would be substantially higher closer to it.

Increased health problems shown *below* levels created by Wi-Fi radiation.

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Headaches

Annual cost of headaches amongst adults in the EU is €173 billion (Linde et al. 2012). **Both EHS & non-EHS report suffering these as a result of EMF exposure. It is not yet known to what extent EMF exposure contributes to this overall cost.**

RF electric field levels

• Highly significant dose-response relationship noted between residential locations & headaches when comparing high field & low field exposure groups – *mean exposures levels of 1.17 V/m compared to 0.70 V/m ($p < 0.001$)* (Eger & Jahn 2010, 2010a).

RF power densities

• Significant link ($p < 0.017$) recorded between headaches & exposures to power densities >0.05 µW/cm^2 (maximum 0.41 µW/cm^2) compared to ≤0.01 µW/cm^2 (Hutter et al. 2006).

• Increased incidence of headaches found at 1.0 µW/cm^2 (Simonenko et al. 1998).

It is likely headache disorders documented will significantly increase with further increased exposures. *The exposure levels shown above are less than those caused by Wi-Fi.*

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Concentration, memory & learning problems

Memory function – *animals*

Mice exposed approx. 2 hours daily to RF/ microwave radiation for 4 days less proficient in transferring learned information to next day & exhibited deficits in consolidation &/or retrieval of information (Fragopoulou et al. 2009).

Rats exposed to RF/microwave mobile phone radiation 2 hours every week for 55 weeks exhibited *significantly reduced memory functions after exposures (p = 0.02)* Nittby et al. (2008).

Offspring of rats exposed to mobile phone radiation for 1 hour daily during pregnancy had far fewer nerve cells in part of brain used for consolidating information from short-term to long-term memory (p < 0.01)
(Odaci et al. 2008).

Memory function – *humans: Significant associations found between field exposure & concentration problems at levels below 0.1 µW/cm²* (Hutter et al. 2006).



Image courtesy of David Castillo Dominici at FreeDigitalPhotos.net

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Depression

Depression, a symptom of EHS & noted in non-EHS exposed to fields, is the world's leading cause of Disability (WHO 2012). Suicide is a major cause of adolescent deaths.

Affects 30 million EU citizens & Costs €92 billion annually

(Evans-Lacko & Knapp 2014).

Heightened risk of medical illness for people with depression.

Medical condition	Risk level
Alzheimer's disease	1.71 to 2.67 times the rate for general population
Cancer	1.35 to 1.88 times the rate for general population
Diabetes (type 2)	Depression is an independent risk factor
Epilepsy	4 to 6 times the rate for general population
Obesity	Childhood or adolescent depression is a predictor of obesity
Stroke	2.6 times the rate for general population

Higher depressive tendency associated with RF exposures of 0.25-1.29 V/m (0.0165-0.4400 µW/cm²) compared to 0.05-0.22 V/m (0.0006-0.0128 µW/cm²) (p = 0.0016) (Oberfeld et al. 2004).

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Sleep problems

Poor sleep may be a causal factor in premature ageing, melatonin reduction, cancer, high blood pressure, diabetes, obesity, depression & other mental health problems. It can also tax the immune system (Ackermann et al. 2012).

*"**Hundreds of billions of dollars a year are spent on direct medical costs …** Compared to healthy individuals, individuals suffering from sleep loss, sleep disorders, or both are **less productive**, have an **increased health care utilization**, and an **increased likelihood of accidents**,"* Colten & Altevogt (2006).

Power densities of 0.002-1.0 µW/cm² associated with sleep disorders
(Simonenko et al. 1998, Altpeter et al. 1997, 1995).

Effects on sleep quality reported in EHS & non-EHS alike.

Obesity & overweight linked with sleep problems.

Obesity is now a global epidemic & costs Europe over €33 billion annually (Fry & Finley 2005). It increases risk of cardiovascular disease, diabetes, cancer & other diseases (WHO 2014).

Sleep debt increases fatigue, making individuals exercise less & reducing their physical activity. It also increases levels of the hormone grehlin thereby stimulating appetite (Taheri et al. 2004).

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Other conditions linked with EMF exposures

There is a growing evidence indicating that even low intensity EMF exposures exposures can cause ill health in non-EHS individuals.

