

Summary

The Procrustean Approach

Setting Exposure Standards for Telecommunications Frequency Electromagnetic Radiation

(A thesis by Don Maisch PhD, 2010)

Introduction

According to an ancient Greek legend there was a bandit nicknamed Procrustes or “The Stretcher”. He forced travellers to lie on his bed. If they were too long he cut off their limbs to fit the bed. If they were too short they were stretched on a rack until they fitted the bed. Theseus, a legendary Athenian king, killed him.

One of the derived meanings of the Procrustean bed is an arbitrary standard to which exact conformity is forced. It was used to refer to Western radio frequency setting by Professor Parin, a member of the USSR Academy of medicine.

Don Maisch was a member of the Standards Australia TE/7 committee which examined what constituted a suitable precautionary approach when setting radio frequency (RF) exposure standards in order to address scientific uncertainty and provide adequate public health protection. That committee was ultimately disbanded because a suitable definition of a precautionary approach could not be agreed upon. The matter was then given to a body that would come up with the conclusion that the government wanted.

The thesis contends, rather than taking a precautionary approach, Western standard setting organisations have followed a Procrustean approach. This consists of cutting off from consideration scientific data that does not conform to their bed of knowledge. This is detrimental to public health protection.

The thesis concludes with the argument that, given the sheer number of people exposed to RF/MW from telecommunication devices, there is an urgent need to conduct an international reassessment of the biological limits placed on current RF/MW standards.

Ch 1: Development of Risk Assessment/Analysis

P7 There are two differing views on how best to address risks:

1. Because of scientific uncertainty it is 'better to be safe than sorry'. The US Environmental Protection Agency talked of 'conservative risk assessment'.
2. From the regulated industry viewpoint, unfounded fears fuelled excessive regulation which posed a risk to the economy. This viewpoint by 'revisionists' was a reaction to Agency conservative risk assessments posing a risk to industry. Quantitative risk assessment (QRA) is the scientific qualitative evaluation of the potential hazard to health. It involves four steps – hazard identification & characterisation, exposure assessment and risk characterisation.

P8 In this thesis, the main focus of QRA is to radio frequency and microwave non-ionising radiation from telecommunications technology. This includes the risks identified and those excluded (possible adverse effects from non-thermals). This chapter focuses on the politics and development of QRA in US, but is relevant internationally.

P10 This thesis examines present day technological QRA as primarily a 'revisionist' counter-reaction to the rise of reflexive modernity in the 1960s & 1970s with the rise of public awareness and concern.

P11 The rise of the risk society in the 1960s coincided with the birth of the environmental movement in US e.g. concern about DDT exposure.

P13 The challenge for industrial society was how to respond best to the new legislative restrictions.

P15 There were new global risks:

- (1) Exposure to ionising radiation from nuclear accidents,
- (2) Risks in the workplace,
- (3) The ubiquitous presence of radiofrequency / microwave radiation from telecommunications technology.

P16 The US National Environmental Act of 1969 required all federally funded projects to be justified in environmental impact statements setting out the various benefits and costs, preferably quantitatively.

P20 The spread of nuclear power saw the rise of probabilistic risk assessment.

P26 The Rio Declaration (UN, 1992) and The Wingspread Statement (1998) addressed uncertainty and recommended the Precautionary Approach.

P27 The telecommunications industry rejected the cautionary approach saying that it is 'based on fear, resulting in wasteful and misguided regulations'.

P28 The 1980s saw an exploration of how to apply risk/benefit analysis (QRA) to RF. Examples are given.

P33 This outlines problems that can arise.

P41 On weight of evidence (WOE). This concept was introduced in the early 1990s to improve the risk assessment of Superfund toxic disposal sites in the US. Krinsky defines WOE as 'a process or method in which all scientific evidence that is relevant to the status of a causal hypothesis is taken into account.' IEEE defines WOE as an approach to assessing the scientific literature on possible biological effects from RF exposure for standard setting as a process involving an "evaluation of the quality of test measurements, size and power of study designs, the consistency of results across studies and biological plausibility of dose-response relationships and statistical associations." When evaluating RF literature, only "well conducted and published confirmation and replication of studies that produce the same result contribute to the

WOE". The primary feature of the WOE approach, as used in RF standard setting health risk assessment is to exclude the biological relevance of RF exposures at levels below official standards, which are based on limiting biological tissue heating from RF exposure to protect against thermal damage at high level exposures.

