

## Artificial Light in the Environment: Human Health Effects

The type of artificial light that individuals are exposed to can occasionally cause detrimental effects. Impartial interdisciplinary research is urgently required on establishing the potential effects of different types of light on health, stress-levels, productivity, well-being and the environment so that the correct types of lighting can be created.

### Incandescent Light Bulbs

More research needs to be undertaken as to why certain at-risk groups often state that they perform better under incandescent forms of artificial lighting, and how alternative sources of illumination may be adapted to meet these parameters.

Though fluorescent lights can save energy when correctly used; so can incandescent lights if people use them properly, particularly for areas like hallways and bathrooms where their use can be intermittent.

#### How careful and aware you?

[print this factsheet](#)

UK Health Protection Agency advice: 'most unlikely to cause any harm', but broken or not, CFL bulbs must never go into your household bin.

[what you need to do in the event of breakages, and about disposal](#)

### Artificial Lighting and Health/Productivity

A partial listing of health and social problems that fluorescent light have been implicated as aggravating is given below along with some referenced examples:

Aggression	Dental caries	Headaches
ALS	Dizziness	Hyperactivity
Attention Deficit Disorder	Dyslexia	Irritability
Autism	Dyspraxia	Learning difficulties
CFS/ME	Eczema	Lupus
Cancer	Electro-hypersensitivity	Reduced muscle strength
Reduced concentration	Epilepsy	MS
Confusion	Eye irritation	Nausea
Diabetes	Eye strain	Photosensitivity
Dermatitis	Fatigue	Xeroderma pigmentosum

The effects of LED units on individuals, particularly at risk groups has still to be properly assessed, though it has been noted that some individuals with Electro-hypersensitivity, Lupus and ME can react badly to them.

The quality and quantity of illumination individuals (and animals) receive, and the time of day they receive it, is crucial to their well-being; with poorly specified artificial lighting (and exposure to light whilst sleeping) being linked to incidences of stress, poor health and reduced lifespan.

### Animal Studies – Carcinoma Development and Life-Span

#### Increased exposure to fluorescent light and cancer risk

In a 2-year pilot study undertaken by S.L. Gabby MD to determine the effects of different lighting regimes on C<sub>3</sub>H mice (which are highly prone to tumour development, 98% of males and females normally spontaneously develop breast carcinoma). The following results were obtained:

Type of Light	No. of pairs of C <sub>3</sub> H mice	Effects on test-animals	Comments
A. Pink fluorescent	30 pairs	29 female mice developed cancer – the other died of liver problems.	Females died 1 month earlier than those in Group B. 1-2 offspring per litter, instead of 6-15.
B. Daylight-white fluorescent	30 pairs	24 of 30 female mice developed cancer – 2 other females died of liver problem.	Able to breed 2 months longer than A. Also had larger litters than A.

C. Daylight through windows into basement room	8 pairs (used as control)	Developed cancer 3 months after Group A, and 2 months after Group B	2 pairs of 8 pairs carcinoma free at time of report.
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Source: S.L. Gabby (1961), *Observations on the effects of artificial light on the health and development of mice*, cited by J.N. Ott (1982), *How to Stay Healthy*, Devin-Adair (1982), ISBN 0-8159-61 21-9. Note: Lighting conditions were the only variable used.

An additional pilot study by J.N. Ott using the same type of mice further demonstrated the link between light and mortality rate from spontaneous tumour development. Over 2,000 C<sub>3</sub>H mice were used in that experiment, the results of which are shown below.

Type of Light	Average Lifespan of C <sub>3</sub> H Mice
Pink fluorescent	7.5 months
Daylight white fluorescent	8.2 months
Full-spectrum plastic glazing	15.6 months
Natural outdoor daylight	16.1 months

Source: J.N. Ott (1973), *Health and Light: The Extraordinary Study That Shows How Light Affects Your Health And Emotional Well-being*, Ariel Press, USA, ISBN 0-89804-098-1.

