Approved Minutes

ICES/SCC-28
Sheraton Gunter Hotel
San Antonio, TX
January 20, 2002
8:00 AM – Noon

1. Call to Order
Chairman E. Adair called the meeting to order at 0810 h. Each of the attendees introduced her/himself (see Attachment 1 for list of attendees).

2. Approval of Agenda
Upon a motion by T. McManus that was seconded by J. Daly, the agenda was unanimously approved without modification. (See Attachment 2 for agenda.)

3. Approval of June 10, 2001 Minutes
Upon a motion by K. Jaffa that was seconded by T. McManus, the minutes of the June 2001 ICES meeting were unanimously approved without modification.

4. Executive Secretary’s Report
   a) C95.4. Petersen reported that PAR P1472 (Recommended Practice for Determining Safe Distances from Radio-frequency Transmitting Antennas when Using Electric Blasting Caps During Explosive Operations) was extended until December 2002 to allow completion of another recirculation ballot. An additional recirculation is necessary to accommodate changes recommended by SCC-10 (Terms and Definitions) and SCC-14 (Quantities, Units and Letter Symbols) and changes recommended by the Institute of Manufacturers of Explosives. He also reported that the project number was changed from P1472 to C95.4 to bring it into line with the other ICES standards.
b) C95.6. Petersen also reported that the IEEE-SA-Standards Board approved the original title of the low frequency standard (permitted the use of the word safety in the title). The title is now Standard for Safety Levels With Respect to Human Exposure to Electromagnetic Fields, 0 to 3 kHz. He also reported that the project number was changed from P1555 to C95.6 to bring it into line with the other ICES standards. Invitations to ballot on C95.6 will be sent by the IEEE Balloting Center in the next week or two. An e-mail will be sent to the ICES membership this week explaining that the leadership will take the necessary steps have the IEEE SA-Standards Board approve all non-IEEE SA members who join the balloting group.

c) PAR Extensions for C95.1 and C95.3. Petersen reported that PARs PC95.1 (Standard for Safety Levels With Respect to Human Exposure to Electric and Magnetic Fields, 3 kHz to 300 GHz) and PC95.3 (Recommended Practice for Measurements and Computations with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 100 kHz to 300 GHz) have been extended for four years. He noted that the revision of C95.3 would be going to ballot in the next month or so.

d) Litigation. Petersen reported that IEEE has been named in at least one lawsuit involving cell phones – the Murray case – along with a number of wireless carriers, manufacturers and ANSI. He then read the statement from the IEEE Bylaws that discuss indemnification of members of IEEE committees and working groups. Specifically, IEEE indemnifies members of committees working on approved projects, i.e., a valid PAR is in effect, whether they are IEEE members or not. (See Attachment 3 for indemnification statement.)

5. IEEE Standards Activities Report

No Report.

6. Chairman’s Report

Adair announced that Dr. Ralf Bodemann accepted the position of Vice-Chairman of ICES. She also reported that the international membership of ICES has been steadily increasing. The effort to increase the number of members from outside of the US began in earnest at the Munich meeting. Also discussed were the meetings between the leadership of ICES and ICNIRP where viewpoints were exchanged and agreements were established for exchanging draft documents. A third meeting was planned but agreement could not be reached on a venue because of member conflicts.

Adair thanked A. Varranelli for setting up this meeting in San Antonio and for setting up and maintaining the ICES website. She noted that currently the website has a public area and a private area – the private area is for the SC-4 Revision Working Group. Minutes of the main committee and its subcommittees, meeting announcements and other information regarding ICES activities are posted at this site (http://grouper.ieee.org/groups/scc28/). She encouraged the other subcommittees to make more use of the website for conducting business and requested that their chairs post their meeting announcements and agendas on
the web. Adair also thanked Petersen for his efforts in interacting with the Standards Board and educating them about ICES activities.

