SUBLIMINAL FLICKER Part II: Fluorescent Lights and Flicker Sensitivity

by Richard Conrad, Ph.D. Revised 03/12/09

Subliminal: *below the threshold of conscious perception; inadequate to produce conscious awareness but able to evoke a response.*

All types of fluorescent lights have some amount of flicker. Most of this flicker is invisible, at least to the conscious mind. Flicker is invisible when it consists of pulses or waves of light that repeat one after the other so rapidly that they appear to fuse together into steady light. Our flicker fusion frequency (the frequency above which we no longer consciously see flicker) ranges from about 25 to 55 Hz (Hz means times per second). Flicker fusion frequency varies with the person, with the intensity and color of the light, and also depends on where the light falls on the retina. Optic nerve signals proportional to flicker at frequencies far above the conscious flicker fusion frequency do reach our brain from the eye (as shown by EEG and other studies). **Any invisibly flickering light that affects the brain is what I call subliminal flicker.**

Fluorescent room lights powered by the old-fashioned type of ballast produce subliminal flicker at 60 Hz. This is consciously bothersome to sensitive people, and has long-term effects on normal people who work under them for many hours every day. Most of the lamp flicker is at 120 Hz, which is usually too fast to be a problem. But because of the way the lamps operate, enough 60 Hz subliminal flicker is produced to cause symptoms. **Some brands of the new electronic ballasts, including those in the new CFLs (compact fluorescent lights), remove this flicker, and some do not. Symptoms caused by subliminal flicker can include any of the following:** a feeling of being unable to focus, disorientation, confusion, attention deficit/brain fog, irritability, headache, migraine, eye or neck pain, dizziness, queasiness, or an uncomfortable feeling down through the chest. For some people similar symptoms can be caused by the highly artificial color spectrum of some fluorescents.

All types of fluorescent lights generate EMF. The worst EMF comes from the high frequency electronic ballasts in the modern fluorescent tube fixtures and in the compact fluorescent lamps. These not only radiate emissions through space from their actual location, but also transmit their electrical noise back through the wiring that supplies their electricity. The EMF from the ballasts then re-radiates from wiring all over the building.

Neither the 60 Hz flicker nor the EMF emission levels are reported by manufacturers. Because new laws mandate the replacement of most incandescent bulbs with compact fluorescents by 2012, many more people will very soon be subliminally affected or will suffer outright from disabling symptoms such as migraines.

It is important to note here that **CFLs actually have only one-half of the efficiency** that is reported by the manufacturers and used in calculating and touting environmental benefits. This is because they have a very poor "power factor" of about 0.5, which means that they actually draw and use two times more current than registers on a watt-hour meter. Thus it may save on your immediate electric bill, but uses up twice the fuel at the power plant (actually more than twice, since higher currents incur greater losses over the transmission lines), and eventually we all pay for it in a couple of ways. Also, the failure mode of CFLs can be to smoke and burn. For more details, see http://sound.westhost.com/articles/incandescent.htm#equ. Some of the efficiency comparisons against incandescent bulbs have been made not against the standard-life incandescent, but against the long-life incandescent which has about one-half the efficiency of the standard-life bulb. Another fudge factor of one-half; thus some of the efficiency comparisons with incandescents have been **exaggerated by factor of four**. Other similar misinformation has been put forth by manufacturers and politicians worldwide.

All fluorescent lamps utilize a mercury vapor arc inside the lamp. The ultraviolet light from this arc causes phosphor powders coated on the inside surface of the glass to emit blue, green and red light (the net effect being white light). The red emission from the phosphor has a slow time decay, and so the red light has a low amount of flicker (the red light is integrated over time). The blue emission is very fast and has the most flicker. This is why, in spite of good intentions, the expensive full-spectrum (more bluish) lamps have a greater subliminal flicker effect on the brain (unless their ballasts happen to be of the type that removes all flicker).

Since the worst flicker is in the blue, it is helpful to wear glasses that block some of the blue light. Therefore amber or rose-colored glasses, especially when worn together with a visor or a hat with a visor, allow us to be more comfortable under fluorescent lights. For some people, taking the supplements bilberry and/or carnosine before going into fluorescent-lit areas can reduce sensitivity to flicker.

Every fluorescent light has a drop of metallic mercury inside which is used to generate the ultraviolet arc. Because of their high efficiency, fluorescent lamps are beneficial for reducing global warming, but the problems caused by high local concentrations of mercury during breakage and disposal are being ignored.

Hopefully LED lighting will become less expensive to the point where they can replace compact fluorescents. Some of the newest LEDs just becoming available have a natural, warm and pleasant color. Theoretically LEDs can be flicker and EMF free, but unless the electronic engineers who design their power supplies develop a biological conscience, they will use switching-type supplies (which are high in EMF) and will operate the LEDs in pulsed DC mode (which will generate additional large amounts of EMF).

Richard Conrad has a Ph.D. in biochemistry, and does environmental consulting by phone for persons with MCS, EMF or Electrical Sensitivity (ES, EHS, EMS) or flicker sensitivity. 808/695-1128 (Hawaii daytime hours), www.conradbiologic.com.