Conditions linked with environmental EMF exposures include:

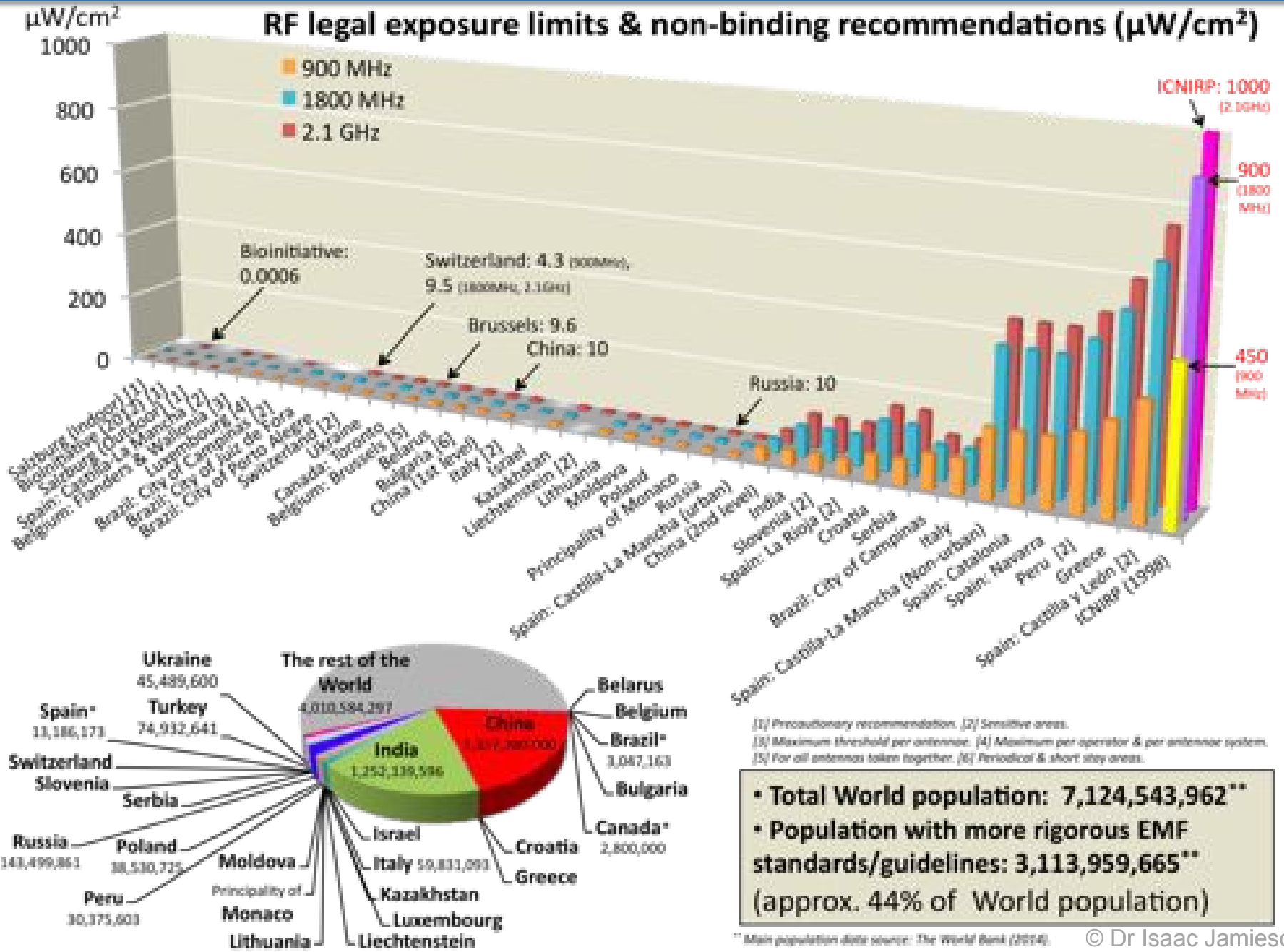
Alzheimer's disease (Davanipour & Sobel 2009, Huss et al. 2009)
Asthma (Jamieson et al. 2010, Bach 1967)
Autism (Herbert & Sage 2012, Kane 2004)
Cancer (Coureau et al. 2014, Moon et al. 2014, Hardell & Carlberg 2013)
Immune system effects (Boscolo et al. 2001, Novoselova et al. 1999)
Infertility (Avendaño et al. 2010, Otitoloju 2010, Aitken & De Iuliis 2007)
Childhood & adult leukaemia (Hocking 1996, Dolk et al. 1997)
Miscarriage (Li et al. 2002)
DNA damage (De Iuliis et al. 2009, Adlkofer 2004)
Oxidative stress (Kumar et al. 2012, Agarwal et al. 2009, Ilhan et al. 2004).