Adair then reviewed the recent “ERA” meeting held in Luxembourg that was sponsored by the European Commission: Health and Consumer Protection Directorate-General. (See the ICES website for the minutes of the ICES Luxembourg meeting for more details.) She explained that several members of ICES, Adair, Bodemann, Chou, McManus, and Osepchuk, attended the meeting. McManus organized a special meeting of ICES immediately following the ERA meeting which had 24 attendees, many of whom were unfamiliar with ICES. She said that a number of stimulating topical discussions took place the second day and that the format of the meeting was excellent for exchanging ideas. Several attendees expressed interest in joining ICES – many were enthusiastic about the open process. A future similar meeting in Zurich is being considered.

Adair reviewed the accomplishments of the subcommittees. She acknowledged the major accomplishment of SC-3 led by Kent Jaffa in completing the low frequency standard. She noted that the SC-4 Revision Working Group has met four times in the past two years and is well on its way to completing a draft revision of C95.1-1991.

Adair also reviewed the activities of the EXCOM and explained their oversight role on ICES activities. EXCOM meets formally several times each year and several additional times by teleconference. The efforts of the EXCOM include coordination between SC-3, SC-4 and ANSI Z136 to ensure smooth transitions in the overlap regions. Members of EXCOM will be meeting with IEEE staff in March to discuss a number of issues including voting by non-IEEE SA members, voting by IEEE members who are not ICES members or invited experts, fund-raising (e.g., for travel of key people to meetings), and the development of a policy for providing rapid response to misinformation perpetuated by the media.

The issue of frivolous litigation was raised and it was agreed that the indemnification issue would be added to the list of issues that would be discussed with IEEE. Osepchuk raised the issue of pushback by the IEEE Standards Department regarding the use of the word “safe” in standards. Tell asked why IEEE is concerned about using words like safe and safety in its standards. Petersen explained that it is more an issue of how it is used rather than if it is used. He explained that regarding the low frequency standard, the title on the PAR was originally changed by removing the word safe at the request of IEEE counsel. He said that the decision was not final – counsel wanted to see how the word was used in the standard before approving its use. As noted earlier, the revised PAR with the original title was recently approved – even though IEEE counsel mildly objected. Osepchuk said that he would draft a white paper on the issue because he felt ICES has not seen the last of the issue. Osepchuk pointed out that the issue is one of perception – RF is mysterious and not well understood and it would be inappropriate to conclude that even innocuous devices such as traffic radars are safe. He compared this position with that of electricity where the word “safety” is freely used in the standards, including in title of the National Electrical Safety Code, and said that he sees it as a matter of education.

Osepchuk said that EXCOM would try to encourage the IEEE Public Relations Department to address the issue of rapid response to misinformation in the media. He also recommended initiation of a program to generate and publish articles on standards
development, the role of ICES etc., for publication in widely read magazines such as *IEEE Spectrum*. He said that at the COMAR meeting, Foster suggested a short summary that could refer to other papers. Petersen noted that there is a draft COMAR TIS on standards development that could be massaged to accomplish this. Adair noted that several recent papers on standards have been published, e.g., the Osepchuk and Petersen article in *IEEE Microwave Magazine* and one that she and Petersen are working on for the 50th anniversary issue of *IEEE Transactions on Microwave Theory and Techniques*.

Adair reviewed the upcoming WHO Workshop on Adverse Temperature Levels in the Human Body. The workshop, which will be held in Geneva, March 20-21, 2002 and is by invitation only, will address the thermal characteristics of cells, tissues and organs of the body – conclusions should be available shortly thereafter. Adair also provided an update on the planned joint ICES/ICNIRP thermophysiology workshop. She said that planning is on hold until after the WHO workshop.

Ralf Bodemann introduced himself to the committee. He said that he attended the first meeting of ICES in Munich in June 2000. He explained that during the short period of interaction since the Munich meeting he has grown to appreciate the work of the committee, especially the work of SC-3 in developing a soundly-based standard, and the work of the EXCOM in their oversight role and their efforts in trying to remove barriers and achieve acceptance outside of IEEE. He said that one of his main personal efforts is to gain international harmonization – Europeans consider ICES as the North American equivalent of CENELEC. He said that he would contact other important organizations in Europe and try to educate them regarding ICES activities.

