Approved Meeting Minutes
ICES TC95 Meeting

Mantra Southbank Hotel
161 Grey Street, Southbank, Brisbane, Australia
Saturday, 16 June 2012
0900 – 1200 h

1. **Call to Order**
   Chairman Chou called the meeting to order at 0900 h.

2. **Introduction of those Present**
   Those in attendance, including call-in attendees, introduced themselves (see Attachment 1 for attendance list).

3. **Approval of Agenda**
   Following a motion by Douglas that was seconded by Elder, the agenda was approved without modification (see Attachment 2 for approved agenda).

4. **Approval of December 2011 TC95 minutes**
   Following a motion by Dovan that was seconded by Kavet, the minutes of the 14th December 2011 meeting were approved without modification (see Attachment 3).

5. **ICES Chairman’s Reports**
   Bodemann reported that the ICES AdCom had a meeting in Plantation Florida in December 2011, a Telephone Conference in April 2012, and met in Brisbane on 15 June 2012.

   Bodemann reported that he attended the 7th ICNIRP NIR Workshop (Edinburgh, UK, 9 – 11 May, 2012) as a Guest. Although there were a number of good presentations, there were no reports of new work/issues. Bodemann also reported that he accepted an invitation from Emilie van Deventer and attended the WHO IAC meeting in Geneva where he presented an update of ICES activities, including an analysis of difference of INCIRP Guidelines and IEEE Standards. Bodemann explained the WHO’s definition of a Collaborative Organization status of ICNIRP is different from the status/conditions for WHO Endorsement status, which will be governed by a different set of requirements.
6. **TC95 Chairman’s Report**  
Chou reviewed a number of meetings where he gave presentations on issues relating to ICES activities (see Attachment 4). He pointed out that his presentations at the November/December 2011 meetings in Malaysia, where he was the keynote speaker in four cities, were well-received. The meetings were sponsored by the Malaysian Communications and Multimedia Commission; the title of his presentation was “Addressing the Safety Concerns of RF Exposure.” This November/December activity was a second government sponsored meeting after the July 2011 meeting in Penang.

He also reported on the meetings in India in February 2012 and Taiwan in April 2012.

7. **Executive Secretary’s Report**  
Petersen by phone provided an update on the status of ICES standards and recent changes in IEEE SA procedures (see Attachment 5).

8. **Treasurer’s Report**  
Treasurer Report from Petersen was presented (see Attachment 6). The opening balance 31 December 2011 was $9774.14. Income and expenditures, including deposit for the meetings in Brisbane, yielded a net expense of $632.60. The 31 May closing balance was $9141.54 (not including income and expenses for this meeting in Brisbane).

9. **Membership Chairman’s Report**  
Murphy presented the membership report (see Attachment 7). The report included welcoming 16 recent new members. A breakdown of the TC95 membership by country was also presented, which stands in June 2012 at 133 members representing 25 countries (this does not include members of the subcommittees who are not members of the parent committee, TC95). Murphy reported that following the ICES Winter Meeting each year, the membership lists are reviewed and the membership updated. Members who joined TC95 before the end of the previous year, who have not attended meetings or otherwise participated in the business of TC95, will be contacted to determine if they are still interested in maintaining official membership on the Committee. Those failing to respond positively will be dropped from the membership roles. The membership of individuals who join TC95 each year will be reviewed at the end of the next calendar year.

10. **Topic presentation**  
a) **Why are EMF issues taking so long to resolve?**  
Repacholi thanked Chou for the invitation to make a presentation at this meeting on “Why are EMF issues taking so long to resolve?” (see Attachment 8). He discussed the historical backgrounds of both ELF & RF research, the role of the media, the role of the WHO EMF Project and its R&D, and the importance of systematic reviews of the scientific literature with its many publications with varying degrees of certainty/quality.

b) **Should standards be revised because there are reported possible biological effects of RF exposure?**  
Chou made a presentation to the meeting on “Should standards be revised because there are reported possible biological effects of RF exposure?” (see Attachment 9). He first discussed the existing extensive research database that covers a number of disciplines
from *in-vitro* to epidemiology. He also discussed the importance of “quality of science” when looking at “established” versus “possible” effects, and the difference between “biological” and “adverse health” effects. Chou also presented a historical development of the IEEE/ICES RF safety standards and the ICNIRP guidelines for protecting against adverse health effects, which are different from the rationales of other interested organizations that based on precaution or avoiding possible (unconfirmed or speculative) biological effects.

11. Reports from the Subcommittees

   a) **SC1 (Techniques, Procedures, Instrumentation and Computation)**
   
   Douglas reported that SC1 met on 14 June 2012 in Brisbane where revision of the C95.3 standard was discussed. He pointed out that the revision of C95.3-2002 will combine the 2002 standard and C95.3.1-2010 into a single standard covering the frequency range of 0 Hz to 300 GHz. An Editorial WG is being formed to draft the combined document aiming to have a first draft by August 2012.

   b) **SC2 (Terminology, Units of Measurements and Hazard Communication)**
   
   Cleveland reported that SC2 met on 14 June 2012 (see TC95 SC2 14 June 2012 minutes for details). During that meeting SC2 discussed and finalized most of the comments on the C95.7 draft received to date.

   c) **SC3 (Safety Levels with Respect to Human Exposure, 0 Hz–3 kHz)**
   
   SC3 met jointly with SC4—the report is given below.

   d) **SC4 (Safety Levels with Respect to Human Exposure, 3 kHz–300 GHz)**
   
   Kavet reported that SC3 and SC4 met jointly yesterday on 15 June. He reported that a major effort during the meeting was discussion and resolution of the comments received on the PC95.1 draft circulated for comment in May. Nearly all the comments were resolved—those that were not will be addressed by the Editorial Working Group at their meeting in August.

   Kavet also reported that a number of excellent technical presentations, including those by Anderson, and Hirata, were given during the meetings (see TC95 SC3/SC4 15 June 2012 minutes for details).

   Dovan reported that there is a written SC3/SC4 report on the response to the Government Accountability Office (GAO) that addresses a number of questions relating to mobile telephone safety and the ICES standards process. A copy of this report is attached to the minutes of the SC3/SC4 meeting to provide detailed replies to the GAO.

   e) **SC5 (Safety Levels with Respect to Electro-Explosive Devices)**
   
   No report

12. **ICES Website improvement**

   Chou reminded everyone to send him their bio-sketches and a photo for posting on the ICES website. Dovan displayed the ICES Website on screen but was unable to access the membership page that shows the individual biographies. The webmaster will look into this problem. Cleveland asked that if the IEEE Website has a link to IEEE/ICES website.
13. New Business
Murphy passed on the sad news that Dennis Blick, a long-term member of ICES and COMAR, passed away in July last year.

Murphy reported that there is a plan to organize a 2-day Workshop on Safety Factors, 14–15 January 2013, in conjunction with the planned TC95 meetings (16–18 January) at the new Tri-Service Research Lab located at Fort Sam Houston, Texas.

Joe Elder reported that a draft COMAR TIS on Smart meters is being prepared and should be finalized in July of this year and submitted for publication shortly thereafter.