Resolution 1815 of the Council of Europe calls for all reasonable measures to be taken to reduce exposure to electromagnetic fields, particularly RF/ microwaves (PACE 2011).

The cost to society of (over) exposure to electromagnetic pollution is far higher than generally realised.

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Why the EU should protect its citizens better



- **Total World population: 7,124,543,962****
- **Population with more rigorous EMF standards/guidelines: 3,113,959,665****
  (approx. 44% of World population)

** Main population data source: The World Bank (2014).

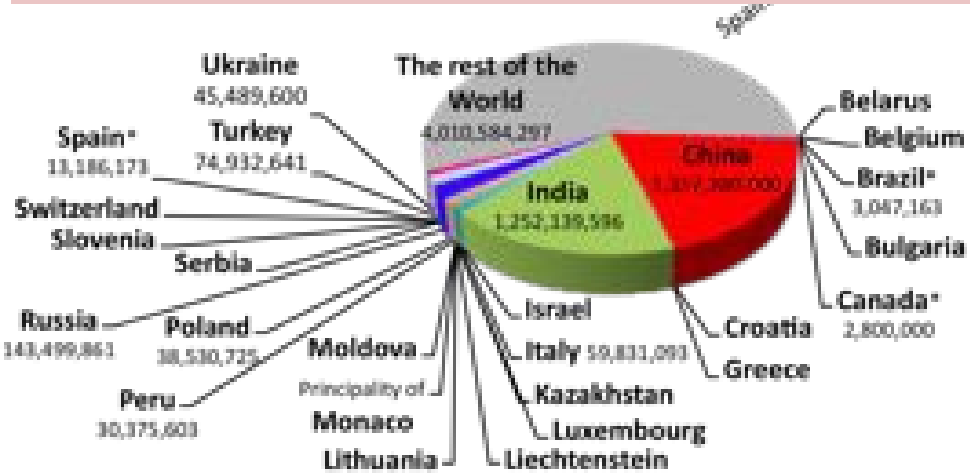
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Why the EU should protect its citizens better

"the ICNIRP guidelines are neither mandatory prescriptions for safety, the "last word" on the issue nor are they defensive walls for Industry or others." Paolo Vecchia, ICNIRP Chairman 2004-2012 (Vecchia 2008).

China: Out of 109 epidemiological studies, 108 noted biological effects as a result of EMF exposure. ***"No matter what the exposure level may be, lower or higher than [the Chinese] EMF exposure limits for public, health effects had been reported in these papers. …"*** Cao (2007).

*"… there is reasonable basis to conclude that **RF-EMFs are bioactive and have a potential to cause health impacts.** … Epidemiological evidence gives that RF-EMF should be classified as **a human carcinogen. The current safety limits and reference levels are not adequate to protect public health. New public health standards and limits are needed."*** (Hardell et al. 2012).



Over 40% of the World have exposure guidelines at least 10-fold more rigorous than ICNIRP guidelines.

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European Convention on Human Rights

Human rights are required to be part of all policy making (DCA 2006).

Article 2 - Right to life: "*Everyone's right to life shall be protected by law*" (Council of Europe 2014). **This includes those who are EHS.**

This Article is relevant in situations where health may be put at risk & is not restricted to risk of death or actual death (European Commission 1996).

Article 3 - Prohibition of torture: *No one shall be subjected to torture or to inhuman or degrading treatment or punishment*" (Council of Europe 2014).

Article 12 - Right to marry: "*Men and women of marriageable age have the right to marry and to found a family, …*" (Council of Europe 2014).

Article 14 - Prohibition of discrimination: *"The enjoyment of the rights and freedoms set forth in this Convention shall be secured without discrimination …"* (Council of Europe 2014).



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When authorities are aware (or should be aware) of real risk to life they are under obligation to take appropriate mitigative action to protect those at risk
(Hoffman & Rowe 2010).

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Creating benefits, encouraging innovation – inclusive design

<u>Creating more biologically-friendly wired & wireless technologies & environments helps address EHS issues & will boost innovation & economic growth.</u>

Companies that properly address ethical, environmental & sustainability issues deliver considerably better long-term financial returns on equity & returns of assets than those failing to address such matters (Juniper 2013).