7. Treasurer’s Report

A. Varanelli reported that after expenses for this meeting and the Luxembourg meeting are resolved, the balance in the ICES account should be about $4 k. He said that he expects revenue from the dissolution of the Electrical Energy Association, a strong supporter of rational science-based standards and co-sponsor of IEEE SCC-34. H. Bassen asked whether short courses could be a means for generating revenue – Petersen responded that it could. He said that it was done in the past and is worthwhile considering doing again. C. K. Chou suggested contacting the MMF for support.

8. Membership Chairman’s Report

The Membership Chairman imparted the sad news of the passing of Dr Ulf Bergqvist last September. Dr. Bergqvist had suffered a heart attack. He will be greatly missed by the EMF community worldwide. Dr Bergqvist was a member of ICES, a founding member of ICNIRP and a strong supporter of harmonization between ICNIRP and ICES. He was Europe’s leading researcher in the field of electrical hypersensitivity and it had been as a result of his energy and initiative that the COST 281 Action (on the health effects of mobile telephony) had been set up by the EU last year. An appreciation of the life of Dr Bergqvist had been delivered by T. McManus at the special meeting of ICES in Luxembourg on December 1st 2001, and some highlights from that appreciation were presented.
The Membership Chairman also reported that Mr. Ian Crabtree of Transpower, New Zealand was now making a good recovery from surgery following a serious illness. All present wished Ian a full and speedy return to health and sent their good wishes.

Twelve new members had joined ICES since the previous meeting in San Antonio in November 2000. Between November 2000 and the meeting in St. Paul in June 2001, four new members joined:

- Dr Ralf Bodemann, Siemens, Germany
- Dr Sakari Lang, Nokia, Finland
- Dr Sheila Johnston, Independent Consultant, UK
- Dr Peter Gajsek, Institute of Public Health, Slovenia

Between St. Paul in June, 2001 and Luxembourg in December 2001, a further four new membership applications were accepted:

- Dr Thanh Dovan, Powernet, Australia
- Dr Eric van Rongen, Health Council, The Netherlands
- Dr Patrick Mason, USAF, Brooks AFB, San Antonio
- Dr Georges Goldberg, retired former Chairman of IEC Advisory Committee on Electromagnetic Compatibility, Switzerland

Since Luxembourg, yet four more new membership applications had been accepted.

- Dr James NcNamee, Health Canada, Canada
- Dr Gregor Durrenberger, Federal Institute of Technology, Switzerland
- Dr Dennis Blick, Veridian Engineering, San Antonio
- Prof Linda de Jager, Head, School of Health Technology, Bloemfontein, South Africa

9. International Liaison Chairman’s Report

M. Murphy presented the report. He described upcoming recent international standards meetings, future meetings, ongoing standards projects and NATO activities. (See Attachment 4.) McManus recalled David Black’s excellent presentation in Helsinki. He said that he was limited to 25 minutes at that meeting so he invited him to give an open ended talk in Dublin—which he could barely complete in two and one-half hours. (See Attachment 5 for a summary of the Helsinki presentation.) D. Blick expressed appreciation for the international efforts of McManus and Murphy. He said that he now has six reviewers from outside of the US on his in vivo literature evaluation group.

10. Report on ICES and Fundraising

Osepchuk reviewed the earlier efforts at fundraising by Tom Budinger – then the chairman of SCC-28. He also mentioned the recent meetings with Jerry Walker, IEEE Standards
Department Manager of Business Development. He also met with Harry Epstein, Standards Board member with SCC oversight, seeking direction from the Standards Board regarding potential contributors, e.g., IEEE Societies. He pointed out that he would again be meeting with Walker in March to discuss the issue further.

11. Reports from the Subcommittees

a) SC-1 (measurements and computation). H. Bassen reported that the revision of C95.3-1991 – *Recommended Practice for Measurements and Computations with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 100 kHz to 300 GHz* was approved by SC-1 with one initial ballot and one recirculation ballot. The draft was submitted to the IEEE Standards Department for editorial review (SCC-10 and SCC-14) and an ICES balloting group is now being formed – invitations to ballot should be sent by the IEEE Balloting Center within the next two weeks.

