PLC/'Linky'/BPL, Smart Meters and health

Power Line Communications (PLCs) - *also known as 'Linky' in France and Broadband over Power Lines (BPL) in the USA* - transform electric grids into smart grids through turning them into communications networks by placing RF-modulated carrier signals onto grid wiring. A variety of PLC systems use different frequency bands depending on the characteristics of the wiring they operate on – Refer to section on '*Power Line Communications*'.

The effects of PLC on health have yet to be properly assessed. Some electrohypersensitive (EHS) individuals appear to react adversely to PLC signals as indicated by the following anonymous testimonial:

"*Jack (not his real name) has been sensitive to wireless transmitters for well over a decade. …*

In the spring of 2011, [he and his girlfriend] traveled to their rented house … When he arrived, he could immediately feel something had changed. It was as if a cell tower had been erected nearby, but he could not find one. It was unlikely to be the neighbors, since they lived on a large lot and he could still feel it when he drove some distance away. It seemed to be everywhere. …

After asking around, they found out that the local utility had swapped out all of the electrical meters over the winter. The new smart meters communicate with the utility's computers by [PLC]. … The signal is not very powerful, but the antennas are huge and everywhere. … The pulses bother him even fifty feet (15 meters) from the house, with the power line 150 feet (50 meters) on the other side of the house." Anon (2011).

Radio-frequency emissions can also be created by the Switched-Mode Power Supply (SMPS) of Smart Meters.

Tests have indicated that some Smart Meters, even when their transmitters are disabled, can create radio-frequency voltage spikes on consumers' indoor electric wiring due to their SMPS. This occurs over the frequency range of 4-60 kHz, typically with a 2 volts amplitude (Brangan & Heddle 2011).

It has been suggested by some, including (Milham 2011), that the detrimental health effects which have been noted with some wireless Smart Meters – even ***before*** their wireless function is enabled – may be because of the addition of this 'dirty electricity' onto mains wiring [placebo effects too can come into play – *present author's comment*]. Further research is required to determine the possible extent of any such problems, if they do indeed exist, and if they do, how they may be remedied.

As little work has been undertaken on the possible biological effects of PLC and Smart Meter emissions in the radiofrequency range, reference is made to past research cover similar frequencies to those they can create.

Whilst the SMPS of some Smart Meters can create frequencies of 4-60 kHz on indoor wiring (Brangan & Heddle 2011), PLC typically operate at frequencies between 9-500 kHz and at frequencies of ≥1 MHz (Wikipedia 2011).

Literature review covering different frequencies

4-500 kHz frequencies

"*Acute biological effects have been established for exposure to ELF electric and magnetic fields in the frequency range up to 100 kHz that may have adverse consequences on health*," WHO (2007).

1-100 kHz (natural atmospherics/sferics)

These are naturally occurring electromagnetic impulses of short duration (500μs) normally in the 1-100 kHz range, with a frequency maximum normally around 10 kHz. They are of low-intensity (<0.1μT).

Reiter's work revealed significant positive correlations between sferics impulse rates and humans' pain levels from brain injuries, operation scars and wounds, plus incidences of asthma, angina pectoris and migraine. Increased reaction times, accident-rates, incidents of crime and suicides were also noted during natural enhanced sferics activity (Reiter 1974, 1954).

Research by Fischer & Grossmann (1990) revealed the following probabilities for increased 10 kHz activity: general troubles, insomnia, increased accident frequency or muscular spasms (p <0.001), hypertension, suicide or thrombosis (p <0.05). Biases towards positive correlations were found with migraine, colic, depression and heart attacks.

Natural sferics activity can also influence platelet adhesiveness and risk of thrombosis (whilst increased adhesiveness is not a risk issue for thrombosis by itself, when there is reduced blood flow, heart failure, or blood vessel walls are already damaged, increased adhesiveness may greatly increase its risk of occurring).

Ranscht-Froemsdorf & Rinck (1972) revealed that variations in susceptibility to thrombosis (and haemorrhage) could occur under simulated natural electro-climates, whilst Jacobi et al. (1973) demonstrated that a rapid transformation in weather accompanied by sferics with field-strengths of 0.02-0.4 V/m, could significantly alter the degree of platelet adhesiveness that was measured (p <0.001).

Ruhenstroth-Bauer et al. (1984), found a significant positive correlation between incidence of increased 28 kHz sferics and the epileptic seizures of human sufferers (Spearman's rank correlation-coefficient for entire group of 0.30, p <0.0001), and a negative correlation with incidence of 10 kHz sferics and seizures (negative correlation = -0.20, p <0.0032).

A significant positive association between sferics activity in the 28 kHz range and onset of myocardial infarction in humans (r = 0.15) was made by Ruhenstroth-Bauer et al. (1985). Cheng (1985) commenting on that work, and additionally citing GMCCG (1984), stated that similar findings had been made in China indicating that this was a universal phenomenon.

4-100 kHz (manmade)

The controversial work of Havas (2006), Milham (2010) and Milham & Morgan (2008) is also of interest with regard to the possible health effects of PLC and Smart Meter SMPS emissions, as the 'dirty electricity' (*electromagnetic energy that deviates from a pure mains-frequency sine wave and contains both harmonic and transient components*) they document in their research carries similar radio frequency radiation transients.

The RF filters used to reduce exposure to 'dirty electricity' in the research by Havas (2006) do so over the 4-100 kHz range, and have been claimed to reduce the risk and occurrence of a number of health and behavioural problems.

They have no effect in reducing exposure to frequencies below that frequency range which can also be biologically active.

≥1 MHz high-frequency (manmade)

A pilot study instituted by Commander Russell M. Jaffe in 1978 (who was Senior Staff Physician at the US National Institutes of Health at that time) indicated that whilst exposures to frequencies in the 0.1-100 MHz range appeared to weaken human muscle strength, proper shielding restored both tone and strength (Ott 1982). As PLC and the SMPS Smart Meters can create interference in this range it may prove wise to undertake similar experimentation.

≥100 MHz ultra-high-frequency (manmade)

Von Klitzing (1993) demonstrated that 15min exposure to 150 MHz signals of low amplitude (1 μW/cm^2) pulsed with frequencies corresponding to 8-10 Hz human brainwaves increased human alpha-rhythms.

Future research

Independent research, using properly validated research methods, is urgently required to determine to what, if any, effects PLC and Smart Meter SMPS may have on national health, wellbeing and prosperity.

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