Safety of radio signals from Smart Meters installed by WEL Networks

EMF Services
Professional EMF measurement and advisory services

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About EMF Services and the author of this report

EMF Services is a division of Monitoring and Advisory Services NZ Ltd (MAASNZ), and provides professional measurement and advisory services related to possible health effects of electromagnetic fields (EMFs), such as the extremely low frequency (ELF) electric and magnetic fields found around any wiring, appliances or infrastructure carrying mains electricity, and the radiofrequency (RF) fields produced by radio transmitters and some industrial equipment.

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1 Introduction and summary

This report discusses the safety of the radio signals transmitted by Smart Meters being installed in the Hamilton area by WEL Networks.

Smart Meters send information about electricity consumption back to the supplier through a radio link. The model of Smart Meter being introduced by WEL Networks uses a radio communications card which operates at relatively low power, and only transmits for a very short time each day.

Measurements made at a typical WEL Networks Smart Meter installation, with the meter mounted in a metal box on an external wall showed that:

- Exposures to the radio signal behind the meter (on the inside of the wall), averaged over 30 seconds, were almost always less than 0.0005% of the limit allowed for the public in the New Zealand radiofrequency (RF) field exposure Standard[1].
- The maximum 30 second average exposure was less than 0.003% of the public limit.
- On average, the meter transmits for one minute 22 seconds over the day.

Exposures in front of the meter (in a typical installation) were greater than behind it, but still well below the limits in the Standard. 30 cm from the front of the meter, time averaged exposures would still be less than 0.39% of the limit. Even if the Smart Meter were to transmit continuously, exposures would still comply with the limits.

These measurements are described in more detail in EMF Services Report 2012/36 *Measurements of radiofrequency fields from a WEL Networks Smart Meter*, available from WEL Networks.

The exposure results obtained on the WEL Networks meter are consistent with those obtained on meters in Australia and the USA which use the same radio communications card.

The limits in the New Zealand exposure Standard follow international recommendations, and are based on careful examination of research into possible health effects of RF fields. A wide range of possible health effects has been investigated. Overall there is no persuasive evidence of health risks from exposures which comply with the recommended limits. Recent reviews by several national and international health organisations confirm these conclusions.

On this basis, exposures to the radio signals from WEL Networks Smart Meters do not pose any health risks.

More detailed information is contained in the rest of this report.

[1] NZS 2772.1:1999 *Radiofrequency Fields Part 1: Maximum exposure levels – 3 kHz to 300 GHz*. Compliance with this Standard is recommended by the Ministry of Health.

2 Exposure limits recommended in New Zealand

The New Zealand Ministry of Health recommends using New Zealand Standard NZS 2772.1:1999 *Radiofrequency Fields Part 1: Maximum exposure levels – 3 kHz to 300 GHz* to manage exposure to RF fields. This Standard is based closely on Guidelines published by the International Commission on Non-Ionising Radiation Protection (ICNIRP). ICNIRP is an independent scientific body recognised by the World Health Organisation for its expertise in this area. Their exposure Guidelines, which are based on a careful review of the health effects research, were first published in 1998[2], and reaffirmed in 2009[3] following a review of more recent research in this area[4].

NZS 2772.1 sets limits for exposure to the RF fields produced by all types of transmitters, and covers both public and occupational exposures. Limits for the public are stricter than those for occupational exposures, and are set at levels 50 times lower than those at which adverse health effects might occur.

If exposures vary over time (as they do with the transmissions from Smart Meters, which only transmit intermittently), they can be averaged over six minutes.

The Ministry of Health convenes a committee every six months to review new research in this area and advise the Director-General of Health of any potential consequences for the Ministry's recommendations. The Committee is also required to bring issues of significance, or suspicions of health effects occurring at levels which comply with current limits, to the attention of relevant Ministers.

[2] http://www.icnirp.de/documents/emfgdl.pdf
[3] http://www.icnirp.de/documents/StatementEMF.pdf
[4] http://www.icnirp.de/documents/RFReview.pdf

3 Research into possible health effects of radiofrequency fields

3.1 Overview

Research into possible health effects of RF fields has been going on for over sixty years. This has included:

- Studying the health of people who, because of their work or where they live, may be exposed for several years to higher levels of RF fields than others.
- Studies of people exposed in their homes or in laboratories to determine whether short term exposures cause any effects.
- Laboratory research on animals to see whether long or short term exposures to RF fields causes effects which are not seen in unexposed animals.
- Laboratory research on animals and cell cultures to investigate how RF fields might interact with the body, and if they do, at what exposure levels these interactions occur.

