ICES

International Committee on Electromagnetic Safety

ICES (SCC-39) Annual Report: 2008 – 2009

Includes

Technical Committee 34 (Product Safety Relative to the Safe Use of Electromagnetic Energy)

and

Technical Committee 95 (Safety Levels with Respect to Human Exposure to Electric, Magnetic and Electromagnetic Fields)

1 December 2009

CONTENTS

ICES (SCC-39) Annual Report: 2007 – 2008

1. Scope

"Development of standards for the safe use of electromagnetic energy in the range of 0 Hz to 300 GHz relative to the potential hazards of exposure of humans, volatile materials, and explosive devices to such energy. Such standards will be based on established effects and include safety levels for human exposure to electric, magnetic and electromagnetic fields, including induced currents from such fields, methods for the assessment of human exposure to such fields, standards for products that emit electromagnetic energy by design or as a by-product of their operation, and environmental limits."

The structure of ICES/SCC-39 is shown below in Figure 1.

2. Administrative Committee (AdCom)

2.1 AdCom Membership

The membership of the AdCom is shown below in Table 1; additional "at large" members are being sought, particularly from outside the US.

2.2 AdCom Activities

AdCom members continue to interact with the World Health Organization (EMF Project) and the International Commission on Non-Ionizing Radiation Protection (ICNIRP) to explore paths toward international harmonization of standards for the safe use of electromagnetic energy. The increased international ICES membership is providing greater influence within the international community. ICES representatives regularly participate and give presentations on the role of ICES in international standard setting at important international meetings, such as the following: the WHO EMF Project International Advisory Committee; PIERS (Progress in Electromagnetics Research Symposium; URSI (Union Radio-Scientifique Inter-nationale); ITU (International Telecommunications Union); IEC (International Electrotechnical Commission), ICNIRP, IEEE EMB-S; the Bioelectromagnetics Society (BEMS); the October 6 – 9, 2009 workshop sponsored by the EU Presidency and the Commission on Worker Safety held in Umea Sweden; and at the November 19 – 20, 2009 Global Coordination of Radiofrequency Communication Research and Health Policy meeting in Melbourne Australia. ICES members also play a role in drafting public documents on contemporary RF safety issues, e.g., the former Chair of the ICES Membership Committee, Tom McManus, was the main author of the WHO Model Legislation document, which included finding common ground where different opinions existed.

ICES members including, Dr. Michael Murphy (Chairman of the ICES Membership Committee), Mr. Art Thansandote (Co-chairman of TC95/SC4), Dr. J. Patrick Reilly (member of TC-95/SC-3 and a major contributor to IEEE C95.5-2002 – R2007) represented ICES (by invitation) at a number of ICNIRP Collaboration Meetings and prepared critiques of ICNIRP documents (also by invitation). Other AdCom members, including ICES Chairman Dr. Ralf Bodemann, also represent ICES at ICNIRP meetings worldwide.

2.3 Highlights (2008 – 2009)

- The Administrative Committee (AdCom) met in Dallas, San Diego, Plantation, FL, Davos, Switzerland, and several times between these meetings by teleconference. In addition to other duties, the ICES AdCom plans and arranges meetings of TC 34 and TC 95 and their subcommittees, and approves (or rejects) applications for membership on the ICES technical committees. Dr. Ralf Bodemann (Siemens AG, Germany, and ICES Chairman), Dr. Tom McManus (consultant to the Irish Department of Communications and Natural and Marine Resources, AdCom "at large" member and former Membership Chairman), Dr. Sheila Johnston (independent consulting neuroscientist from Ireland, AdCom "at large" member and former Membership Chairman), and Dr. Michael Murphy (US Air Force Research Laboratory, Brooks City Base, TX, Membership Chairman) have become ICES roving ambassadors to the EU member states. Each has given several presentations in support of ICES and the IEEE open consensus process for standards setting. Murphy is also President of the Bioelectromagnetics Society (BEMS – the pre-eminent Society for the study of the interaction and effects related to the exposure of living systems to electric, magnetic and electromagnetic fields at frequencies below 300 GHz. He and several other ICES members serve as ICES liaison to the BEMS Board of Directors. Dr. C-K Chou (Motorola Enterprise Mobility Solutions and TC95 Chairman) has given numerous presentations on IEEE ICES standards in China, Egypt, France, Japan, Malaysia, Singapore, South Africa, and Taiwan.
- In May 2009, the IEEE entered into a Technical Cooperation Agreement (TCA) with the NATO Standardization Agency (NSA) in order to share knowledge of each organization's standards development activities. The objective of the agreement is to avoid duplication of technical standards whenever possible. In addition, on 30 July 2009, ICES entered into a Specific Agreement with the NSA for the conversion of the standard covered by NATO STANAG 2345 Med. (Edition 3) – "Evaluation and Control of Personnel Exposure to Radio Frequency Fields – 3 kHz to 300 GHz," into an IEEE Standard. The result of this agreement is standards project (PC95.1-2345) that is now being developed by an ICES TC95 SC-3/SC-4 working group.
- Following circulation of an IEC TC106 "Q" document titled "Establishment of joint IEC TC106 – IEEE SCC-39/TC-34 projects on the evaluation of specific absorption rate (SAR) using numerical techniques," ICES TC-34 will be submitting three draft standards to be jointly developed by IEC and IEEE and published as dual logo standards.
- While attending the November 2009 Global Coordination of Research on Electromagnetic Fields and Health (GLORE) Workshop in Melbourne, Australia, TC-95 Chairman, Dr. C-K Chou, took the opportunity to organize a meeting of local TC-95 members to discuss national and international ELF & RF standard development activities.

2.4 Policies and Procedures

The ICES Policies and Procedures were accepted by AudCom and the SASB at the June 2007 meeting.

2.5 ICES Website

AdCom members have recently completed a new ICES website (http://www.ices-emfsafety.org/), which includes separate sections for TC-34 and TC-95 with public and private sections for the main committees and the subcommittees (ICES owns the domain); File Transfer Protocol (FTP) services for subcommittee activities are also included. In addition, TC-34 maintains the following websites:

http://grouper.ieee.org/groups/scc34/sc2/ (public),
http://grouper.ieee.org/groups/scc34/sc2/private/moindex.html (private).

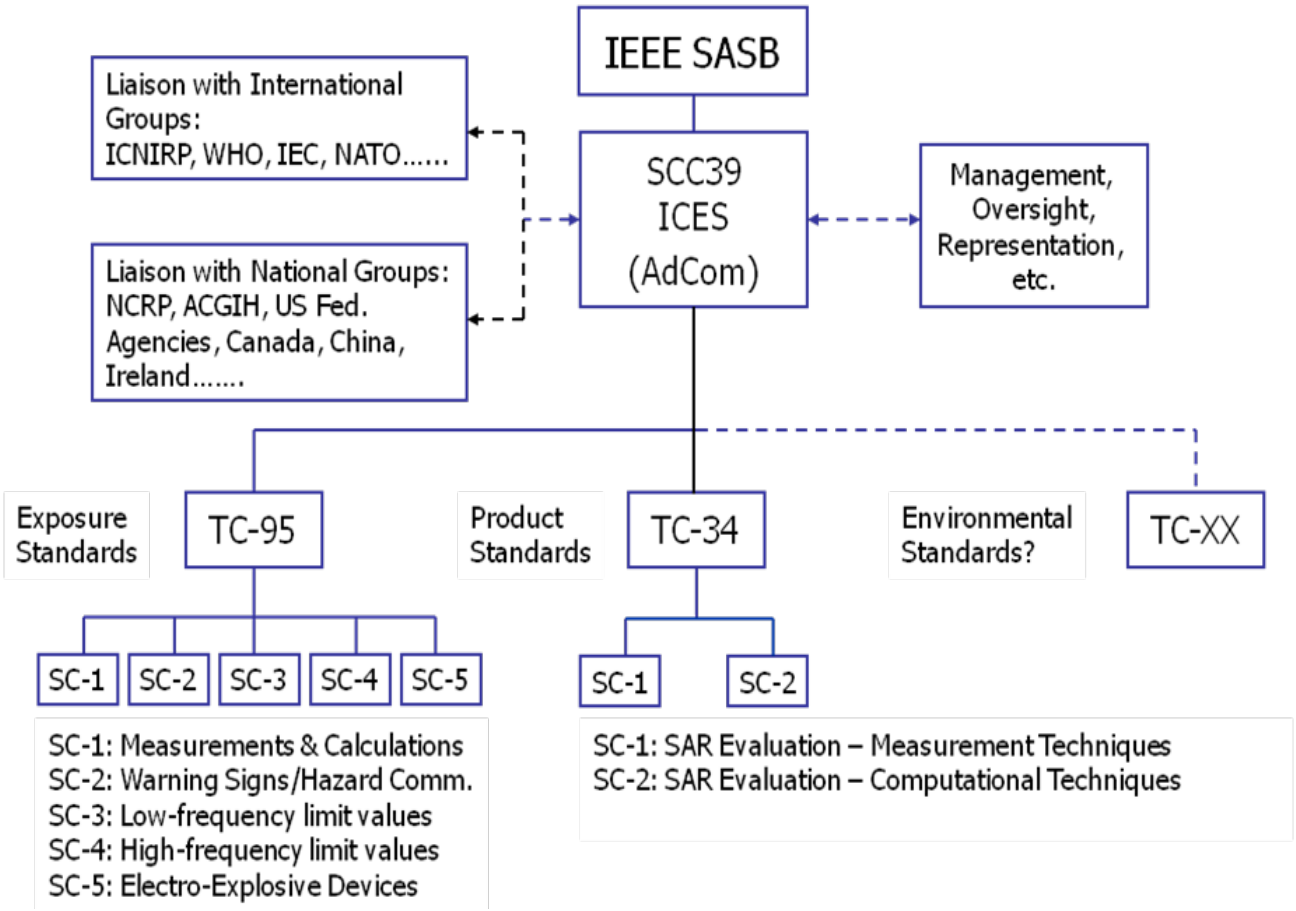

Figure 1—ICES Structure

Table1—ICES AdCom

OFFICE	NAME	AFFILIATION	COUNTRY
Chairman	Dr. Ralf Bodemann	Siemens AG	DE
Vice Chairman	Kenneth Gettman	NEMA	US
Executive Secretary	Ronald C Petersen	R C Petersen Associates LLC	US
Treasurer	Arthur Varanelli	Independent Consultant	US
Chairman, Memb. Comm.	Dr. Michael Murphy	Air Force Research Laboratory	US
Chairman TC-34	Dr. Wolfgang Kainz	USFDA/CDRH)	US
Chairman, TC-34/SC-1	Dr Mark Douglas	Found. for Research on Information Technologies in Society	CH
Chairman TC-95	Dr. C-K. Chou	Motorola Enterprise Mobility Solutions	US
Chairman TC-95/SC-1	Howard Bassen	USFDA/CDRH)	US
Chairman TC-95/SC-2	Richard Tell	Richard A Tell and Associates	US
Chairman TC-95/SC-3	Thanh Dovan	SP AusNet Pty. Ltd.	AU
Co-Chairman TC-95/SC-4	Art Thansandote	Health Canada	CA
Co-Chairman TC-95/SC-4	Dr Marvin Ziskin, MD	Temple University Medical School	US
Chairman TC-95/SC-5	Robert Needy	Naval Surface Warfare Ctr.	US
Chairman Emeritus	Dr. John Osepchuk	Full Spectrum Consulting	US
At Large Member	Dr. Sheila Johnston	Independent Consulting Neuroscientist	IE
At Large Member	Dr. Tom McManus	Consultant - Dept of Comm. & Marine &Natural Resources	IE
IEEE Staff Liaison	Bill Ash	IEEE Standards	US

3. Technical Committee-34

3.1 Scope

The scope of Technical Committee 34 (TC-34) is "The development of product performance standards relative to the safe use of electromagnetic energy for specific products that emit electromagnetic energy at frequencies between 0 and 300 GHz, i.e., the frequency range covered by the basic restrictions and maximum permissible exposure (MPE) values developed by the IEEE International Committee on Electromagnetic Safety (ICES)." (The scope remains the same as the scope of SCC-34 before reorganization.)

Standards developed by TC-34 are expressed in terms of easily measured parameters, e.g., output power, current, voltage, which are derived from the basic restrictions and MPE values found in the latest revisions of IEEE C95.1 and C95.6. Included in the scope are standards, guides and recommended practices that describe measurement and computational protocols for determining compliance with the basic restrictions and derived limits (MPEs) found in the IEEE C95 standards and in other relevant national and international standards and guidelines. This committee was originally a collaborative effort between IEEE and the Electromagnetic Energy Association (EEA); EEA was disbanded in August 2001.

