

Health effects from the electromagnetic fields of Compact Fluorescent Lights (CFLs)

Incandescent bulbs are being banned in the EU. Their replacements, energy-saving compact fluorescent lights (CFLs), have significant health dangers from their electromagnetic fields.

1. Recommended EMF safety distances for CFLs

The German consumer organization Stiftung Warentest recommends keeping at least 1.5 metres from CFLs because of the electromagnetic pollution, while EMF UK recommends 2 metres. CRIREM says that they should not be used for reading, desk or bedside lights. The Swiss consumer magazine K-Tipp concluded that "All tested CFLs cause electrosmog" and the Swiss government recommends a safety distance of at least 30 cm because of the high EMFs. For people sensitive to EMFs there should be greater distances; some recommend up to 7 metres. Many sensitive people do not use any CFLs in their homes.

2. CFLs have electric fields up to 67 times above TCO limits

EMF health problems from the high electric and magnetic fields of CFLs have been known since 1992, when Baubiologie Maes' evidence was published in "Öko-Test". "The body currents caused by the unnecessary electrosmog of energy-saving lamps are 30 to 100 times higher than from incandescent lamps," according to Dr. Heinrich Eder of the Bavarian Environment Agency. Most CFLs exceed the accepted TCO safety limits, some by up to 67 times.

The German Friends of the Earth (BUND) in 2009 recommended for CFLs the TCO limit of 1 V/m for VLF (kHz range), and 10 V/m for ELF (50 Hz) at 30 cm, with 0.02 V/m for lamps used close to the body, and 0.2 V/m for VLF by 2015.

In 2008 Viglen called TCO'99 "the world leading labeling scheme for display equipment". TCO started in 1992 under the Swedish Confederation of Professional Employees and covers ecology, emissions, energy and ergonomics. About half of all

display monitors now meet the TCO standards.

	incandescent bulb	Halogen bulb	TCO safety limit (at 30 cm)	"Öko-Test" (2008) 16 CFLs	German Federal Office for Radiation Protection BfS (2008), 37 CFLs
AC electric field: VLF: 2-400 kHz (electronic ballast)	0 V/m	0 V/m	1 V/m	7-15 V/m	4.8-59 V/m
AC electric field: ELF: 5-2,000 Hz (power frequency, 50 Hz)	10 V/m	10 V/m	10 V/m	30-42 V/m	
AC magnetic field: VLF: 2-400 kHz (electronic ballast)	0 nT	0 nT	25 nT	3-25 nT	

3. Harmonics and spikes of the CFL electric and magnetic fields

The problems of high electric and magnetic fields are made worse by many distortions to the sine-wave of the 50 Hz field. CFLs produce numerous harmonics and spikes across the entire kilohertz range from the power frequency, and into the megahertz range from the electronics frequency.

4. CFLs cause transients on wiring (LF radio transmissions)

CFLs impose low frequency transients on electric wiring, often known as "dirty electricity". These frequencies, in the kHz range and extending into the radio MHz range, have been shown to produce adverse health effects on humans, ranging from involuntary muscular movement among people who are EMF-sensitive to cancers and increased diabetes and MS. The health danger of transients has been called "one of the greatest practical discoveries of the modern era".

5. CFLs emit direct radio frequencies

CFLs act as radio transmitters – one radio ham is said to have constructed a transmitter using CFLs. Some GE electronically ballasted CFLs carry a warning against use “near maritime safety equipment or other critical navigation or communication equipment operating between 0.45-30MHz”. The radio interference can be heard on a household radio receiver held near a CFL.

6. CFLs emit pulsed EMFs, not optical flicker

CFLs, like other fluorescent lights, require alternating current. In older fluorescent lights with magnetic ballasts the current flowed through the tube as a smooth sine wave at mains frequency of 50 Hz (50 cycles per second), making the light flash on and off 100 times a second. In years gone by this could have disturbed epileptics and migraine sufferers with a high critical flicker threshold.

Almost all CFLs now use electronic control gear, with a switched-mode power supply in the base of the lamp itself. It converts the mains AC to DC and chops it electronically into a series of sharp rectangular alternating pulses which light the lamp. Dr Goldsworthy states: “However, the new frequency, which is usually about 40 kHz, is so high and the gaps between pulses are so short that the relatively slow response of the phosphors can fill them easily. Consequently, these lamps do not flash.”

CFLs also produce from the electronic ballast EMF pulses at 100 Hz and 40-50 dB, similar to DECT cordless phones. The highest frequency, however, at which someone can perceive flicker is 70-90 Hz, depending on modulation and brightness, although a flicker fusion threshold above 60 Hz is rare and 16 Hz is the general fusion frame threshold. The HPA report (2008) appears to argue that optical flicker is a cause of people’s adverse health reactions to CFLs, although the SCENIHR opinion of 2008 denied it was flicker; neither has recorded the health effects of the known EMF pulses from CFLs.