P43 Conclusions: While QRA is viewed as objective, it can be used to justify a previously made decision in support of a new product or in support of new technology. This point is followed up later in regard to new technology.

Ch 2: Peer review and expert advisory panels

P45 The central issue of this chapter is the relatively recent attempts (1970+) to revise the definition and role of peer review and expert advisory committees, specific to environmental regulation, in areas that may pose a financial risk or burden to industrial corporations. An essential part of modern scientific practices and the environmental regulatory system is the concept of peer review to ensure that work is scientifically significant and of a high standard.

P46 This chapter examines the peer review/ expert advisory process as it developed in the US because RF standard setting first developed in US and was then internationalised. Included here is an examination of 'procrustean tendencies', as opposed to public interest. The process of peer review (PR) of submitted manuscripts is thought to have started with the Royal Society of London in 1752.

P47 Peer review in the US was influenced by the 1945 report "Science The Endless Frontier" by V Bush, the Director of the Office of Scientific Research and Development. This was a blueprint for later post-war science policy. The report recommended the establishment of the National Research Foundation (NRF). The National Science Board (NSB), comprised of representatives of the science community, would be created and was designed to be non-bureaucratic and apolitical. Note the difference between 'grants' PR which allocates limited research funds, 'manuscript' PR that guards the entry into scientific literature and 'regulatory' PR that evaluates scientific research for governments.

P48 The advantages of peer review seem self-evident and are discussed here.

P50 The weaknesses of PR are discussed here. Rustom Roy, a critic of basic PR, saw PR as a way to ensure that scientific publications fit in with current scientific paradigms and obstructs revolutionary developments.

P51 Funding to research bodies can create a conflict of interest which can influence decisions.

P54+ Several alternatives to traditional PR models are presented:

- (1) A super PR. This is based on reviewing the authors, not the particular work.
- (2) DARPA model. Here a single, strong manager makes decisions.
- (3) Expert elicitation. In areas where hard data is lacking, the considered opinions of experts are elicited.
- (4) Open PR. Here peers, authors and interested public can discuss a paper.

(5) Extended peer community. In complex, new environmental issues an open dialogue between all parties can occur.

P57 The Daubert Appeal case created grounds for making Judges “gatekeepers” to judge the credentials of witnesses. By the 1980s there were many large-scale toxic tort litigation cases. In the Daubert case, Merrell Dow Pharmaceuticals were sued for the alleged birth defects caused by the drug Bendectin. In order to aid the court four 'Daubert Criteria' were established for evaluating the admissibility of expert testimony, as follows:

- (1) Whether the methods on which testimony are based are testable.
 - (2) The potential rate of error.
 - (3) Whether peer review has occurred.
 - (4) Whether the method is generally accepted in the relevant scientific community.
- The Daubert Criteria were accepted by the US Supreme Court as a guide, rather than prescriptive.

P60 In the case *Newman v Motorola* (2000), Newman, a neurologist, alleged that Motorola's mobile phone had caused his brain tumour. Judge Blake disallowed expert testimony for Newman on the basis of Daubert's Criteria. She stated that only the effects of thermal energy were widely accepted.

P63 The general approach in rulings based on Daubert is to critique the plaintiff's science in isolation from the rest of the body of submitted evidence. WOE means that all the available evidence should be evaluated, not just a subset of the evidence. The WOE approach is usually applied when no individual study or other body of evidence is sufficient to demonstrate that a cause-effect relationship exists on its own. Lawyers defending companies have urged that Daubert be applied to all regulatory agencies.

P65 Economically-based political actions instigated in the 1900s and 2000s by the US federal administration have had the purposeful effect of placing a very restrictive peer review process on federal agencies. This policy has been enacted through the US Office of Management and Budget (OMB) and has created a revisionist 'peer review' process to block the accumulation of a scientific literature base inimical to American industrial interests.

P77 The revisionist attempts to revise US regulatory risk assessment and peer review essentially are aimed at transferring control over the regulatory processes to the industrial sector of the US economy. These attempts are done under the guise of improving regulatory science, but they are intended to protect economic interests at the expense of public health protections.