High sustainability companies significantly outperform their low sustainability rivals (Eccles et al. 2011). **The same should hold true for Europe if it aims to be biosustainable.**

Tax benefits should be provided to encourage such growth.



Image by Mataev (2011)

Council of Europe's Resolution 1815 (PACE 2011).

"[take all reasonable measures] … to reduce costs, save energy, and protect the environment and human health, …"

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Low EMF design is now an accepted best practice

WELL Building Standard®

This is a new international performance-focused system for recording, monitoring & certifying features in the built environment which impact human health & wellbeing. **It puts health & wellness at the centre of design & construction decisions.**

This standard promotes EMF-protected design & works in alignment with the Living Building Challenge, the LEED Green Building Rating System & other major global sustainable building programs (International Well Building Institute 2014).

Building Biology Exposure Guidelines

These precautionary guidelines have been developed by medical doctors & scientists. Among the factors assessed, with relevance to EHS sufferers, are AC & DC electric & magnetic fields, RF radiation, geological disturbances and air ion levels (Baubiologie Maes IBN 2008).

Wherever possible building regulations should address the accessibility issues & inclusive design requirements of those adversely affected by manmade EMFs.

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Educating designers & empowering the individual

The Russian National Committee on Non-Ionizing Radiation Protection suggest that where possible electrical items which can emit raised fields be located where individuals are unlikely to spend prolonged periods of time (RNCNIRP 2007).



Image sources courtesy of RNCNIRP (2007)

Raised exposures



Reduced exposures

Ideally, EMF field templates should be developed for distinct items of electrical equipment to allow appropriate separation distances to be planned & their locations optimised.

Legislation should ensure all RF emissions from smart appliances can be deactivated.

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Many solutions already exist, or can be created …

It is time to drastically rethink how technologies are designed and used.

• They need to be **tested** for their potential biological effects **before** they are rolled out. **Early warning scientists should be heeded** so the best results can be achieved (Harremoës et al. 2001).

• Design professionals & the general public need to be properly **educated** about electromagnetic hygiene & how EMF risks can be minimised.

• **White zones** should be encouraged & where possible linked through with nature areas. This will help EHS & the planet.

• **Low field/no field technologies should be encouraged.**

The principles of concepts such as the Living Building and the WELL Building Standard® should be expanded upon to create healthy, towns, healthy countries & "Healthy & Prosperous Europe".

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Insurance Industry perspectives on EMFs

Swiss Re (2013) comments that electromagnetic pollution may cause:

"potentially high financial, reputational and/or regulatory impact or significant stakeholder concern. … ***Over the last decade, the spread of wireless devices has accelerated enormously. … This development has increased exposure … the health impacts of which remain unknown…*** *The WHO has classified extremely low-frequency magnetic fields and radiofrequency electromagnetic fields… as potentially carcinogenic …* ***If a direct link … were established, it would open doors for new claims and could ultimately lead to large losses under product liability covers."***

Unforeseen consequences of electromagnetic fields (Swiss Re 2013)
Overall potential impact: High
Time Frame: >10 Years.

Lloyd's of London (2010) state: *"The danger with EMF is that, like asbestos, the exposure insurers face is underestimated and could grow exponentially and be with us for many years."* **Lloyd's refuses to cover claims linked with RF radiation** (Ryle 1999).

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Legal actions & rulings related to EMF exposure

2011: The Labour Court in Madrid declared hypersensitivity, caused in part by RF exposure, can cause permanent disability. **Its ruling set a precedent for future conditions related to EHS. [The verdict awarded the college professor, who has been permanently incapacitated, a permanent disability pension at 100% of base salary rate** (WEEP News 2011)].

2012: The Italian Supreme Court affirmed a casual link between a businessman's heavy mobile phone use & his brain tumour (Alleyne 2012, Microwave News 2012).

2013: The Australian government ordered to pay claims for damaging the health of an employee with EMF sensitivity (Administrative Appeals Tribunal of Australia 2013, GSMA 2013).

2013: An Israeli cell phone company compensates a customer who contracted cancer (Leibovich 2013, Raz & ZivIsraeli 2013).

