INTERNATIONAL EMF PROJECT
International Advisory Committee Meeting

Online meeting, hosted by WHO, Geneva, Switzerland
June 2022

Rapporteur – Martin Gledhill, representative of the Ministry of Health of New Zealand

Tuesday 7 June

Session on non-ionizing radiation

Opening of the meeting

Due to the COVID-19 pandemic, the IAC meeting was again held online. ***Maria Neira***, Director of the WHO Department of Environment, Climate Change and Health, welcomed participants and thanked them for attending, and expressed her hope that in 2023 the meeting could be in person. She noted that environmental health is responsible for more than 25% of the global burden of disease, and that her department pays close attention to the potential risks of radiation.

Update on WHO and its non-ionizing radiation programme

Emilie van Deventer invited participants to review the draft minutes of the previous meeting (circulated before this meeting) and send feedback by email or through the chat feature.

The Director General of WHO has commenced his second term and WHO is continuing with its 13th global programme of work covering the period 2019-2023. A new initiative is to promote the use of behavioural and social sciences to improve public health (for example, by improving sun protection behaviours). Work on Covid-19 has shown the importance of good science communication and a compilation of WHO concepts is available https://www.who.int/teams/epi-win/scicom-compilation. There are interesting parallels with science communication about new technologies.

WHO is placing increasing emphasis on transparency in all areas of its work, including funding, data and partnerships, and making WHO information available to everyone. Gender equity and human rights are required to be mainstreamed in all WHO activities.

A compendium of WHO guidance on interventions to create healthier environments (including radiation) is now available at https://www.who.int/tools/compendium-on-health-and-environment.

There are currently three staff in the radiation unit. The unit has developed a database on radon and national policies addressing radon. Current projects include work on radioactivity in food, ethics in radiological imaging and providing support to Ukraine for its nuclear power facilities. WHO had cybersecurity issues that led to a temporary suspension of the list servers, but these should be available again soon.

Non-ionizing radiation protection

Update on the draft WHO Framework (*Rick Tinker, ARPANSA)*
A paper has been published in the Journal of Radiation Protection that provides an overview of the motivation for the framework. Because there is no harmonisation of approaches between countries, many governments maintain different regulatory approaches depending on the population exposed or the exposure situation. The framework is intended to give a consistent approach to protection so that NIR can be used both safely and ethically. It is targeted at governmental authorities, including policy-makers and relevant authorities responsible for authorizing products and services that use NIR, and people involved in the management of NIR applications and health protection. The intention is to help countries increase the consistency of administration while reducing regulatory red tape. Countries may use the framework to benchmark against their NIR protection, and to help develop protection systems and harmonise approaches for NIR protection.

The framework covers any applications that create risks from NIR, across the whole NIR spectrum (including infrasound and ultrasound), and considers protection of the public, workers and patients. It can be adapted to cover different circumstances. The environment, audible sound and military personnel in combat are outside the scope.

The three main NIR protection principles are:

- Limitation – exposures should not exceed limits
- Justification – exposures should do more good than harm
- Optimisation – balancing risks against benefits

The framework promotes an appropriate level of protection without unnecessarily limiting NIR use. The general approach is to provide a framework of protection for the three categories of exposure (public, occupational and medical) and set responsibilities for managing protection and safety. Information should be available for stakeholders and research is encouraged.

The next step is to edit the document professionally , prior to a broad and targeted stakeholder review.

Ethics and non-ionizing radiation (*Andreas Reis, WHO)*
One of WHO's six core functions is to articulate ethical and evidence-based policy options. Key ethical principles and values include justice/equity, informed consent, weighing risks and benefits, prudence and precaution, transparency, respect and proportionality of public health measures. Information provided about a treatment (or medical trial) must be comprehensible, and consent should be voluntary.

Risks and benefits should be considered from the point of view of the individual and community (and sometimes employer and shareholder).