Ch 3: The Development of the IEEE C95.1 RF standard

P81 This chapter explores reasons why the thermal paradigm came to be the primary focus in RF standard setting while other possible biological effects were arbitrarily rejected for reasons other than scientific quality control. In the development of the IEEE C95.1 RF standard military and corporate interests were able to assume control over the standard setting debate from the beginning and establish faulty risk assessment and

science evaluation procedures. These were to their mutual benefit to ensure that setting exposure limits would never become a threat to the development of new RF-emitting technology, be it for military or commercial purposes.

P81 The end of the 19th century heralded the birth of the electronic age. By 1900 electrotherapy devices were widespread. The medical community was aware of the possibility of electromagnetic fields being used in therapy.

P83 There were warnings as early as 1928 that “extreme care” was needed when working on radiowave apparatus due to the risk of extreme heating. In 1935 the AMA convened its Council on Physical Therapy (CPT) to check claims of companies marketing diathermy machines. It set the tone for future discussions on non-thermal (athermal) bio-effects. It was stated that “the burden of proof still lies with those who claim any biological action of these currents, other than thermal heat production”. Military planners inherited this viewpoint. The burden of proof was not on the manufacturers, but on users. (*P84*)

P86 The importance of radar was realised in WW2 and the Korean War.

P87 There was a search for RF standards after WW2.

P89 Biophysicist Herman Schwan recommended 10 milliwatts (mW)/sq.cm. to limit temperature rise, based on his thermal model. By 1960 all three branches of US military had adopted this standard. Alternative theories proposing bio-effects not related to heating were ignored.

P90 The only organisation with the capacity to produce the research was the military. This created a conflict of interest.

P91 The Tri-Service Research Program (1951-60) had the purpose of validating the Air Force's thermally based “protective criteria” that its in-house standard was based on. Minimal overheating was acceptable because the body has the ability to cool itself.

P92 Post-Sputnik (1957) the US feared the Soviets more than anything else.

P93 A statement by Michaelson at this time summed up the then current thinking that if the US adopted stringent RF standards, similar to the Soviets, “the harm that would be done to industry and the military would outweigh any proposed public health benefit”. By 1961 the thermal effects only approach, as exemplified by Knauf and Schwan, was well on its way to becoming accepted as the only way that RF microwave exposure interacted with the human body. Alternative research projects were curtailed. Becker, a researcher, noted that research evidence for non-thermal effects came to be viewed as a threat to national security. He has written about political attempts to curtail his research programs at the Veterans' Administration. Most pressure came from the Department of Defence.

P94 The Soviets took a different approach to the effects of RF microwaves on the body. After looking at the effects of less than 10 milliwatts (mW)/sq.m., the Soviet 1958 occupational exposure standard was set at 0.01 mW/sq.m. = 10 microwatts(μ W)/sq.m., 1/1000 that of the US standard. In his forward to the 1970 book “Electromagnetic Fields

and Life”, relating to Soviet bioelectromagnetic research, stated that “EMFs can have non-thermal effects and that living organisms of diverse species- from unicellular organisms to man- are extremely sensitive to EMFs. Some of the discovered features of the biological action of EMFs clearly do not fit the Procrustean bed of the heat theory.”

P95 In 1960 the Academy of Medical Sciences in the USSR published a report, “Biological Action of Ultrahigh Frequencies” that identified biological effects from both animal and human exposure to radiofrequencies above 300 MHz. The Soviet scientists observed a detectable thermal effect at 10 mW/sq cm and above. But they were primarily concerned with biological effects below the thermal threshold of 10 mW/sq cm. Much of the work was documenting the actual health effects of workers working with UHF. Symptoms such as dizziness, sleeplessness, heart palpitations etc are listed. The consideration of the actual bio-effects on Soviet workers influenced the setting of the 1958 Soviet occupational exposure standard at 0.01mW/sq cm. This is 1/1000 that of the US thermal protective standard limit of 10 mW/sq cm. Soviet work standards were stricter in other ways also. The Soviet military was not bound by these stricter standards.

P97 A number of weaknesses of the US Tri-Services Program are listed. They are too lengthy to summarise here.