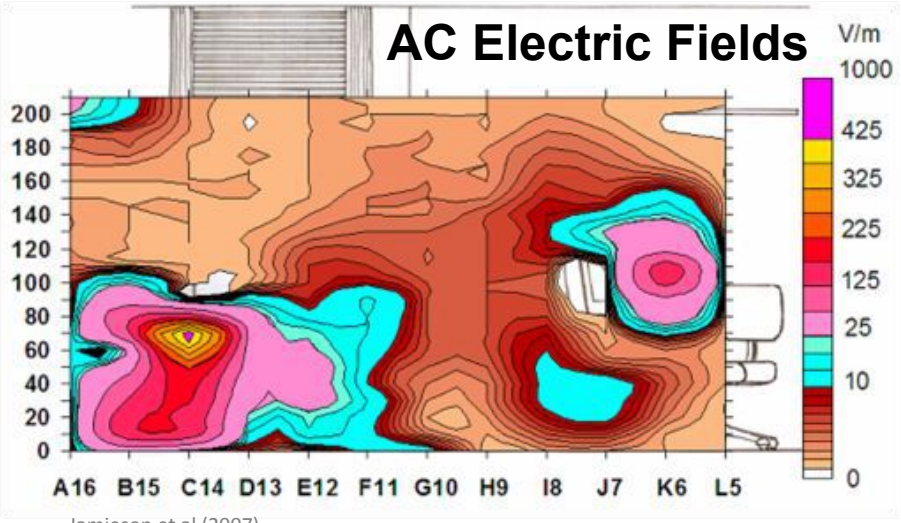
Such cases seem likely to increase unless proper proactive measures are applied. Biologically friendly EMF exposures should be sought as a matter of best practice.

2014: Major mobile phone companies & their parent companies saw £5.5 billion (€6.95 billion) wiped off their share values as a result of proposed US legal action related to mobile phone use & brain tumours (Kendall 2014).

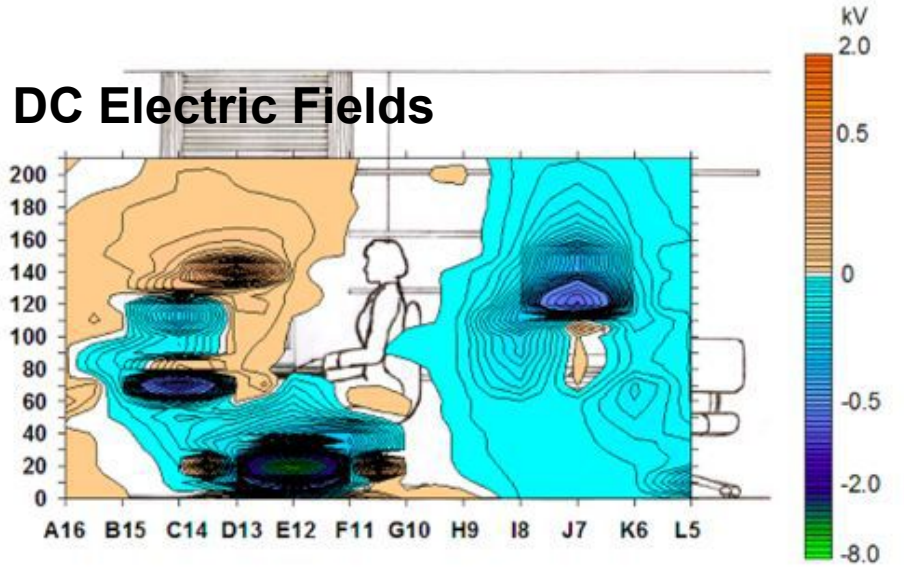
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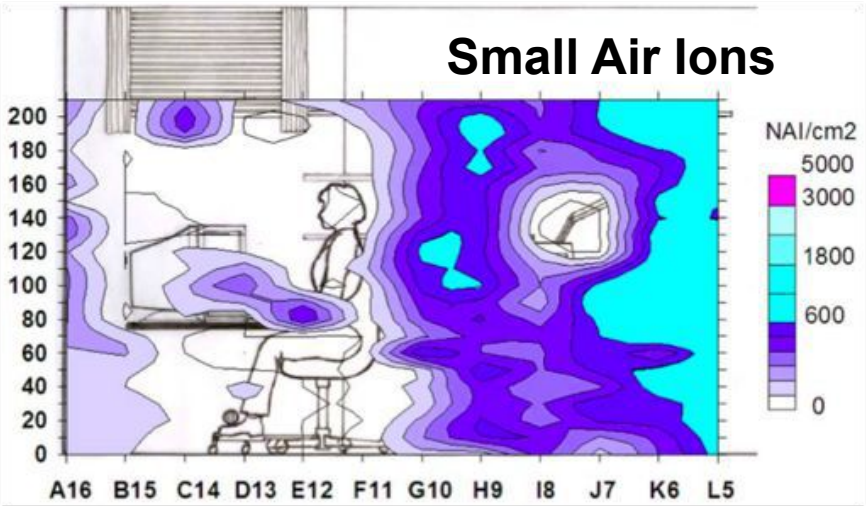
Respiratory problems & infections