There is limited evidence about risks from some parts of the NIR spectrum. Prudence suggests assessing the potential for, and likelihood of, harm, and some obligation for oversight and monitoring. There are some examples of prudence or precaution, such as the Swiss environmental law and the European Environmental Agency. There are also WHO documents on ethics in novel technologies, including a policy brief on radiological imaging, which

encompasses NIR technologies. (However, there is no WHO document on precautionary approaches.)

NIR sources are used for a variety of applications and in different settings (e.g. clinical use vs. non-medical use). For NIR, there can be clashes between individual and public interest (e.g. "not in my backyard" objections). Trust, transparency and public engagement are important, as are education, information and consent (such as consent forms for commercial sunbed users).

Precaution deals with decision-making where there is uncertainty. Adequate regulation and oversight mechanisms are needed, as is research and monitoring.

Occupational exposures: Experience with implementing the EMF Directive (*Peter Jeschke, BAuA, Germany)*
A recent conference in November 2021 was convened by the German Federal Institute of Occupational Safety and Health (BAuA) to review 8 years' experience with the EU EMF Directive 2013/35/EU. It covered many aspects, including difficulties in implementation, health surveillance, exposure assessment, risks of implanted devices, supporting employers and evolution of the Directive.

A report is available at https:// www.baua.de/EN/Service/Publications/Report/Gd107.html

Airborne ultrasound: Update of ICNIRP statement (*Ken Karipidis, ICNIRP)*
Airborne ultrasound is produced by several industrial processes (cleaning, drilling, emulsifying etc), some commercial products (pest repellers, burglar alarms, remote controls…) and may also be produced unintentionally by machinery like compressors, pneumatic tools and jet engines. There is a suggestion that public and occupational exposures are increasing.

The 1982 WHO Environmental Health Criteria (EHC) monograph 22 on "Ultrasound" included airborne ultrasound. Four effects were identified: skin and tissue heating, adverse auditory effects, physiological effects, and non-specific symptoms. Based on this review the INIRC of the IRPA published interim guidelines in 1984 that covered occupational and public exposures. ICNIRP has now established a project group to see whether these need to be revised, either as guidelines or a statement.

The project group is still in progress but finds that research is still limited. Some new knowledge suggests that the 1984 guidelines can be improved, but it is also noted that those guidelines are often not applied. There are significant data gaps, and more research is needed.

The project group will be developing a statement on the validity of the 1984 guidelines that will discuss developments in the science and make recommendations on what to do next.

Non-ionizing radiation protection
NIR at the 6th European Congress on Radiation Protection (*Peter Jeschke, BAuA)*
Peter Jeschke gave a brief overview of NIR topics covered at the EU-IRPA European Congress on Radiation Protection. Further information is available on the conference website and in the abstract book.

Wednesday 8 June

Session on electromagnetic fields (EMFs)

Opening of the meeting

Emilie van Deventer welcomed participants and introduced a poll to gather an overview of participation. Eric van Rongen was chosen to chair the meeting, ahead of his retirement from the Health Council of the Netherlands.

Update from international organizations on electromagnetic fields activities

WHO (*Emilie van Deventer, WHO and Jos Verbeek, University Medical Centres, Amsterdam)*
Emilie gave an overview of the EMF Project and explained the role of the secretariat. Five countries have provided financial contributions towards the project in the past year (Australia, Ireland, Israel, New Zealand, Switzerland) and the Netherlands have provided staff time. Other countries have hosted meetings or funded participation or translated documents free of charge. Three of the five Collaborating Centres on EMF have been redesignated in the past year. The UK Health Security Agency has taken over from Public Health England.

Projects in the current biennium workplan (2022-23) include the EHC monograph on Radiofrequency fields (RF) (including the scoping report and systematic reviews), the framework for NIR protection, and updating the RF Research Agenda and the EMF Dialogue Handbook.