P98 In the 1950s there were short-lived civilian alternatives to the military's 10 mW/sq cm standard. Some companies put more emphasis on empirical data (like the Soviets) because they were not satisfied with the military's thermal only approach. New technological advances made standards harder to maintain. Hence developed the growing philosophy of “risks versus benefits”.

P100 In the 1970s the US Air Force proposed PAVE PAWS, a more powerful coastal early warning radar system. There was some opposition based on health grounds. The IEEE concluded that there was “no evidence in the peer-reviewed scientific literature” supporting the need to take into account biological effects when setting RF standards. Physicist Robert Adair summed up the “risk v benefit” dilemma when he stated that the push to limit standards was “damaging to the Air Force in its role in defence of the US- *my* country- and *my* Air Force”.

P105 There were wide differences in expert understandings on EMF bio-effects between physicists on the one hand and bioelectromagnetic scientists on the other. A case is given where physicists were excluded from a review panel on EMF effects because “physicists were considered too sceptical of EMF bio-effects and that they had trouble accepting what was going on in the field”. In 1962 “The Moscow Affair” occurred. The Soviets beamed highly focused microwaves into the US Moscow Embassy, in the range 0.005-0.018 mW/sq cm. These were 500x US standard and 2x Soviet standard. The US could not officially protest because the doses were well within their standards. In 1967 President Johnson asked Kosygin to discontinue the practice. Preliminary studies suggested that the US Moscow staff were adversely affected. Follow up studies were conducted but allowed to peter out, for the sake of convenience.

P107 In the 1950s and '60s the issue of RF standards went international. The Soviet and Eastern European standards were a worry to the US lest they spread to Western

Europe. Not only was there a Cold War race, there was a RF standards race. This occurred in organisations like WHO and NATO. The credibility of researchers who questioned the 10 mW/sq cm was questioned.

P108 Simply put, a recognition of low-intensity effects was seen as a risk to national and global security and outweighed possible health effects. Commitment to 10 mW/sq cm was cemented into place during the Cold War and is a legacy of those years.

P109 In the 1960s a battle ensued between the US Air Force, Navy and IEEE over who would set the RF standards. A six year squabble between the factions led to an agreed occupational standard in 1966.

P110 Steneck, in "The Microwave Debate" (1984), stated that "The early standard-setters accepted thermal thinking as a fact of science and ignored the weaknesses of their evidence through an act of faith". Steneck believed that the 1966 standard was developed primarily by producers for industrial and military users, not by customers or consumers. Of 15 members, 10 were from the armed services, the others from the Petroleum Institute, Space Administration, General Dynamics, Treasury and US Public Health Service.

P111 To address the perceived limitations of the 1966 standard, Ophthalmologist Milton Zaret wrote an open letter to the American National Standards Institute (ANSI) noting the lack of epidemiological studies on large populations. To avoid the impression of certainty where none existed, Zaret recommended changing the phrase explaining the safety of below threshold exposures from "will not" to "is believed not to result in any noticeable effect to mankind". This would have been in keeping with chairman Rosenthal's call for a vigorous and active program of research to validate the standard. Zaret's recommendations were discussed by the committee and rejected. Industry representatives opposed the idea. Keeping the thermal only emphasis of the standard brought certainty for the rapidly developing technology for civilian and military applications.

P113 In 1978 the IEEE Committee on Man and Radiation had a workshop that included discussion on ongoing cooperation between US and Soviet scientists. It applauded the ecological validity of Soviet biological studies which was lacking in western studies. It concluded that "[i]n short, the Soviet scientist has profited from US engineering, and the US scientist from Soviet methodology".

P114 The C95.1 1982 ANSI RF standard reaffirmed the maximum permissible exposure of 10 mW/sq cm. **P116** Stenck noted "This should come as no surprise. C95 activities are coordinated by the navy and IEEE, two user-oriented associations. Roughly 2 of every 3 C95 members represent military or industrial interests. Many of the scientists who advised ...were funded by the military".

