

EMF Update



Information for members of the Electricity Supply Association of Australia Limited (ABN 98 052 416 083)

August 2001

Editorial

Since the last EMF Update in April 2000 there have been a number of significant developments in the EMF and health issue. The most notable of these was the publication in March 2001 of a comprehensive review of the science by the National Radiological Protection Board (NRPB) in the UK. The findings of this review were similar to those of the US National Institute of Environmental Health Sciences (NIEHS) in 1999, which were reported in the last issue of EMF Update.

Within ESAA, EMF activities have generally continued at a level similar to last year, although the misleading (and premature) reporting in the UK of the NRPB review produced an increase in media interest and public concern on the topic. ESAA has updated both its EMF Policy and EMF information package and is revising its public information brochure to take account of the latest scientific review findings.

Two ESAA EMF scientific workshops have been held since the last EMF Update was published. These workshops have provided an opportunity for EMF researchers and those interested in research to discuss the latest work underway. As well as power frequency health matters, time has been devoted to discussion of work in the area of mobile phone health effects.

The special guest speaker at the 2000 Scientific Workshop was Mr Josh Berle from Mobile Telecommunications Advisory Group, Federation of the Electronics Industry in the UK who spoke on the Stewart Report on mobile phones

and subsequent developments. The 2001 Scientific Workshop, which was held on 6 July, was noticeably better attended than the previous year. The special guest speaker was Dr Ken Olden, Director of the US National Institute of Environmental Health Sciences which published the major EMF review report of 1999. Dr Olden spoke on EMF developments in the USA following the NIEHS Report.

In the area of scientific studies, there have been a number on the possible relationship between EMF exposure and childhood cancer, particularly leukaemia. Perhaps the most significant were three "meta-analyses" which pooled the results of existing childhood leukaemia (epidemiological) studies. All three of these analyses lent support to the existence of a weak association between EMF and childhood leukaemia. These studies are reviewed later in this Update.

More recently, the International Agency for Research on Cancer (IARC), an agency of the World Health Organisation, has reviewed the effects of 50 Hz magnetic fields on cancer formation and classified them as a "possible carcinogen", based on the evidence related to EMF and childhood leukaemia. Given the findings of the NIEHS and NRPB reports, such a classification was not unexpected.

The California Department of Health Services is currently reviewing the effect of EMF on a number of health conditions (including various cancers) and has issued its draft report for public comment. It is not clear at this stage what policy implications this review may have in California or elsewhere.

The health effects of mobile telephone and radio frequencies have also continued to be an area of public interest, including the publication in May of the report of the Australian Senate Inquiry into Electromagnetic Radiation.

While there are occasional instances of court cases being instigated in relation to the issue of EMF and health, none has progressed significantly since the last EMF Update.

For the future, ESAA will continue to inform the public of the latest developments in the science and regulatory areas. Currently, ARPANSA is considering the development of a survey of residential magnetic fields in Australian homes and is proposing a review of the current National Health and Medical Research Council guidelines for power frequency EMF. ESAA will participate in these activities where it can make a useful contribution.

ESAA recognises that the issue of EMF and health is one of genuine community concern which is best served by informed discussion of the total body of the science rather than selective and biased reporting. Until the science becomes more certain, ESAA will continue to advise its members to operate their electricity systems 'prudently' within the guidance of the relevant Australian health authorities.

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CHILDHOOD CANCER STUDIES

A number of results of studies related to EMF exposure and the incidence of childhood cancer have been published over the last year or so. The most significant includes a further report from the UK Childhood Cancer Study, the largest national study of this type to date, and a number of meta-analyses of childhood leukaemia studies where data from several previous studies in different countries have been pooled.

UK Childhood Cancer Study

The second report from the UK Childhood Cancer Study (UKCCS), a major study of childhood cancer in the United Kingdom (see EMF Update of April 2000), has failed to establish any link between exposure to magnetic fields associated with electricity supply and childhood cancer. The study is based on analysis of 3390 cases and 3380 controls, which makes it the largest national study of its kind to date. The study published in November 2000 is the second in a series of childhood cancer studies being conducted in the UK, the first of which was published in December 1999.