14. Future Meetings

a) Summer: Fort Sam Houston, Texas 16-18 January 2012
The next meetings of TC95 and its subcommittees are scheduled to take place in San Antonio in January 2013. Murphy and Klauenberg are preparing for hosting the meetings at the new facility at Fort Sam Houston, Texas. As soon as the arrangements are finalized, a preliminary meeting announcement will be distributed.

15. Adjournment
There being no further business, the meeting was adjourned at 1150h.

Minutes taken by Thanh Dovan for Ron Petersen
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<td>Ron</td>
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<td>Mike</td>
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*Via telephone
ICES

International Committee on Electromagnetic Safety

ICES TC95 Meeting

Mantra Southbank Hotel
161 Grey Street, Southbank, Brisbane, Australia
Saturday, 16 June 2012
0900 – 1200 h

1. Call to Order

2. Introduction of those Present

3. Approval of Agenda

4. Approval of 14 December 2011 TC95 minutes

5. ICES Chairman’s Reports

6. TC95 Chairman’s Report

7. Executive Secretary’s Report

8. Treasurer’s Report

9. Membership Chairman’s Report

10. Topic presentations
    a) Why are EMF issues taking so long to resolve?
    b) Should standards be revised because there are reported possible biological effects of RF exposure?

11. Reports from the Subcommittees
    a) SC1
    b) SC2
    c) SC3
    d) SC4
    e) SC5

12. ICES Website Improvement

13. New Business

14. Future Meetings
    a) January 2013, Dates and venue TBD

15. Adjourn
1. Call to Order
   Chairman Chou called the meeting to order at 1300 h.

2. Introduction of those Present
   Those in attendance introduced themselves. (See Attachment 1 for attendance list.)

3. Approval of Agenda
   Following a motion by Needy that was seconded by Ziskin, the agenda was approved without modification. (See Attachment 2 for approved agenda.)

4. Approval of 11 June 2011 TC95 minutes
   Following a motion by Cotton that was seconded by Meltz, the minutes of the June 2011 meeting were approved without modification.

5. ICES Chairman’s Reports
   Bodemann provided an update on the revision process of the EU workers directive, specifically the Commission proposal that was submitted to the European Council and the European Parliament. While the Parliament requested only minor amendments, there were sufficient concerns in the Council that lead to highly controversial discussions. He noted that the Polish Presidency tried to come up with a compromise, but because of time constraints it could not be implemented. The current draft (18 November 2011) is contradictory, inconclusive, and hardly practicable. As there are still many reservations and concerns by most of the EU member countries, the draft was only reported to the Council on 1 December 2011. He pointed out that the Danish Presidency will continue the work in early 2012. It is expected that the deadline for transferring the current Directive (2004/14/EC) into national legislation will be delayed another two years—until April 2014.
Bodemann also reported on the “EU Conference on EMF and Health,” which was held in Brussels, 16-17 November 2011, by the General Directorate “Health and Consumer Protection” of the European Commission and the “Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR).” The goal was to update the Commission on the current state of scientific knowledge and to advise the EU in the matter research that should be funded in order to close gaps in knowledge. One of their key conclusions is that the “nocebo effect,” an effect caused by the suggestion or belief that something is harmful, is a major contributor to electrohypersensitivity. More information can be found on the Conference website (http://ec.europa.eu/health/electromagnetic_fields/events/ev_20111116_en.htm).

Presentations can be downloaded at http://ec.europa.eu/health/electromagnetic_fields/events/ev_20111116_presentations_en.htm;

A press release with key conclusions can be found at http://ec.europa.eu/dgs/health_consumer/dyna/enews/enews.cfm?al_id=1198

Bodemann concluded his report by presenting the 2011 IEEE SA International Award to Bertram Jon Klauenberg (who was unable to attend the 4 December IEEE SA Awards Banquet). He pointed out that Klauenberg received this award for his ongoing efforts to push ICES and the IEEE C95 standards in Europe. The following are some of his major achievements: taking the lead in negotiating the agreement between the NATO Standardization Agency and the IEEE to consider an IEEE standard as the replacement for NATO STANAG 2345; providing presentations on IEEE ICES on several occasions at the European level (e.g., EU Conference held in Umea/Sweden in 2009); and exempting military services from the limit values proposed by the EU Commission for the EU Workers Directive in June 2011. Petersen noted that Wally Read, former President of the IEEE, was the first recipient of the award. Since that time (2002) there have been 13 recipients—three of whom are ICES members.

6. TC95 Chairman’s Report

Chou reviewed a number of meetings where he gave presentations on issues relating to ICES activities (see Attachment 3). He pointed out that his presentations at the November/December meetings in Malaysia, where he was the keynote speaker in four cities, were well-received. The meetings were sponsored by the Malaysian Communications and Multimedia Commission; the title of his presentation was “Addressing the Safety Concerns of RF Exposure.” This November/December activity was a second government sponsored meeting after the July meeting in Penang. He saw it as an excellent opportunity to inform the audience of issues different from what they may see or hear from the media.

Chou announced that a new version of WHO Fact Sheet 193 (Electromagnetic fields and public health: mobile phones – June 2011) is now available. In addition to the ICNIRP Guidelines, the revised fact sheet also cites IEEE C95.1-2005. (http://www.who.int/mediacentre/factsheets/fs193/en/). He also announced that the Chairman of TC95/SC2, Ric Tell, was elevated to IEEE Fellow—he will prepare a short statement for the ICES website announcing Ric’s elevation in status. He concluded the Chairman’s Report by reminding those who have not yet done so to submit a short biography (300 words or less) and a photograph for posting on the private pages of the ICES website.
Submit the bios and photos to Chou and he will expedite posting. So far only 28 bios have been posted.

7. Executive Secretary’s Report
Petersen provided an update on the status of ICES standards and recent changes in IEEE SA procedures. (See Attachment 4.) He noted that the ICES Annual Report was accepted at the December 2011 meeting where he gave a short presentation on ICES activities to the Standards Board. He pointed out that the current ICES Policies and Procedures (P&Ps) expire 31 December 2012—revised P&Ps will have to be submitted and accepted by the Standards Board before 31 December 2012 in order for ICES to continue working on standards projects. He suggested waiting until after the June SASB meeting before submitting revised P&Ps. The SCC Type 2 Baseline P&Ps are still under development and it would be advisable to wait until they are approved before moving forward.

Petersen also noted that there have been several major changes in IEEE SA policy, which includes the following:

— **Reaffirmations:** There will be no new reaffirmation or stabilization ballots—the only actions allowed by sponsors will be revisions, amendments and corrigendum, and withdrawals. Standards will now have a 10 year maintenance cycle (extended from 5 years). The status for a standard will be either active or inactive—all standards must have a revision approved by the IEEE-SASB prior to the close of Year 10 in order to remain active. Standards not approved as a revision will become inactive after year 10.