The CFL manufacturer Philips argued that flicker from early CFLs can even interfere with infra-red TV remote sensors, according to a front-page report in the Daily Telegraph on 12th April 2010, but Emma Clements, of Carshalton, Surrey, said that CFL bulbs in other parts of the house affected their Virgin

Media Samsung set-top box, a problem confirmed by a Virgin Media spokesman.

If, therefore, CFLs do not flicker, the adverse health effects are probably from the EMF pulses on the brain and nervous system. The magnetic component of CFL radiation can, according to Dr Goldsworthy, “penetrate deep into the human body where it generates electrical voltages proportional to its rate of change. The rapid rise and fall times of these magnetic pulses can therefore give relatively massive and potentially damaging voltage spikes both in living cells and across their membranes.”

7. EMFs and blurred vision

EMF sensitivity is now regarded by many scientists as connected with membrane leakage through low-level EMF effects on the membrane voltage. This ion leakage across membranes explains the fuzzy vision people can experience near EMFs and CFLs. In responding to light the eye’s vision is activated by increased voltage across the membranes of light-sensing rods and cones, so, in reverse, membrane leakage can cause reduced vision or blurring – a common electro-sensitivity symptom. Some people experience temporary poor eyesight when working close to CFLs or in a high EMF environment, although if measured by an optician in an EMF-free environment their eye-sight seems fine.

8. Gradual acceptance of the EMF health dangers from CFLs

Health Canada released data on EMF emissions from CFLs in March 2010. For the kHz range (VLF), the worst-case CFL is given as 126 V/m at 20 cm. This is 45% above the ICNIRP’s six-minute heating and shock exposure limit of 87 V/m, or, converted to a 30-cm distance, 56 times higher than the TCO limit of 1 V/m.

On 30th March 2010 swissinfo.ch, in a report headed “Study warns of green light bulb electrosmog”, stated that Swiss health officials are recommending that people stay at least 30 centimetres away from energy-saving light bulbs, to ensure the electric fields are well under international limits. Low- and medium-frequency magnetic and electric fields can induce electric currents in the body which, above a certain frequency, can stimulate nerves and muscles. The Swiss study, undertaken for the Federal Offices of

Health and Energy, found that medium-frequency electric fields were primarily responsible for these currents. Depending on the lamp, current field densities in the immediate vicinity reach 10-55% of the 6-minute heating and shock exposure limit.

The UK HPA report of 2008, on the other hand, was limited to optical and not EMF issues, and it attributed adverse health effects to optical rather than EMF factors: "The optical output of all tested CFLs was modulated at a frequency between 15 and 40 kHz, representing the frequency of the electronic ballast. In addition, all had a 100 Hz envelope with modulation in excess of 15%. This degree of modulation at this frequency may be perceived and has been linked to a number of adverse effects." (Khazova & O'Hagan "Optical radiation emissions from compact fluorescent lamps" 2008; HPA "Emissions from compact fluorescent lights" 9th October 2008) Critics suggest that the limitation to supposedly optical effects is to avoid admitting health problems from EMFs.

The HPA report blaming optical effects above the flicker threshold is opposed to the SCENIHR opinion ("Light Sensitivity", 23rd September 2008, p.28) which found no problem with the optical emissions. The latter concluded: "It can therefore be concluded that the flicker from energy saving bulbs is most unlikely to produce significant adverse health effects even in flicker susceptible individuals."

The SCENIHR opinion was unable to find many "suitable direct scientific data" on CFLs and health symptoms, and based some of their conclusions on inadequate Swiss evidence for EMFs from 2004. The Swiss Federal Office of Energy and the Swiss Federal Office of Public Health report (Bundesamt für Energie, 2004) used a rod instead of the recommended disc sensor for CFL VLF (kHz range) tests, producing extremely low results of 0.1-5 V/m, at odds with the common 15-60 V/m from most other tests. It enabled this report to claim that CFLs should be able to meet the TCO limit of 1 V/m. The testing was supported by two lighting manufacturers, Osram and Philips. On page 25 the report showed that one additional grounding conductor attached to a metal lampshade would allow a CFL to meet the TCO limits.

9. The SCENIHR's refusal to examine EMFs from CFLs

After its public consultation in January 2010, asking for further areas of concern about CFLs following its 2008 Lighting Sensitivity opinion, the SCENIHR refused to examine the EMFs from CFLs in the modified mandate:

"Electromagnetic fields, including those emitted by compact fluorescent lamps, were subject to previous opinions of SCENIHR", referring to the January and July 2009 SCENIHR opinions on Health Effects of EMFs ("Explanations for the changes in the SCENIHR mandate on artificial light following the public consultation on the working mandate", 2010, doc. 025b, section 3.2.2).

This is problematic, however. The radio frequencies from CFLs are in what the SCENIHR identifies as "the Intermediate Frequency range". The 2007 SCENIHR opinion on "Health Effects of EMFs" concluded that "Experimental and epidemiological data from the IF range are very sparse. Therefore, assessment of acute health risks in the IF range is currently based on known hazards at lower frequencies and higher frequencies." The January 2009 opinion upheld this assessment. Neither of these SCENIHR opinions seems to refer to CFLs or their direct radio emissions or their transients or to published research on CFLs.