This latest study examined the effects of distance to electrical facilities and calculated magnetic fields on the incidence of childhood cancer. It concluded that –

“There was no evidence that either proximity to electrical installations or the magnetic field levels they produce in the UK is associated with increased risk of childhood leukaemia or any other cancer.”

These findings support those of the earlier UKCCS study where measured magnetic fields were used as the measure of “exposure”. Magnetic field exposures of children in the UK seem to be relatively low with the UKCCS indicating that only 0.4% of children have exposures greater than 4mG. This may be compared with the exposures for the Ahlbom meta-analysis (see below) covering some nine countries, including the UK, where 0.8% of exposures were greater than 4 mG.

Meta-Analyses Related to Childhood Leukaemia

A number of meta-analyses of existing epidemiological studies of childhood leukaemia have been published since the

last issue of EMF Update. These analyses pool data from existing studies in different countries to obtain larger data sets, thereby providing more statistical power to detect associations that may not have been evident in the studies considered separately. Three of these are of particular interest: the first meta-analysis was performed by Angelillo and Villari (1999) for the World Health Organisation (WHO) and the other two were those of Greenland et al (2000) and Ahlbom et al (2000).

The analysis by Angelillo and Villari was based on epidemiological studies from 12 countries with measured magnetic fields as the exposure metric. Angelillo and Villari estimated a statistically significant association between EMF exposure and childhood leukaemia with a relative risk of 1.59. They concluded:

“enough evidence exists to conclude that dismissing concerns about residential EMFs and childhood leukaemia is unwarranted.”

The study is available on the WHO web site and also in the Bulletin of the WHO (1999) 77 (11), 906-915.

Ahlbom et al (2000) pooled results from nine national studies, including various

European countries, the UK, USA and New Zealand. Original data from these studies were used for the analysis and exposure ranges of 0 to <1, 1 to <2, 2 to <4 and >4 mG were analysed. The analysis found a statistically significant association between magnetic field exposure and childhood leukaemia for average exposures greater than 4mG with a relative risk of about 2. This exposure level was the highest exposure category in the study and represented some 0.8% of the populations studied. Adjustment for confounding variables did not appreciably change the results. (Brit. J. Cancer (2000) 83 (5), 692-698)

Greenland et al (2000) performed a similar pooled analysis on results from twelve national studies, including eight that were considered in the Ahlbom analysis but they did not include the UKCCS data. The general result was similar to Ahlbom et al. but with a statistically significant association between EMF exposure and childhood leukaemia for average exposures greater than 3mG, which was the highest exposure group in this analysis. There was also some evidence of increasing risk of childhood leukaemia with increasing exposure above 1.5mG. (Epidemiology, Nov 2000, 11(6), 624-634)

INTERNATIONAL AGENCY FOR RESEARCH ON CANCER (IARC) CLASSIFICATION

An expert scientific working group of the Monographs Programme of the International Agency for Research on Cancer (IARC), a part of the World Health Organisation, has recently reviewed the effects of static and time-varying ELF (including 50 Hz) EMF on human health. No new studies were performed as part of this assessment but it was based on a review of existing studies in the literature.

IARC has concluded that:

“ELF magnetic fields are possibly carcinogenic to humans, based on consistent statistical associations of high level residential magnetic fields with a doubling of risk of childhood leukaemia. Children who are exposed to residential ELF magnetic fields less than 0.4 microtesla have no increased risk of leukaemia. Because of insufficient data, static magnetic fields and static and ELF

electric fields could not be classified as to carcinogenic risk to humans.”

“In contrast, no consistent evidence was found that childhood exposures to ELF electric or magnetic fields are associated with brain tumours or any other kinds of solid tumours. No consistent evidence was found that residential or occupational exposures of adults to ELF magnetic fields increase risk for any kind of cancer.”

“No scientific explanation has been established for the observed association of increased childhood leukaemia risk with increasing residential ELF magnetic field exposure.”