3.2 Reorganization

The structure and activities of TC-34 were recently examined and a decision was made to re-organize the committee. Originally, TC-34 consisted of the following three subcommittees: SC-1 (Pleasure-boat radar), SC-2 (SAR evaluation), and SC-3 (Effectiveness of RF-protective clothing). Initially there was considerable interest in the activities of SC-1 and SC-3, but this interest has dwindled during the past few years. The decision was made to disband SC-1 until there is evidence of increased interest. SC-3 was also disbanded. The EMB-S Committee on Man and Radiation (COMAR) was be asked to consider drafting a technical information statement on pleasure boat radar. The remaining subcommittee, SC-2, was divided logically into two subcommittees—SC-1 (SAR evaluation—measurement techniques) and SC-2 (SAR evaluation—numerical techniques). SC-2 includes the following four working groups:

- WG-1 (General requirements for using the FDTD method for SAR calculations);
- WG-2 (Specific requirements for FDTD Modeling of vehicle mounted antenna configurations);
- WG-3 (Specific requirements for FDTD modeling of mobile phones/personal wireless devices);
- WG-4 (Requirements for using the finite-element method for SAR Calculations, specifically vehicle-mounted antennas and personal wireless devices).

The two subcommittees and their working groups are very active and hold face-to-face meetings and teleconferences several times per year. The face-to-face meetings are usually held in conjunction with IEC TC106/PT62209, which has a similar scope and with whom TC-34 has a Category D Liaison.

3.3 Membership Roster

See Table TC-34-2 (NOTE—All members listed are members of TC-34, TC-34/SC-1 and TC-34/SC-2, i.e., the members of SC-1 are also members of SC-2 and also members of TC-34, and vice versa.)

3.4 Meetings (2008-2010)

- February 11-14, 2008 – Plantation, FL including joint meeting with IEC TC106, Project Team 62209 (SC-2)
- April 17, 2008 – teleconference (SC-2)
- May 16 – 18, 2008 – Shanghai, China (SC-1 and SC-2) at the 2nd International Conference on Bioinformatics and Biomedical Engineering (ICBBE 2008)
- August 19, 2008 – teleconference (SC-1 and SC-2)
- October 22 – 24, 2008 – Paris, France (SC-1 and SC-2)
- December 9, 2008 – teleconference (SC-2)
- March 4-6, 2009 – Turin, Italy
- April 28, 2009 – teleconference
- June 19-22, 2009 – Davos, Switzerland
- August 25, 2009 – teleconference
- September 8-10, 2009 – Helsinki, Finland
- October 27, 2009 – teleconference
- November 30 - December 2, 2009 – Rio de Janeiro, Brazil
- January (date TBD), 2010 – teleconference
- March (date TBD), 2010 – Stockholm, Sweden
- May (date TBD), 2010 – teleconference
- June (date TBD), 2010 – Seoul, South Korea

3.5 Subcommittee activities

3.5.1 Subcommittee 1 (SAR evaluation – measurement techniques)

- Joint meetings were held (and continue to be held) with IEC TC-106 – PT 62209 to work on draft standard IEC 62209-2, "Human exposure to radio frequency fields from handheld and body-mounted wireless communication devices – Human models, instrumentation, and procedures – Part 2: Procedure to determine the specific absorption rate (SAR) for mobile wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)."

- An international multi-laboratory comparison of computed SAR in an anthropomorphic, dielectric-filled head phantom was initiated in August 2009. The project involved numerical simulations taken in nine labs in Asia, Europe, and North America. This inter-comparison was completed in November 2009. The results will be published in the appropriate technical journal.

- **P1528:** Work has begun on the revision of IEEE 1528 (which also extends the frequency range of SAR measurement standards up to 6 GHz) with the collaborative efforts of IEC P62209. In addition, SC-1 is collaborating with PT62209 toward the development of standards for devices held within 20 cm of the body (including body-worn, hand-held and desktop devices). It has been proposed that this work should be directed towards a jointly developed standard bearing a dual IEC/IEEE logo. This would further strengthen the harmonization of international standards.

3.5.2 Subcommittee 2 (SAR evaluation – numerical techniques)

3.5.2.1 P1528.1:

- The section on the evaluation of the numerical uncertainty of FDTD simulations of 1528.1 has been finalized. It defines general methods for assessing the contribution of typical uncertainties of the FDTD technique, such as absorbing boundary conditions, grid resolution, etc., on the numerical model. The validation of the numerical model of the device under test requires basic experimental evaluation.

- The section for the code validation of 1528.1 has been finalized. It describes novel methods to evaluate the accuracy of standard FDTD implementations and possible extensions. Moreover, a set of generic benchmarks has been defined which allow the correct functioning of the FDTD simulation platform. Reference results for all benchmarks have been provided.

- A particular geometry, the “SAR Star”, has been defined. It tests the implementation of the SAR averaging algorithm defined in IEEE 95.3 for symmetry, averaging in edges and pointed structures as well as gaps.

- A task force has been formed to provide guidelines on power normalization considering antenna mismatch, power regulation, digital modulation etc.

- An annex on anatomical modeling and representation of biological tissue has been added to 1528.1.

- A study group has been formed to analyze techniques for SAR calculation and averaging for planar and stair-cased surfaces considering alignment and tissue content of the cube as well as numerical uncertainties.

3.5.2.2 P1528.2:

- The section on uncertainty evaluation in P1528.2 has been drafted. General approach to evaluate uncertainties has been extensively discussed and agreed upon within the working group.

- The study on 1-g and 10-g average SAR computations and variability of the results has been conducted for the ideal layered brick model. The initial results provide enough data to identify and standardize the most robust and accurate algorithm for voxel SAR and average SAR evaluation. Once the selected algorithm is implemented in the numerical codes the similar study will have to be completed for the bystander and passenger models.

- The standard vehicle model was used in the inter-comparison study to evaluate variability of the computed incident fields from the vehicle mount antennas as part of the uncertainty budget in subsequent SAR simulation for the bystander model.

- A separate study is underway to evaluate the effect of different body sizes on the whole body average SAR. The study aims at evaluating appropriate scaling factors for the whole body SAR to be used with the standard bystander model currently defined in 1528.2.

3.5.2.3 P1528.3:

- The inter-laboratory comparison with CAD-based models has been completed and the results were presented at a workshop in conjunction with the meeting in Paris and also at the BEMS conference in Davos. It was decided at the Paris workshop to conduct additional simulations to identify the causes for the observed deviations between the laboratories, and this follow-up study was presented at the meeting in Turin. The main conclusion is that reproducible results can be obtained, which motivates the further work on the P1528.3 standard.

- A journal paper has been produced with the results from CAD-based cell phone inter-laboratory comparison; it is anticipated that it will be published in early 2010. There has not been much change in the P1528.3 draft during past year. There have been some discussions and inputs regarding the uncertainty section, but it was agreed that the changes will be considered together with the P1528.1 uncertainty section. The actual drafting process will continue after the 1st phase of inter-laboratory study is completed.

- Results from simulations of the generic CAD phone model have been produced by several laboratories and have been implemented in the benchmark validation section of the P1528.3 draft.

- The P1528.3 draft has been updated with the experiences obtained from the conducted inter-laboratory comparison. However, there remains work to be done to finally complete the uncertainty section, but it is agreed that the changes will be considered together with the P1528.1 uncertainty section.

3.5.2.4 P1528.4:

- An early version of a Recommended Practice has been produced that covers the same topics as P1528.1, P1528.2 and P1528.3 combined. The P1528.4 draft closely follows the earlier PARs and frequently refers to them, while changing FDTD specific guidelines into finite element analysis (FEM)-specific guidelines. As the P1528.1, P1528.2 and P1528.3 continue to grow and evolve, so will those of P1528.4.

3.6 TC-34 PARs

3.6.1 SC-1 PARs

3.6.1.1 P1528 (Approved June 2009)

Title: Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques

Scope: To specify protocols for the measurement of the peak spatial-average SAR in a simplified model of the head of users of handheld radio transceivers used for personal wireless communications services and intended to be operated while held next to the ear. It applies to contemporary and future devices with the same operational characteristics as contemporary devices that operate in the 300 MHz–6 GHz frequency range and provides a conservative estimate of the peak spatial-average SAR representative of that which would be expected to occur in the heads of a significant majority of persons during normal use of these devices, but which may not be the absolute maximum value that could possibly occur under every conceivable combination of head size, head shape, handset orientation, and spacing relative to the head.

Purpose: The purpose of this recommended practice is to provide a protocol for the measurement of the peak spatial-average SAR in an anatomical model of the human head of users of wireless handsets intended to be operated while held next to the ear. It provides the users with standardized and accepted protocols, measurement and validation techniques, and means for estimating the overall uncertainty in order to produce valid and repeatable data. Specific SAR limit values are not included since these are found in other documents, e.g., IEEE C95.1 and the International Commission on Non-Ionizing Radiation Protection (ICNIRP) guidelines.

3.6.2 SC-2 PARs

3.6.2.1 P1528.1 (Approved September 2005; PAR extension request submitted October 2009)

Title: Recommended Practice for 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 Difference Time Domain (FDTD) Method for SAR Calculations

Scope: This recommended practice describes the concepts, anatomical models for compliance assessments, techniques, validation procedures, uncertainties and limitations of the finite-difference time-domain technique (FDTD) when used for determining the spatial peak specific absorption rate (SAR) in standardized human anatomical models exposed to wireless communication devices. Recommendations for standardized anatomical models and general benchmark data for these models are provided. Specific SAR limit values (basic restrictions) are not included since these are found in other documents, e.g., IEEE C95.1-200X.

Purpose: The purpose of this recommended practice is to specify numerical techniques and standardized anatomical models used for determining the spatial peak specific absorption rates (SAR) in the human body of users for wireless communication devices. SAR is determined by applying Finite Difference Time Domain (FDTD) techniques to

simulate the field conditions produced by wireless devices in anatomically correct models of the human anatomy. Intended users of this practice will be (but will not be limited to) wireless communication device manufacturers and wireless service providers that are required to certify that their products comply with the applicable SAR limits, and government agencies.

3.6.2.2 P1528.2 (Approved September 2005; PAR extension request submitted October 2009))

Title: Recommended Practice for Determining the Peak Spatial Average Specific Absorption Rate (SAR) in the Human Body from Wireless Communications Devices, 30 MHz - 6 GHz: Specific Requirements for Finite Difference Time Domain (FDTD) Modeling of Vehicle Mounted Antenna Configurations

Scope: This recommended practice describes the concepts, techniques, vehicle models, validation procedures, uncertainties and limitations of the finite-difference time-domain technique (FDTD) when used for determining the spatial-peak specific absorption rate (SAR) in standardized human anatomical models exposed to vehicle mounted antennas. Recommended vehicle models and general benchmark data for these models are provided. Antenna locations, operating configurations, exposure conditions and positions of persons exposed to the vehicle mounted antennas are defined. Intended users of this practice will be (but will not be limited to) wireless communication devices manufacturers, service providers for wireless communication that are required to certify that their products comply with the applicable SAR limits and government agencies. Specific SAR limit values (basic restrictions) are not included since these are found in other documents, e.g., IEEE C95.1-200X.

Purpose: The purpose of this recommended practice is to specify numerical techniques, anatomical models, and vehicle models used for determining the spatial peak specific absorption rates (SAR) in the human body when exposed to vehicle-mounted antennas used by wireless communication devices. SAR is determined by applying Finite Difference Time Domain (FDTD) techniques to simulate the field conditions produced by wireless devices in standardized anatomically correct models of the human anatomy.

3.6.2.3 P1528.3 (Approved March 2006)

Title: Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Body from Wireless Communications Devices, 30 MHz - 6 GHz: Specific Requirements for Finite Difference Time Domain (FDTD) Modeling of Mobile Phones/Personal Wireless Devices

Scope: The scope of this project is to describe the concepts, techniques, models, validation procedures, uncertainties and limitations of the finite-difference time-domain technique (FDTD) when used for determining the spatial-peak specific absorption rate (SAR) in standardized human anatomical models. These models are exposed to personal wireless devices, e.g. mobile phones. It recommends and provides guidance on modeling of personal wireless devices and provides benchmark data for simulation of such models. It defines model contents and provides guidance on meshing and test positions at the anatomical models. This document will not recommend specific SAR values since these are found in other documents, e.g., IEEE C95.1-2005.

Purpose: The purpose of this document is to specify numerical techniques, and anatomical models to determine spatial peak specific absorption rates (SAR) in the human body of persons exposed to personal wireless devices. SAR will be determined by applying Finite Difference Time Domain (FDTD) techniques to simulate the field conditions produced by wireless devices. It will use standardized anatomically correct models of the human anatomy.

3.6.2.4 P1528.4 (Approved June 2008)

Title: Recommended Practice for Determining the Peak Spatial Average Specific Absorption Rate (SAR) in the Human Body from Wireless Communications Devices, 30 MHz - 6 GHz: Requirements for Using the Finite-Element Method for SAR Calculations, specifically involving Vehicle Mounted Antennas and Personal Wireless Devices

Scope: The scope of this recommended practice is to describe the concepts, techniques, models, validation procedures, uncertainties and limitations of the Finite-Element Method when used for determining the peak spatial average specific absorption rate (SAR) in standardized models of the human anatomy exposed to wireless communication devices, in particular vehicle-mounted antennas and personal wireless devices such as hand-held mobile phones. Guidance on modeling such devices and benchmark data for simulation are provided. It defines model contents, guidance on meshing and test positions at the anatomical models. This document does not recommend specific SAR values since these are found in other documents, e.g., IEEE C95.1-2005.