— **Interpretations:** Because of possible liability issues and the inefficiency of the process, in June 2011 the SASB approved a proposal to eliminate the formal practice of issuing interpretations. It was agreed that it is more sensible to simply funnel comments on standards to sponsors for handling (not through the IEEE SA Standards Department). Any resulting document changes would appear in a revision, amendment or corrigendum, each of which requires a PAR and committee consensus. In order to maintain ANSI accreditation, the IEEE SA is required to have an interpretations policy—the interpretations policy can be that we do not supply Interpretations.

8. Treasurer’s Report
Petersen reported that the opening balance 1 June 2011 (before the Halifax meeting) was $8585.21. (See Attachment 5.) Income and expenditures from the Halifax meeting yielded a net profit of $752.75. The current balance (not including income and expenses for this meeting) is $9359.22. Anticipated non-meeting expenses going forward include annual website maintenance (~$3000).

9. Membership Chairman’s Report
In Membership Chairman Murphy’s absence, Petersen presented the membership report. (See Attachment 6.) The report included welcoming 7 new members. A breakdown of the membership by country was also presented, which stands at 130 members representing 25 countries. Petersen pointed out that following the ICES Winter Meeting each year, the membership lists are reviewed and the membership updated. Members who joined ICES before the end of the previous year, who have not attended meetings or otherwise participated in the business of ICES, will be contacted to determine if they are still interested in maintaining official membership in the Committee. Those failing to respond positively
will be dropped from the membership roles. The membership of individuals who join ICES each year will be reviewed at the end of the next calendar year. Petersen pointed out that there are several members who have changed e-mail addresses and cannot be contacted. He reminded everyone that if they change their e-mail address and intend to remain on the committees, they have to let the secretary know.

**ACTION ITEM 1:**
Murphy and Petersen will begin the membership review. The updated membership list is to be available at the 2012 June meeting.

10. **Topic presentations**

**Global Coordination of Research on EM Fields and Health (GLORE)**
Weller provided an update on the status of the GLORE Program (see Attachment 7). He briefly reviewed the history and background of the program and the recent meeting held in Seoul, KR, where he gave a presentation on Regulatory Policy and Public Opinion in the USA. Updates of a number of issues and studies were presented, including results of recent research in the US being conducted as part of the National Toxicology Program, and by the National Institute of Drug Abuse and the Food and Drug Administration. There were numerous updates of research world-wide presented during the two-day meeting. In response to a question from Meltz regarding the presentation on the *Update of the Regulations and Policies in Korea*, where it shows Korea adopted the precautionary principle 9 September 2011, Weller explained that the adoption was a political decision brought about by public pressure. Chou noted that currently the regulations in Korea are a hybrid derived from the 1991 IEEE standard and the 1998 ICNIRP guidelines. For example, the ICNIRP guidelines are used for whole body exposures from antennas, such as mobile telephone base station antennas, which is consistent with the limits used by many countries. However, the C95.1-1991 value of 1.6 W/kg averaged over 1 g of tissue is used for localized exposure, which is inconsistent with the limits used by most countries, i.e., 2 W/kg averaged over 10 g of tissue.

11. **Reports from the Subcommittees**

   a) **SC1 (Techniques, Procedures, Instrumentation and Computation)**

   DeFrank reported that SC1 met 13 December where updates to the revision of the C95.3 standards were discussed. He pointed out that the revision of C95.3-2002 will combine the 2002 standard and C95.3.1-2010 into a single standard covering the frequency range of 0 Hz to 300 GHz. He noted that a PAR for the revision was submitted to the SASB New Standards Committee for consideration at their Continuous Processing Teleconference, or at their March meeting. He also discussed a number of items that will be considered during the revision process, including uncertainties associated with monitoring, multipath and reflection analysis/measurement techniques, and techniques for measuring low duty cycle RF fields.

   b) **SC2 (Terminology, Units of Measurements and Hazard Communication)**

   Tell reported that SC2 met 13 December. A ballot Group is being formed for subcommittee ballot on revisions to C95.7-2005; the PAR was approved in November. He explained that he will try to move the revision through the SC2 balloting process quickly and then to Sponsor ballot. While the subcommittee is considering the normative
portions of the draft, examples will be prepared to help illustrate concepts and applications of various aspects of an RF safety program. He pointed out that depending on the time it takes to develop suitable examples, they may be considered either for an annex or be published as a second document, e.g., C95.7.1.

c) SC3 (Safety Levels with Respect to Human Exposure, 0 Hz–3 kHz)
SC3 met jointly with SC4—the report is given below.

d) SC4 (Safety Levels with Respect to Human Exposure, 3 kHz–300 GHz)
Thansandote reported that SC3 and SC4 met jointly 13 and 14 December. He briefly reviewed the following presentations given at the meetings: measurement of charged aerosols around DC transmission lines (Bailey); contact current exposure limits (Reilly), update on the status of PC95.1-2345—the civil standard being developed to replace NATO STANAG 2345 (Klauenberg); the list of questions presented by the Government Accountability Office (Ziskin). With respect to the latter, Thansandote noted that a response was provided by several members of TC34 and TC95 speaking as individuals—not for IEEE. (See TC95 SC3/SC4 13-14 Minutes for details.)

Thansandote also noted that there was considerable discussion of a paper by Gandhi, et al. (Exposure limits: The underestimation of absorbed cell phone radiation, especially in children) recently published in *Electromagnetic Biology and Medicine*, which contains a number of misleading issues. He pointed out that after considerable discussion at the SC3/SC4 meeting as to whether SC4 should respond, the consensus was that it would be appropriate if the response came from COMAR, with the support of SC4. He concluded by noting that much of the time during the meeting was spent addressing comments received on PC95.1 (Draft 2.4V3, October 2011) that was sent to SC3 and SC4 in November. Not all the comments were resolved—those that were not will be addressed by the Editorial Working Group at their next meeting.

e) SC5 (Safety Levels with Respect to Electro-Explosive Devices)
Needy reported that while the requirements of C95.4 appear to be stable, SC5 is investigating new developments in electro-explosive devices that might require changes to the standard. Right now the intent is to try to decide if and what should be changed based on these developments.

12. ICES Website improvement
Chou reminded everyone to send him their bio-sketches and a photo for posting on the ICES website. He said that there seems to be little activity on the web and asked for suggestions on how we might increase viewership. Meltz recommended identifying key people, e.g., SC chairs, and ask them to solicit important issues from their membership that would be of interest to the public. This could include short articles, updates, etc., that could be posted on the public pages of the website, perhaps quarterly. Murphy noted that there are a number of links to other sites and recently articles on Klauenberg’s IEEE SA International Award and Tell’s elevation to IEEE Fellow have been posted.

13. New Business
Bailey reminded everyone that the European Commission and the Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR) is launching a request for a new
scientific opinion on the potential health effects of exposure to EMF. He said that interested parties are invited to submit comments, which may be an opportunity for ICES to be heard.

14. Future Meetings

a) Summer: Brisbane, Australia 14-16 June 2012
The next TC95 series of meetings will be held in Brisbane, Australia, in conjunction with the 34th Annual Meeting of the Bioelectromagnetics Society. Thanh Dovan is working with members of BEMS on the meeting venue and specific dates. As soon as these are finalized, a preliminary meeting announcement will be distributed.

b) Winter
A number of proposals were discussed for the 2012 winter meeting venue. The consensus was to poll the membership and solicit information on various possibilities for the winter meeting venue, including dates, rates for meeting rooms and lodging, convenience with respect to travel, etc. Bodemann suggested holding the meetings in January instead of December to avoid travel issues associated with Christmas.