Further information is available from the IARC web site www.iarc.fr. IARC Monograph No 80 providing full details of the study will be issued in due course.

EMF REVIEW BY THE ADVISORY GROUP ON NON-IONISING RADIATION (AGNIR) FOR THE UK NATIONAL RADIOLOGICAL PROTECTION BOARD (NRPB)

A major report entitled “ELF Electromagnetic Fields and the Risk of Cancer” prepared by the Advisory Group on Non-Ionising Radiation (AGNIR) for the National Radiological Protection Board (NRPB) in the UK was released in March 2001. The AGNIR review was chaired by the eminent British epidemiologist, Sir Richard Doll and confirmed that adverse health effects have not been established. After considering the report, the NRPB concluded that it “provides no additional scientific evidence to require a change in exposure guidelines”.

The review concluded:

“Laboratory experiments have provided no good evidence that extremely low frequency EMFs are capable of producing cancer, nor do human epidemiological studies suggest they cause cancer in general. There is, however, some epidemiological evidence that prolonged exposure to higher levels of power frequency magnetic fields is associated with a small risk of leukaemia in children.”

However, it goes on to say that:

“the epidemiological evidence is currently not strong enough to justify a firm conclusion that such fields cause leukaemia in children.”

The above conclusion regarding leukaemia in children resulted from consideration in the NRPB report of the meta-analyses mentioned above, particularly the study of Ahlbom et al. Page 135 of the NRPB report concludes –

“However, the recent pooled analysis of Ahlbom et al. (2000) of studies ... indicates a relative risk of nearly 2.0 in those exposed to more than $0.4 \mu\text{T}$ compared to those exposed to less than $0.1 \mu\text{T}$. This excess is unlikely to have been due to chance. ... These uncertainties make it difficult to know how much of the observed excess may have been due to a causal effect.”

Although the NRPB review identified areas where additional research could be conducted to address remaining scientific issues, it did not recommend any changes to existing EMF exposure guidelines.

The findings of the review are consistent with those of other major reviews in

recent times, in particular, the 1999 review report of the US National Institute of Environmental Health Sciences (see EMF Update of April 2000). This report concluded that – “The scientific evidence suggesting the ELF-EMF exposures pose any health threat is weak. The strongest evidence for health effects comes from associations observed in human populations with two forms of cancer, childhood leukaemia and chronic lymphocytic leukaemia in occupationally exposed adults. ...”

Further to the discussion of evidence related to childhood leukaemia, the NRPB review found that:

- there is no cause and effect relationship between any level of EMF exposure and any cancer;
- many animal studies on EMF and cancer provide “no convincing evidence” that EMF can cause or contribute to cancer;
- laboratory studies provide “no good evidence” that EMF can cause biological changes related to the development of cancer;
- based on the many epidemiological studies of adults exposed to EMF at home or at work, there “is no reason to believe” that EMF exposure plays any role in adult leukaemia or brain cancer; and
- scientific research has not demonstrated any increased risk of any kind of cancer in adults exposed to EMF at home or at work.

Summaries of the NRPB report are available on the NRPB web site www.nrpb.org.uk. The full report of some 179 pages is

available from the NRPB (Documents of the NRPB, Volume 12, No. 1, 2001). It provides a valuable review of the literature on this topic under a number of categories including cellular studies, epidemiological studies and occupational studies, and some suggested areas for further research.

Non powerline sources important

An interesting side-issue arising from the publicity surrounding the release of the NRPB report emerged in a radio interview with Sir Richard Doll who noted that “...in the UK about three quarters of the high exposures are quite away from power lines”.

This view was also supported by Dr John Loy, Chief Executive Officer of Australian Radiation protection and Nuclear Safety Organisation (ARPANSA) who issued a statement “Does Electricity Cause Cancer” in March 2001. In this statement he said: “It is important not to fixate on the location of external power lines, including high voltage transmission lines, as the prime cause of exposure. Exposure to ELF magnetic fields can arise from ground currents, internal household wiring and the use of electrical appliances as much as from exposure to the external power lines.”