P118 In 1993, in a surprising break with military policy, Dr Godfrey, a Director at the Phillips Laboratory at Kirkland Air Force base, limited exposure for employees to 0.01mW/sq cm. This was due to advice from Dr Kanavy, chief of the biological effects group. Kanavy had concluded that there is consensus that non-thermal effects do exist and the ANSI/IEEE standards are deemed inadequate to protect human health. "The

existence of non-thermal effects are essentially denied by omission". Such concerns were ignored.

P119 In 1993 the Federal Communications Commission proposed adopting the ANSI/IEEE C95.1-1992 RF standard for evaluating RF/MW hazards as part of its responsibilities under the National Environmental Policy Act. Comments were sought and 100 were received. A brief examination here illustrates the vast chasm that separates public health protection considerations from those of fostering unfettered technological advancement. Proponents of the latter dominate the groups making decisions on standards. For instance (P122), in 1996 17 of 31 members of the IEEE standards committee were associated with the Department of Defence.

P125 The 1986 National Council on Radiation Protection & Measurement (NCRP) did take into account non-thermal (athermal) effects, an unpopular concept to the industry and IEEE as it undermined previous statements.

P127 In 1997 the Federal Communications Commission (FCC), a US government agency that regulates interstate and international communications by radio, TV, wire, satellite and cable, reaffirmed its previous decision to base its RF standard mainly on the NCRP RF recommendations of 1986. They stated that "we have based our guidelines on the recommendations of the Environmental Protection Agency, the Food and Drug Administration and the National Institute for Occupational Safety and Health. The FCC had come under immense corporate lobby pressure to prevent their operational requirements from being restricted.

P129 IEEE SCC Sub-committee 4 attempted to tackle the mobile phone compliance problem as the technology increased in capacity. Examples are given of industry's emphasis on playing down the problem of health concerns.

P130 When a TV program decided to test five mobile phones for compliance with the FCC standard they found that all four US testing laboratories refused to do the work. It was suggested that they feared being blacklisted by the industry. The testing was done in Germany and 4 out of 5 did not comply, although compliance could depend on the position of the phone. The former head of the Cellular Telephone Industry Association's Wireless Technology Research Group said "It is possible for the industry to submit the findings that are favourable to them and have the FCC only review those. In fact this industry is regulating itself."

P145 Public concerns over telecommunications technology, and the ever-increasing development of new devices, are dismissed by the IEEE standard setters as simply based on public interest and unfounded fears.

P146 An example is given indicating an inbuilt bias in RF/MW standard setting towards research concentrating only on the thermal paradigm.

P147 A study by Huss et al (2006) concluded "Our study indicates that the interpretation of the results from existing and future studies of the health effects of radiofrequency radiation should take sponsorship into account".

P153 Conclusions: Common to all the standards and guidelines examined in this chapter is a scientific assumption that the only hazardous biological effect from RF exposure is thermal in nature. The emphasis of benefit over risk was understandable during the cold war, but continues to this day. With members linked to the 'military-industrial complex' firmly in control of the IEEE's RF standards committees from the beginning, their continuing task was essentially to refine the thermal paradigm by encouraging research to further add validity to the thermal paradigm and not to test its basic assumptions. This paradigm has been challenged on a number of occasions by knowledgeable experts and government agencies, but without success. Conflict of interest has long been an essential policy to block the possibility of change inimical to those who control the process. The importance of this chapter is to expose the subjective nature of the existing RF standard setting process as it has played out in the US.

Ch 4: The thermal paradigm spreads internationally

P155 The foundations of the international effort to address both ionising and non-ionising radiation protection can be traced back to the US in the 1950s. In the 1970s the World Health Organisation (WHO) took up the issue creating working groups and committees. This led to ICNIRP, a non-government organisation authorized to deal with non-ionising radiation protection and the WHO International EMF Project (IEMFP). The latter's primary function is to conduct risk assessments, risk management and risk perception/communication. ICNIRP develops standards. The central argument in this chapter is that IEMFP and ICNIRP's claims of independence from industry, and by implication the military, must be considered a necessary requirement for their scientific credibility.

P165 In 2000 the WHO Committee of experts on Tobacco Industry Documents released a 260 page document detailing the tobacco industry's strategies to undermine the work of the WHO. WHO listed steps to ensure that it did not happen again. References were to the tobacco industry, but the general principles were wider. These included ensuring consistent enforcement of conflict of interest policies and taking steps to educate their scientific investigators and collaborators about (tobacco company) efforts to undermine research.