**ACTION ITEM 2**
The Secretary will poll TC95 and its subcommittees soliciting recommendations regarding a venue for the winter 2012 TC95 meetings. Included will be a list of specific items that should be addressed including meeting room and lodging costs, convenience for travel, other opportunities, etc.

15. Adjournment

There being no further business, the meeting was adjourned at 1535h.

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**Action Items Arising from the 14 December 2011 TC 95 Meeting**

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<td>1. Begin the membership review. The updated membership list is to be</td>
<td>Murphy, Petersen</td>
<td>Complete before 1 June 2012</td>
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<td>available at the June meeting.</td>
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<td>2. The Secretary will poll TC95 and its subcommittees soliciting</td>
<td>Petersen</td>
<td>Initiate by 1 April 2012</td>
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<td>recommendations regarding a venue for the winter 2012 TC95 meetings.</td>
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<td>Included will be a list of specific items that should be addressed</td>
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<td>including meeting room and lodging costs, convenience for travel,</td>
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<td>other opportunities, etc.</td>
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TC95 Chairman Report

C-K. Chou, Ph.D.
Chairman, Technical Committee 95
International Committee on Electromagnetic Safety

[A similar version presented at PIERS at Kuala Lumpur on March 27, 2012]
Malaysia public forum meeting

AGENDA

14.00 hrs: Guests arrival and registration

14.30 hrs: Opening
- Mohd Ali Hanafiah
- Chief Officer of Resource Planning and Malaysia Communications and Multimedia Cyberjaya Malaysia

14.50 hrs: What scientists and regulators have done to make sure RF applications are safe?
- Dr. CK Chou (Ph.D.)
- Chairman of Task Team 95 of the International Electromagnetic Safety of IEEE

15.15 hrs: RBS EMF exposures level
- Mohd. Yusof Ali
- Ex-Malaysian Nuclear Agency

15.45 hrs: EMF application precaution
- Prof. Dr. KH Ng
- Professor of Medical Physics, University

16.15 hrs: Panel discussion and Q & A
- Dr. Yee Thiam Sun (Moderator) (Medical Practitioner and a
- Mohd Ali Hanafiah (MCMC)
- Dr. CK Chou (IEEE)
- Prof. Dr. KH Ng (UM)
- Mohd Yusof Ali (MNA)
- Mr. Michael Milligan (MMF)
- Secretary General, Mobile Manufacturers Forum

16.45 hrs: Afternoon tea

17.30 hrs: Session end
Malaysian Public Meetings (11/29-12/2/2011)
Indian meetings (Feb 7-8, 2012)
Taiwan National Communications Commission
(4/6/2012)
International Committee on Electromagnetic Safety

Secretary’s Report

TC95 Meeting
16 June 2012
Mantra Southbank Hotel
Brisbane, Australia

R Petersen
ICES – Administrative

Policies and Procedures (P&P):
- Defines organizational structure (SCC-39)
- Based on “SA Baseline P&Ps for Type 2 SCCs” (with deviations)
- Accepted by SASB Audit Committee, June 2007
- Working Group (SC) P&Ps Required – Random Audits
- **Action: Review/revise/re-submit before December 2012**

Annual Report (2010-2011)
- Accepted by SASB, December 2011
- Overview presented by Secretary at December 2011 SASB Meeting

Interpretation requests
- No outstanding interpretation requests
ICES TC95 Standards: Status

- **C95.1-2005**: (Safety levels, 3 kHz – 300 GHz)
  - Approved 2005; published 2006
  - PAR for revision approved (June 2010)
  - Revision will incorporate C95.6-2002

- **C95.1a**: (Safety levels, 3 kHz – 300 GHz)
  - Published May 2010
  - Amendment 1 (sets ceiling values for induced and contact current)

- **C95.2-1999**: (RF energy and current flow symbols)
  - Reaffirmed 2005
  - PAR for revision approved (November 2010)
ICES TC95 Standards: Status

- **C95.3-2002**: (RF measurements and computation: 100 kHz to 300 GHz)
  - Reaffirmed 2008
  - PAR for revision approved (February 2012)
  - Revision will incorporate C95.3.1

- **PC95.3.1**: (Measurements and computation: 0 Hz to 100 kHz)
  - Incorporates IEEE 1460
  - Published May 2010

- **C95.4-2002**: (Safe distances from antennas during blasting operations)
  - Reaffirmed 2008
ICES TC95 Standards: Status

- **C95.6-2002:** (Safety levels - 0 to 3 kHz)
  - Reaffirmed 2007
  - Will be incorporated into C95.1 revision

- **C95.7-2005:** (RF safety programs)
  - PAR for Revision approved (November 2010)

- **1460-1996:** (Measurement of quasi-static electric and magnetic fields)
  - Reaffirmed 2008
  - Incorporated into C95.3.1
  - Action - Withdraw (2013 or earlier)
New Projects

- **PC95.1-2345**: (Standard for the Evaluation and Control of Personnel Exposure to Electric, Magnetic and Electromagnetic Fields, 0 Hz to 300 GHz)
  - PAR approved (September 2009)
  - Civil standard for consideration as NATO STANAG 2345 replacement
**ICES TC34 Standards: Status**

- **P1528-201X**: (Peak Spatial-Average SAR in the Human Head from Wireless Communications Devices: Measurement Techniques)
  - Revision of IEEE 1528-2003/2005
  - Sponsor ballot in process
  - Consider as candidate IEC/IEEE dual logo standard?
TC34: IEC/IEEE Jointly Developed Standards Projects

- **IEC/IEEE P62704-1**: (Peak spatial average SAR in the human body from wireless communications devices, 30 MHz - 6 GHz: General requirements for using the FDTD method.)
  - P1528.1 PAR approved (September 2005); PAR extension request approved (December 2009); PAR withdrawn (March 2011)
  - Approved as jointly developed standard project (March 2011)

- **IEC/IEEE P62704-2**: (Peak spatial average SAR in the human body from wireless communications devices, 30 MHz - 6 GHz: Specific requirements for FDTD modeling of vehicle mounted antenna configurations.)
  - P1528.2 PAR approved (September 2005); PAR extension request approved December 2009; PAR withdrawn (March 2011)
  - Approved as jointly developed standard project (March 2011)
TC34: IEC/IEEE Jointly Developed Standards Projects

- **IEC/IEEE P62704-3:** (Peak spatial-average SAR in the human body from wireless communications devices, 30 MHz - 6 GHz: Specific requirements for FDTD modeling mobile phones/personal wireless devices)
  - P1528.3 PAR approved (March 2006; PAR withdrawn (March 2011)
  - Approved as jointly developed standard project (March 2011)

- **IEC/IEEE P62704-4:** (Determining the peak spatial average specific absorption rate (SAR) in the human body from wireless communications devices, 30 MHz - 6 GHz: General requirements for using the finite-element method (FEM) for SAR calculations and specific requirements for modeling vehicle-mounted antennas and personal wireless devices)
  - P1528.4 PAR approved (June 2008): PAR withdrawn (December 2011)
  - Approved as jointly developed standards project (December 2011)
SASB Changes

Effective Jan 1, 2012

- There will be no new reaffirmation or stabilization ballots
  - The only actions allowed by Sponsors will be:
    - Revision
    - Amendment/Corrigendum
    - Withdrawal
  - Standards will have a **10 year maintenance cycle**
    (extended from 5 years to 10 years after the last date of approval or maintenance action)
  - The status for a standard will be either **active** or **inactive**
  - All standards must have a revision approved by the IEEE-SASB prior to the close of Year 10 in order to remain active
  - Any standard not approved as a revision will become inactive after year 10
SASB Changes

Categories of Inactive Standards:

- **inactive - superseded:** These standards have been replaced with a revised version of the standard.

