Section 15

Overview of Major Ongoing Research Projects on Electromagnetic Fields and Health

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Research studies on potential health effects due to exposure to electromagnetic fields (EMF) have been conducted for at least 30 years in several parts of the world. Many projects have been initiated by international organisations, universities, research institutions, and specialized centers.

In this section of the toolkit, six important ongoing international projects on electromagnetic fields and health are presented:

1. The EMF project of the World Health Organization (WHO)
2. MOBI-KIDS project: Study on Communication Technology, Environment and Brain Tumours in Young People
3. EFHRAN: European Health Risk Assessment Network on Electromagnetic Fields Exposure
4. COSMOS project: Cohort Study of Mobile Phone Use and Health.
5. SEAWIND project: Sound exposure and risk assessment of wireless network devices
6. NTP Rodent project: National Toxicology Program laboratory multigenerational rodent studies.

15.1 The EMF Project of the World Health Organization[1]

The International Electromagnetic (EMF) project was established by the World Health Organization (WHO) in 1996. Participants in the project include several countries, the International Commission on Non-Ionizing Radiation Protection (ICNIRP), and WHO collaborating institutions from Australia, Canada, Germany, UK, and the US. Canada is represented in this project by the University of Ottawa.

The project was initiated because of scientific questions and public concerns regarding potential health effects of electromagnetic emissions in the frequency range 0 Hz–300 GHz. It includes four themes: (1) scientific research, (2) development of databases for researchers worldwide, (3) guidance for the development of EMF safety standards, and (4) transfer of knowledge.

The project defined two distinct areas to be investigated:

- At extremely low frequencies (ELF), the project is focused on the risk of leukemia among children exposed to 50/60 Hz magnetic fields from electrical power lines. This subject was considered important because of previous epidemiological studies suggesting that children exposed to ELF magnetic fields may be at increased risk of developing leukemia.
- In the RF range of the electromagnetic spectrum, i.e., from 100 kHz to 300 GHz, the fast development of mobile phone technology and its extensive use among

children and young adults raised concerns about the potential impact of RF waves from mobile phone radiating antennas on a user's head, considering the very short distance between the antenna and the head.

- The number of mobile phone users is expected to continue increasing, particularly among children and teen age populations.

As a result, for EMF in the radiofrequency range, the aim of the research is to study the potential long-term health effects associated with mobile phone use.

The research program of the EMF project is overseen by an ad hoc Research Coordination Committee (RCC) composed of specialists representing national and international institutions.

EMF project progress reports

To date, 16 progress reports (1997–2011) have been posted on the WHO website: http://www.who.int/peh-emf/publications/reports/en/index.html

The 2012 report has not yet been released.

15.2 MOBI-KIDS Project[2]

The MOBI-KIDS project is an international case-control study on potential risks of brain cancer among young mobile phone users. It was initiated in 2009 and involves 16 research centers from European and non-European countries including Canada, which is represented by the University of Ottawa in this project. Invitations to join the research program have been extended to other countries as well.

The main objective of the project is to assess the potential association between mobile phone use and brain tumours in young individuals aged 10 to 24 years.

Over the period 2010–2014, the epidemiological study will involve two groups of mobile phone users: 2000 young people with brain tumours and a similar number without brain tumours.

A basic project questionnaire is used by the participating centres to collect information about the two groups. The questionnaire includes questions on demographic factors, residential history and mobile phone use habits.

In addition to the data collected by participant centres, RF exposure evaluations will be performed by two European centres known for their technical capability in the field.

Some complex issues in this project need to be considered. First, brain tumours among young people are not frequent and may have different causes, i.e., environmental factors other than RF, genetic reasons, etc. Secondly, the projected number of 2000 young people affected by this malignancy might not be easy to reach and may not be large enough to draw precise estimates of risk. Further, the

intermittent exposures to RF waves from mobile phone antennas are considered too low in comparison to ICNIRP's exposure limits and unlikely to induce brain malignancies.