There has been good progress on the systematic reviews that will inform the RF EHC. Nine out of 10 protocols have been published and registered in appropriate databases, and all but one of the review teams has completed their selections of studies. Several have also completed data extraction and risk of bias analyses. The value of systematic reviews was illustrated with an example of animal fertility in relation to EMF exposures – while 36 studies have been published in the period 1978-2017, no change in effect has been noted since 1991, meaning that studies published since then (about half of the total) have served no useful purpose.

The Scoping Review has been updated to 2021, a new table of contents prepared, and new chapter summaries drafted.

The current plan is that the Scoping Review will be finished late 2022/early 2023, the systematic reviews will be published in 2022/23 and the EHC RF monograph and updated research agenda in 2023. 20 experts have been short-listed for the Task Group that will review the draft Scoping Review and form conclusions from that Review and the systematic reviews. There will also be an updated survey of national policies, based on the 2012 version. Help is needed to update the survey questionnaire and run the survey.

The 2002 EMF Dialogue Handbook will be revised (e.g. to take account of social media) and redesigned. Other international organizations have expressed interest in co-sponsoring this work. The EMF section of the WHO website has been redesigned. In future all national EMF reports will be bundled together, rather than having separate country pages. IAC participants

were invited to ensure that information on the Global Health Observatory EMF pages is up to date. In a poll on possible topics for webinars the most popular were exposure assessment of 5G, and EMF and the environment. A further poll will be held this year.

International Agency for Research on Cancer - IARC (*Isabelle Deltour, IARC)*
The COSMOS study now has 310,000 participants in six countries, with German participation starting soon. IARC has set up the French arm of the study in collaboration with the national Constances cohort. Population exposure in France is being estimated using the XMobiSense app and the Devin exposimeter, in order to examine usage patterns and determinants of exposure. Findings from 300 volunteers will be extrapolated to the French population.

With regard to the International COSMOS study, studies of recall patterns, sleep disturbances, headaches, tinnitus and hearing loss have been completed in some countries. Studies on cancer, cardiovascular disease, ALS and birth outcomes are continuing.

A study on glioma in Nordic countries shows no trends over time and does not support the ORs reported by Hardell and others. In some cases, however, the data are consistent with ORs reported in the Interphone study.

IARC is also analysing parental ELF exposures in relation to childhood leukaemia, and exposure levels in low to middle-income countries.

International Telecommunications Union - ITU (*Reyna Ubeda, ITU)*
ITU-T Study Group 5 considers environmental effects and develops standards on human exposure. It has prepared updated guidance on exposure assessment in ITU-T K.91 and has recommended that other reports be updated.

ITU-R has a chapter in its spectrum monitoring handbook on NIR measurements. There are ongoing studies on measurement techniques and how to present results.

ITU-D has published a report covering ITU resolutions on EMF, updated RF limits and policies on limiting exposures.

European Commission - DG Health (*Giulio Gallo, EU)*
Giulio Gallo provided an overview of public and occupational EMF protection in the EU. The EU has recently asked SCHEER for an opinion on whether the RF section of the EU 1999 recommendations on public limits are still suitable or whether, in the light of ICNIRP's 2020 revised limits, the EU recommendation should also be revised. A draft opinion is due in July 2022, following which there will be public consultation before finalising the opinion at the end of 2022. Depending on the Opinion, the EU's ELF recommendations may also be revised.

European Commission - DG Research and Innovation (*R Araujo, EU)*
EU Environment and Health research looks at large numbers of outcomes and agents. Funding of this research is generally increasing.

In the Horizon Health programme (HORIZON-HLTH-2021-ENVHLTH-02-01), four EMF-related projects have been selected for funding and are due to start soon. These are:

- Seawave - scientific based exposure and risk assessment of radio frequency and millimetre wave systems from children to elderly (5G and beyond)
- GOLIAT - 5G exposure, causal effects, and risk perception through citizen engagement
- ETAIN - exposure to electromagnetic fields and planetary health
- NextGEM - next generation integrated sensing and analytical system for monitoring and assessing radio frequency electromagnetic field exposure and health

A website will be set up to monitor progress.