Raised AC &/or DC electric fields can increase contaminant & pathogen deposition onto the body & nearby surfaces. They can also increase their presence within personal breathing zones (Jamieson et al. 2010).



Jamieson et al (2007)





At 0 kV DC facial deposition of >0.07 *µm particles ≈100 particles/mm²/hr*

At ±5-6 kV DC facial deposition ≈1,000 particles/mm²/hr (Wedberg 1991, 1987, 1986).

Grounding equipment, optimising humidity, specifying the correct materials & air ion levels helps correct this (Jamieson et al. 2010).

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Autism Spectrum Disorder

Lifetime costs for someone with high-functioning autism is £3.1 million (€3.96 million).
For low-functioning autism it is £4.6 million (€5.87 million) (Knapp et al. 2007).

The number of individuals diagnosed with autism is steadily increasing.
Electromagnetic pollution may be a risk factor for ASD (Kane 2004).

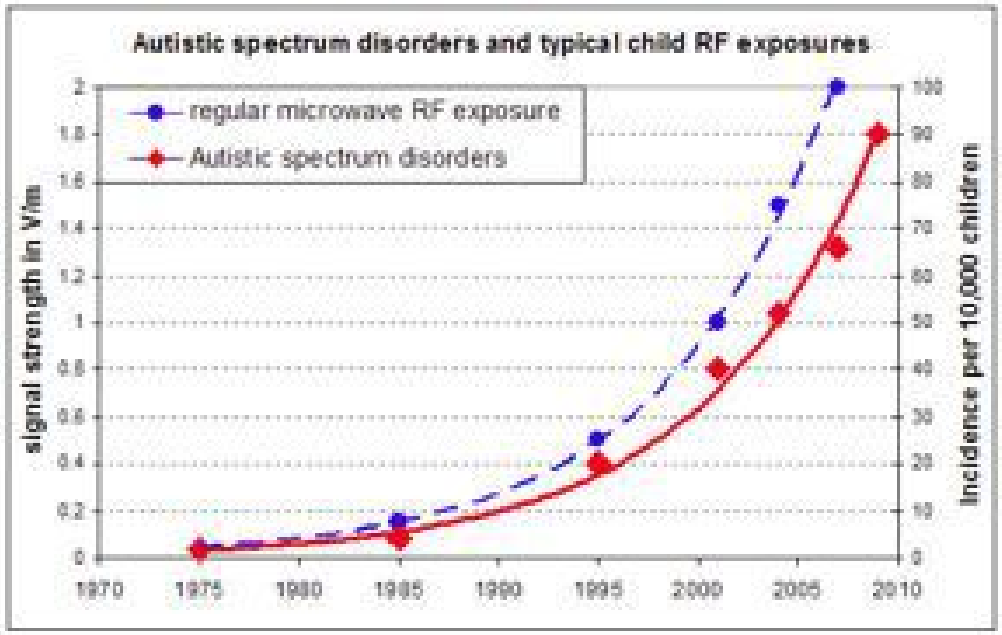


Image: Powerwatch (2013)

Refer to the review by Herbert & Sage (2012) in the BioIniniative Report 2012 for further details on potential mechanisms.

"The fast rise in diagnosed autistic spectrum disorders over the last 20 years closely matches the rise in children's RF exposure" Alasdair Philips (Powerwatch 2013).

It appears prudent to determine if raised EMF exposures do increase autism risk, and if so how new generations of 'bio-friendly' technology can mitigate, or even reverse, such risk.

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Infertility

There is need to urgently address possible effects of EMF exposures on fertility.

Animals: *Irreversible infertility noted in mice after 3 generations at exposures of 1.053 µW/cm^2. Lower exposures of 0.168 µW/cm^2 linked with total infertility in after 5 generations* (Magras & Zenos 1997).