For more detail on the statement, see the comments on ARPANSA in the Regulatory section elsewhere in this Update. The full statement, which discusses the NRPB review and its relation to Australian conditions, is available on the ARPANSA web site www.arpansa.gov.au.

SENATE INQUIRY INTO ELECTROMAGNETIC RADIATION

The Senate Environment, Communications, Information Technology and Arts References Committee has failed to reach a consensus on the health effects of electro-magnetic radiation (EMR) as it applies to telecommunications equipment, including mobile phones.

The report on the Inquiry into Electromagnetic Radiation by the committee chair, Democrat Senator Lyn Allison was issued on 4 May 2001. The report, which was not supported by the other five committee members, strays from the Inquiry's Terms of Reference to include two recommendations on extremely low frequency electric and magnetic fields (EMFs) associated with power lines and some discussion of the health effects of power lines.

The two recommendations which include EMF are:

"Recommendation 2.1 The Committee Chair recommends that, particularly in the light of recent reports of links between power lines, radio towers and leukaemia, additional research into extremely low frequencies and TV/radio tower exposure should be carried out." and

"Recommendation 2.2 The Committee Chair recommends that precautionary measures for the placement of power lines be up-graded to include wide buffer zones, and undergrounding and shielding cables where practicable".

Government members of the committee, in their dissenting comments, queried the basis for the above two recommendations, saying that the Committee had heard insufficient evidence on the issue of extremely low frequency EMFs and that EMF fell outside the scope of the Committee's terms of reference. Opposition senators expressed similar reservations about these conclusions and produced an extensive minority report which is part of the main report.

The government senators also note: "While the association between magnetic fields and childhood leukaemia needs to

be taken seriously, the strength of the evidence and the effect, if real, may not warrant expensive further precautions at this stage." They point out that "...the

electricity industry already adopts a prudent avoidance approach in the design and operation of its electricity generation, transmission and distribution systems".

EMF HEALTH EFFECTS UNLIKELY – NETHERLANDS HEALTH COUNCIL

A special committee at the Health Council of the Netherlands in The Hague released its annual update on possible health effects of extremely low frequency (ELF) electromagnetic fields on May 29. Recommendations highlight the conclusion that:

"Present scientific data do not indicate that exposure to environmental electromagnetic fields – such as generated by power lines and mobile phone base stations – constitute a health hazard."

Their chapter on "Major Scientific Developments" includes some commentary on recent studies. Health council committee members discuss results of three meta-analyses of residential exposure to power-frequency EMF and risk of childhood leukaemia published since their previous review. The Dutch committee concluded that:

"these recent meta-analyses show a consistent association between relatively high measured or calculated magnetic field strengths and an increased risk of childhood leukaemia. However, from an epidemiological point of view, an association with a relative risk of smaller than 2 is to be considered as weak. Furthermore, the committee does not think that either 0.3 microtesla or 0.4 microtesla (3 or 4 mG) should be regarded as a definite threshold field strength, above which the risk is suddenly increased."

They go on to discuss the differences between calculated and measured field levels and how they are interpreted in these studies, concluding that:

"it therefore remains the committee's belief that it is not likely that children (or adults) living near to high-voltage power lines are at risk through exposure to electromagnetic fields generated by those lines."

The Netherlands report also contains discussion on a relatively new topic – ELF exposure and heart rate. Here, committee members note that:

"while the nature of any relationship that may exist between exposure to relatively high 50/60-Hz magnetic fields and heart abnormalities remains unclear, the possibility that prolonged exposure has an effect cannot be excluded."

The fact that data from only one epidemiological study (by Savitz, 1999) are available means that results carry "limited weight," they add. Nevertheless, the subject "warrants further research and the committee will follow the developments closely."