Update from NGOs

International Commission on Non-Ionizing Radiation Protection - ICNIRP (*Rodney Croft, ICNIRP)*
New guidelines covering static and low frequency fields (including movement through static fields) are being prepared. They will replace existing Guidelines for these frequencies.

ICNIRP noted data gaps while preparing their 2020 guidelines and will document these to promote research in these areas and provide greater precision in future updates.

A project group is looking at the effects of EMFs on the environment, based on papers of sufficient quality. This will use the BfS 2019 workshop as a starting point.

International Commission on Occupational Health - ICOH (*Alberto Modenese, ICOH)*
ICOH convenes a scientific committee on radiation and work that has worldwide membership. The most recent World Congress was held in 2022 and included several sessions on EMF safety. Abstracts are available at https://www.sciencedirect.com/journal/safety-and-health-at-work/vol/13/suppl/S.

IEEE/International Committee on Electromagnetic Safety - ICES (*Jafar Keshvari - ICES)*
Jafar Keshvari provided an overview of ICES activities in its TC94 (Product Compliance Assessment Standards) and TC 95 (developing EMF exposure limits) committees. ICES also liaises with other national and international bodies such as the IEC, WHO, NATO and the ITU.

ICES is currently revising its C95.7 standard on EMF safety programmes. This standard will complement the other C95 standards developed by ICES and provide the framework for developing safety programmes.

ICES has recently published a guide for the definition of incident power density to correlate surface temperature elevation. This guide is needed in order to undertake 5G product compliance assessments.

A further activity is to convene the COMAR (committee on man and radiation] group that examines and interprets research on the effects of electromagnetic fields and presents findings in technical information papers and position statements.

Review of recent research

Research review of laboratory studies (*Maria Rosaria Scarfi, CNR-IREA)*
Dr Scarfi gave an overview of experimental studies appearing on the EMF-portal in 2021, concentrating on those considered to be informative for health risk assessment.

Few studies of static fields have been published, and they cover a wide variety of conditions. ELF field in vitro and in vivo studies cover a similarly wide range of conditions. Human studies have investigated effects on the cardiovascular system and perception of phosphenes. As in previous years, there has been little research on IF. Research on RF fields has covered a wide variety of outcomes, and some work has considered the combined effects of RF fields and other agents.

About 50% of papers published over the past year were considered uninformative due to poor quality. Future work should try to evaluate mechanisms by which EMFs interact with biological systems and investigate new technologies.

Research review of epidemiological studies (*Isabelle Deltour, IARC)*
A study by Khan et al looked at blood cancers and brain tumours in Finnish adults living in buildings with indoor transformers. People living on the ground and first floor were considered to be exposed, and their outcomes compared with those living on other floors. The results suggested a decreased risk of most blood cancers, apart from a small increased risk of ALL.

Schuz published an update of the UK "million women" study and concluded that cellphone use under normal conditions does not increase the incidence of brain tumours.

The Mobi-Kids study has been published and found no evidence of a causal association between wireless phone use and brain tumours in young people.

Discussion of upcoming activities
A poll on potential webinar topics gave the following results:

Topic	**% interest**
How to communicate about health in the context of 5G	79
Updating national EMF standards: challenges and benefits	63
Understanding the scientific review process of radio frequency fields	57
Use of emf for medical purposes	45
The role and importance of oxidative stress for human health	39
Other (I will send my proposal to WHO)	5

Thursday 9 June

Session on optical radiation

Opening of the meeting

Emilie van Deventer welcomed participants and Craig Sinclair was appointed chair.

Update from international organizations on optical radiation activities

WHO (*Emilie van Deventer, WHO)*
Emile van Deventer gave an overview of the optical radiation programme, which can be traced back to the 1995 Intersun project and now fits into Goal 3 of the Sustainable Development Goals.