- **Inactive - reserved:** These standards are removed from active status through an administrative process for standards that have not undergone a revision process within 10 years.

- **inactive - withdrawn (valid for standards categorized after 1 January 2012):** These standards have been removed from active status through a ballot where the standard is made inactive as a consensus decision of the balloting group.
SASB Changes

Revisions

- A revision ballot may result in:
  - Changes to the standard
  - Changes to only the references or bibliography
  - No changes at all
- In the event that no changes are made, the standard will retain its designation (i.e., the year will not change).
- The title page will reflect the fact that a maintenance action occurred but no changes were made.
- This will keep the standard active for another 10 years
### SASB Changes

**SASB Assigned Expiration Dates**

<table>
<thead>
<tr>
<th>Standard</th>
<th>Year*</th>
<th>Expiration Date</th>
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<tbody>
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<td>C95.7</td>
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*Date of initial approval
SASB Changes

Elimination of Interpretations

- The IEEE- SA Standards Board approved a proposal to eliminate issuing interpretations in June 2011
- Current practice: Interpretations should not constitute an alteration to the original standard
  - At present, they are permitted to provide meaning to text that is ambiguous
SASB Changes

Rationale

- Inefficient and a risk
  - Interpretation responses made in an attempt to clarify ambiguous text to be derived from a process that does not inform all materially interested parties of the activity
  - Interpretations do not require consensus to be achieved through the Sponsor balloting process
SASB Changes

Solution

- More sensible to simply funnel comments on standards to Sponsors for handling
  - Any resulting document changes would appear in a revision amendment/corrigendum
  - All require PARs – an open process & consensus through balloting
- Therefore interpretations as discrete documents should be discontinued
SASB Changes

Going Forward

- Elimination of Interpretations
  - In order to maintain ANSI accreditation, IEEE is required to have an interpretations policy.
    - The interpretations policy can be that IEEE does not supply Interpretations
  - Changes became effective 1 January 2012
  - Changes to Ops Man, ByLaws, etc
  - “The IEEE does not offer interpretations of its standards”
Secretary’s Report

Thank You
International Committee on Electromagnetic Safety

Treasurer’s Report

TC95 Meeting
16 June 2012
Mantra Southbank Hotel
Brisbane, Australia

R Petersen
# Statement: 31 December 2012 – 31 May 2012

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ICES TC95 Membership Report
16 June 2012
Brisbane, Australia

Dr. Michael R. Murphy
Science Director
Directed Energy Bioeffects
Air Force Research Laboratory
ICES TC95 Membership Report
Outline

• Recent New Members
• Current Membership
• Maintaining Official Membership in ICES TC95
• Becoming a Member of ICES
<table>
<thead>
<tr>
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<td>Rajat Mathur</td>
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<td>Amnon Duvdevany</td>
<td>Israel</td>
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<td>Donald Farrer</td>
<td>San Antonio</td>
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<td>John Brewer</td>
<td>USAF, Singapore</td>
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<td>Shrivastava</td>
<td>Devashish, USA</td>
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<tr>
<td>Chungsang Ryu</td>
<td>Korea</td>
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<tr>
<td>Kenichi Yamazaki</td>
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<tr>
<td>Daoud Attayi</td>
<td>Canada</td>
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<td>Martin R. Doczkat</td>
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<td>Sam Adhikari</td>
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<td>Martin Gledhill</td>
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### TC95 Current Membership

**TC95 membership, June 2012 - 133 Members**

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25 countries
Maintaining Official Membership in ICES TC95

• Following the ICES Winter meeting each year, the membership roles will be reviewed. Members who joined ICES before that year, who have not attended meetings or otherwise participated in the business of ICES that year, will be contacted to determine if they are still interested in maintaining official membership in the Committee. Those failing to respond will be dropped from the membership roles. The membership of individuals who joined ICES within that year will be reviewed at the end of the next calendar year.
Privileges of Official Membership on IEEE ICES TC95

• Access to protected part of ICES Website
• E-mail notification of meetings and other events
• Permission to publically cite self as “Member of ICES TC95”
• Listing in the preface of IEEE C95 standards, if you contribute
• Inclusion in membership statistics
• Voting on committee issues at meetings and by letter (e-mail) ballot
• Participating in all ballots on ICES standards, subject to IEEE rules.

To apply for membership, e-mail
Michael.R.Murphy98.civ@mail.mil
EMF High Peak Power Pulse Bioeffects and Standards

Michael R. Murphy, “Introduction”, Air Force Research Laboratory, USA

C. K. Chou, “Is Microwave-Pulse Induced Hearing an Adverse Health Effect? ” Motorola Solutions, USA

René de Seze, “Health Hazards of High Peak Power Microwaves”, INERIS, France

Guozheng Guo, “Research on EMP Bioeffects”, 4th Military Medical University, Peoples Republic of China

Thomas Vernier, “Modeling and Measuring the Bioeffects at Extremely Short (high) Timescales (frequencies)”, U. of Southern California, USA

Gale Craviso, “Nanoelectropulse Modulation of Neurosecretion”, U. of Nevada School of Medicine, USA

Andrei Pakhomov, “Dose-Response and Quantitative Studies of Bioeffects of Nanosecond Electric Pulses”, Old Dominion U., USA

Bennett Ibey, “Investigations of Cellular and Genetic Effects of High Peak Power Microwave Exposure”, Air Force Research Laboratory, USA
Why are EMF issues taking so long to resolve?

Dr Michael Repacholi
Visiting Professor, University of Rome “La Sapienza”
Former Coordinator, WHO International EMF Project
Chairman Emeritus, International Commission on Non-Ionizing Radiation Protection
EMF has been researched for some 70 years and the topic is as current as ever.

New and intrusive EMF technologies cause waves of public concern (power lines with Wertheimer Leeper 1979; microwave ovens led to Canadian RED Act, VDTs, radars, cell phones, wireless technologies etc).