One other evaluation contained in the update is discussion of Professor D. Henshaw's corona ion hypothesis which is discussed in a separate article in this EMF Update

Reflecting on the research scene to date, Health Council committee members acknowledge that public concern over health effects of ELF EMF continues and, in some cases, "good scientific data is scarce." They identify one area where more information is needed, i.e. the possibility that some individuals might perceive or be extra sensitive to EMF and they recommend study to gain greater insight in this area.

The committee report and press release in English-language versions available on the Web at: <http://www.gr.nl/engels/publications/Reports/frameset.btm>.

The recent update is not a "stand alone" document but assumes that the reader has a copy of the 67-page Health Council report issued in March 7 2000, which is still available at the same site.

(Based on a report by EMF Gateway, USA)

EMF REVIEW AND NEW RESEARCH FROM JAPAN

A book entitled "Biological and Health Effects from Exposure to Power-line Frequency Electromagnetic Fields – Confirmation of Absence of Any Effects at Environmental Fields Strengths" by editors H Takebe, T Shiga, M Kato and E Masada summarises recent research on EMF and health in Japan. (The book is published by Ohmsha Ltd and IOS Press, website www.iospress.nl).

The book written by four university academics in Japan reviews the field of ELF EMF literature and publishes some new Japanese research. The research plan for the new research was developed by the Tokyo Electric Power Company Inc. and supervised by the four authors/editors of the book. As the book notes, this is one of the rather rare research reports published by private industry in Japan.

Part 1 of this book presents the studies completed by the editors, along with related reviews of related research done by others. The review of health effects of EMF using worldwide literature overlapped in time and scope with the US RAPID study.

Part 2 presents the toxicology studies carried out in Japan, mainly at the Mitsubishi Chemical Safety Institute with the support of the Tokyo Electric Power Company, many of which have not been available in English before. These included carcinogenicity experiments with rats and a study of the effects of exposure on genes: in both cases their results were negative.

CALIFORNIA DEPARTMENT OF HEALTH SERVICES DRAFT EMF REPORT

In July 2001, the California Department of Health Services (CDHS) published a draft EMF Report on their web site. The report is entitled "Evaluation of the Possible Risks from Electric and Magnetic Fields (EMFs) from Power Lines, Internal Wiring, Electrical Occupations and Appliances" and is labeled "Draft 3 for Public Comment, April 2001 – Do not cite or quote". The report has not yet been finalised and has been released to allow comments by members of the public and the scientific community until September 10.

The report deals with magnetic fields from all types of exposure to electricity including power lines, internal wiring, electrical occupations and appliances. The report is mainly a review of existing scientific studies on EMF by three officials of the CDHS and attempts to attribute a probability that EMF may contribute to various medical conditions. Two methodologies are used to attribute a probability and these are:

- the IARC classification system as applied by the three officials; and
- one devised by the CDHS, which attributes a probability to the likelihood that EMF may contribute to various medical conditions.

The CDHS report investigates 13 health conditions which have been associated with EMF effects for possible links to EMF and identifies a number of these as "possibly" being caused by EMF. However, the report also notes, "there is a chance that EMFs have no effect at all

The use of the IARC classification system by CDHS resulted in five conditions being identified as "possible carcinogens" (IARC category 2B) or above (childhood and

adult leukemia, adult brain cancer, miscarriage and Lou Gehrig's disease). This is in contrast to the findings of IARC itself, which only classified ELF EMF as a "possible carcinogen" in relation to childhood leukemia (see IARC article in this EMF Update).

Using the CDHS classification system, the three reviewers considered the existing scientific literature and consulted extensively with other experts and each other before reaching their individual conclusions as to the numerical probability assigned to the likelihood that EMF may contribute to the 13 health conditions.

The draft report also included as appendices, reports of recent research into electrosensitivity and EMF by Dr P Levallois of Canada, and miscarriage and EMF by Dr G Lee of CDHS. While the work on electrosensitivity showed no strong relationship with EMF exposure, the work on miscarriage suggested some possible increased risk related to maximum magnetic field exposure. The CDHS Report also discusses a range of policy options which could be used to reduce the risk of

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EMF exposure in the community as well as identifying some priorities for additional research on power frequency EMF.