Nevertheless, it is believed that a larger participation of countries at the world level to increase significantly the study sample may help in detecting any possible association between mobile phone use and brain cancer if such an association exists.

MOBI- KIDS project progress reports

No progress report has been released so far. The University of Ottawa, which is the Canadian participant in this project, will be requested to provide any useful information about the advancement of this project.

15.3 European Health Risk Assessment Network on Electromagnetic Fields Exposure (EFHRAN)[3]

The European Health Risk Assessment Network on Electromagnetic Fields Exposure (EFHRAN) is a three-year (2009–2011) project funded by the European Commission (EC) aiming at establishing a network of experts to conduct health risk assessments for exposure to EMF waves. Participants include universities, research centres and collaborating partners from the European Union along with a few non-European countries and WHO.

The project covers low frequency (0–300 Hz), intermediate frequency (300 Hz–100 kHz), and high frequency (100 kHz–300 GHz) electromagnetic waves. This overview will focus on RF waves.

The main research goals of the project are: monitoring evidence of EMF-related health risks and quantification of potential health risks posed by EMF.

Three research areas were defined in the EFHRAN project:

- Exposure and dose assessment
- Risk analysis and hazard identification
- Risk characterization and management.

Only the research part of the project, i.e., exposure and dose assessment, will be discussed in this section.

Exposure and dose assessment

This part is related to the evaluation of the EMF exposure levels in Europe for RF waves and Extremely Low Frequency (ELF) EMF fields. Several methods were used to investigate the levels and patterns of public exposure to RF in some European countries and the main ones are described below:

a. Permanent RF monitoring systems: Survey programs have been conducted by means of continuous RF monitoring systems to record emissions from fixed RF sources such as radio and television stations, mobile phone base stations, radars, etc. Such systems have been installed in Italy, Greece, Germany, Portugal, Malta, Slovenia, and the UK. The readings recorded by the monitoring systems are accessible to the general public through internet gateways.

b. On-site RF measurement campaigns: These are measurements that have been conducted near mobile phone base stations in nearly all European countries since the 1990s. The results of the surveys showed that more than **60%** of the measured RF exposures were below 0.003 W/m^2; fewer than **1%** were above 0.095 W/m^2; and fewer than **0.1 %** were above 1 W/m^2.

   The recommended public exposure limits in European countries range from 4 to 10 W/m^2.

c. Personal and micro-environmental RF exposure assessment: In this study, a selected number of individuals from the general public were provided with personal exposure meters (PEM) to wear during several days for the assessment of their exposure.

   The results of the experiment showed that the average personal exposures were far lower than the on-site exposures (point b).

d. Exposure from mobile phones: Europe has the highest penetration of mobile phone use in the world. The assessment of mobile phone exposure was conducted on the basis of different studies carried out in Europe and outside the continent. It was concluded that the local exposure in the head due to mobile phone use is considerably higher than that due to other RF sources such as broadcast stations and mobile phone base stations.

e. Exposure to RF wireless systems: The studies that were conducted in some European countries showed that the exposure to wireless devices such as cordless phones, blue tooth, and Wi-Fi systems were below mobile phone exposure. However, for long periods of exposure to wireless sources, the total exposure due to wireless systems may not be negligible.

In addition to the above assessments, the project provides useful information on RF dosimetry modelization and RF dosimetric considerations of far field exposure.

To summarize this part on exposure assessment, it is established that mobile phones and portable wireless devices contribute the most to the exposure of the public.

EFHRAN project progress reports

The following reports have been released by EFHRAN:

- Risk analysis of human exposure to electromagnetic fields (revised) – October 2012[4]
- Report on the level of exposure (frequency, patterns, and modulation) in the European Union – Part 1: Radiofrequency (RF) radiation (Aug. 2010)[5]
- Risk analysis of human exposure to electromagnetic fields ((July 2010)[6]
- Report on the analysis of risks associated to exposure to EMF: in vitro and in vivo (animals) studies (July 2010).[7]

15.4 COSMOS Project[8]

COSMOS is a recent project launched by six European countries: Denmark, Finland, France, Netherlands, Sweden, and the UK. Additional European countries are invited to join the COSMOS program.