Optical radiation IAC meetings have been held since 2011. The optical radiation programme is funded through voluntary contributions, and in the past year these have been received from Australia and Norway. Other countries have made in-kind contributions, such as translation of documents. WHO works with international agencies, NGOs and seven collaborating centres, of which three have been redesignated in the past year.

WHO commissioned the Queensland Institute of Medical Research, Australia to develop a desktop review of existing national or international reports that provide research recommendations on UV and a plan for the research priority-setting exercise, based on the WHO 2020 guidance on research priority-setting exercise. The UV Research Agenda should promote research that will fill gaps in knowledge to improve public health interventions and risk communication. WHO is also supporting the globalisation of a UV Index app developed in Australia. A launch is planned for 21 June.

A new compendium of WHO and other UN guidance on health and the environment includes a section on radiation and health. The compendium is available for download at https://www.who.int/tools/compendium-on-health-and-environment. A Health and Environment Scorecard will be released on 16 June and will include indicators on several radiation-related topics, including UV.

Two WHO webinars have been arranged over the past year, one on "Disinfection using UV Radiation" and the other on "Striking a Balance between harms and benefits of UV exposure".

Countries are invited to send in annual reports on UV activities, and to check the accuracy of data on the WHO's GHO website. The IARC Global cancer Observatory (gco.iarc.fr) now includes data on cancers attributable to UV, including non-melanoma skin cancers.

United Nations Environment Programme - UNEP (*Sophia Mylona, UNEP)*
Sophia Mylona provided an overview of the treaties protecting the ozone layer, starting with the 1985 Vienna Convention and 1987 Montreal Protocol. The success of these treaties is attributed to three factors: assessment panels, financial mechanisms and compliance mechanisms. There has also been flexibility to adjust the protocols as new scientific data becomes available.

The next 4-yearly assessment reports are due by the end of December 2022, and a synthesis report must be presented by April 2023. Further information is available on the Ozone Secretariat website https://ozone.unep.org.

Update from non-governmental organizations on optical radiation activities

International Commission on Non-Ionising Radiation Protection - ICNIRP (*Nigel Cridland, ICNIRP)*
ICNIRP's current work plan includes five project groups covering optical activities:

- Short wavelength light and circadian rhythm – greater exposures to short wavelength (blue) light have aroused concerns about possible effects on the circadian rhythm. The group will review existing research and suggest new work to improve knowledge.
- Laser pointers - the current statement on laser pointers is 20 years old and pointers are now more widespread and powerful. There are also many reports of injuries. The statement will be revised to increase awareness of current issues and reduce injuries.
- Laser guidelines - a number of known issues need to be resolved and the guidelines made consistent with the approach of other organisations.
- UV guidelines - there are recognised uncertainties, and questions over the relative spectral effectiveness factor at short wavelengths.
- Chronic UV exposure - long term effects on the interior eye need to be addressed, as do the roles of UVA and UVB in the development of cataracts, and of UV in macular degeneration. Recent evidence on skin ageing and skin cancer must also be reviewed.

International Commission on Occupational Health - ICOH (*Alberto Modenese, ICOH)*
Most ICOH optical radiation activities over the past year have been related to the risks of solar UV exposure. There were sessions at the recent Congress aimed at raising awareness of occupational skin cancer risks. A WHO/ILO report estimating the burden of disease from solar UV in occupational settings has been published and is available on the WHO website. The report concludes that there is a significant increased risk of non-melanoma skin cancers when working with exposure to solar UV. Work has now started on a systematic review on the effectiveness of interventions to reduce solar UV exposures in outdoor workers, and the development of a job-exposure matrix.

International League of Dermatological Societies - ILDS (*Lars French, ILDS)*
The ILDS is present in 90 countries, has 195 member organisations and represents more than 200,000 specialists. Its goal is to strengthen and improve access to skin health around the world. It works closely with the WHO on six key areas of mutual interest and engages with humanitarian projects.