Activists are well-organized, have many well-read web sites, conduct their own “scientific” reviews identify only positive effects and are more influential politically (e.g. Bioinitiative report).
People’s fear of radiation is triggered by past events and especially by media reports.
Mobile phones 'more dangerous than smoking'

Brain expert warns of huge rise in tumours and calls on industry to take immediate steps to reduce radiation

By Geoffrey Lean
Sunday, 30 March 2008

Mobile phones could kill far more people than smoking or asbestos, a study by an award-winning cancer expert has concluded. He says people should avoid using them wherever possible and that governments and the mobile phone industry must take "immediate steps" to reduce exposure to their radiation.

The study, by Dr Vini Khurana, is the most devastating indictment yet published of the health risks.
* The press has seen this as a big-sell topic and fuels public concern with a barrage of positive study results without quoting authorities that can balance their reports.
* There are many totally unbalanced TV reports and documentaries that give much more credence to activist assertions than mainstream science
* Mainstream science still doesn’t have an effective response to this barrage of misinformation
Cell phones are hugely beneficial for commerce, emergencies, social contact etc*. 
People happily subject themselves to medical X-rays, a carcinogen with known probability for causing cancer. 
Yet people are more worried about RF fields, that are “possibly carcinogenic” according to IARC, and are probably even more beneficial than ionizing radiations!! 
Why the disconnect in reasoning? 
It seems fear of the unknown is worse than knowing the facts and dealing with them...

Smokers inhale about 0.04 pCi of radioactive polonium 210 from each cigarette (because uranium daughters are selectively absorbed by growing tobacco plants)

Po-210 is a highly toxic $\alpha$-emitter. Hugely damaging to lung tissue. used to kill former Russian spy in the UK (Alexander Litvinenko)

30 cigarettes smoked each day gives the same radiation dose to the lungs as about 300 chest X-rays a year*

* Prof Robert N Procter (Stanford University) article in the Herald Tribune (2-3 Dec. 2006, p6)

Why do people choose to ignore known risks demonstrated by the science yet worry about EMF?
In 1996 WHO recognized the difficulty its member states were having in dealing with EMF issues and concerns about possible health risks voiced in various countries.

Establishing the International EMF Project, using WHO’s well established rules for determining whether there existed any real risk to public health has been a major step forward.

As the peak UN health body the main role of WHO is to advise its member states on all health issues.

WHO’s EMF Project also recognized early that communicating the science was 50% of the battle, the other 50% being research needs.
Electromagnetic Fields and Public Health - The Present Evidence

• What happens when you are exposed to electromagnetic fields?
• Biological effects and health effects
• Conclusions from scientific research

EMF Risk Communication - Dealing with Public Perception

• Multiple Determinants of the EMF Risk Issue
• How is risk perceived?
• The need for risk communication
• Managing EMF risk communication

EMF Exposure Guidelines and Policies - The Present Situation

• Who decides on guidelines?
• What are guidelines based on?
• Why is a higher reduction factor applied for general public exposure guidelines?
• Precautionary approaches and the Precautionary Principle
• Science-based and precautionary approaches for EMF
• What is WHO doing?

WHO booklet: Good source of information
WHO’s EMF Project has contributed hugely to focusing EMF research by identifying key gaps in knowledge (WHO Research Agenda) needed to make better health risk assessments (EHC review program).

This led to large, well-funded research programs by the EC, many national authorities and industry.

Now these national programs are coming to an end, industry has all but stopped funding research.

However, this is leaving small, low quality studies to come to the frontline of publicity and increased opportunity for activism to promote generally false positive results.
What is really left to research to determine if real health risks exist?

WHO is promoting studies relating to children’s sensitivity to EMF... this is a genuine area for more research: Includes

- Determining why an association between childhood leukaemia and ELF magnetic fields
- Children’s sensitivity to EMF. Will their use of mobile phones lead to health effects in later life?... there are good hypothetical reasons to believe so (developing organism, thinner skulls, different dielectric properties in the brain that mean a higher and deeper local SAR from cell phones).

- All other potentially sensitive organ systems have been studied with no effect from exposures below the international guideline levels.
What can be done to bring the issue to a close?
Systematic reviews

* All too often activists and other critics note that the composition of the review committee determines the outcome, not the science.
* Systematic reviews do not depend on the reviewers. A protocol describing how the review will be conducted is agreed by all authors before the review begins. This includes
  * Reviewing ALL studies on the topic irrespective of quality or language
  * How all studies will be assessed (worksheets)
  * How study results will be synthesized (meta analyses, narratives)
  * How conclusions are reached and causality assessed (Hill Criteria)

Protocol and worksheets in the online appendix:
# Epidemiology Study Quality Assessment Worksheet

<table>
<thead>
<tr>
<th>Study Criteria</th>
<th>Summary of criterion (see protocol page and item number provided in brackets for full criterion)</th>
<th>Additional Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Funders</td>
<td>Discloses funding source</td>
<td></td>
</tr>
<tr>
<td>Reporting</td>
<td>Satisfies STROBE most important checklist items for particular study design in reviewer’s judgment (see attached checklist)</td>
<td></td>
</tr>
<tr>
<td>Data analysis</td>
<td>Results derived using all of the appropriate standard statistical methods, unless other methods convincingly justified</td>
<td></td>
</tr>
<tr>
<td>Selection - participation bias</td>
<td>Case-control or cohort studies: selection and participation of study participants independent of exposure and disease status. Ecological studies: study population selected from whole population or a defined region or population strata</td>
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</tr>
<tr>
<td>Confounding</td>
<td>Corrected for confounding if needed and reported both unadjusted and adjusted risk estimates.</td>
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</tr>
<tr>
<td>Recall and information bias</td>
<td>Case-control studies with retrospective exposure assessment: assessment used objectively recorded exposure data. Cohort studies: objectively recorded exposure data used or self-reported exposure data obtained before occurrence of the disease.</td>
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<tr>
<td>Random exposure error</td>
<td>Validated that the method used for estimating exposure was highly correlated with validated exposure and demonstrated that random exposure misclassification did not change the result.</td>
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</tr>
<tr>
<td>Registration bias</td>
<td>Ecological studies: data obtained from registries with high % of disease registration that does not change significantly over time.</td>
<td></td>
</tr>
</tbody>
</table>

††Criterion fully satisfied [including when the criterion is satisfied as a result of the study design]
†Criterion partially satisfied [Refer to protocol for additional detail]
#Criterion not satisfied [including when not addressed in the study].

Insert comments on study and complete data extraction table below.