Purpose: The purpose of this document is to specify numerical techniques, anatomical models, and other models of the human anatomy and vehicles to determine the peak spatial average specific absorption rates (SAR) in the human body of persons exposed to wireless communication devices, in particular vehicle-mounted antennas and personal wireless devices, such as hand-held mobile phones. SAR is determined using a Finite-Element simulation of the electromagnetic field conditions produced by wireless devices in standardized models of the human anatomy. Intended users of this practice will be (but will not be limited to) wireless communication devices manufacturers, service providers for wireless communication that are required to certify that their products comply with the applicable SAR limits, and government agencies.

3.7 Drafts

3.7.1 SC-1 (Measurement Techniques)

A draft of P1528b (Amendment 2) was prepared and balloted by the subcommittee in April, 2007. It was decided at that time that because of the number of issues addressed it would be appropriate to revise the standard instead of completing an amendment. The PAR for P1528b was withdrawn and a PAR submitted for the revision of IEEE 1528-2003 (and 1528a-2005). A subcommittee draft of the revision was balloted in January 2009. Although the vote was unanimous in favor of the draft, a number of comments were submitted during the balloting process. The comments have largely been addressed, and sponsor ballot will commence late in December 2009 or early in 2010.

3.7.2 SC-2 (Computational Techniques)

Partial first working drafts of P1528.1, P1528.2 and 1528.3 have been prepared. Important decisions have been made and parameters defined, e.g., head model, electrical properties of

the dielectric phantom head material, distance between the handset and the head, measurement positions. A draft of P1528.4 has been prepared as well.

3.8 Objectives and goals for the past year and the TC's performance relative to meeting these goals and objectives.

3.8.1 SC-1 (Measurement techniques)

3.8.1.1 Objectives (2009)

- Hold ICES TC-34 SC-2 meetings, including joint meetings with IEC 62209 to foster harmonized measurement standards. (Met)
- Complete first draft of IEEE 1528b (Amendment 2) for subcommittee voting in 2008 and sponsor ballot in 2009. (Not met – P1528b was withdrawn and the 1528-2003/1528a-2005 are being revised instead)
- Withdraw PAR for IEEE P1528b (Met)
- Submit PAR for IEEE P1528-2005 revision (Met)
- Complete balloting draft of the revision of IEEE 1528-2003/1528a-2005 (Met)
- Continue to explore the process for jointly developed standards with IEC TC106 for the following: maintenance of IEC 62209-1 and the revision of IEEE 1528-2003; and draft IEC62209-2 and IEEE 1528. (Not Met)

3.8.1.2 Current levels of activity with milestones indicated

- Complete sponsor balloting draft of the revision of IEEE 1528-2003/1528a-2005 (4^{th} Q 2009)
- Submit RAR extension requests for P1528.1 and P1528.2 (4^{th} Q 2009)
- Initiate P1528 Sponsor ballot (1^{st} Q 2010)
- Continue to explore the process for jointly developed standards with IEC: for the following: maintenance of IEC 62209-1 and the revision of IEEE 1528-2003/1528a-2005 and draft IEC62209-2 and IEEE 1528 (3^{rd} Q 2010)

3.8.2 SC-2 (Numerical techniques)

3.8.2.1 Objectives (2009)

- Complete 1^{st} working draft of P1528.1 (Met)
- Complete 1^{st} working draft for P1528.2 (Met)
- Complete 1^{st} working draft for 1528.3 (Met)
- Prepare 1^{st} working draft of P1528.1 (Met)
- Develop a healed version of the SAM CAD files. A new approach is needed to solve the problem of a unified and healed SAM CAD model. (Ongoing)

- Submit PAR for new standard (P1528.4) to address numerical analyses techniques other than FDTD, e.g., the Finite Element Method as soon as it becomes more clear which direction the work develops. (Met-2008)

3.8.2.2 Current levels of activity with milestones indicated

- P1528.1 – complete subcommittee ballot draft (4th Q 2010)
- P1528.2 – complete subcommittee ballot draft (4th Q 2010)
- P1528.3 – complete subcommittee ballot draft (4th Q 2010)
- P1528.4 – complete 2nd working draft (2nd Q 2010)
- Develop a healed version of the SAM CAD files. A new approach is needed to solve the problem of a unified and healed SAM CAD model (Ongoing)
- Submit New Work Item Proposals to the USNC for P1528.1, P1528.2 and P1528.3 as jointly developed/dual logo TC-34/IEC TC106 standards projects (1st Q 2010)

3.9 Website

A website and reflector was set up several years ago for SC-2 (now SC-1 and SC-2) and operates successfully. All meeting minutes, action items, motions, and drafts are posted on the web – SC balloting is carried out electronically. The site has recently been updated and reorganized. Public areas contain links to other sites important for subcommittee activities, e.g., the USAF Dosimetry Handbook, Tables of Dielectric Properties of Tissues (Gabriel), schedules for meetings. A private area contains draft sections of the practice, the results of measurements on canonical models, etc.

The website URL is: http://grouper.ieee.org/groups/scc34/sc2/

A reflector was also set up. The address is stds-ices-tc34@ieee.org

3.10 IEEE Staff support requirements

Originally, secretarial services for SC-2 provided by the Cellular Telecommunications and Internet Association (CTIA) are now provided by volunteer committee members. Support in setting up meetings at IEEE Piscataway has been required in the past; availability of the IEEE Staff Engineer at meetings held at IEEE is desirable. Bill Ash is the Staff Engineer for both TC-34 and TC-95—his engineering background and broad knowledge of IEEE procedures is invaluable to this committee.

3.11 Liaison with other committees

Liaison with other committees occurs via the circulation of drafts, common meetings and common membership on committees such as CENELEC, IEC, ITU, ARIB and other standards developing organizations, and through a “Category D” liaison with IEC TC106/PT62209. Coordination has also been established with IEEE societies, e.g., EMC-S via representation on the Standards and Advisory Coordination Committee (SACCom).

3.12 Issues: Joint IEC/IEEE development project: IEC 62209 and IEEE 1528

Although P1528.1, P1528.2 and P1528,3 have been accepted in principle by IEC TC106 as jointly developed IEEE/IEC dual logo standards, TC-34 is still seeking IEC approval of IEEE P1528 and IEC P62209 as jointly developed IEC/IEEE standards projects.

Rationale: IEC TC106/PT62209 and IEEE TC-34/SC-1) have worked hand in hand to develop IEC 62209-1-2005 "Human Exposure to Radio Frequency Fields from Hand-held and Body-mounted Wireless Communication Devices - Human Models, Instrumentation, and Procedures - Part 1: Procedure to Determine the Specific Absorption Rate (SAR) for Hand-held Devices used in Close Proximity to the Ear (Frequency Range of 300 MHz to 3 GHz)" and IEEE 1528-2003 "IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques" and are now working together to develop Part 2 of 62209 and the revision of 1528-2005/1528a/2005. During the development of IEEE 1528-2003 and IEC62209-1-2005, a large number of TC-34 members also participated on the IEC PT, sharing drafts to ensure harmonization. Thus the two existing standards were developed jointly by many of the same people but issued separately as two distinct standards. PT62209 is now working on the maintenance of Part 1 and on Part 2 of the standard (to address body-mounted radios); TC-34 has a Category D Liaison with PT62209 for development of this project and is working with the IEC PT. Both groups have to a large extent common membership (45% of the 62209 PT are TC-34/SC-1 members; 40% of TC-34/SC-1 are members of PT62209). Moreover, during the past two years, the TC-34 WG and PT62209 have held 6 face-to-face meetings and a number of joint teleconferences. While these are dedicated to PT62209 business, or TC-34 business (to limit the time), the discussion topics are common to both WGs and members of both WGs participate.

These are important standards for the wireless communications industry where harmonization is critical. Having a single dual logo standard is important for a variety of reasons and both 62209 Project Team Leader and the leadership of TC-34/SC-1 believe that IEC 62209 and IEEE 1528 are ideal candidates for such a project.

3.13 Membership

See Table TC-34-2 for detailed membership information.

Table TC-34-1

TC-34 Leadership

OFFICE	NAME	AFFILIATION
Chair-	Dr. Wolfgang Kainz	US FDA/CDRH
Vice- chair	Dr. Mark Douglas	IT'IS Foundation
Secretary	Dr. John M. Osepchuk	Full Spectrum Consulting
Treasurer	Arthur Varanelli	Independent Consultant
Chair – SC-1 (SAR evaluation—measurement techniques)	Dr. Mark Douglas	IT'IS Foundation
Chair – SC-2 (SAR evaluation—numerical techniques)	Dr. Wolfgang Kainz	FDA/CDRH
Chair – WG-1 (P1528.1)	Andreas Christ	IT'IS Foundation
Chair – WG-2 (P1528.2)	Giorgi Bit-Babik	Motorola Labs
Chair – WG-3 (P1528.3)	Martin Siegbahn	Ericsson
Chair – WG-4 (P1528.4)	Martin Vogel	ANSOFT

Table TC-34-2
TC-34 Membership (December 2009)

	Last Name	First Name	Affiliation	Interest Category	Country
1.	Balzano	Quirino	University of Maryland	A	US
2.	Bassen	Howard	US Food and Drug Administration	G	US
3.	Beard	Brian	US Food and Drug Administration	G	US
4.	Bit-Babik	Giorgi	Motorola	P	US
5.	Bodemann	Ralf	Siemens	PI	DE
6.	Case	David	Cisco	P	US
7.	Chan	Kwok	US Federal Communications Commission	G	US
8.	Chang	Isaac	US Food and Drug Administration	G	US
9.	Chao	Justin	PC TEST	U	US
10.	Chen	Ji	University of Houston	A	US
11.	Choi	Hyung-Do	ETRI	P	KR
12.	Chou	C-K.	Motorola	P	US
13.	Christ	Andreas	IT IS Foundation	A	CH
14.	Davis	Chris	University of Maryland	A	US
15.	Derat	Benoit	Field Imaging	P	FR
16.	Dianyuan	Qi	CATR-MIIT	G	CN
17.	Douglas	Mark	IT IS Foundation	A	CH
18.	Faraone	Antonio	Motorola	P	US
19.	Forrester	John	Qualcomm	P	US
20.	Foster	Ken	University of Pennsylvania	A	US
21.	Francavilla	Mauro	Telecom Italia	P	IT
22.	Gabriel	Sami	Vodafone	P	UK
23.	Gallant	Josette	Industry Canada	G	CA
24.	Hamada	Lira	NICT	G	JP
25.	Harrington	Tim	US Federal Communications Commission	G	US
26.	Hauswirth	Steve	Motorola	P	US
27.	Hayes	Gerard	Sony Ericsson	P	US
28.	Heirman	Don	Consultant	P	US
29.	Hibi	Keiichi	Sharp	P	JP
30.	Hong-Bin	Jin	China Mobile	U	CN
31.	Joyner	Ken	Samsung	P	AU
32.	Jun	Haeyoung	Samsung	P	KR

	Last Name	First Name	Affiliation	Interest Category	Country
33.	Kainz	Wolfgang	US Food and Drug Administration	G	US
34.	Kenny	Jon	Sony Ericsson	P	UK
35.	Keshvari	Jafar	Nokia	P	FI
36.	Kuster	Niels	IT IS Foundation	A	CH
37.	Lee	Ae-kyoung	ETRI	U	KR
38.	Liu	Steve	PC TEST	U	US
39.	Loader	Benjamin	National Physical Laboratories	G	UK
40.	Lu	Lin	Qualcomm	P	US
41.	Magana	Luis	PC TEST	U	US
42.	Manteuffel	Dirk	Uni-Kiel	A	DE
43.	McIntosh	Robert	Telstra	U	AU
44.	Meier	Matthias	Motorola	P	DE
45.	Monebhurrun	Vikass	Supelec	A	FR
46.	Morrissey	Joseph	Broward College	A	US
47.	Nappert	Hughes	Industry Canada	G	CA
48.	Nicol	Stuart	Aprel	U	CA
49.	Niskala	Kai	Nokia	P	FI
50.	Onishi	Teruo	NTT DoCoMo	P	JP
51.	Park	DS	Samsung	P	KR
52.	Parmentier	Jack	Lenovo	P	US
53.	Penney	Chris	Remcom	P	US
54.	Petersen	Ron	Consultant	GI	US
55.	Poirier	Marcel	Industry Canada	G	CA
56.	Pokovic	Katja	SPEAG	P	CH
57.	Prokop	Alexander	CST	PM	DE
58.	Proulx	Stephane	Industry Canada	G	CA
59.	Roman	John	Intel	P	US
60.	Schiavoni	Andrea	Telecom Italia	U	IT
61.	Schulteis	Geoff	Sierra Wireless	U	US
62.	Seabury	Dave	ETS	P	US
63.	Shah	Yogi	Medtronic	P	US
64.	Shinji	Tanabe	Mitsubishi	P	JP
65.	Siegbahn	Martin	Ericsson	P	SE
66.	Simon	Winfried	IMST	P	DE
67.	Stéphane	Picard	Industry Canada	G	CA

	Last Name	First Name	Affiliation	Interest Category	Country
68.	Thors	Björn	Ericsson	P	SE
69.	Tornevik	Christer	Ericsson	P	SE
70.	Toropainen	Anssi	Nokia	P	FI
71.	Trinchero	Daniele	Polito	A	IT
72.	Vogel	Martin	Ansoft	P	DE
73.	Watanabe	Soichi	NICT	G	JP
74.	Whelan	Conrad	Acceleware	U	CA
75.	Wiart	Joe	ORANGE	U	FR
76.	Wittig	Tilmann	CST	P	DE
77.	Ye	Qiubo	Communications Research Center	G	CA

A = General Interest: Academic
G = General Interest: Government
GI = General Interest
P = Producer
U = User

4. Technical Committee -95

4.1 Scope

The scope of ICES TC-95 is:

"Development of standards for the safe use of electromagnetic energy in the range of 0 Hz to 300 GHz relative to the potential hazards of exposure of man, volatile materials, and explosive devices to such energy. It is not intended to include infrared, visible, ultraviolet, or ionizing radiation. The committee will coordinate with other committees whose scopes are contiguous with TC-95." (The scope remains the same as the scope of SCC-28 before reorganization.)