Recently the ILDS has helped revise the ICD, which now includes the capability to code for occupational relevance in occupational skin diseases. Future work includes a systematic review on the economic effects of occupational skin cancer and supporting the development of melanoma and keratinocyte skin cancers.

International Electrotechnical Commission - IEC (*Jafar Keshvari, IEC)*
Jafar Keshvari provided an overview of the work of the IEC TC 76, which prepares standards for

equipment incorporating lasers and LEDs, and standards for assessing compliance with limits recommended by other organisations, such as ICNIRP. Current work includes updating laser safety standards to take account of new technologies and applications, revising the laser classification standard and laser measurements. A technical report is being prepared to provide guidance for laser displays and shows.

Non-coherent light sources also fall within the scope of TC 76, and there are projects covering the safety of UV lamps, and light sources for illumination and signalling.

International Commission on Illumination - CIE (*Peter Blattner, CIE)*
The CIE supports the science of optical radiation and lighting and promotes discussion and information exchange on these topics. Through an agreement with the CIPM it defines quantities and action spectra in photometry and radiometry, and it publishes position statements, technical publications and international standards.

There are several projects of interest to the optical radiation IAC:

- Work on non-visual effects of lighting
- Preparation of a technical note on indoor light exposures that best support health
- Revision of the standard on photobiological safety of lamps
- A position statement on UVC
- The role of lighting in prevention of myopia
- A review of the Vitamin-D action spectrum.

Briefing on UVC

UV-C: Open research questions (*Cornelia Baldermann, BfS)*
Far UVC, used for disinfection, does not penetrate far into the skin or cornea. Several health effects are already known, such as DNA damage, gene modulation, photokeratitis and erythema. Long term exposure can cause cancer.

However, there is little research on the effects of far UVC and many open questions, such as whether skin data from animal models can be transferred to humans, the transmission of UVC through tear film and the effects of low doses of UVC over long periods. To date studies have been done with healthy volunteers, but it is not clear whether this data can be applied to those who may be more vulnerable, such as people with corneal or skin lesions and children whose corneas and skin are thinner than adults'. Because of the increasing use of far UVC it is important to investigate these questions.

Tackling safety issues of UVC devices: Singapore's experience (*Ho Seng Kim, National Environment Agency)*
In the light of advice from WHO and ICNIRP about hazards from UVC lamps used for disinfection, Singapore's National Environment Agency examined what products were available and what hazards they might pose.

Some products have exposed UVC sources but no safety features to prevent accidental exposure. The agency constructed a risk rating based on the likelihood of harm occurring in combination with the severity of the consequences of exposure. Products all fell into low or medium risk categories, so regulation was discounted. Given the wide availability of these

products, regulation would have been difficult to enforce. Instead, the agency took an approach of working in partnership with retailers to provide information and guidance on the safe use of these products. In particular there was an advisory on the safe use of UV sterilisers in the home and safety guidelines for UVC devices for industrial purposes.

The agency worked with major physical and online retailers to remove over 8,000 unsafe devices from the Singapore market. There were several challenges, such as an online sales platform disagreeing that UVC is a safety hazard and one online operator requiring regulations to support them taking down listings, in case the sellers complained.

The development of standards such as IEC 62471-6 on the photobiological safety of ultraviolet lamp products, and the implementation of product safety certification, would assist in reducing the hazard of devices that emit UVC.

Discussion on WHO future priorities

A poll on potential webinar topics gave the following results:

Topic	**% interest**
The UV index and its dissemination	64
Control of high-powered laser pointers to the public	63
Using behavioural sciences to communicate about UV radiation	56
Global burden of UV-related eye diseases	50
Use of optical radiation for medical purposes	50
Global burden of skin cancers	47
Regulatory control of sunbeds	45
Sunscreens: benefits and issues	41
Lighting – temporal light artefacts (TLAs) and perception	30
Other (I will send my proposal to WHO)	11

There will be a webinar on UV in the near future.