If, therefore, the SCENIHR refuses to consider the frequencies of EMFs known to be emitted from CFLs as the cause of the adverse health effects from CFLs, the revised SCENIHR report on Light Sensitivity due in 2011 could be forced to conclude that the adverse health effects from CFLs are caused by optical flicker, in opposition to its own conclusion of 2008. Alternatively it might postulate a high rate of UV-C emissions from all CFLs, if there is evidence that such emissions can produce typical EMF symptoms, or check any ultrasonic emissions which have been thought to disturb some household pets.

The link between fluorescent lights and melanoma was established in the 1980s, however, when magnetic ballasts were in use. It therefore probably relates more to UV-B than to the recent studies showing a dose-response association between incidences of melanoma and EMFs with regard to the proximity and frequency of VHF radio transmissions.

10. EMFs from CFLs as a cause of migraines and epilepsy

It is likely that, apart from known UV effects, some or most of the adverse health effects of CFLs are caused by EMFs and not unknown UV A/B/C effects or supposed optical flicker. Some people sensitive to EMFs experience similar symptoms from both CFLs and other sources of EMFs which do not emit UV or flicker, or can suffer from CFLs even when shielded from their light but not their radio emissions. Instances of migraine and epilepsy can also be triggered by other sources of EMFs in addition to CFLs. It is therefore possible that sufferers of migraine and epilepsy may be reacting more to the EMFs than the UV or supposed optical flicker in CFLs.

11. EMFs from CFLs as an enhancer of photosensitivity

UV reactions are probably enhanced by the presence of EMF emissions, since people sensitized to EMFs often become more photosensitive as a result of their EMF sensitisation. This could relate to the known effects of EMFs on mast cells found in the skin and elsewhere in the body.

12. Case study: removal of CFLs helped end EMF symptoms

Taken from an internet blog by Shivani Arjuna of 7th May 2005 warning about the health dangers of CFLs

(www.waccobb.net/forums/waccoreader/33382-cfl-dirtyelectricity-post-esense-group.html):

"You could not pay me any amount of money to use CFL bulbs in our house. In my own case, symptoms included severe insomnia, head pain, tingling of my left arm and leg and frightening cardiac arrhythmia. I had gone the ER twice in an ambulance and undergone \$18,000 worth of medical tests before the cause of my symptoms was finally determined to be exposure to electrical pollution. (Not brain cancer, as had finally been suspected!) When we cleared my personal environment of the damaging frequencies, the symptoms disappeared. My thyroid also resumed healthy function and I was able to discontinue thyroid medication. The doctors who had followed my case were extremely surprised, as they so rarely see such a total cessation of cardiac or thyroid problems. I believe this would be more common, if more people removed the cause of their symptoms."

Further information:

www.buildingbiology.ca/cflights_govrep.php
(2010, government reactions to EMF health problems from CFLs)

www.buildingbiology.ca/pdf/2009cflights.pdf
(2009, Wolfgang Maes, "In the Cold Light of Day: Energy-Saving Lamps", *Wohnung+Gesundheit* ("Home and Health"), Baubiologie Maes (Building Biology Standard), Special Supplement, Issue 133, trans. Katharina Gustavs)

www.cflimpact.com/?p=187
(2009, CBC TV, CFLs and EMF transients)

www.cflimpact.com/wp-content/uploads/drggoldsworthy.pdf
(2008, Dr Andrew Goldsworthy "CFLs: What you need to know about low energy lighting")

www.cflimpact.com/wp-content/uploads/havas.pdf
(2008, Dr Magda Havas "Health Concerns associated with Energy Efficient Lighting and their Electromagnetic Emissions")

www.cflightbulb.org/tag/emf/
(migraines, comparison with LED)

www.emfuk.co.uk/CFL_Table/CFL%20Table.html
(2009, tables of EF and MF measurements of specimen CFLs)

www.emfuk.co.uk/CFL_Table/graphs.html
(2009, oscillograms and spectrograms of specimen CFLs)

www.news-service.admin.ch/NSBSubscriber/message/attachments/18707.pdf
(2010, Nadakuduti J, Douglas M, Capstick M, Kühn S, Benkler S, Kuster N, *Assessment of EM Exposure of Energy-Saving Bulbs & Possible Mitigation Strategies: Final Report*, Bundesamt für Energie, Bundesamt für Gesundheit. (Published in: Bundesbehörden der Schweizer Eidgenossenschaften, pp.1-83.)

www.youtube.com/watch?v=A55081TOIbQ&NR=1
(2008, Global TV, Canada: radio frequencies, low frequency transients and neurological problems)

www.youtube.com/watch?v=6CVLa_tRsiY
(2008, Global TV, Canada: UV radiation and skin problems)

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