4.2 TC-95 Membership Roster

(See Tables TC-95-2 through Table TC-95-7.)

With the leadership of Dr. Sheila Johnston (former Membership Chairman), and Dr. Michael Murphy, Membership Chairman, the non-US membership of ICES continues to grow.

Several members of TC-95 have been inactive or have changed e-mail address and can no longer be contacted; their continuing status continues to be addressed by the Membership Committee. In terms of stakeholders, the membership continues to be well balanced. About 50% of the TC-95 membership are IEEE members, not all of which are SA members (there may be more IEEE and IEEE SA members than indicated on Tables TC-95-2 thru TC-95-7), which is to be expected and defended in view of the interdisciplinary nature of our membership. TC-95 is grateful for their voluntary contributions of talent and time under conditions where it would be an unreasonable imposition to require IEEE membership. TC-95 recognizes the financial burden for travel and loss of income generating business opportunity already born by many volunteers during TC-95 activities. However, IEEE SA membership is required of all TC-95 leadership (e.g., Committee and Subcommittee Chairs, Co-Chairs) and is encouraged for all members.

4.3 Meetings (2008-2010)

4.3.1 Main Committee

- June 8, 2008 – San Diego, CA
- December 4, 2008 – Fort Lauderdale, FL
- June 21, 2009 – Davos, Switzerland
- Januray 15, 2010 – Silver Spring, MD
- June 2010 – Seoul South Korea (in conjunction with the Bioelectromagnetics Society Annual Meeting – exact date TBD)

4.3.2 Subcommittee 1 (Measurements and Computation)

- Feb 7, 2008 – Teleconference
- Feb 19, 2008 – Silver Spring, MD
- December 2, 2008 – Plantation, FL

- February 5, 2009 – Silver Spring, MD
- September 28, 2009 – Silver Spring, MD
- February 2010 – Venue TBD

4.3.3 Subcommittee 2 (Warning Signs, Symbols and Hazard Communication)

- December 2, 2008 – Plantation, FL
- January 13, 2010 – Silver Spring, MD

4.3.4 Subcommittee 3 (Safety Levels – 0-3 kHz)

- June 7, 2008 – San Diego, CA
- December 3, 2008 – Fort Lauderdale, FL
- June 20, 2009 – Davos, Switzerland
- Januray 14, 2010 – Silver Spring, MD
- June 2010 – Seoul, South Korea (in conjunction with the Bioelectromagnetics Society Annual Meeting exact date TBD)

4.3.5 Subcommittee 4 (Safety Levels – 3 kHz to 300 GHz)

- June 7, 2008 – San Diego, CA
- December 3, 2008 – Fort Lauderdale, FL
- June 20, 2009 – Davos, Switzerland
- Januray 14, 2010 – Silver Spring, MD
- June 2010 – Seoul, South Korea (in conjunction with the Bioelectromagnetics Society Annual Meeting exact date TBD)

4.3.6 Subcommittee 5 (Safe Distances from Antennas during Blasting Operations)

- June 7, 2008 – San Diego, CA

4.4 Main Committee and Subcommittee Status

4.4.1 Main Committee

A major effort during the past several years has been to increase the membership of ICES, particularly non-U.S. members. TC-95 now has members from Australia (4), Bulgaria (1), Canada (6), China (1), Finland (1), France (2), Germany (1), Greece (3), Hungary (1), Ireland (4), Israel (2), Italy (4), Japan (4), Korea (2), Malaysia (4), the Netherlands (1), New Zealand (1), Poland (1), Sweden (1), Slovenia (1), South Africa (1), Switzerland (3), Thailand (1), Turkey (1), the United Kingdom (7) and the United States (72), i.e., approximately 43% of the main committee membership is from outside the US.

The TC-95 mailing list now approaches 350, including subcommittee members and observers. Nine years ago, the long-standing practice of sending hard copies of our extensive documents through the mail to our global mailing list was discontinued – all communications are now via e-mail and the Internet; meeting minutes are posted on the ICES website. The ICES Website (http://www.ices-emfsafety.org/index.php5) contains

both open and private pages for TC-95 and its subcommittees and links to TC-34 and its subcommittees. All agendas, approved meeting minutes, white papers, RF research databases, draft standard documents, and many special reports are publicly available; certain proprietary or working documents are available only to members of the subcommittees on private sections of the site. The TC-95/SC-4 literature database, containing more than 4200 titles, which now appears on the WHO website, is also publicly available (http://www.who.int/peh-emf/research/database/IEEEdatabase/).

The following reaffirmations were approved by the IEEE SASB in 2008:

- IEEE C95.4-2002 (2008): IEEE Recommended Practice for Determining Safe Distances from Radio Frequency Transmitting Antennas When Using Electric Blasting Caps During Explosive Operations. (Approved March 2008.)
- IEEE 1460-1996 (2002, 2008): IEEE Guide for the Measurement of Quasi-Static Magnetic and Electric Fields. (Approved June 2008.)
- IEEE C95.3-2002 (2008): IEEE Recommended Practice for Measurements and Computations of Radio Frequency Electromagnetic Fields With Respect to Human Exposure to Such Fields, 100 kHz–300 GHz. (Approved June 2008.)

4.4.2 Subcommittee 1 (Measurement and Computation)

Subcommittee 1, which has responsibility for IEEE C95.3 "IEEE Recommended Practice for Measurements and Computations of Radio Frequency Electromagnetic Fields With Respect to Human Exposure to Such Fields, 100 kHz–300 GHz" and IEEE 1460 "IEEE Guide for the Measurement of Quasi-Static Magnetic and Electric Fields," is now in the process of developing a new standard, PC95.3.1 "Recommended Practice for Measurements and Computation of Electric, Magnetic and Electromagnetic Fields With Respect to Human Exposure to Such Fields, 0 - 100 kHz," which extends downward the frequency range of ICES measurement standards. A draft has gone through initial sponsor ballot (with 95% approval), comments are being addressed and a recirculation ballot will be initiated early December. IEEE 1460 has been incorporated into PC95.3.1; IEEE 1460 will be withdrawn when C95.3.1 is published.

IEEE C95.3-2002 "Recommended Practice for Measurements and Computations of Radio Frequency Electromagnetic Fields with Respect to Human Exposure to Such Fields, 100 kHz-300 GHz" and IEEE 1460 "Guide for the Measurement of Quasi-Static Magnetic and Electric Fields" were reaffirmed in June 2008. Eventually IEEE C95.3 and C95.3.1 will be combined into a single standard covering the frequency range of 0 Hz to 300 GHz.

4.4.3 Subcommittee 2 (RF Warning Symbols, Safety Programs and Hazard Communication)

Subcommittee 2 has responsibility for the following standards: "IEEE C95.7-2005 IEEE Recommended Practice for Radio Frequency Safety Programs, 3 kHz to 300 GHz" and C95.2-1999 (2006) "IEEE Standard for Radio-Frequency Energy and Current-Flow Symbols." C95.2 was reaffirmed at the September 2005 SASB meeting; C95.7 was approved at the same SASB meeting and published in March, 2006. At this time there are no PARs for new or existing projects. Initial thoughts within SC-2 to develop a short-course describing the implementation of an RF safety program based on C95.7 were tabled.

While SC-2 believes that several new documents for example guides or amendments, that would demonstrate the application of C95.7-2005 for RF safety programs for different work scenarios would be useful adjuncts to the Recommended Practice, there has been a lack of interest in diligently pursuing the project. As a stimulus to the subcommittee's thinking for developing such guides or amendments, a proposal was made to organize a workshop meeting to be held during 2010 for exploring how RF safety programs have been implemented in various organizations.

There is still some interest in compiling a glossary of terms used in ELF and RF safety. A number of such terms have been compiled over the years by SC-2 and by the EMB-S Committee on Man and Radiation (COMAR). Also, the subcommittee has not decided on whether it will develop a standard for safety programs where exposures may occur at frequencies below 100 kHz.

4.4.4 Subcommittee 3 (Safety Levels – 0 to 3 kHz)

Subcommittee 3 has responsibility for C95.6-2002 (R2007) "IEEE Standard for Safety Levels with Respect to Human Exposure to Electromagnetic Fields, 0–3 kHz." During the past six years, members of SC-3 have presented four short courses on C95.6-2002; two in the US, one in Canada and one in Ireland. In addition, there were two technical presentations in Australia—all very well received. The attendees were mainly from the power utilities and government agencies.

At present, no major revisions of this standard are anticipated but key members of SC-3 continue open dialog with members of other organizations with similar interests, e.g., the International Commission on Non-Ionizing Radiation Protection (ICNIRP), to iron out philosophical differences in the rationale for each of the standards and guidelines. In addition, members of SC-3 are in the process of exploring the development of an "application guide" as an adjunct to C95.6-2002 (R2007). There are no PARs for new or existing projects but members of SC-3 are working with members of SC-4 on PC95.1-2345. C95.6 will eventually be incorporated into the revision of IEEE C95.1-2005 (see below).

4.4.5 Subcommittee 4 (Safety Levels – 3 kHz -300-GHz)

Subcommittee 4 has responsibility for the C95.1 standard "IEEE Standard for Safety Levels with Respect to Human Exposure to Electromagnetic Fields, 0–3 kHz." This standard was first published as a USASI standard in 1966 and revisions were published as ANSI standards in 1974 and 1982. In 1991 a revision was published as an IEEE standard. It was reaffirmed in 1997, a corrigendum published in 1999 and an amendment in 2004. The latest revision, C95.1-2005 was approved by the SASB at the September 2005 meeting and published in April 2006. The revision is the result of a major effort by SC-4 to fully review and evaluate the relevant scientific literature. An amendment (PC95.1a) that specifies ceiling values for induced and contact current, distinguishes between peak power density and localized exposure, and corrects other technical issues that have been brought to the attention of SC-4 was approved during sponsor ballot and will be submitted to RevCom before the end of 2009. Revision of C95.1-2005 will begin after Amendment 1 is approved. IEEE C95.6 will be incorporated into this revision. Following approval of the revision of C95.1, which will now cover the frequency range of 0 Hz to 300 GHz, C95.6 will be withdrawn. Simultaneously, work has begun on PC95.1-2345, which is intended to replace NATO STANAG 2345 (Edition 3) "Evaluation and Control of Personnel Exposure to Radio Frequency Fields – 3 kHz to 300 GHz."

SC-4 continues to pursue the investigation of relationships between localized tissue temperature increase and peak spatial-average SAR (100 kHz to 3 GHz) and power density (3 GHz to 300 GHz) as a basis for a decision on the need to revise the limits for localized exposure at frequencies from 100 kHz to 300 GHz. Although numerous studies that report effects at levels below those where thermal mechanisms would prevail, all reliable evidence indicates that established adverse effects are thermal in nature and, therefore, changes in temperature under localized exposure conditions is important with respect to devices that produce such exposures, e.g., mobile telephones. The results would provide a scientifically sound basis for the current SAR limits for localized exposure or the basis for a change.

An ad hoc committee has been established to address bio-effects at THz frequencies. This is the continuation of a joint effort between members of SC-4 and ANSI ASC Z136 (laser safety) that began informally in 2000. While there was little data in 2000, there is a growing body of data that can be used to provide additional science-based support for reaffirming or revising the maximum permissible exposure values at 300 GHz (the upper frequency of IEEE C95.1 and the lower frequency of ANSI Z136.1). There is close coordination between ICES and ANSI ASC Z136 (ICES Secretary, Ron Petersen, chairs the Z136 committee.)

4.4.6 Subcommittee 5 (Safe Distances from Antennas during Blasting Operations)

Subcommittee 5 is responsible for C95.4-2002 (IEEE Recommended Practice for Determining Safe Distances from Radio Frequency Transmitting Antennas When Using Electric Blasting Caps during Explosive Operations). The standard was reaffirmed at the March 2008 SASB meeting. The standard is stabile and there are no PARs for new or existing projects.