A wide variety of possible effects has been investigated including: cancer; effects on pregnancy; effects on the brain and nervous system; effects on behaviour, reaction times and learning; effects on sleep; and causing symptoms such as headaches and general discomfort. Much of this work, especially in the past 25 years, has concentrated on the frequencies used by cellphones and cellphone base stations (cellsites). This is particularly relevant to the radio signals from Smart meters, as they operate at similar frequencies to cellphones and cellsites.

It was discovered very early on that the energy of the radiofrequency fields making up the radio signals is absorbed in the body and converted to heat. If the radio signals are very intense, the body is unable to cope with the extra heat and starts to suffer symptoms of heat stress. To date no harmful effect occurring at lower levels of exposure have been found. Prevention of any heating has formed the basis of exposure limits for over thirty years.

3.2 Recent reviews of research

This research into health effects of RF fields has been reviewed several times in recent years by national and international health bodies, including:

- Norwegian Institute of Health (2012)[5]
- UK Health Protection Agency (2012)[6]
- Spanish Scientific Advisory Committee on Radio Frequencies and Health (2011)[7]
- International Commission on Non-Ionising Radiation Protection(ICNIRP) (2009)[8]
- French Agency for Environmental and Occupational Health Safety (AFSSET) (2009)[9]
- European Union Scientific Committee on Emerging and Newly Identified Health Risks (2007 and 2009)[10]

[5] http://www.fhi.no/dokumenter/545eea7147.pdf
[6] http://www.hpa.org.uk/Publications/Radiation/DocumentsOfTheHPA/RCE20HealthEffectsfromRFElectromagneticFields/
[7] http://www.ccars.es/sites/default/files/Report_on_RF__health_2009-2010_EN.pdf
[8] http://www.icnirp.de/documents/RFReview.pdf
[9] http://www.afsset.fr/upload/bibliotheque/964737982279214719846901993881/Rapport_RF_20_151009_l.pdf

While noting that further research should be carried out in some areas, these reports all conclude that recent research results do not warrant revision of current exposure limits.

Much of the research in the past 25 years has looked for health effects at levels which comply with current limits. While there have been occasional reports of such effects, subsequent studies have been unable to reproduce them.

The only effect which does appear with any consistency is a very small change in the electro-encephalogram (EEG) following exposure to signals of the type produced by a GSM cellphone. However, the changes observed are very small in comparison to variations which occur naturally, and there do not appear to be any effects on mental processes or sleep quality, or any consequences for health. It is possible that if these effects are real, they may be caused by very subtle localised heating.

The Norwegian report referred to above concluded:

> "***Overall conclusion on the possible health hazards from exposure to weak RF fields***
>
> A large number of studies have examined the possible effects of exposure to weak RF fields (i.e., exposure within the ICNIRP's reference values). The studies have been performed on cells and tissues, and in animals and humans. The effects that have been studied apply to changes in organ systems, functions and other effects. There are also a large number of population studies with an emphasis on studies of cancer risk. The large total number of studies provides no evidence that exposure to weak RF fields causes adverse health effects. Some measurable biological / physiological effects cannot be ruled out."

3.3 Health effects of particular interest

Two potential health effects are often mentioned as concerns in relation to Smart Meters: cancer and "Electromagnetic hypersensitivity" (EHS – a broad range of symptoms reported by some people who feel that they are unusually sensitive to RF fields). These are discussed in more detail below.

3.3.1 Cancer

A great deal of research has been undertaken to investigate whether exposures to RF fields increase the risk of cancer, especially whether people who use cellphones are at greater risk than those who do not (or use them very infrequently).

The research was reviewed in 2011 by a panel established by the International Agency for Research on Cancer (IARC)[11]. One of IARC's functions is to classify substances, activities (for example, particular occupations) and physical agents (for example, x-rays) according to the likelihood that they cause cancer.

IARC classified RF fields as a 2B "possible" carcinogen, which puts them in the same class as coffee and pickled vegetables. A 2B classification does not mean that a risk has been established, but that some data suggests there could be one. However, it is also recognised that there are weaknesses in the studies suggesting a risk, which could mean that they

[10] http://ec.europa.eu/health/electromagnetic_fields/research/index_en.htm
[11] http://www.iarc.fr/en/media-centre/pr/2011/pdfs/pr208_E.pdf

have reported a "false positive". For comparison, IARC's Class 2A "probably carcinogenic" category includes PCBs and fumes from hot frying, and Class 1 "carcinogenic" includes alcoholic drinks, diesel exhaust and asbestos.[12]

The IARC conclusion was based largely on the findings of studies on brain tumour risks in cellphone users, which showed that the incidence of some types of brain tumour was higher in people who had used cellphones a lot, compared with other users or people who had never used a cellphone. However, the researchers cautioned that this apparent increased risk could have been caused by biases in the data, and other sources of information, including studies on animals exposed over their entire lifetimes, does not suggest an effect of RF fields on cancer. Brain tumour rates from the past thirty years do not show any pattern suggesting an increase which is correlated with the take-up of mobile phones.