Bassen also reported that a motion by SC-1 was approved to reaffirm P1460-1996 – *IEEE Guide for the Measurement of Quasi-Static Magnetic and Electric Fields* rather than revising and extending the guide to cover the frequency range of 0 to 100 kHz. SC-1 will coordinate with the Power and Engineering Society regarding the reaffirmation. A new project, a recommended practice to cover 0 to ≥100 kHz (PC95.7?) will be submitted to NesCom – C95.3 will be used as a model for the new project. A working group was established to draft an outline – additional members will be solicited. Section editors will be assigned after the outline is complete – members from the product/appliance fields will be included.

b) SC-2 (symbols, warning signs terminology and units and hazard communication). R. Tell reported that the last meeting of SC-2 was held September 11 and 12, 2001 but was curtailed by the terrorist events in NY and the Pentagon. He explained that the current draft of the practice on RF safety programs still needs work and that the committee would probably meet next in Quebec. He also mentioned that there is a possibility that sections of the draft may be used in the revision of C95.1.

c) SC-3 (low-frequency exposure limits). K. Jaffa reported that Reilly gave a presentation on spatial averaging at Friday’s SC-3 meeting. Comments on the last draft were also discussed at that meeting. All negative comments, except those of one person, have been resolved and the draft is ready for ballot. The invitation to ballot should be sent to the balloting pool by IEEE during the next few days – IEEE agreed to shorten the term to respond to the invitation to 3 weeks. The goal is to try to submit the standard to the Standards Board in time for their June meeting.

d) SC-4 (RF exposure limits). J. D’Andrea discussed the literature evaluation process and complimented the evaluation working group chairmen. He noted that C. K. Chou has put in a tremendous effort organizing and co-chairing the Revision Working Group meetings. He reviewed the list of questions developed at the SC-4 meeting (see the ICES website for the SC-4 meeting minutes) and discussed the rationale for support or rejection of each. He pointed out that SC-4 would distribute and formally answer each of the questions raised by the RF Inter-Agency
Working Group. R. Weller asked if the measurement distance specified in the draft revision of 1991 standard would conflict with C95.3 – Petersen said that it is possible. If there is a conflict between the two standards, a corrigendum could be issued. Weller then questioned why SC-4 was even getting into the measurement distance issue.

Chou then reviewed the timetable for the completion of the revision. He explained that SC-4 is about half way through the literature evaluation process and more than one-half of the white papers have been completed.

e) SC-5 (safe distances from RF sources during blasting operations). Petersen paraphrased the report from DeFrank and Koban – both of whom were on temporary assigned duty with the military. The PAR for C95.4 (formally P1472), entitled Recommended Practice for Determining Safe Distances From Radio-frequency Transmitting Antennas When Using Electric Blasting Caps During Explosive Operations, was extended by the Standards Board until December 2002. The reason for the extension is to accommodate another recirculation that is necessary to address comments from SCC-14 and the Institute of Makers of Explosives. Both cochairman feel confident that C95.4 will be ready for recirculation by March 02.

In response to a question from Fichtenberg, Petersen said that dealing with hidden or camouflaged sources near blasting operations is not specifically dealt with in C95.4. Proctor noted that the issue is similar to working in manholes – it is up to the worker to assess any potential threats.

12. New Business
M. Meltz asked if there was a leadership manual for ICES, e.g., documentation that outlines the responsibilities of the chairman, secretary, treasurer etc. and suggested that one be developed if there is not. He also asked if a recurrent calendar is kept – he suggested posting one if it isn’t. The answer to both questions was no. Meltz said that the point is to have documentation that describes the duties of each of the officers for new members who desire to attain a leadership position on ICES. McManus supported the idea. He said that the IEEE is a mystery to many of the new members and simplified explanations are needed. He also suggested that the leadership should be more firm and insist that IEEE representation be present at the ICES meetings.

FOR ACTION
Petersen will have the ICES Operating Procedures posted on the web.