4.5 PARs

The following TC-95 PARS are currently active:

- PC95.1-2345, "Standard for the Evaluation and Control of Personnel Exposure to Electric, Magnetic and Electromagnetic Fields, 0 Hz to 300 GHz,"
- PC95.1a, "Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz - Amendment: Specifies Ceiling Limits for Induced and Contact Current, Clarifies Distinctions between Localized Exposure and Spatial Peak Power Density,"
- PC95.3.1, "Recommended Practice for Measurements and Computation of Electric, Magnetic and Electromagnetic Fields With Respect to Human Exposure to Such Fields, 0 - 100 kHz."

4.5.1 SC-1 PARs

PC95.3.1 (Approved December 2003; PAR extension request approved December 2007 – 2nd PAR extension is on NesCom December 2009 agenda):

Title: Recommended Practice for Measurements and Computation of Electric, Magnetic and Electromagnetic Fields With Respect to Human Exposure to Such Fields, 0 - 100 kHz

Project scope: This recommended practice describes 1) methods for measuring external electric and magnetic fields and contact currents to which persons may be exposed, 2) instrument characteristics and the methods for calibrating such instruments, and 3) methods for computation and the measurement of the resulting fields and currents that are induced in bodies of humans exposed to these fields. This recommended practice is applicable over the frequency range of 0 to100 kHz.

Project purpose: The purpose of this recommended practice is to describe preferred measurement techniques and computational methods that can be used to ascertain compliance with contemporary standards for human exposure to electric and magnetic fields in the frequency range of 0 to 100 kHz such as IEEE C95.1, C95.6 and similar standards. This document is intended primarily for use by engineers, biophysicists, and other specialists who are familiar with basic electromagnetic (EM) field theory and practice, and the potential hazards associated with exposure to EM fields. It will also be useful to bioeffects researchers, instrument developers and manufacturers, those developing calibration systems and standards, and individuals involved in critical hazard assessments or surveys.

4.5.2 SC-4 PARs

PC95.1a (Approved June 2008)

Title: Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz - Amendment: Amendment 1: Specifies Ceiling Limits for Induced and Contact Current, Clarifies Distinctions between Localized Exposure and Spatial Peak Power Density, and Corrects Other Known Errors in C95.1-2005

Scope: This amendment specifies ceiling values for induced and contact current, clarifies the distinctions between “localized exposure” and “spatial peak power density,” and corrects other known technical and editorial errors.

Purpose: The purpose of this amendment is to provide ceiling values for induced and contact current that appeared in IEEE C95.1, 1999 Edition, but were inadvertently omitted in IEEE C95.1-2005, and to clarify the distinctions between “localized exposure” and “spatial peak power density, and correct other known errors.

PC95.1-2345 (Approved September 2009)

Title: Standard for the Evaluation and Control of Personnel Exposure to Electric, Magnetic and Electromagnetic Fields, 0 Hz to 300 GHz

Status: New Standard Project

Project scope: Recommendations are made that protect personnel against established adverse health effects associated with exposure to electric, magnetic and electromagnetic fields in the frequency range of 0 Hz to 300 GHz. The recommendations are expressed in terms of basic restrictions (BRs) and reference levels. The BRs are limits on internal fields, specific absorption rate (SAR), and power density; the reference levels are derived from the BRs, and are expressed in terms of external fields and induced and contact current. The recommendations, which protect against effects associated with electrostimulation, and localized and whole-body heating, are intended to apply to all personnel. These recommendations do not apply to exposures of patients by, or under the

direction of, physicians and medical professionals. These recommendations are not intended for the purpose of preventing interference with medical and other devices that may exhibit susceptibility to electric, magnetic or electromagnetic fields.

Project purpose: The purpose of this standard is to protect personnel against established adverse health effects associated with exposure to electric, magnetic and electromagnetic fields in the frequency range of 0 Hz to 300 GHz.

4.6 Objectives and goals for the past year and the TC's performance relative to meeting these goals and objectives.

- Work with the ICES AdCom, with the guidance of IEEE staff, to develop a fund-raising program to support critical travel, special projects and meetings, visiting scientists and experts, and other critical needs – 4th Q 2009. (Ongoing)
- Continue international membership expansion led by Dr. Murphy. Introduce new members for leadership positions with emphasis on non-US members, women and younger members. (Ongoing)
- Strengthen liaisons with ICNIRP, IEC, WHO, COST 281. (Ongoing)
- Pursue the project on publicizing ICES and C95.1 standards in the literature and at international meetings. (Ongoing)
- Complete the TC-95 portion of the ICES website (http://www.ices-emfsafety.org/), include subcommittee sections, and provide FTP service for subcommittee activities – 4th Q, 2008. (Met)
- Complete subcommittee balloting draft of PC95.3.1 "Recommended Practice for Measurements and Computations with Respect to Human Exposure to Electric and Magnetic Fields, 0 to 100 kHz" – 4th Q 2009. (Met – now in Sponsor ballot)
- Complete draft of commonly used terms – 2nd Q 2008. (Not met)
- Publish general interest paper on C95.1-2005 (e.g., in *IEEE Spectrum*) and technical paper (e.g., in *Health Physics*) – 4th Q 2008. (Partially met)
- Complete reaffirmation ballots on IEEE 1460, C95.3, C95.4 and C95.6 – 3rd Q, 2007. (Met – 2nd Q 2008)
- Submit PAR for C95.1a (Amendment 1) – 4th Q, 2007. (Met – submitted 2nd Q 2008)
- Complete draft, subcommittee balloting and sponsor balloting on C95.1a – 4th Q 2008 (Met – Approved, submitted to RevCom 4th Q 2009)
- Organize first meeting of the SC-4 "THz ad hoc" with key members of ANSI ASC Z136 (laser safety) to discuss new data and address issues relating to the interface (300 GHz) between IEEE C95.1-2005 and ANSI Z136.1-2007 – 1st Q, 2008. (Met)

4.7 Current levels of activity with milestones indicated

- Work with the ICES AdCom, with the guidance of the IEEE staff, to develop a fund-raising program to support critical travel, support for special projects and meetings, support for visiting scientists and experts, and other critical needs. (4th Q 2010)

- Continue international membership expansion led by Dr Murphy. Introduce new members for leadership positions with emphasis on non-US members, women and younger members. (Ongoing)
- Strengthen liaisons with ICNIRP, IEC, WHO, COST 281, etc. (Ongoing)
- Arrange for 2010 meetings of TC-95 and its subcommittees (1st Q 2010)
- Pursue the project on publicizing ICES and C95.1 standards in the literature and at international meetings. (Ongoing)
- Complete draft of commonly used terms. (4th Q 2010)
- Complete guide for the application of C95.6. (3rd Q 2010)
- Submit PAR and begin the revision of C95.1-2005 (incorporating C95.6). (3rd Q 2010)
- Submit PAR and begin revision of C95.3-2002 (incorporating C95.3.1). (4th Q 2010)
- Continue efforts with IEEE SA staff to release ICES safety standards IEEE C95.1, C95.6 and C95.7 for distribution as publicly available documents, e.g., downloadable from the ICES website. (2nd Q 2010 – see 4.10.3).
- Complete 1st working draft of PC95.1-2345. (2nd Q 2010)
- Complete outline of the revision of C95.1-2005. (2nd Q 2010)
- Organize a workshop to explore how RF safety programs have been implemented by various organizations (SC-2). (4th Q 2010)

4.8 IEEE Staff

Support in setting up meetings at IEEE Piscataway has been required in the past; availability of the IEEE Staff Engineer at meetings held at IEEE is desirable. Mr. Bill Ash is the Staff Engineer for both TC-34 and TC-95—his engineering background and broad knowledge of IEEE procedures is invaluable to this committee.

4.9 Other Activities:

Members of ICES TC-95 are continually involved in a wide spectrum of activities that relate to standard-setting including research, education, and drafting of regulations. Members participate in the governmental activities in many nations, as well. These include the FCC and FDA in the US, the EU/EC in Europe, and Standard setting bodies in China. TC-95 members participate in the broad activities of the WHO and its EMF Project as well as the European EBEA, and in various other meetings around the world.

4.10 Issues

4.10.1 Recognition of C95 measurement standards by IEC TC106

ICES has twice submitted without success IEEE C95.3-2002 to the IEC for consideration as an IEC/IEEE dual logo standard. The issue seems to focus on objections by a number of EU countries who are looking for a standard that specifically addresses EC Directives, e.g., CENELEC standards that contain exposure limits (ICNIRP). It is unlikely that further attempts will succeed as the C95.3 is due to be revised.

4.10.2 Interaction with ICNIRP

Members of ICES have tried unsuccessfully to coordinate harmonization activities with the International Commission on Non-Ionizing Radiation Protection (ICNIRP). ICNIRP, a group of 14 individuals develops safety limits for exposure to electromagnetic energy over the frequency range of 0 to 300 GHz, i.e. the same frequency range as IEEE C95.6 (0 – 3 kHz) and C95.1 (3 kHz – 300 GHz). The ICNIRP process for developing guidelines is closed, uncertain, and relies on claims of "no commercial vested interests" to maintain "credibility," especially within the EU states. Members of the ICES AdCom have met several times with members of ICNIRP (twice at ICNIRP's request) to discuss methods of coordination but attempts at sharing documents are one-way only.

ICES will continue to discuss the IEEE standards and process at major international fora to help recruit key scientists and engineers who have no other way of participating in setting safety standards. Indications are that there may be a closer relationship with ICNIRP in the future. This stems from an issue in the EU whereby a European Commission (EC) Worker Safety Directive to implement ICNIRP-based guidance in the workplace has been delayed four years (until 2012) because of impacts to several stakeholder groups including MRI operators performing certain interventional procedures would be exposed to low frequency magnetic fields in excess of the ICNIRP limits. The relevant ICNIRP limits are far more restrictive than those of IEEE C95.6 and the incorporation of extremely large safety factors in the ICNIRP limits has never been explained. Additional stakeholder impacts included industry (welders and heat-sealer operators) and military (induced and contact current impacts on operations). PC95.1a (submitted to RevCom) eliminated the induced contact current issues that remain under the ICNIRP guideline.

Some of these issues were discussed at a roundtable symposium on exposure standards at the 2008 meeting of the Bioelectromagnetics Society. Dr. C-K Chou (TC-95 Chair) represented ICES and Paolo Vecchia (ICNIRP Chair) and James Lin represented ICNIRP. This roundtable provided a forum to promote further harmonization of the two major international standards. More recently, the impacts of the EC Directive were discussed and debated at a meeting of stakeholders in Umea, SWE 6-8 October 2009, where Drs. C-K Chou and J. Patrick Reilly described the IEEE standards, and TC95 and ICES. The EC representative challenged the chairs of ICNIRP and ICES to explain why they could not meet to harmonized standards, Dr. Ralf Bodemann emphasized the ICES willingness to meet with ICNIRP to further harmonization of standards. Unfortunately, ICNIRP continued to be reluctant claiming it would destroy its credibility by working with a group that included industry. The stakeholders in attendance were largely impressed with the IEEE process and position on harmonization.

4.10.3 IEEE C95.1, C95.6 and C95.7 – Publicly available documents?

Since about 1994, IEEE C95.1-1991 has been the basis for NATO Standardization Agreement (STANAG) 2345 "Evaluation and Control of Personnel Exposure to Radio Frequency Fields – 3 kHz to 300 GHz." This was encouraged by the US members of the STANAG Ad Hoc (mostly from the Air Force and/or ICES). The objective of the specific agreement between NATO NSA and IEEE is to provide a standard that NATO could incorporate into the STANAG by reference (instead of incorporating tables and values from the C95 standards as it does now). ICES feels that the probability of acceptance would be considerably higher if PC95.1-2345 (when approved) would be

made publicly available at no cost (e.g. downloadable on the web), along with IEEE C95.1, C95.6, and C95.7, all of which are public health and safety documents (not specifications or performance standards). ICES sees this as an opportunity for IEEE to broaden its visibility and recognition in Europe and elsewhere.

The issue of publicly available documents is becoming ever more important in the EU. For example, most of the NATO nations are EU members and are inclined to follow EC Directives including "Worker Safety Directive 2004/40/EC of the European Parliament and of the Council of 29 April 2004 on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (electromagnetic fields)." Included in this Directive are references to the ICNIRP guidelines. However, that Directive has just been delayed 4 years due to MRI compliance issues with the ICNIRP guidelines, which increases the probability that IEEE C95.1 and C95.6 (and the STANAG replacement document) would be considered in the interim (IEEE C95 standards rather than the ICNIRP guidelines). A potential barrier is the ICNIRP guidelines are available at no charge – the IEEE C95 standards are not.

This issue is becoming ever more evident. For example, the call for IEEE SA to release the health and safety standards C95.1, C95.5 and the C95.7 was repeated by attendees at the October 6 – 9, 2009 Umea Sweden workshop sponsored by the EU Presidency and the Commission on Worker Safety that addressed issues relating to the Worker Directive. In particular, there are two major standards or guidelines under consideration for adoption or as a foundation for the revised Directive; the IEEE C95 series and the ICNIRP guidelines. Clearly, a major step forward was made at Umea, as many in attendance were very favorable about the IEEE process and the standards. Attendees were, however, very adamant about not selecting IEEE over ICNIRP because IEEE charges for the documents, while ICNIRP has published its guidelines in *Health Physics*, the journal of the Health Physics Society, and has arranged to have its guidelines available on several websites. That is, while the workshop attendees argued that although they considered the IEEE as a favorable potential foundation for the revision of the EC Directive, unless it was available at no cost they would not support its adoption. The ICNIRP guidelines have numerous areas of conflict with the comparable C95 standards and the ICNIRP guidelines have been shown to have operational and potential health and safety impacts. It therefore is in the interest of public health and safety and medical, industrial, governmental, and military safe operations to have unrestricted no-cost access to the C95 series. Dr. C-K Chou, TC-95 Chairman, who just returned from the November 19 – 20, 2009 international meeting "Global Coordination of Radiofrequency Communication Research and Health Policy" held in Melbourne Australia, reported that here too attendees voiced concern about the IEEE C95 standards not being publicly available documents.