The life expectancy of those animals under fluorescent lights was significantly less than that obtained under natural light. The effects of exposures to different light frequencies and types of artificial lighting should also be more fully investigated.

## Human Studies – Fluorescent Lights and Malignant Melanoma

### Increased exposure to fluorescent light and cancer risk

A study in *The Lancet* (of 274 women with malignant melanoma and 549 matched controls) indicated that exposure to fluorescent light at work was associated with double the risk of succumbing to malignant melanomas. The risk appeared to increase with duration of exposure to fluorescent lighting and was greater in women who predominately worked in offices, as opposed to those who worked indoors but not in office environments. A significantly increased risk was also noted in males exposed to fluorescent lighting (V. Beral, S. Evans, H. Shaw & G. Milton (1982), 'Malignant melanoma and exposure to fluorescent lighting at work', *The Lancet*, 7 August 1982, pp. 290-293).

Whilst these findings should be treated with caution, when studied in conjunction with the animal research listed above, they indicate that the type of light (and associated electromagnetic frequencies) animals and individuals are exposed to can be of immense importance biological importance to health.

## Human Studies – Fluorescent Light and Health/Work Efficiency

### Muscle strength and Fluorescent lights

Fluorescent lights can emit radio-frequencies in the MHz range. Research undertaken by Commander Russell M. Jaffe, M.D., Ph.D, U.S.P.H.S., Senior Staff Physician at the U.S. National Institutes of Health in 1978, indicated that frequencies in the 0.1-100 MHz range appeared to weaken muscle strength and proper shielding restored both tone and strength. These findings were also indicated in the work of John N. Ott in his publication *Light, Radiation and You: How to Stay Healthy*, Devin-Adair (1982), ISBN 0-8159-61 21-9.

### Full-Spectrum Vs Cool-white fluorescent lights

Research indicates that cool-white fluorescent lights can cause stress and reduce learning ability. The use of standard cool-white fluorescent lights has been linked with incidences of attention deficit disorder, fatigue, hyperactivity and irritability in children. Such incidents appear to be significantly reduced by using RF-shielded full-spectrum lighting and/or natural unfiltered daylight. A study by Painter (1976) showed a 32% reduction in children's hyperactivity when fluorescent lighting was removed from their classrooms (M. Painter (1976), 'Fluorescent lights and hyperactivity in children: An experiment', *Academic Therapy*, Vol. 12, pp. 181-184, ISSN: 0001-396X).

Research by H. Wohlfarth and S.C. Wohlfarth (1982), 'The Effect of Color Psychodynamic Environmental Modification Upon Psychophysiological and Behavioral Reactions of Severely Handicapped Children', *The International Journal of Biosocial Research*, 3, No. 1, pp. 10-38, showed that introducing full-spectrum lighting (along with special colour schemes for classrooms) resulted in reducing average systolic blood pressure by 20 points per child, with significant improvements in behaviour (including reduced aggression) being noted. Importantly when the full-spectrum units were replaced with cool-white fluorescent units, the children's systolic blood pressure increased and their behaviour deteriorated.

## Animals Studies – Fluorescent Lights and Dental Caries

### Cool-white fluorescent light linked to increased dental caries

I.M. Sharon, R.P. Feller, and S.W. Burney, 'The Effects of Lights of Different Spectra on Caries Incidence in the Golden Hamster', *Archives of Oral Biology* 16, no. 12 (1971): pp.1427-1431, reported that hamsters exposed for 15 weeks to cool-white fluorescent lights, whilst being fed with a cavity-inducing diet, had five times greater incident of dental caries than hamsters raised under similar conditions and diet that were exposed to full-spectrum lighting. The tooth decay in the hamsters exposed to cool-white lighting was found to be ten times more extensive than that of those under the full-spectrum regime.