13. Next Meeting
The next meetings ICES and its subcommittees will be immediately after the BEMS meeting. The meetings, which will be held in Quebec City, will begin at 1300 h, Thursday27, 2002. A schedule will be sent and posted on the web in March or April.

14. Adjourn
There being no further business, upon a motion by A. Varanelli and a second by T. Dovan, the meeting was adjourned at 1145 h.
Attachments

ICES/SCC-28 Meeting
Sheraton Gunter Hotel
San Antonio, TX
January 20, 2002
8:00 AM – Noon

1. List of Attendees
2. Approved Agenda
3. IEEE Committee Member Indemnification Statement
4. International Liaison Presentation
5. Summary of David Black’s Helsinki Presentation
**Attendance List**

*Sheraton Gunter Hotel*

**San Antonio, TX**

**January 20, 2002**

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M = Member  
O = Observer
# Preliminary Agenda

1. Call to Order: Adair  
2. Approval of Agenda: Adair  
3. Approval of June 10, 2001 Minutes: Petersen  
4. Executive Secretary’s Report: Petersen  
5. IEEE Standards Activities Report: Ortiz  
6. Chairman’s Report: Adair  
7. Treasurer’s Report: Varanelli  
8. Membership Chairman’s Report: McManus  
9. International Liaison Chairman’s Report: Murphy  
11. Reports from the Subcommittees: Adair  
12. New Business: Adair  
13. Plans for Future Meetings: Adair  
14. Adjournment: Adair
IEEE Indemnification Statement

IEEE Bylaws: Section I-300 (Management/General)

3. Indemnification. To the extent permitted by law, IEEE shall indemnify (i) each Director, Officer, former Director and former Officer of IEEE, (ii) each person who serves as a duly authorized voluntary member or employee of a duly authorized IEEE activity, (iii) each person who shall have served at the request of IEEE as a Director or Officer of another organization, against judgements, fines, amounts paid in settlement and reasonable expenses, including without limitation attorney's fees and expenses, actually and necessarily incurred by such person in connection with the defense of any action, suit, or proceeding to which such person is made or threatened to be made a party by virtue of such service; provided (i) that such service is found by the Board of Directors to have been duly authorized and is not found by the Board of Directors to have been taken in bad faith or in a manner inconsistent with the purposes or objectives of IEEE as expressed in Bylaws, IEEE Policy and Procedure Manuals, or resolutions duly adopted by the Board of Directors or Executive Committee or in policies and procedures duly adopted by an IEEE organizational unit which are applicable to the activity at issue, (ii) the person to be indemnified has otherwise met the standard of conduct set for the in Section 722 or established by Section 721 of the New York Not-For-Profit Corporation Law, and (iii) that such indemnification is not otherwise prohibited by law. The foregoing right of indemnification shall not be exclusive of other rights to which such person may be entitled.
TOPICS

• Recent International Standards Meetings

• Future Meetings

• Ongoing Standards Projects

• NATO Activities
2001: ICES Heard ‘Round the World’

• WHO EMF Regional Meeting – Varna, Bulgaria, April
  • ICES represented by Michael Murphy (20 min talk)

• European Bioelectromagnetics (EBEA) Meeting, Helsinki, Sept.
  • Excellent talk emphasizing ICES standards by David Black

• WHO EMF Regional Meeting, Seoul, South Korea, October
  • ICES represented by Patrick Mason (30 min talk)

• European Commission EMF Meeting, Luxembourg, December
  • ICES represented by Ellie Adair

• ICES Special Meeting, Luxembourg, December

• WHO EMF Regional Meeting, Cape Town, South Africa, December
  • ICES represented by Vitas Anderson (45 min talk)
WHO EMF Regional Meeting, Seoul, South Korea

Standards Presentations
- ICNIRP
- IEEE (ICES)
- New Zealand/Australia
- China
- Japan
- Malaysia
- Korea
Korean EMF Standards