We believe that if the IEEE C95 safety standards have any chance of global acceptance, it will only be after free access is provided. Pubic release will increase IEEE penetration into new markets as a "loss leader" where prospective new members will have opportunity to learn about IEEE. This could also attract the small consultant businesses that are the principal customers of the C95 standards but often do not update their documents due to cost. This creates a potential compliance accuracy and safety problem. Moreover, since NATO members are expected to buy the IEEE document when the new STANAG 2345 is written, it would be advantageous to NATO interoperability to have the document web-based. It would also further favorable ratification. IEEE SA was very

eager to become involved with NATO, noting it would further international recognition of IEEE.

Taking the responsible public action ensuring public health and worker safety should be attractive to the business side of IEEE SA. The message can be presented as a marketing tool that will expand the market share and increase revenue. Moving IEEE standardization activities in this safety area will serve as good advertising for IEEE, very likely increase international membership, and lead to international harmonization of safety standards addressing exposure to electromagnetic energy. Conflicting standards creates doubt and fuels the imagination of those who want to believe that exposure to low levels of electromagnetic is harmful.

4.10.4 Responding to Advocacy Groups

A major ICES concern has been responding to advocacy groups that are gaining an increasing stronger foothold, particularly outside of North America. The most notable group are the advocates of the *BioInitiative Report* (a non-peer reviewed selective, rather than comprehensive, review of the literature that mixes discussions on science with social issues). This group has gained momentum pushing for unrealistic restrictive standards and policies that must be continually rebutted. The EMB-S Committee on Man and Radiation (COMAR – which is made up mostly of ICES members) recently published a peer reviewed article in *Health Physics* that spotlights errors and inconsistencies in the web published *BioIniitative Report*. IEEE/ICES experts need standards developmental organizational support in countering unscientific claims that would be catastrophic if implemented as law or regulation.

4.11 Membership

See Tables TC-95-1 through Table TC-95-7 for committee and subcommittee membership information.

Prepared and submitted by:

Ron Petersen
Executive Secretary, SCC-39 (ICES)

Table TC-95-1

TC-95 Leadership

OFFICE	NAME	AFFILIATION	COUNTRY
Chairman	Dr. C-K Chou	Motorola Enterprise Mobility Solutions	US
Vice Chairman (Vacant)			
Secretary	Ron Petersen	R C Petersen Associates LLC	US
Treasurer	Arthur Varanelli	Independent Consultant	US
Chairman, SC-1	Howard Bassen	US FDA Cntr for Devices and Rad. Health	US
Chairman, SC-2	Richard Tell	Richard A Tell Associates, Inc.	US
Chairman, SC-3	Thanh Dovan	SP AusNet Pty. Ltd.	AU
Co-Chairman, SC-4	Dr. Art Thansandote	Health Canada	CA
Co-Chairman, SC-4	Dr. Marvin Ziskin, MD	Temple University Medical School	US
Chairman, SC-5	Robert Needy	Naval Surface Warfare Ctr.	US

Table TC-95-2

TC-95 Membership: Main Committee (December 2009)

	Last Name	First Name	Affiliation	Interest Category	Country
1.	Abd Rahman	Nazaruddin	Universiti Tenaga Nasional	A	MY
2.	Ammann	Max	Dublin Institute of Technology	A	IE
3.	Anderson	Vitas	Swinburne University	A	AU
4.	Balzano	Quirino	University of MD	A	US
5.	Baron	David	AIHA Representative	U	US
6.	Bassen	Howard	FDA/CDRH	G	US
7.	Bavin	John	Consumers Energy	U	US
8.	Bellier	Pascale	Health Canada	G	CA
9.	Bergeron	John	Independent Consultant	GI	US
10.	Black	David	Environmedix	U	NZ
11.	Bodemann	Ralf	Siemens AG	M	DE
12.	Brecher	Aviva	DOT/RSPA Volpe Ctr.	G	US
13.	Brewer	John	HCJB Global	GI	US
14.	Brooker	Ian	Tyco Fire and Security	M	IE
15.	Bushberg	Jerrold	U. of California, Davis	A	US
16.	Cassata	Jim	Navy Med-NIR Branch	G	US
17.	Chadwick	Philip	EMFields Ltd	GI	UK
18.	Chiang	Huai	Zhejiang Medical University	A	CN
19.	Chiusano	Stephen	Lawrence Livermore Nat'l Lab.	A	US
20.	Chou	C.K.	Motorola Enterprise Mob. Sol.	M	US
21.	Cleveland	Robert	EMF Consulting	U	US
22.	Coghill	Roger	Coghill Research Labs	GI	UK
23.	Cohen	Jules	Independent Consultant	U	US
24.	Comlekci	Selcuk	Suleyman Demirel University	A	TR
25.	Cotton	David	Sitesafe Inc	U	US
26.	Croft	Rodney	Department of Psychology	A	AU
27.	Curtis	Robert	RF CHECK Incorporated	U	US
28.	D'Andrea	John	Naval Health Research Ctr.	G	US
29.	de Seze	Rene	INERIS	A	FR
30.	DeFrank	John	USACHPPM	G	US
31.	d'Inzeo	Guglielmo	La Sapienza University of Rome	A	IT

	Last Name	First Name	Affiliation	Interest Category	Country
32.	Dovan	Thanh	SP AusNet Pty. Ltd.	U	AU
33.	Durrenberger	Gregor	ETH	A	CH
34.	DuToit	Leon	Department of Health	G	ZA
35.	Duvdevany	Amnon	IDF Medical Corps	G	IL
36.	Erdreich	Linda	Exponent	GI	US
37.	Farrer	Donald	Independent Consultant	U	US
38.	Filippopoulos	George	Greek Atomic Energy Comm.	G	GR
39.	Foster	Kenneth	Univ. of Pennsylvania	A	US
40.	Gajsek	Peter	Institute of Public Health	G	SI
41.	Gallant	Josette	Industry Canada	G	CA
42.	Gandhi	Om	Univ. of Utah, Dept. of Elec. Eng.	A	US
43.	Gardner	Robert	MOD D S&F Pol	G	UK
44.	Geber	Kurt	Dynamac Corporation	M	US
45.	George	David	Unisys Corp.	M	US
46.	Gettman	Ken	National Electrical Man Assoc.	GI	US
47.	Grandolfo	Martino	Laboratorio di Fisica	GI	IT
48.	Guy	Arthur	Bioelectromagnetics Consulting	U	US
49.	Haes, Jr.	Donald	BAE Systems	U	US
50.	Halkiotis	Konstantinos	Medical School of Athens	A	GR
51.	Hare	Ed	American Radio Relay League	GI	US
52.	Hatfield	James	Hatfield & Dawson	U	US
53.	Heirman	Donald	Don HEIRMAN Consultants	GI	US
54.	Heroux	Paul	McGill University	A	CA
55.	Holley	Jeff	Florida Power and Light	U	US
56.	Ibey	Bennett	Brooks City Base	G	US
57.	Ikehata	Masateru	Railway Technical Research Inst.	A	JP
58.	Israel	Michel	National Centre of Hygiene	G	BL
59.	Ivans	Veronica	Medtronic Inc.	M	US
60.	Jaffa	Kent	Retired	GI	US
61.	Johnston	Sheila	Independent Consultant	GI	IE
62.	Joyner	Ken	Samsung	M	AU
63.	Kandel	Shaiela	Hebrew University of Jerusalem	A	IL
64.	Karabetsos	Efthymios	Greek Atomic Energy Com.	G	GR
65.	Kavet	Robert	EPRI	GI	US
66.	Kemp	Ray	Galson Sciences Limited	GI	UK

	Last Name	First Name	Affiliation	Interest Category	Country
67.	Kim	Nam	Chungbuk National University	A	KR
68.	Klauenberg	B. Jon	USAF	G	US
69.	Koepfinger	Joseph	Consultant	GI	US
70.	Kuster	Niels	IT'IS Foundation	A	CH
71.	Lang	Sakari	Nokia Corp-Stand & Ind Rel	M	FI
72.	Lin	James	University of Illinois	A	US
73.	Link	Richard	Radiation Safety Inst.of Canada	GI	CA
74.	Lodwick	Jeffrey	US Department of Labor	G	US
75.	Manatrakul	Nisakorn	Ministry of Public Health	G	TH
76.	Manning	Michael	IndeXsar, Ltd	U	UK
77.	Mason	Patrick	USAF/AFRL/HEDR	G	US
78.	Mathur	Rajat	Hammett & Edison, Inc.	U	US
79.	Maurer	Stewart	RF & ELF Consultant	U	US
80.	McManus	Tom	Consultant	GI	IE
81.	McNamee	James	Health Canada	G	CA
82.	McQuade	Jill	USAF	G	US
83.	Meltz	Martin	Retired	GI	US
84.	Miyagi	Hiroaki	Japan NUS Co., Ltd	U	JP
85.	Montgomery	Noel	Air Force Research Laboratory	G	US
86.	Moore	Michael	Oak Ridge National Lab	G	US
87.	Morrissey	Joe	NOVA South Eastern U	A	US
88.	Mukhopadhyay	Amitabha	Con Edison	U	US
89.	Murphy	Michael	Directed Energy Bioeffects	G	US
90.	Muthuvelu	Pirunthavany	Ministry of Health	G	MY
91.	Needy	Robert	Naval Surface Warfare Ctr.	G	US
92.	Nelson	David	Michigan Technical University	A	US
93.	Ng	Kwan-Hoong	Dept of Radiation	GI	MY
94.	Osepchuk	John	Full Spectrum Consulting	GI	US
95.	Packer	Malcolm	Harris RF Communications	M	US
96.	Pakhomov	Andrei	McKesson Bio Services	GI	US
97.	Paul	William	Int. Brotherhood of Elect.Workers	GI	US
98.	Persson	Bertil	Lund University	A	SE
99.	Petersen	Ronald	R C Petersen Associates	GI	US
100.	Ravazzani	Paolo	Italian Nat Res Council	GI	IT
101.	Reilly	J. Patrick	Metatec Associates	GI	US

	Last Name	First Name	Affiliation	Interest Category	Country
102.	Repacholi	Michael	WHO (Retired)	GI	CH
103.	Roach	William "Pat"	AFRL/HEDR	G	US
104.	Roberts	Brad	US Army CHPPM	G	US
105.	Samaras	Theodoros	Aristotle U.of Thessaloniki	A	GR
106.	Scanlon	William	Queens University, Belfast	A	UK
107.	Sheppard	Asher	Asher Sheppard Consulting	GI	US
108.	Swicord	Mays	Mays Swicord Consulting	GI	US
109.	Szmigielski	Stanislaw	Mil Inst of Hygiene and Epi.	G	PL
110.	Tang, MD	Rosa	UTMB, Galveston	GI	US
111.	Tattersall	John	DSTL	G	UK
112.	Tell	Richard	Richard Tell Assoc. Inc.	U	US
113.	Testagrossa	Paul	Alcatel-Lucent	U	US
114.	Thansandote	Art	Health Canada	G	CA
115.	Thomas	Robert	Optical Radiation Branch AFRL	G	US
116.	Thuroczy	Gyorgy	Nat Res Inst for Radiobiology	G	HU
117.	Tofani	Santi	Servizio Di Fisica Sanitaria	G	IT
118.	Umbdenstock	Donald	Tyco/Sensormatic	M	US
119.	van Rongen	Eric	Health Council of the Netherlands	G	NL
120.	Varanelli	Arthur	Independent Consultant	G	US
121.	Wan Nor Liza	Mahadi	Mahadi. Inst Univ Malaya	A	MY
122.	Wiart	Joe	France Telecom Orange Labs	GI	FR
123.	Williams, Jr.	Louis	Louis A. Williams Jr. & Assoc.	U	US
124.	Yoo	Done-Sik	Elect & Telecom Res Inst	A	KR
125.	Zipse	Donald	Electrical Forensics, LLC	U	US
126.	Ziriax	John	Naval Health Research Center	G	US
127.	Ziskin, MD	Marvin	Temple Univ. Medical School	A	US

A = General Interest: Academic
G = General Interest: Government
GI = General Interest
P = Producer
U = User

Table TC-95-3

TC-95 Membership: SC-1 (Techniques, Procedures, Instrumentation and Computation)