## **Human Studies – Fluorescent Lights and Stress**

### **Cool-white fluorescent light linked to increased stress levels**

Research by F. Hollwich and B. Dieckhues (1980), 'The Effect of Natural and Artificial Light Via the Eye on the Hormonal and Metabolic Balance of Animal and Man', *Ophthalmologia* 180, No.4, pp. 188-197, investigated the effects of individuals exposed to either high levels of illumination from full-spectrum or cool-white fluorescent lights. Raised levels of ACTH and cortisol (indicators of stress) were found as a result of exposure to cool-white units, but not under the full-spectrum units. In addition to reducing immune system functioning, and mental performance, raised stress levels can also stunt children's growth. It appears that cool-white fluorescent tubes were legally banned in some German medical institutions.

It would be worthwhile determining additionally the effects of different types of light and light spectra on stress levels and incidents of street crime/accidents.

### **Comment**

Whilst radio-frequency (RF)-shielded full-spectrum fluorescent lighting appears to have many advantages over other forms of fluorescent light, it is not generally available. The advantages of using non-shielded full-spectrum fluorescent light, whilst not as great, also appear to be demonstrated in the review above. How they and other forms of artificial lighting, such as compact fluorescent bulbs, compact halogen bulbs and LEDs, compare with incandescent light to individuals sensitive to artificial light have yet to be properly ascertained.

The creation and the further development of the alternative types of lighting mentioned above may further help resolve this issue. In the meantime a thorough evaluation of the effects of different types of lighting on health and productivity should be undertaken at the earliest possible opportunity, with a view to helping develop more beneficial and sustainable lighting types.

Whatever the outcome of such tests, it is suggested that fluorescent lights, both the standard units and compact fluorescent bulbs, are not the total solution, and that exemptions should be made to the general ruling to allow for the continued use of incandescent lights until the release of the new generation of energy-efficient incandescent lights scheduled for 2010.

It is suggested that, as a precautionary and good practice measure, manufacturers of light boxes should at the very least ensure that their units are RF-screened, and also that lead tape (or similar) is used to block the passage of soft x-rays from the cathodes of such units. This can be easily and inexpensively achieved, and can be used as an additional selling point.

Whilst short exposures to unipolar air ionisation has been indicated as being beneficial in treating some ailments, its use does not suit everybody, and can also depend on the emotional state of the individual at time of ionisation. Prolonged exposures to unipolar negative air ionisation has been shown to be markedly reducing the lifespans of animals continually exposed to such regimes when compared to animals used as controls in low field regimes (E.W. Kellogg III, M.G. Yost, E.J. Reed and A.P. Krueger (1985), 'Long-term effects of air ions and DC electric fields on Namru Mice: first year report', *International Journal of Biometeorology*, Vol. 29, No. 3, pp. 253-268). Bipolar ionisation, when used in the correct concentrations, appears more beneficial to health, and is legally required in the Russian Federation in areas where computers are used SanPiN (2003).

In order for active air ionisation measures to be used effectively, high fields, such as can be created by unshielded fluorescent units should be mitigated though proper grounding. Individuals should also be suitably grounded to enhance ion uptake.

Radio frequencies and small air ions are entirely different entities.

## **Energy-saving compact fluorescent lightbulb (CFL) issues**

Electromagnetic fields from the electronics  
Radio-frequency contamination back into mains electricity  
Flicker from the switching frequency  
Fragmented or biased colour spectrum  
Total energy footprint including manufacture and disposal  
Mercury content (approx 3-4mg per unit)

[Compact Fluorescent Lamps: What You Need to Know About Low Energy Lighting, Dr Andrew Goldsworthy](#)

This comprehensive document explains some potential mechanisms for health effects.

[Health Concerns associated with Energy Efficient Lighting and their Electromagnetic Emissions, Dr Magda Havas](#)

[Environmental and Health Concerns Associated with Compact Fluorescent Lights, an environmental petition; Dr Magda Havas and Dr Thomas Hutchinson](#)

[Understanding fluorescent light bulbs](#)