- Closely follows ICNIRP Guidelines except
  - Limits for induced currents, contact current, & pulsed EMF are not included
- Mobile phone limits are based on IEEE C95.1
WHO EMF Regional Meeting, Seoul, South Korea
Future Meetings

• Bioelectromagnetics Society (ICES meets just before)
  • June 23-27

• URSI 27th General Assembly – Maastricht, NL, 17-24 Aug, 2002
  • Not much expected on standards

• WHO EMF & Human Health. Researches & Standards
  • 3rd Int. Conference. Moscow & St. Petersburg, 23-27 Sept 2002

• Biological Effects of Electromagnetic Fields: 2nd Int Congress
  • Rhodes, Greece, 7-11 October 2002
  • Not much expected on standards?

• WHO Regional Meeting on EMF Health and Standards Harmonization
  • Guilin, China, 28-31 October 2002
  • http://www.who.int/peh-emf/
WHO EMF & Human Health. Researches & Standards
Moscow & St. Petersburg, 23-27 Sept 2002

Moscow – 23-24 Sept
St. Petersburg – 25-27 Sept
Abstracts due March 1, 2002

Chairman
Yurgrigor@cityline.ru

Chair Man
WHO Regional Meeting on EMF Health and Standards Harmonization, Guilin, China 28-31 October 2002

http://www.chinavista.com/travel/guilin/guilin01.html
Ongoing International Standard’s Projects

Basic Materials for EMF Standards in Former Soviet Union
- Funded by USAF
- Chaired by Yuri Grigoriev, Russia
- Results to be reported at WHO Russia meeting 2002

Criteria for Standards in the Field of Radio Frequency Radiation in Some East European Countries
- Funded by USAF
- Chaired by Michel Israel, Bulgaria

Database of World EMF Standards
- Funded by WHO
- Organized by Dina Simunic, Croatia
General Medical Working Group (MED)
50\textsuperscript{th} meeting: Brussels, BE 10-16 Jun 2001

- Standardization Agreement (STANAG) 2345 *Evaluation And Control Of Personnel Exposure To Radio Frequency Fields - 3 KHz To 300 GHz (EDITION 3, Ratification Draft)*: Submitted for ratification

- Based primarily on C95.1 – Occupational limits

- Modifications based on report organized by Dr. Marvin Ziskin
  - New medical reporting proforma
  - New “Actions to be taken in case of a suspected or actual overexposure above PEL”
  - New “The Role of the Physician”
Presentation in Dublin

“Health Issues and the Role of Standards and Safety Factors in respect of Cellphone Technology in the context of Public Requirements for a Precautionary Approach”

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An informal colloquium organised by the Department of Public Enterprise

Date: 20 September 2001
Venue: ESBI, St Stephen’s Green, Dublin

Participants:
Ms Olivia Dobbs - Public Affairs Manager Eircom
Mr John McAuley - Managing Director, Compliance Engineering, Ireland
Mr Joe McEnri - EMF Advisor, ESBI
Dr Tom McManus - Chief Technical Advisor, Department of Public Enterprise
Dr Mary O’Mahony - Specialist in Public Health Medicine, Southern Health Board
Mr Fred Quinn - Radio Planning Manager, Eircom
Dr William Scanlon - Director, Centre for Communications Engineering, University of Ulster
Professor Philip Walton - Department of Physics, University College, Galway
Elaine Robinson - Senior RF Engineer

Standards for regulating human exposure to ultra high frequency radio-signals first appeared in the 1950’s, and since then have become well established, stable and coherent. Most modern standards are based on dosimetric techniques of estimating and limiting the amount of energy which may be deposited in body
tissues by internal fields resulting from exposure to external radiation or electromagnetic fields. Such standards have evolved over four decades and the process by which this development and refinement has occurred is, to some extent independent of the ongoing validation which has resulted in continued acceptance and application of contemporary RF standards.

It is widely accepted that current standards, such as those published by IEEE and the Guidelines published by ICNIRP are referenced to thresholds of observable and repeatable effects. Tissue heating predominates at high frequencies, and so the onset of detectable disturbances to thermal homeostasis forms the basis of the lowest observable effect threshold used by RF standards above 10MHz.