	Last Name	First Name	Affiliation	Interest Category	Country
1.	Babij	Tadeusz	Florida International University	A	US
2.	Balzano	Quirino	University of MD	A	US
3.	Baron	David	AIHA Representative	GI	US
4.	Bassen	Howard	FDA/CDRH	G	US
5.	Bodemann	Ralf	Siemens AG	P	US
6.	Bowman	Joe	NIOSH	G	DE
7.	Brecher	Aviva	DOT/RSPA Volpe Ctr.	G	US
8.	Brooker	Ian	Tyco Fire and Security	P	US
9.	Chou	C.K.	Motorola Enterprise Mob. Solutions	P	IE
10.	Cleveland	Robert	EMF Consulting	U	US
11.	Cohen	Jules	Independent Consultant	GI	US
12.	DeFrank	John	USACHPPM	G	US
13.	Gandhi	Om	Univ. of Utah, Dept. of Elec. Eng.	A	US
14.	Guy	Arthur	Bioelectromagnetics Consulting	GI	US
15.	Hatfield	James	Hatfield & Dawson	U	US
16.	Heirman	Donald	Don HEIRMAN Consultants	GI	US
17.	Ivans	Veronica	Medtronic Inc.	P	US
18.	Klauenberg	B. Jon	USAF	G	US
19.	Kumbier	Werner	Narda Safety Test Solutions	P	US
20.	Kuster	Niels	IT'IS Foundation	A	DE
21.	Luebbers	Raymond	Remcom Inc.	P	CH
22.	Manning	Michael	IndeXsar, Ltd	P	US
23.	Mantiply	Ed	FCC/OET	G	UK
24.	Moore	Michael	Oak Ridge National Lab	G	US
25.	Needy	Robert	Naval Surface Warfare Ctr.	G	US
26.	Osepchuk	John	Full Spectrum Consulting	GI	US
27.	Petersen	Ronald	R C Petersen Associates	GI	US
28.	Roberts	Brad	US Army CHPPM	G	US
29.	Tell	Richard	Richard Tell Assoc. Inc.	U	US
30.	Testagrossa	Paul	Alcatel-Lucent	U	US
31.	Umbdenstock	Donald	Tyco/Sensormatic	P	US

	Last Name	First Name	Affiliation	Interest Category	Country
32.	Williams, Jr.	Louis	Louis A. Williams Jr. & Associates	GI	US
33.	Wimmer	George	Ansoft LLC	P	US
34.	Zhou	Ping	Ansoft LLC	P	US

A = General Interest: Academic
G = General Interest: Government
GI = General Interest
P= Producer
U = User

Table TC-95-4

TC-95 Membership: SC-2: (Terminology, Units of Measurements and Hazard Communication)

	Last Name	First Name	Affiliation	Interest Category	Country
1.	Anderson	Vitas	Swinburne University	A	AU
2.	Baron	David	AIHA Representative	U	US
3.	Bassen	Howard	FDA/CDRH	G	US
4.	Bellier	Pascale	Health Canada	G	CA
5.	Biby	Richard	Crown Castle International	G	US
6.	Black	David	Environmedix	GI	NZ
7.	Bodemann	Ralf	Siemens AG	P	DE
8.	Boyer	Jim	Lawrence Livermore National Labs	G	US
9.	Brecher	Aviva	DOT/RSPA Volpe Ctr.	G	US
10.	Bushberg	Jerrold	U. of California, Davis	A	US
11.	Chou	C.K.	Motorola Enterprise Mob. Solutions	P	US
12.	Cleveland	Robert	EMF Consulting	U	US
13.	Coghill	Roger	Coghill Research Labs	GI	UK
14.	Conover	David	NIOSH Contractor	G	US
15.	Curtis	Robert	RF CHECK Incorporated	U	US
16.	D'Andrea	John	Naval Health Research Ctr.	G	US
17.	DeFrank	John	USACHPPM	G	US
18.	Erdreich	Linda	Exponent	GI	US
19.	Everist	Donald	Cohen, Dipell and Everist	U	US
20.	Gajda	Greg	Health Canada	G	CA
21.	Gettman	Ken	National Electrical Man Assoc.	GI	US
22.	Guy	Arthur	Bioelectromagnetics Consulting	GI	US
23.	Haes, Jr.	Donald	BAE Systems	U	US
24.	Hare	Ed	American Radio Relay League	U	US
25.	Hatfield	James	Hatfield & Dawson	U	US
26.	Hubbard	Roy	Technology Services International	U	ZA
27.	Ivans	Veronica	Medtronic Inc.	P	US
28.	Johnson	Robert	L-3 Microwave NARDA	P	US
29.	Johnston	Sheila	Independent Consultant	PI	IE
30.	Joyner	Ken	Samsung	P	AU

	Last Name	First Name	Affiliation	Interest Category	Country
31.	Kantner	Kimberly	AT&T	U	US
32.	Khalil	Kathy	SPAWARSYSCEN Charleston	G	US
33.	Kierl	Bill	Motorola, Inc	P	US
34.	Klauenberg	B. Jon	USAF	G	US
35.	Kumbier	Werner	Narda Safety Test Solutions	P	DE
36.	Kuster	Niels	IT'IS Foundation	A	CH
37.	Lathrop	Janet	Resource Strategies, Inc	GI	US
38.	Mantiply	Ed	FCC/OET	G	US
39.	Meltz	Martin	Retired	GI	US
40.	Mercer	Christopher	Vodacom Group, Pty Ltd	U	ZA
41.	Montgomery	Noel	Air Force Research Laboratory	G	US
42.	Murphy	Michael	Directed Energy Bioeffects	G	US
43.	Nappert	Hughes	CEM Industry Canada	G	CA
44.	Needy	Robert	Naval Surface Warfare Ctr.	G	US
45.	Norman	Larry	Pike Electric	U	US
46.	Osepchuk	John	Full Spectrum Consulting	GI	US
47.	Persson	Bertil	Lund University	A	SE
48.	Petersen	Ronald	R C Petersen Associates	GI	US
49.	Proctor	Ken	US Army	G	US
50.	Roberts	Brad	US Army CHPPM	G	US
51.	Rogers	Walt	Veridian Eng/RFR Branch	GI	US
52.	Rowley	Jack	Telstra Research Labs	U	AU
53.	Scanlon	William	Queens University, Belfast	A	UK
54.	Seabury	David	Chase Systems Inc.	P	US
55.	Smith	Matthew	Dade Moeller & Associates	GI	US
56.	Strickland	Richard	RF Safety Solutions	P	US
57.	Tell	Richard	Richard Tell Assoc. Inc.	U	US
58.	Testagrossa	Paul	Alcatel-Lucent	U	US
59.	Thansandote	Art	Health Canada	G	CA
60.	Ulcek	Jerry	FCC	G	US
61.	Varanelli	Arthur	Independent Consultant	GI	US
62.	Williams, Jr.	Louis	Louis A. Williams Jr. & Associates	GI	US
63.	Ziskin, MD	Marvin	Temple Univ. Medical School	A	US

A = General Interest: Academic G = General Interest: Government GI = General Interest
P= Producer U = User

Table TC-95-5

TC-95 Membership: SC-3 (Safety Levels with Respect to Human Exposure, 0-3 kHz)

	Last Name	First Name	Affiliation	Interest Category	Country
1.	Abd Rahman	Nazaruddin	Universiti Tenaga Nasional	A	MY
2.	Adlkofer	Franz	VerUm Foundation	A	DE
3.	Ammann	Max	Dublin Institute of Technology	A	IE
4.	Anderson	Vitas	Swinburne University	A	AU
5.	Bailey	William	Exponent Inc.	GI	US
6.	Barker	J. Richard	General Cable	P	US
7.	Baron	David	AIHA Representative	GI	US
8.	Bassen	Howard	FDA/CDRH	G	US
9.	Bavin	John	Consumers Energy	U	US
10.	Bellier	Pascale	Health Canada	G	CA
11.	Bergeron	John	Independent Consultant	GI	US
12.	Black	David	Environmedix	GI	NZ
13.	Bodemann	Ralf	Siemens AG	P	DE
14.	Boeggeman	Charles	PECO Energy Co.	U	US
15.	Brecher	Aviva	DOT/RSPA Volpe Ctr.	G	US
16.	Brewer	John	HCJB Global	GI	US
17.	Brooker	Ian	Tyco Fire and Security	P	IE
18.	Carberry	Robert	Northeast Utilities	U	US
19.	Cassata	Jim	Navy Med Non-Ionizing Rad Branch	G	US
20.	Chadwick	Philip	EMFields Ltd	GI	UK
21.	Coghill	Roger	Coghill Research Labs	GI	UK
22.	Comlekci	Se.cuk	Suleyman Demirel University	A	TR
23.	Cotton	David	Sitesafe Inc	U	US
24.	Croft	Rodney	Department of Psychology	A	AU
25.	Curtis	Robert	RF CHECK Incorporated	U	US
26.	Dale	Steiner	ABB Power T&D Company	U	US
27.	D'Andrea	John	Naval Health Research Ctr.	G	US
28.	de Seze	Rene	INERIS	A	FR
29.	DeFrank	John	USACHPPM	G	US
30.	d'Inzeo	Guglielmo	La Sapienza University of Rome	A	IT
31.	Douglas-Miller	Ruth	Kansas State University	A	US
32.	Dovan	Thanh	SP AusNet Pty. Ltd.	U	AU

	Last Name	First Name	Affiliation	Interest Category	Country
33.	DuToit	Leon	Department of Health	G	ZA
34.	Duvdevany	Amnon	IDF Medical Corps	G	IL
35.	Erdreich	Linda	Exponent	GI	US
36.	Farrer	Donald	Independent Consultant	GI	US
37.	Feero	William	Independent Consultant	GI	US
38.	Fichtenberg	David	State of Washington, Med Asst Ad	GI	US
39.	Filippopoulos	George	Greek Atomic Energy Comm.	G	GR
40.	Gallant	Josette	Industry Canada	G	CA
41.	Gandhi	Om	Univ. of Utah, Dept. of Elec. Eng.	A	US
42.	Geber	Kurt	Dynamac Corporation	P	US
43.	George	David	Unisys Corp.	P	US
44.	Gettman	Ken	National Electrical Man Assoc.	GI	US
45.	Gibney	Kelly	Retired	GI	CA
46.	Goldberg	Georges	Advisory Comm. on EMC	GI	CH
47.	Goulet	Daniel	Hydro-Quebec	P	CA
48.	Haes, Jr.	Donald	BAE Systems	U	US
49.	Hanna	Bob	DCMNR, Ireland	G	IE
50.	Hernandez	Martin	Florida Power & Light Co.	U	US
51.	Herz	Michael	Pacific Gas & Electric Co.	U	US
52.	Hicks	Danny	South Carolina Electric & Gas Co.	U	US
53.	Holley	Jeff	Florida Power and Light	U	US
54.	Hubbard	Roy	Technology Services International	U	ZA
55.	Ibey	Bennett	Brooks City Base	G	US
56.	Ikehata	Masateru	Railway Technical Research Institute	A	JP
57.	Ivans	Veronica	Medtronic Inc.	P	US
58.	Jaffa	Kent	Retired	GI	US
59.	Johnston	Sheila	Independent Consultant	GI	IE
60.	Karabetsos	Efthymios	Greek Atomic Energy Commission	G	GR
61.	Kautz	Richard	Ford	P	US
62.	Kavet	Robert	EPRI	GI	US
63.	Kim	Nam	Chungbuk National University	A	KR
64.	Koepfinger	Joseph	Consultant	GI	US
65.	Kuster	Niels	IT'IS Foundation	A	CH
66.	Lathrop	Janet	Resource Strategies, Inc	GI	US
67.	Link	Richard	Radiation Safety Institute of Canada	GI	CA

	Last Name	First Name	Affiliation	Interest Category	Country
68.	Lodwick	Jeffrey	US Department of Labor	G	US
69.	Lotz	Gregory	NIOSH	G	US
70.	Mair	Peter	Fronius International GMBH	P	DE
71.	Manatrakul	Nisakorn	Ministry of Public Health	A	TH
72.	Mason	Patrick	USAF/AFRL/HEDR	G	US
73.	Mathur	Rajat	Hammett & Edison, Inc.	U	US
74.	McManus	Tom	Consultant	GI	IE
75.	McNamee	James	Health Canada	G	CA
76.	Merritt	James	USAF Research Lab	G	US
77.	Miyagi	Hiroaki	Japan NUS Co., Ltd	P	JP
78.	Montgomery	Noel	Air Force Research Laboratory	G	US
79.	Morrissey	Joe	NOVA South Eastern U	A	US
80.	Murphy	Michael	Directed Energy Bioeffects	G	US
81.	Muthuvelu	Pirunthavany	Ministry of Health	G	MY
82.	Nappert	Hughes	CEM Industry Canada	G	CA
83.	Needy	Robert	Naval Surface Warfare Ctr.	G	US
84.	Nelson	David	Michigan Technical University	A	US
85.	Ng	Kwan-Hoong	Dept of Radiation	G	MY
86.	O'Connor	Roger	Dept of Comm., Marine and Nat Res	G	IE
87.	Osepchuk	John	Full Spectrum Consulting	GI	US
88.	Paul	William	Int. Brotherhood of Elect.Workers	GI	US
89.	Petersen	Ronald	R C Petersen Associates	GI	US
90.	Pittman	Steve	Potlach Pulp and Paperboard	P	US
91.	Podhrasky	Robert	Garrett Metal Detectors	P	US
92.	Proctor	Ken	US Army	G	US
93.	Ravazzani	Paolo	Italian Nat Res Council	G	IT
94.	Reilly	J. Patrick	Metatec Associates	GI	US
95.	Roberts	Brad	US Army CHPPM	G	US
96.	Sahl	Jack	J. Sahl Associates	GI	US
97.	Samaras	Theodoros	Aristotle University of Thessaloniki	A	GR
98.	Sawdon	Dave	IBM Global Services	P	UK
99.	Sheppard	Asher	Asher Sheppard Consulting	GI	US
100.	Slesin	Louis	Microwave News	GI	US
101.	Sliney	David	US Army CHPPM Retired	G	US
102.	Swicord	Mays	Mays Swicord Consulting	GI	US