<table>
<thead>
<tr>
<th>Phone use</th>
<th>**Outcome number</th>
<th>Lower CI</th>
<th>Upper CI</th>
<th>*Latency (yrs)</th>
<th>Point estimate</th>
<th>First author, year</th>
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</tbody>
</table>

* Latency is defined as the time between the last date when exposure was considered in the study (i.e., the reference date) and the date of diagnosis. [This not the same as the latency of the disease]

** Outcomes: 1 = glioma, 2 = meningioma, 3 = neuroma, 4 = parotid.
# In Vivo Study Quality Assessment Worksheet

First author, year and brief title:

<table>
<thead>
<tr>
<th>Study Criteria</th>
<th>Summary of criterion (refer protocol item number provided in brackets for full criterion).</th>
<th>Additional Weight</th>
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<tbody>
<tr>
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<tr>
<td>Reporting</td>
<td>Clear statement of hypothesis</td>
<td></td>
</tr>
<tr>
<td>Reporting</td>
<td>Description of study methods sufficient for replication of study</td>
<td></td>
</tr>
<tr>
<td>Reporting</td>
<td>Data reported sufficient to independently confirm results of analyses</td>
<td></td>
</tr>
<tr>
<td>Data analysis</td>
<td>Results derived using all of the appropriate standard statistical methods, unless other methods convincingly justified</td>
<td></td>
</tr>
<tr>
<td>Blinding</td>
<td>Researchers blinded to which exposed and control groups</td>
<td></td>
</tr>
<tr>
<td>Blinding</td>
<td>Researchers blinded during data management and analyses</td>
<td></td>
</tr>
<tr>
<td>Bias</td>
<td>Random assignment of animals to experimental groups</td>
<td></td>
</tr>
<tr>
<td>Duration</td>
<td>Sufficient duration after exposure for effect to be observed</td>
<td></td>
</tr>
<tr>
<td>Treatment &amp; management</td>
<td>Exposed and control groups treated and managed same way, except for exposure</td>
<td></td>
</tr>
<tr>
<td>Controls</td>
<td>Positive and sham controls used as appropriate to study</td>
<td></td>
</tr>
<tr>
<td>Sentinels</td>
<td>Used sentinels to detect pathogens that could affect outcome</td>
<td></td>
</tr>
<tr>
<td>Environment</td>
<td>Properly controlled and documented environmental conditions</td>
<td></td>
</tr>
<tr>
<td>Sterile technique</td>
<td>Used in all appropriate procedures</td>
<td></td>
</tr>
<tr>
<td>Exposure system</td>
<td>Properly calibrated and delivers dose known to reasonable accuracy</td>
<td></td>
</tr>
<tr>
<td>GLP</td>
<td>Applicable good lab practices used</td>
<td></td>
</tr>
<tr>
<td>Animal restraint</td>
<td>Animals habituated before exposure, same restraint for exposed and controls, and detailed analysis of range of dose received, especially if animal growth taken into account, as applicable</td>
<td></td>
</tr>
<tr>
<td>Dose range if animals move</td>
<td>Detailed analysis of range of dose received if animals free to move, especially in long term studies if animal growth taken into account, as applicable</td>
<td></td>
</tr>
<tr>
<td>Histopathology</td>
<td>Diagnoses reviewed by independent panel of pathologists</td>
<td></td>
</tr>
<tr>
<td>Consistency</td>
<td>Extent of internal consistency across data sets</td>
<td></td>
</tr>
</tbody>
</table>

††Criterion fully satisfied [including when the criterion is satisfied as a result of the study design]
†Criterion partially satisfied [Refer to protocol for additional detail]
#Criterion not satisfied [including when not addressed in the study].

Insert comments on study and complete data extraction table below.

**Mouse/Rat numbers** (Cross out which animal type not applicable to study reviewed)

<table>
<thead>
<tr>
<th>Exposed with tumors</th>
<th>Exposed without tumors</th>
<th>Sham exposed with tumors</th>
<th>Sham exposed without tumors</th>
<th>Exposure level (W/kg)</th>
<th>First author, year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Only tumor outcomes are to be inserted here, not genotoxic outcomes such as gene expression, DNA fragmentation/mutation.
Systematic review conclusions

- Systematic reviews lead systematically, transparently and logically to unchallengeable results and conclusions, and using the Hill Criteria can be used to determine whether EMF is causally related to some health effects.
- They are used in many other fields, including assessing the results of clinical trials.
- The methodology is sound and is the way to review the EMF science in the future.
- However the problem for EMF has always been the low quality studies. Epidemiology studies are relied upon for determining effects in human populations but they are generally flawed or subject to many biases or confounding.
- EMF animal studies are almost uniformly negative but are given less weight in health risk assessments. This makes it difficult to reach definitive conclusions about causality.
Promoting the science

- Don’t leave major scientific studies in journals... unread by the public. They need the information clarified and synthesized by reputable agencies.
- National authorities, professional and scientific organizations, and industry should continue to be active in promoting the science (web sites e.g. “EMF Explained”, press releases, statements countering misinformation etc).
- Promoting the science could require establishing separate media agencies to promote science and deal with the press (e.g. Japan EMF Information Center).
- WHO is doing all it can to provide science-based information, so PROMOTE IT.
- At present activists are winning the battle and many in the press and public believe them...
If low quality studies can’t be published in good peer-reviewed journals, there are many others prepared to publish them. There are already standards* published for high quality science and reviews, and these need to be amended to develop criteria for quality EMF studies and promote them to all journals before they publish EMF studies.

*Cochrane Handbook (Higgins and Green, 2009. [http://www.cochrane.org/training/cochrane-handbook](http://www.cochrane.org/training/cochrane-handbook))


So why is the EMF issue taking so long to resolve?

What’s needed

- Lack of promotion of authoritative scientific conclusions. WHO is providing independent, sound science based reviews and conclusions ... use them as much as possible
- Allowing misinformation to go unchallenged. Media centers or similar are needed to provide a balanced view
- Some activists deliberately promote misinformation in a very readable and believable way. Some are genuinely concerned while others use it for profit (witnesses in court action, selling “protective” equipment etc). They need challenging; they have more time, better media contacts, well-prepared spokespeople, believable and active web sites and newsletters that are widely read.
- So until these issues are addressed seriously we will see EMF as an issue well past our lifetimes.
Thank you for your attention

Prof. Mike Repacholi
Department of Information Engineering, Electronics and Telecommunications (DIET)
University of Rome “La Sapienza”
E-mail: mrepacholi@yahoo.com
Should Standards Be Revised Because There Are Reported Possible Biological Effects of RF Exposure?

C-K. Chou, Ph.D.
Chairman, Technical Committee 95
International Committee on Electromagnetic Safety

[A similar version presented at PIERS at Kuala Lumpur on March 27, 2012]
Extensive Research Database

- The biological effects of RF exposure have been studied for more than 60 years.

- Current IEEE database contains 5109 entries, of which 2739 are relevant to biological effects of RF exposure (June 2012)

http://ieee-emf.com/
## Mobile Telephony Related Studies

<table>
<thead>
<tr>
<th>Study Type</th>
<th>Published</th>
</tr>
</thead>
<tbody>
<tr>
<td>Epidemiology</td>
<td>305</td>
</tr>
<tr>
<td>Human</td>
<td>270</td>
</tr>
<tr>
<td>Animal</td>
<td>282</td>
</tr>
<tr>
<td>In Vitro</td>
<td>277</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1134</strong></td>
</tr>
</tbody>
</table>

*June 2012*
WHO Comment on Database (2008)

- “Scientific knowledge in this area is now more extensive than for most chemicals.”

- “….current evidence does not confirm the existence of any health consequences from exposure to low level* electromagnetic fields.”