It is also widely accepted that the standards incorporate factors for safety and uncertainty as well as for population variability, although the exact magnitude of these factors is rarely defined. A figure of 50 is widely quoted and this idea is based on the approach taken by the earliest dosimetric standards. A factor of 10 had been applied to a benchmark shown to be associated with a defined and repeatable adverse effect, that of whole body heating in small experimental animals. Later when public standards were developed, a further factor of 5 was applied, initially on the basis of time-dose equivalence. However, there has never been any confirmation of an effect from accrued energy, and so the additional factor of five came to be justified on other grounds.

Later research showed that the inevitably non-uniform nature of energy distribution in animals exposed to RF could result in localised areas of heat deposition up to 20 or 25 times higher than the whole body average. It appears to be as a result of this observation that the much higher limits for partial body exposure were allowed on the basis that these were equivalent to the localised effects which would result from non-uniform effects of whole body exposure.

Two or three decades ago, it was unlikely that there could have been anticipation of the importance which partial body exposure parameters would assume in the late 20th century as a result of the miniaturisation of electronics and the development of the mobile telephone and similar devices. More recent research allows for considerable review of the adequacy of the approach to standard setting which has resulted from
this evolution. Techniques of computational dosimetry have advanced since the first phantom modelling was undertaken 30 years ago.

The Finite Difference Time Domain (FDTD) method has been progressively enhanced and provides by far the greatest number of relevant literature citations on SAR distribution. This work has found that the derived partial body exposure limits do provide adequate protection, although perhaps not with the degree of equivalence in different exposure conditions intended by the original safety factors.

The ICNIRP figure of 2W/kg for continuous localised exposure to the head and trunk remains well supported [1, 2], although the occupational level of 10W/kg may be close to biological effects of evolving interest.

There are important differences in the way in which standards are applied to conditions of localised near-field exposure, such as cellphone handsets and whole body far-field exposure. In the handset example, the nature of close-coupling to tissue means that only a proper estimation of actual absorption is satisfactory and so the parameter of Specific Absorption Rate (SAR) is universally used. The Specific Absorption (SA) (rather than its rate) is only used in standards where integrated energy from pulses must be considered. This is reasonable because of the well accepted understanding that the ultimate fate of absorbed electromagnetic energy is heat, and this is conducted and dissipated by body tissues in a manner which eventually becomes stabilised into an equilibrium of heat gradient. For this reason, time and mass must also be specified.

In the case of whole body exposure, the external fields, on which internal fields depend may be reasonably estimated by knowing the incident power density. This parameter is readily measured in free space by conventional radio-engineering methods. Such power density limits are therefore specified in most standards as a means of demonstrating compliance and in IRPA or ICNIRP derived standards they are known as “reference levels”. However, the correlation between incident power density and ultimately absorbed SAR depends on many other factors, including body shape and size and so conservative correlations in determining reference levels are inevitable. In practice, these result in an additional safety
factor, the magnitude of which is highly variable and not always logically based [3].

Much more exact data than ever available before has been published in recent years as a result of the work by Adair [4-7] which quantifies actual levels of absorption using human volunteers exposed to plane waves from a radio-transmitter under well controlled conditions. The knowledge afforded by the accumulated body of science over the last 30 years, makes it possible to revisit estimates of the safety factors which are intrinsic in modern dosimetric standards and compare them with those originally intended.

In most cases, standards turn out to be safer than they were originally designed to be, however the variance discovered between exposure under different conditions raises a question as to whether a common margin of protection throughout such standards should really be implied. This is of particular relevance at a time when calls are being made in some quarters for a precautionary approach to RF exposure and various techniques including field strength reduction are proposed. Any such intervention cannot sensibly be made without first having an understanding of the safety factors built in to the reference levels which are initially applied. The idea of applying a precautionary approach to RF standards immediately runs into difficulties, which are largely related to uncertainty as to what the precautions are being taken against [8].