	Last Name	First Name	Affiliation	Interest Category	Country
103.	Szmigielski	Stanislaw	Mil Inst of Hygiene and Epidemiology	I	PL
104.	Tell	Richard	Richard Tell Assoc. Inc.	GI	US
105.	Thansandote	Art	Health Canada	G	CA
106.	Thuroczy	Gyorgy	Nat Res Inst for Radiobiology	G	HU
107.	Umbdenstock	Donald	Tyco/Sensormatic	P	US
108.	Valberg	Peter	Gradient Corporation	GI	US
109.	van Rongen	Eric	Health Council of the Netherlands	G	NL
110.	Varanelli	Arthur	Independent Consultant	GI	US
111.	Vijayalaxmi	VJ	Univ. Texas Health Science Ctr.	A	US
112.	Wan Nor Liza	Mahadi	Mahadi. Institute: University Malaya	A	MY
113.	Wiart	Joe	France Telecom Orange Labs R&D	GI	FR
114.	Williams, Jr.	Louis	Louis A. Williams Jr. & Associates	U	US
115.	Woods	Richard	Sensormatic Electronics	P	US
116.	Yandek	Edward	GE Lighting	P	US
117.	Yoo	Done-Sik	Elect & Telecom Res Inst	A	KR
118.	Zipse	Donald	Electrical Forensics, LLC	GI	US
119.	Ziriax	John	Naval Health Research Center	G	US
120.	Ziskin, MD	Marvin	Temple Univ. Medical School	A	US

A = General Interest: Academic
G = General Interest: Government
GI = General Interest
P= Producer
U = User

Table TC-95-6

TC-95 Membership: SC-4 (Safety Levels with Respect to Human Exposure, 3 kHz – 300 GHz)

	Last Name	First Name	Affiliation	Interest Category	Country
1.	Abd Rahman	Nazaruddin	Universiti Tenaga Nasional	A	MY
2.	Ammann	Max	Dublin Institute of Technology	A	IE
3.	Anderson	Vitas	Swinburne University	A	AU
4.	Babij	Tadeusz	Florida International University	A	US
5.	Bailey	William	Exponent Inc.	GI	US
6.	Baron	David	AIHA Representative	GI	US
7.	Bassen	Howard	FDA/CDRH	G	US
8.	Bellier	Pascale	Health Canada	G	CA
9.	Bergeron	John	Independent Consultant	GI	US
10.	Black	David	Environmedix	GI	NZ
11.	Bodemann	Ralf	Siemens AG	P	DE
12.	Brecher	Aviva	DOT/RSPA Volpe Ctr.	G	US
13.	Brewer	John	HCJB Global	P	US
14.	Brooker	Ian	Tyco Fire and Security	P	IE
15.	Bushberg	Jerrold	U. of California, Davis	A	US
16.	Cassata	Jim	Navy Medical NIR Branch	G	US
17.	Chadwick	Philip	EMFields Ltd	GI	UK
18.	Chesnick	Scott	National Heart Lung Blood Inst.	GI	US
19.	Chiang	Huai	Zhejiang Medical University	A	CN
20.	Chou	C.K.	Motorola Enterprise Mob.Solutions	P	US
21.	Cleveland	Robert	EMF Consulting	GI	US
22.	Coghill	Roger	Coghill Research Labs	GI	UK
23.	Comlekci	Se.cuk	Suleyman Demirel University	A	TR
24.	Cotton	David	Sitesafe Inc	U	US
25.	Croft	Rodney	University of Wollongong	A	AU
26.	Curtis	Robert	RF CHECK Incorporated	U	US
27.	D'Andrea	John	Naval Health Research Ctr.	G	US
28.	de Seze	Rene	INERIS	A	FR
29.	DeFrank	John	USACHPPM	G	US
30.	Dini	David	U L	U	US

	Last Name	First Name	Affiliation	Interest Category	Country
31.	d'Inzeo	Guglielmo	La Sapienza University of Rome	A	IT
32.	Dovan	Thanh	SP AusNet Pty. Ltd.	P	AU
33.	Durrenberger	Gregor	ETH	A	CH
34.	DuToit	Leon	Directorate Rad. Control/DOH	G	ZA
35.	Duvdevany	Amnon	IDF Medical Corps	G	IL
36.	Elder	Joe	Independent Consultant	GI	US
37.	Erdreich	Linda	Exponent	GI	US
38.	Farrer	Donald	Independent Consultant	U	US
39.	Fichtenberg	David	State of Washington, Med Asst Ad	G	US
40.	Filippopoulos	George	Greek Atomic Energy Comm.	G	GR
41.	Foster	Kenneth	Univ. of Pennsylvania	A	US
42.	Gajsek	Peter	Institute of Public Health	G	SI
43.	Gallant	Josette	Industry Canada	G	CA
44.	Gandhi	Om	Univ. of Utah, Dept. of Elec. Eng.	A	US
45.	Gardner	Robert	MOD D S&F Pol	G	UK
46.	Geber	Kurt	Dynamac Corporation	PI	US
47.	George	David	Unisys Corp.	P	US
48.	Gettman	Ken	National Electrical Man, Assoc.	GI	US
49.	Goldberg	Georges	Advisory Comm. on EMC	GI	CH
50.	Haes, Jr.	Donald	BAE Systems	P	US
51.	Halkiotis	Konstantinos	Medical School of Athens	A	GR
52.	Hanna	Bob	DCMNR, Ireland	G	IE
53.	Hatfield	James	Hatfield & Dawson	U	US
54.	Heirman	Donald	Don HEIRMAN Consultants	U	US
55.	Heroux	Paul	McGill University	A	CA
56.	Hubbard	Roy	Technology Services International	U	ZA
57.	Ibey	Bennett	Brooks City Base	G	US
58.	Ikehata	Masateru	Railway Tech. Research Institute	A	JP
59.	Israel	Michel	National Centre of Hygiene	G	BL
60.	Ivans	Veronica	Medtronic Inc.	P	US
61.	Johnston	Sheila	Independent Consultant	GI	IE
62.	Joyner	Ken	Samsung	G	AU
63.	Kandel	Shaiela	Hebrew University of Jerusalem	A	IL
64.	Kantner	Kimberly	AT&T	U	US
65.	Karabetsos	Efthymios	Greek Atomic Energy Commission	G	GR

	Last Name	First Name	Affiliation	Interest Category	Country
66.	Kavet	Robert	EPRI	GI	US
67.	Kemp	Ray	Galson Sciences Limited	GI	UK
68.	Kim	Nam	Chungbuk National University	A	KR
69.	Klauenberg	B. Jon	USAF	G	US
70.	Koepfinger	Joseph	Consultant	GI	US
71.	Kwee	Sianette	University of Aarhus	A	DK
72.	Lang	Sakari	Nokia Corp-Stand & Ind Rel	P	FI
73.	Lin	James	University of Illinois	A	US
74.	Link	Richard	Radiation Safety Inst. of Canada	G	CA
75.	Lodwick	Jeffrey	US Department of Labor	G	US
76.	Lotz	Gregory	NIOSH	G	US
77.	Manatrakul	Nisakorn	Ministry of Public Health	G	TH
78.	Manning	Michael	IndeXsar, Ltd	P	UK
79.	Mantiply	Ed	FCC/OET	G	US
80.	Mason	Patrick	USAF/AFRL/HEDR	G	US
81.	Mathur	Rajat	Hammett & Edison, Inc.	U	US
82.	McKenzie	Ray	Telstra Chief Technology Office	U	AU
83.	McManus	Tom	Independent Consultant	GI	IE
84.	McNamee	James	Health Canada	G	CA
85.	McQuade	Jill	USAF	G	US
86.	Meltz	Martin	Retired	GI	US
87.	Miyagi	Hiroaki	Japan NUS Co., Ltd	P	JP
88.	Montgomery	Noel	Air Force Research Laboratory	G	US
89.	Moore	Michael	Oak Ridge National Lab	G	US
90.	Morrissey	Joe	NOVA South Eastern U	A	US
91.	Murphy	Michael	Directed Energy Bioeffects	G	US
92.	Muthuvelu	Pirunthavany	Ministry of Health	G	MY
93.	Nappert	Hughes	CEM Industry Canada	G	CA
94.	Needy	Robert	Naval Surface Warfare Ctr.	G	US
95.	Nelson	David	Michigan Technical University	A	US
96.	Ng	Kwan-Hoong	University of Malaya	A	MY
97.	Osepchuk	John	Full Spectrum Consulting	GI	US
98.	Packer	Malcolm	Harris RF Communications	P	US
99.	Pakhomov	Andrei	McKesson Bio Services	GI	US
100.	Persson	Bertil	Lund University	A	SE

	Last Name	First Name	Affiliation	Interest Category	Country
101.	Petersen	Ronald	R C Petersen Associates	GI	US
102.	Polson	Peter	Ausa Research	GI	US
103.	Proctor	Ken	US Army	G	US
104.	Ravazzani	Paolo	Italian Nat Res Council	G	IT
105.	Reilly	J. Patrick	Metatec Associates	GI	US
106.	Roach	William	USAF/AFRL/HEDR	G	US
107.	Roberts	Brad	US Army CHPPM	G	US
108.	Rybak	Terence	General Motors Proving Grnd.	P	US
109.	Samaras	Theodoros	Aristotle Univ. of Thessaloniki	A	GR
110.	Santomaa	Veli	Independent Consultant	GI	FI
111.	Scanlon	William	Queens University, Belfast	A	UK
112.	Sheppard	Asher	Asher Sheppard Consulting	GI	US
113.	Swicord	Mays	Mays Swicord Consulting	GI	US
114.	Szmigielski	Stanislaw	Mil Inst of Hygiene and Epi.	G	PL
115.	Tattersall	John	DSTL	G	UK
116.	Tell	Richard	Richard Tell Assoc. Inc.	U	US
117.	Testagrossa	Paul	Alcatel-Lucent	U	US
118.	Thansandote	Art	Health Canada	G	CA
119.	Thomas	Robert	Optical Radiation Branch AFRL	G	US
120.	Thuroczy	Gyorgy	Nat Res Inst for Radiobiology	G	HU
121.	Tofani	Santi	Servizio Di Fisica Sanitaria	G	IT
122.	Umbdenstock	Donald	Tyco/Sensormatic	P	US
123.	van Rongen	Eric	Health Council of the Netherlands	G	NL
124.	Varanelli	Arthur	Independent Consultant	GI	US
125.	Wan Nor Liza	Mahadi	Mahadi. Institute: Univ. Malaya	A	MY
126.	Weller	Robert	FCC	G	US
127.	Wiart	Joe	France Telecom Orange Labs	P	FR
128.	Williams, Jr.	Louis	Louis A. Williams Jr. & Associates	GI	US
129.	Woods	Richard	Sensormatic Electronics	P	US
130.	Yoo	Done-Sik	Elect & Telecom Res Inst	A	KR
131.	Zipse	Donald	Electrical Forensics, LLC	GI	US
132.	Ziriax	John	Naval Health Research Center	G	US
133.	Ziskin, MD	Marvin	Temple Univ. Medical School	A	US

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P = Producer U = User

Table TC-95-7

TC-95 Membership: SC-5 (Safety Levels with Respect to Electro-Explosive Devices)

	Last Name	First Name	Affiliation	Interest Category	Country
1.	Babij	Tadeusz	Florida International University	A	US
2.	Balzano	Quirino	University of MD	A	US
3.	Bean	John	Naval Surface Warfare Center	G	US
4.	Colville	Frank	U.S. Army CHPPM	G	US
5.	Comlekci	Selcuk	Suleyman Demirel University	A	TR
6.	DeFrank	John	USACHPPM	G	US
7.	Duvdevany	Amnon	IDF Medical Corps	G	IL
8.	Harmon	Ray	EG&G	P	US
9.	Hatfield	James	Hatfield & Dawson	U	US
10.	Joyner	Ken	Samsung	P	AU
11.	Leidel	David	Halliburton Energy Services	GI	US
12.	Nappert	Hughes	CEM Industry Canada	G	CA
13.	Petersen	Ronald	R C Petersen Associates	U	US
14.	Roberts	Brad	US Army CHPPM	G	US
15.	Stuart	James	Franklin Applied Physics	GI	US
16.	Thompson	Ramie	Franklin Applied Physics	GI	US

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