Emfs

Electromagnetic fields continue to exercise the brains of regulators and risk managers. On May 11th 2000 the Stewart report was published, focussing mainly on radio frequency emissions. Regulators and senior advisors met recently to openly discuss the report and its implications. What follows is s report of the meeting.

Health effects of electromagnetic waves – what is the impact?

At The Royal Institution of Great Britain
21st February 2001
Chatham House Rules.
1. Presentations made by members of the Stewart Committee
2. Open Discussion

Physical effects

The primary interaction between emfs and the body is physical. Physics determines dose rates, distribution of dose and direct effects of dose. Concerns over the health effects of emfs are focussed on those emfs that produce the largest exposed populations i.e. those associated with mains power distribution and use and those associated with radio communications (including mobile 'phones).

Basic facts

Mains

Mains electricity produces electric and magnetic fields that oscillate at 50 cycles per second (Hz). The electric field component does not penetrate the body (some people report being able to sense its presence, probably through an interaction with hair). The magnetic field component interacts with the body much more weakly (10,000,000 less strong) and is able to pass through the body almost un-attenuated. As it passes through, it induces internal electric fields probably of the order of 1 mV per meter if standing 25 metres from a 3 phase power line. Cell membranes act in much the same way a skin, shielding the contents of the cell from the induced electric field. At the cellular level the local field is of the order of 0.1 microvolts across the cell membrane.

Direct and induced fields in the body are smaller than those that are created in living tissues by natural mechanisms throughout life. The only differences that may be of note are that the natural fields are random (as far as is known) and the induced ones have a greater chance of being more coherent and cyclic.

Radio frequency

Radio communications typically produce electric and magnetic fields that oscillate at between 180 kHz and 60 GHz. Power levels from mobile 'phones are of the order of 1 Watt (though actual output varies with demand). Output is not continuous but pulsed between 8 Hz and 200Hz. Direction of output depends on the environment e.g. the proximity of electrical conductors.

Base stations generate ~60 Watts (equivalent to the power of a domestic lamp) in a narrow beam of solid angle 6 degrees or so. At 150 m the fields experienced are much less than those of using a 'phone.

Models of heads have been used to support the assertion that the great majority of 'phone emissions (those that reach the head) are absorbed in the skin. These models predict that the maximum change in temperature of the skin would be of the order of 0.1 centigrade (far less than changes experienced by most people every day without adverse effect).

Health effects

It was reported that in spite of 30 years intensive research, there was **no** evidence of a link between emfs and cancer. HOWEVER, it was announced that a report by Richard Doll (soon to be published) might provide some evidence in support of a link to leukaemia. This report is not yet available. [Of course this report has since been published and is reviewed in the next issue of this journal]

There is clear evidence that use of mobile 'phones while driving a car increases the risk of an accident and therefore the risk of ill health.

Biological effects

There is a world of difference between biological effects and harm. For example, sound waves induce biological effects in the ear (hearing) and most often, do no harm. However in order to establish that harm may be caused it is first necessary to show that there is some biological effect.

There is moderate evidence of an effect on brain function – speeding of reaction times. These results need to be confirmed before they can be relied upon.

There are anecdotal reports of sensitivity to emfs, proposed symptoms include nausea and headache, but these reports have not been confirmed (or tested) in blinded trials.

Fear of injury is quite another matter.

Problems for Regulators

Given the extreme lack of evidence of harm and the paucity of evidence of biological effects one may question the need for regulation or guidance. Even so, the Stewart Report makes advisory comments such as use of mobile 'phones should be kept as low as possible. These comments are based on the application of the Precautionary Principle, which aims to reduce the effects of uncertainty and may, by some strange coincidence, also have the effect of reducing risk.

The basic problems are that no one knows what outcomes are to be prevented or mitigated and no one knows what mechanisms are required for linking emfs with those outcomes. These fundamental uncertainties lead to practical problems:

Exposure

There is and can be no guidance on levels of exposure, types of exposure, locations of exposure, thresholds of exposure.

Shielding

There can be no measure of the effectiveness of shielding, but even if there were, emfs in the field behave very differently from lab conditions.

Measurement of exposure

Given that no one knows which type of exposure may be important there is no guarantee that exposures that have been measured so far are relevant. For example some theories suggest average power deposition should be measured, others suggest peak power, others suggest coherence.

Remote masts

It is popular to fear the erection of base stations near residential sites. This fear is probably aroused by the lack of control of residents over the output of the station (as opposed to free choice of use of the 'phone). It is ironic that the further away from a base station the higher the output from the 'phone and the higher the exposure during use.

Text messaging

Clearly reduces the on time of the 'phone but no one knows if it increases other exposures that may be relevant.

Summary

As yet there is no evidence of harm arising from exposure to emfs. [But see the next volume for a review of the Doll paper]

There are early signs that biological interactions can be observed and measured.

Clearly there are many uncertainties. Given the political interest, this is a subject that will need careful monitoring over the coming years.

Fear of injury may provide the most tangible interaction with insurance in the foreseeable future.

Other developments relating to EMFs

Hockling B. Occupational Medicine. (2001) Vol. 51 #1, p.66-9.

A discussion of Microwave Sickness (MS). This is proposed to be a medical entity, affecting people exposed to radio-frequency radiation.

Symptoms include fatigue, headaches, palpitations, insomnia, various skin symptoms, impotence and altered blood pressure.

Comment

There appear to be no specific tests for MS. There is no identified mechanism linking exposure to reported symptoms.

Diagnosis is by elimination rather than identification. Any exposure to RF radiation could be used as the basis for a diagnosis of MS for any range of symptoms.

Double blind tests would be required to establish any link to exposure.