Standards intend, and in the vast majority of cases certainly do, provide absolute protection against any known adverse effect. In addition, by definition, any precaution which lowers exposure must do so by further increasing an already present safety margin or decreasing time of exposure. Both have been advocated and continue to be promoted as a means of dealing with escalating public concern. In some jurisdictions standards with lower reference levels have been promoted (eg. Switzerland), whereas in other cases limitation of exposure time has been suggested as having some possible merit (eg. Poland).

Recently, in the United Kingdom, the Stewart Committee [9] has suggested limiting exposure to a sub-population hypothesised to be more sensitive to the adverse effects of RF, citing children. This is an extraordinary step to take with a standard designed for public health protection as it implies that one group of the public are not entitled to the same level of protection as another. Stewart also suggested that there may be merit in limiting time of exposure by suggesting a possible safety advantage in keeping cellphone
calls short. This idea effectively hypothesises that any effect might be cumulative over time.

Such advice appears to be a contradiction of the principle of the ICNIRP approach which clearly specifies standards as intended to provide protection for continuous exposure 24 hours a day, 365 days a year [10]. In fact, the idea of time-dose integration appears to be the rationale for the original application of an additional factor of five when the whole body public exposure limit recommended by IRPA was reduced from 0.4 W/kg to 0.08 W/kg. However, the absence of any physical basis for this additional factor appears to have resulted in a changed justification for this factor in the current ICNIRP documents.

Some standards and authors have recommended a precautionary approach not based on lowering thresholds or standards but, depending on an assurance of demonstration that best contemporary practice is being applied. Such an approach is consistent with advances in technology and resource management in general and with continuous improvement in environmental practices. Experience with such an approach in New Zealand [11] has been positive and will continue (see Appendix 1, Section 10 of NZS2772 [11]). A similar provision has been included in the new Australian Standard [12]. This approach is supported by several authors including with the WHO [13-15]. However, in midst of all of this work, it is hard to find clearly estimated and published data regarding the true safety factors which are incorporated in modern standards, even against known and repeatable effects.

References:


Appendix 1

Clause 10 from the New Zealand Standard NZS2772: Part 1: 1999

Clause 5.3 from Draft Protection Standard “Maximum Exposure Levels to Radiofrequency Fields - 3kHz to 300GHz” Radiation Protection Series Publication No. 3
10 PROTECTION – GENERAL PUBLIC EXPOSURE

Measures for the protection of members of the general public who may be exposed to RF fields due to their proximity to antennas or other RF sources shall include the following:

(a) Determination of the boundaries of areas where general public exposure limit levels may be exceeded.

(b) Restriction of public access from these areas where the general public limits may be exceeded.

(c) Appropriate provision of signs or notices complying with AS 1319.

(d) Minimizing, as appropriate, RF exposure which is unnecessary or incidental to achievement of service objectives or process requirements, provided that this can be readily achieved at modest expense.

NOTE – Although ICNIRP considers that the basic restrictions and reference levels in this Standard provide adequate protection, it is recognized that community concerns over RF exposure may be able to be addressed by further minimization of exposure in accordance with the requirements of item (d).

(e) Demonstration that installations are planned and operated in accordance with appropriate industry best contemporary practice.

(f) Notification of the competent authority, as required, in the event of the exposure exceeding the relevant limits.
5.3 PROTECTION-GENERAL PUBLIC EXPOSURE

Measures for the protection of members of the general public who may be exposed to RF fields due to their proximity to antennas or other RF sources must include the following:

(a) Determination of the boundaries of areas where general public exposure limits levels may be exceeded.

(b) Restriction of public access from these areas where the general public exposure limits may be exceeded.

(c) Appropriate provision of signs or notices complying with AS 1319 (Standards Australia, 1994).

(d) Notification to the competent authority, as required, in the event of the exposure exceeding the relevant limits.

(e) Minimizing, as appropriate, RF exposure which is unnecessary or incidental to achievement of service objectives or process requirements, provided this can be readily achieved at reasonable expense. Any such precautionary measures should follow good engineering practice and relevant codes of practice. The incorporation of arbitrary additional safety factors beyond the exposure limits of this Standard is not supported.