*Low level exposure refers to exposure below the limits recommended by ICNIRP and IEEE/ICES.
# Quality of Science (Established vs. Possible)

<table>
<thead>
<tr>
<th></th>
<th>Confirmed and Established Science</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>Unconfirmed report (could be useful)</td>
<td>?</td>
</tr>
<tr>
<td>C</td>
<td>Unconfirmed report contradicts A</td>
<td>?</td>
</tr>
<tr>
<td>D</td>
<td>Unconfirmed report with clear flaws and artifacts</td>
<td>?</td>
</tr>
<tr>
<td>E</td>
<td>Junk report in peer-reviewed literature</td>
<td>?</td>
</tr>
<tr>
<td>F</td>
<td>Junk report in non-peer-reviewed literature</td>
<td>?</td>
</tr>
</tbody>
</table>

Increasing validity

Adapted from Osepchuk [2004]

“Good science is never outdated.” -- Herman P. Schwan
A **biological effect** is an established effect caused by, or in response to, exposure to a biological, chemical or physical agent, including electromagnetic energy. Biological effects are alterations of the structure, metabolism, or functions of a whole organism, its organs, tissues, and cells. Biological effects can occur without harming health and can be beneficial. Biological effects also can include sensation phenomena and adaptive responses. [IEEE Standard C95.1™-2005]

**Possible biological effects** are those changes that cannot be or have not been confirmed by others.
Established Adverse Health Effect:

- A biological effect characterized by a harmful change in health that is supported by consistent findings of that effect in studies published in the peer-reviewed scientific literature, with evidence of the effect being demonstrated by independent laboratories, and where there is consensus in the scientific community that the effect occurs for the specified exposure conditions.

- Established biological effects are explainable by a sequence of mechanisms in full agreement with the laws of biophysics.
Who Sets RF Exposure Standards?

- **ICNIRP**
  - guidelines developed by a committee of appointed experts, no industry representatives
  - endorsed by WHO

- **IEEE-ICES**
  - large committee open to anyone with a material interest
  - about 130 members from 26 countries
  - Open consensus process
IEEE Safety Standards History

- 1960: USASI C95 Radiation Hazards Project and Committee chartered
- 1966: USAS C95.1-1966
  - 10 mW/cm² (10 MHz to 100 GHz)
  - based on simple thermal model
- 1974: ANSI C95.1-1974 (limits for $E^2$ and $H^2$)
- 1982: ANSI C95.1-1982 (incorporates dosimetry)
- 2002: IEEE C95.6-2002 (0-3 kHz)
  (comprehensive revision, 250 pages, 1143 ref.)

http://standards.ieee.org/about/get/index.html
International RF Safety Standards

- **ICNIRP (1998):** “this publication is to establish guidelines for limiting EMF exposure that will provide protection against known adverse health effects”.
  *ICNIRP reconfirmed its guidelines in 2009.

- **IEEE ICES C95.1-2005:** “The purpose of this standard is to provide exposure limits to protect against established adverse effects to human health induced by exposure to RF electric, magnetic and electromagnetic fields over the frequency range of 3 kHz to 300 GHz.”
Other interested organizations

- **International Commission for Electromagnetic Safety (ICEMS)** advocates protection of the public from electromagnetic fields and develops the scientific basis and strategies for assessment, prevention, management and communication of risk, based on the precautionary principle (web posted 5 resolutions)

- **BioInitiative Report** promotes low exposure limits to avoid possible biological effects as a precautionary measure (17 chapters written by 14 individuals); however, international health authorities do not consider the BioInitiative Report to be an objective scientific report.
IARC: International Agency for Research on Cancer

- IARC is an agency of the World Health Organization (WHO)
  - IARC has so far classified 951 agents, mixtures and exposures based on the strength of scientific evidence of their potential as human cancer hazards

- IARC assigns one of 5 classification groups:
  1. known carcinogen (107)
  2A. probable carcinogen (63)
  2B. possible carcinogen (271)
  3. not classifiable (509)
  4. probably not a carcinogen (1)

- The IARC evaluation deals only with the hazard, not the risk
  - It identifies the potential for RF fields to cause cancer under some circumstances (“hazard”) but does not quantify the likelihood of the harm occurring (“risk”)
IARC evaluation of RF EMF

IARC schedule of events

- IARC ad hoc committee met on May 24-31, 2011 in Lyon, France
  - RF Electromagnetic Fields (EMF) scope covers all RF transmitting devices operating in the 3 kHz to 300 GHz frequency range, e.g., Radio and TV transmitters, Radars, microwave ovens, mobile phones, DECT phones, 2-way radios

- RF EMF classification announced on May 31 as possible carcinogen 2B

- June 22, IARC published a summary paper in *Lancet Oncology*
  “Although both the INTERPHONE study and the Swedish pooled analysis are susceptible to bias—due to exposure misclassification, recall, and selection—the Working Group concluded that the findings could not be dismissed as reflecting bias alone, and that a causal interpretation between mobile phone EMF-RF exposure and glioma is possible.”

- In 12-18 months (2H12), IARC will publish a full monograph #102
- In 2012-2013, WHO will publish an *environmental health criteria* document on the RF EMF cancer risk issue based on the IARC monograph
- the International Commission on Non-Ionizing Radiation Protection (ICNIRP) plans to publish updated RF exposure guidelines in 2013-2014
Statements from WHO

WHO (June 22, 2011) Fact Sheet #193 “Electromagnetic fields and public health: mobile phones”

- Are there any health effects?
  - “A large number of studies have been performed over the last two decades to assess whether mobile phones pose a potential health risk. To date, no adverse health effects have been established as being caused by mobile phone use.”

- “WHO will conduct a formal risk assessment of all studied health outcomes from radiofrequency fields exposure by 2012.”
Statements from ICNIRP

International Commission on Non-Ionizing Radiation Protection (July 1, 2011)
“Mobile Phones, Brain Tumours and the Interphone Study: Where Are We Now?”
http://ehp03.niehs.nih.gov/article/info%3Adoi%2F10.1289%2Fehp.1103693

“In summary, Interphone and the literature overall have methodological deficiencies but do not demonstrate greater risk of either glioma or meningioma with longer or greater use of mobile phones, although the longest period since first use examined is <15 years.”

“Although there remains some uncertainty, the trend in the accumulating evidence is increasingly against the hypothesis that mobile phone use can cause brain tumours in adults.”
Expert Reviews (2000-2012)

Statements from Governments and Expert Panels Concerning Health Effects and Safe Exposure Levels of Radiofrequency Energy (95 citations)

No adverse health effects have been confirmed below the current international RF safety guidelines or exposure standards (ICNIRP, IEEE).
Biophysical consideration

- Most, if not all, unconfirmed and/or unreplicated biological effects of RF invoke exceptions from principles of physics, specifically an unrealistic efficiency of nonlinear energy conversion and/or the detection of signals far, far below environmental noise. There can be no biological effect without a prior physical event to trigger it.
ICES TC95 decision

Following the IARC classification of RF fields as a “possible” human carcinogen, the ICES TC95 subcommittees and working groups responsible for reviewing the scientific literature and recommending exposure limits concluded in the June 2011 meeting that the IARC classification of RF energy as a possible carcinogen does not serve as a basis for a revision of IEEE/ICES C95.1.
What standards should be built on?

Rock (scientific evidence)  Sand (unconfirmed reports)