It is a cohort study investigating possible health effects from long-term use of mobile phones and other wireless technologies.

The health of approximately 250,000 European mobile phone users forming the cohort will be followed. The duration of the monitoring is not mentioned, but it is probably longer than 12 years, as recommended by some European health agencies since short term exposure studies (10 years or less) are no longer considered suitable.

The health effects to be studied include:

- Changes in the frequency of specific symptoms over time, such as headaches and sleep disorders
- Risks of cancers and benign tumours
- Neurological and cerebrovascular diseases.

COSMOS project progress reports

No progress report has been released so far as this is a recent project. A paper on project design and enrolment was published in 2011[9]:

Schüz J, Elliott P, Auvinen A, Kromhout H, Poulsen AH, Johansen C, Olsen JH, Hillert L, Feychting M, Fremling K, Toledano M, Heinävaara S, Slottje P, Vermeulen R, Ahlbom A. **An international prospective cohort study of mobile phone users and health (Cosmos): design considerations and enrollment. Cancer Epidemiol. 2011 Feb; 35(1):37-43.**

15.5. SEAWIND project[10]

SEAWIND, Sound Exposure and Risk Assessment of Wireless Network Devices, is a 3-year project funded by the European Union, starting Dec. 2009, on exposure of the population to wireless RF devices and their potential health effects. Forty scientists from eight research institutions in Europe participate to the project.

The RF devices of interest in the project include various consumer devices including: cell phones, cell phone base stations, broadcasting stations, wireless networks (WLAN, WMAN, WiMax, WPAN), cordless phones, RFID scanners, baby monitors, and Bluetooth devices.

The objectives of SEAWIND are to:

- Conduct measurements of public exposure
- Determine fields induced inside the body
- Assessthe effect of RF exposure on cells and DNA
- Use the findings of the project to assist policymakers.

SEAWIND progress reports

As of now, only one report, entitled "Literature review of exposure assessment and dosimetry of wireless network" is available.[11] The report includes useful information and details related to the theoretical and experimental methods applied to assess exposure of members of the public to RF devices. The conclusions of the research report include the following:

- The exposure of the public to all kinds of wireless devices is, in general, well below the ICNIRP reference levels at all frequencies
- Continuous monitoring indicates that the exposure in urban areas is greater than in rural areas
- Personal exposure meters (PEM) data should be used with caution due to technical specifications and should not be employed to evaluate exposure from wireless devices used by the individual wearing the device
- Cell phones deliver the highest exposure (SAR) to the population but Radiofrequency Identification (RFID) Readers (e.g. used for toll booth passes or smart cards) may exceed the exposure to cell phones if in contact with the body
- Indoor exposure to RF and use of new wireless devices requires more research because of scarcity of data in the literature
- Foetal exposure to RF due to the mother's use of wireless devices during pregnancy should be investigated further.

15.6 National Toxicology Program (NTP) Rodent Project[12]

The National Toxicology Program (NTP) headquartered at the U.S. National Institute of Environmental Health Science is conducting laboratory multigenerational rodent studies on the effects of exposure to mobile phone radiofrequency. The studies are being carried out with both sexes of rats and mice and with pregnant female rats. The NTP studies are designed to mimic human exposure and are based on the frequencies (900 and 1900 Mhz) and modulations (CDMA and GSM) in use in the United States.

The NTP has worked closely with radiofrequency experts from the National Institute of Standards and Technology to design a highly specialized exposure system to provide uniform exposure to RF to unrestrained rodents. After establishing field strengths that do not excessively raise body temperature, they are conducting a series of toxicology and carcinogenicity studies.

NTP rodent project progress reports

No progress reports are available. The chronic toxicology and carcinogenicity studies were anticipated to be completed in late 2012 with final study results expected in 2014.

15.7 References

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