Since the IARC classification, several other reviews of the RF field, cellphone and cancer data have been published.

- A systematic review[13] of relevant studies found that they did not suggest a cause and effect relationship between cellphone use for up to ten years and brain tumours, but there was not enough information to form any conclusions for longer term use.
- The review by the UK HPA (reference 6 above) concluded that the evidence on cancer risks, while not definitive, is increasingly in the direction of no material effect of exposure.
- A review by the Swedish Council for Working Life[14] found that overall, the data do not support an effect of mobile phone use on tumour risk, especially when taken together with cancer trend statistics throughout the world.
- The Norwegian Institute of Health (reference 5 above) concluded that data currently available do not suggest an effect of RF fields on cancer, but it is not possible to draw conclusions for periods of use longer than 13 years as no data is yet available.

Whatever may ultimately be decided on the question of cellphone use and brain tumours, it is perhaps most relevant to remember that the IARC 2B classification was prompted by a weakly increased incidence of rare cancers in those with the greatest use of cellphones, but exposures to RF fields from Smart Meters are both much briefer and much weaker than experienced by such users. In particular:

- Exposures from cellphones being used in the studies considered by IARC might have been 1 – 50% of the relevant exposure limit, compared with exposures of 0.0005 – 0.003% of the limit from Smart Meters.
- The minimum average daily use amongst heavy users was about 30 minutes per day, while typically Smart Meters only transmit for 1 – 2 minutes per day.

[12] A more detailed discussion of the IARC classification can be found at the Cancer Research UK website: http://scienceblog.cancerresearchuk.org/2011/05/31/who-verdict-on-mobile-phones-and-cancer/

[13] Repacholi et al. Systematic review of wireless phone use and brain cancer and other head tumours. Bioelectromagnetics 33 (3), 187-206, 2012

[14] http://www.fas.se/en/News/2012/10-years-of-research-on-the-health-risks-of-radiofrequency-fields/

Therefore, whatever may eventually be decided about the risk of brain tumours in heavy users of cellphones, there appears to be no chance that Smart Meters would have any effect of cancer risk.

3.3.2 Electromagnetic hypersensitivity

Electromagnetic hypersensitivity (EHS) is the name given to a range of symptoms, such as headaches, fatigue, stress, sleep disturbances, skin symptoms like prickling, burning sensations and rashes, and pain and ache in muscles experienced by some people who attribute the symptoms to exposures to electromagnetic fields.

A wide range of studies has been carried out to investigate these effects. This includes:

- Laboratory studies in which participants (including some who believe that they suffer from EHS) are exposed to RF fields to determine whether this provokes the symptoms, or whether individuals are able to detect when they are being exposed.
- Studies in the home to determine whether sleep quality is affected by exposures to RF fields.
- Observational studies comparing the occurrence of symptoms to people's mobile phone use or exposure to RF fields from different types of transmitter.

Summaries of the research can be found in Chapter 6 of the UK Health Protection Agency review (reference 6 above) and in other publications[15].

While there is no doubt that some people do experience a wide variety of often unpleasant or debilitating symptoms, the well conducted studies in this area show that occurrence of the symptoms is unrelated to RF field exposures, and that people who consider that they suffer from EHS are not able to detect when they are being exposed or not. On the other hand, there is evidence suggesting that it is a person's belief that they are being exposed, rather than an actual exposure, which triggers the symptoms.

The World Health Organisation (WHO) published a Fact Sheet on the subject in 2005[16], and proposed that the condition be referred to as "Idiopathic Environmental Intolerance Attributed to Electromagnetic Fields" in order to remove any assumptions about what causes the symptoms.

It therefore does not appear as though RF fields from Smart Meters will trigger any of the symptoms associated with EHS/Idiopathic Environmental Intolerance Attributed to Electromagnetic Fields.

[15] See, for example, Rubin et al. Do People With Idiopathic Environmental Intolerance Attributed to Electromagnetic Fields Display Physiological Effects When Exposed to Electromagnetic Fields? A Systematic Review of Provocation Studies. Bioelectromagnetics, DOI 10.1002/bem.20690, 2011 and references cited therein

[16] http://www.who.int/mediacentre/factsheets/fs296/en/index.html