The executive summary and full draft report (of more than 300 pages plus extensive appendices) is available on the CDHS web site www.dhs.ca.gov/ehib/emf. The report is long and involved, and it is suggested that interested readers consult the report itself to get a clear indication of its content.

CORONA ION HYPOTHESIS

Another theoretical mechanism proposed to link health effects to EMF is the "corona ion" hypothesis of Professor D. Henshaw of the University of Bristol in the UK. This hypothesis involves the enhanced deposition of aerosols charged in electric fields, which surround major electrical installations such as power lines.

According to Henshaw's hypothesis, ions associated with strong electric fields around transmission lines may carry viruses, bacteria, radon or other potentially harmful molecules into neighbourhoods near the lines. Residents there may be more likely to breathe them in and have them deposited in the body than people who live far away, thereby increasing disease risk associated with living near power lines, particularly downwind.

The hypothesis was considered in the NRPB report. It comments (page 23) –

"The physical principles for enhanced aerosol deposition in large electric fields are well understood. However, it has not been demonstrated that any such enhanced deposition will increase human exposure in any way that will result in adverse human effects to the general public."

The Netherlands Health Council in their review of health effects of EMF (see other Update article) also discussed the "corona ion" hypothesis. The Dutch Council considers it –

"extremely unlikely that through this pathway the risk of cancer or other diseases might increase."

REGULATORY MATTERS

Commonwealth Government

In Australia, the Commonwealth body charged with the responsibility for regulating safety issues associated with electro-magnetic radiation and electric and magnetic fields (EMFs), is the Australian Radiation Protection and Nuclear Safety Authority (ARPANSA). Since the last issue of EMF Update, ARPANSA has issued two statements on EMF which are available on their web site.

In the first statement, ARPANSA provided an official response to the UK NRPB report. The response from the Chief Executive Officer Dr John Loy was entitled "Does Electricity Cause Cancer? Advice by the CEO of the ARPANSA – March 2001". In this statement, he clarifies the view of ARPANSA on the concerns expressed in the media about the NRPB findings, considers what other overseas authorities have concluded on the issue and relates this to Australian conditions. In considering the findings generally, the CEO states –

"It is important to emphasise that, if the effect is real, it does seem to occur at the high end of what is normally encountered in a residence. The level of 0.4 microtesla and above that provides a positive association in the pooled analysis applies to no more than 0.8% of the population sampled in these studies. There is no reason to believe that Australia would have a vastly different proportion of people in this higher residential exposure range."

He also states that it is quite clear that attention should not be focused on only power lines (see quote in NRPB article).

The statement recommends a number of actions as a follow up to the NRPB report. These include the preparation of a new information sheet (completed – see below), a measurement protocol, a survey

of household EMFs and a review of the existing NHMRC Interim Guidelines on EMF. The last two matters are being referred to the Radiation Health Committee for advice but it is expected that they will proceed in some form.

As a further response to the renewed public concern related to EMF, ARPANSA placed an Information Sheet on its website entitled "Electricity and Health". This document provides more general information on EMFs and discusses a number of issues including typical levels around the home and appliances, exposure guidelines, overseas studies and possible risks. It concludes –

"On balance, the scientific evidence does not indicate that exposure to 50 Hz electric and magnetic fields found around the home, the office or near power lines is a hazard to human health. Since the evidence suggesting causality for childhood leukemia is weak or non-existent it is not possible for authorities to establish a magnetic field level above which chronic exposure would be considered a health hazard. At this stage, any action to reduce exposure must rest with the individual."

Both the CEO Statement and the Information Sheet are available on the ARPANSA web site www.arpansa.gov.au.

Victoria

The Annual Report of the Radiation Advisory Committee, Victoria for the year ending September 2000 considered the health effects of EMF. The Committee has not changed its view during the past year and the report concludes on EMF:-

"Overall, there is insufficient evidence to come to a firm conclusion regarding possible health effects from exposure to power frequency electric and magnetic fields."



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