Humans: ***Wi-Fi connected laptop computers shown to cause significant decreases in sperm motility & increases sperm DNA fragmentation*** - *DNA fragmentation linked to reduced fertilisation & embryo quality, miscarriage & increased illness in offspring, including childhood cancer* (Avendaño et al. 2010, Aitken & De Iuliis 2007).

The radiation from laptop computer using Wi-Fi is 3 times greater than without Wi-Fi & 7-15 times greater than conditions without computer. (Avendaño et al. 2012).



Image courtesy of Arvind Balaraman at FreeDigitalPhotos.net

Wi-Fi laptops 2.2 µW/cm^2 at 0.5m & 0.4 µW/cm^2 at 1m (Peyman et al. 2011).

Laptop computers connected to internet by Wi-Fi shown to damage sperm through *non-thermal* effects at levels well below those permitted by ICNIRP.

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Cancer

In 2009 cancer cost the EU €126 billion (Luengo-Fernandez et al. 2013).

RF radiation: After 5 years, risk of malignant tumours in individuals exposed to raised exposures (from base stations) 3 times higher than those with lower exposures (Eger et al. 2004).

Cancer rates for females living adjacent base stations 4.15 times greater than those at lower exposures ($p < 0.0001$) (Wolf & Wolf 2004).

RF exposure - at levels that can be experienced everyday - can cause DNA damage, which can be a precursor of cancer (De Iuliis et al. 2009, Adlkofer 2004).

Childhood Leukaemia: Association noted between increased incidences of this & mortality at exposures of 8 µW/cm^2 (Hocking et al. 1996).

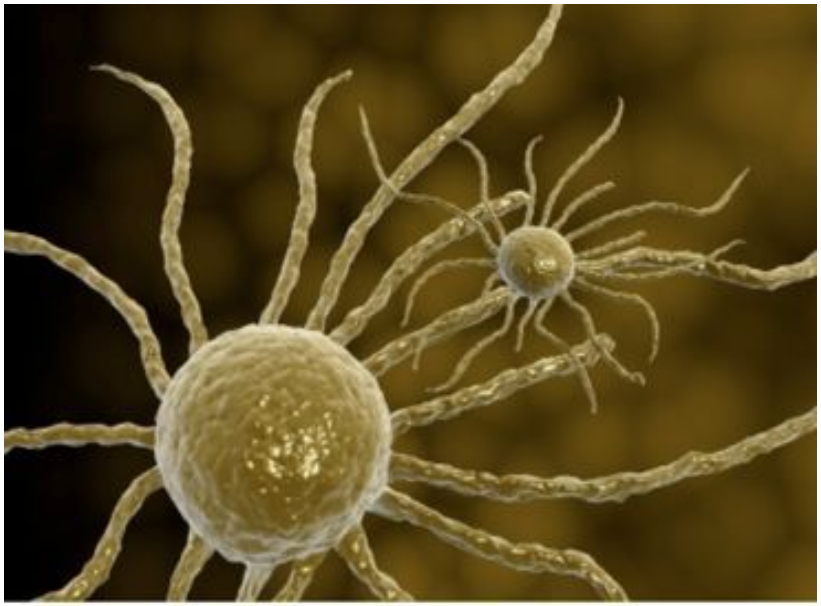


Image: jscreationzs, http://www.freedigitalphotos.net/images/view_photog.php?photogid=1152

Should "*Limit your exposure to EMFs …*" be incorporated into the European Code Against Cancer (ERC 2014)'s '12 ways to reduce your cancer risk'?
- *Foods high in sugar or fat & sugary drinks already are.*

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Alzheimer's & other dementias

The rise in Alzheimer's disease & other dementias may be the "*Most Significant Health Crisis of the 21st Century*," (ADI 2010).

There are in over 6 million people in Europe with dementia (Alzheimer's Society 2014).

It is one of the World's most costly illnesses. In 2008, the cost of dementias in Europe (including Turkey) was €177.2 billion (Alzheimer Europe 2009).

The number of people with dementia is predicted to double by 2030 & more than triple by 2050 (ADI 2010).



Image: Maxintosh, http://farm3.static.flickr.com/2089/2342528894_797f7c3da5.jpg

Exposure to extremely low frequency (ELF) &/or RF radiation is associated with increased risk of dementias (BioInitiative Working Group 2012).

Improved electromagnetic hygiene would reduce risk.

There appears to be a dose-response link between environmental exposures to EMFs & dementias (Davanipour & Sobel 2009, Huss et al. 2009).

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