P161 Repacholi, the chairman of both ICNIRP and IEMFP gave evidence at the Australian Senate Inquiry into Electromagnetic Radiation (2000-01). He stated: The WHO does not allow industry to participate in either standard setting or in health risk assessment. The WHO takes the view that there cannot be industry representation on standard setting working groups. There cannot be someone on the working group who is having an influence on health effects for an industry when they derive benefits from that industry."

P162 As reported by the New York based 'Microwave News' in 2005, the 20 member IEMFP Task Group writing a new Environmental Health Criteria (EHC) document on power frequency EMFs, included, at the request of Repacholi, representatives from the electrical utilities, or organisations with close ties with the industry. Their tasks were to assist in writing the initial draft and review the completed draft. The names of industry members are detailed. This is counter to Repacholi's claim to the Australian Senate.

P163 Industry restriction of unwelcome research is illustrated by the 1994 Hydro-Quebec-funded epidemiology study conducted at McGill University. Initial analysis of the data collected from three electric utilities suggested that workers with greatest exposure to magnetic fields were at greater risk to their health. The researchers wanted to further analyse the data for other associations. Hydro-Quebec, which owned the data, refused further access to the data.

P166 Through WHO the ICNIRP guidelines on RF/MW radiation and ELF non-ionising radiation exposure standards are being promoted globally in order to make a truly international template for national standards. These have generally been readily accepted in the western world where countries are anxious to embrace new technology with few questions.

P168 The culture relating to the health risk associated with radiation exposure has been significantly more conservative in Russia than in the West and ICNIRP guidelines have been resisted there. At the international conference titled "Mobile Communications and Health: Medical, Biological and Social Problems", Moscow 2004, Repacholi and others promoted ICNIRP as the only choice for Russian agencies to live in a global community. All of the Russian organisations present at the conference were of the firm opinion that Russia's low level non-thermally based RF standard was the preferred way to health protection. RNCNIRP chairman Grigoriev said the ICNIRP's "thermal effects for criteria or standards is not a suitable approach." The WHO was being "Insufficient on the precautionary principle." Grigoriev summed up the problem for the Russians as that modern telecommunications may inherently be incompatible with adequate health protection. Late in 2008 the strict Russian RF standard is still in place with the thermal rationale for the ICNIRP Guidelines still being rejected by RNCNIRP.

P170 China also has established far stricter guidelines than ICNIRP, based on research indicating adverse biological effects, other than just tissue heating. China has had one of the strictest exposures to microwave radiation for both public and workers. China's insistence on lower mobile phone standards has forced overseas manufacturers to customise their phones to Chinese regulations. The reason for this flexibility is economic.

P173 For many years the Czech Republic (CR) maintained strict exposure standards. Czech scientists had conducted much of the research on the bio-effects of RF exposure, along with Russian scientists. In 2001 the CR replaced its former strict Soviet-based standards with much relaxed limits based on the ICNIRP guidelines. The reason for the change was an apparent political decision made in favour of economic considerations against the expert advice of the Czech National Institute of Public Health's Advisory Board on Non-ionising Radiation. Dr Musil, the Chair of the board, had opposed the adoption of the ICNIRP guidelines. In an open letter he said that he had been "replaced by a person with no research experience in this area who was willing to accept ICNIRP limits without biophysical qualification."

P184 Examples of expert criticisms are given of both IEEE C95.1 and ICNIRP guidelines are given, along with responses to these criticisms.

P188 Despite severe criticisms of these guidelines the thermal paradigm contained in them reigns supreme for various reasons such as the following: Military and corporate interests have a vested interest in standards that conform to their operational requirements; necessary research effort has been under the control and funding of the telecommunications industry; it is convenient for governments to have national standards under WHO control; the World Trade Organisation (WTO) requires global standards; governments and the public do not want tighter standards that will restrict new technologies; and the coordination of the telecommunications industry on a well-planned global scale overpowers any activist oppositions which tend to occur as one-off activities on a local or regional scale. Consequently, public health protections are sacrificed.

Ch 5: A Case Study on ICNIRP Harmonization and the Australian RF Exposure Standard

P193 The thermally based RF standard setting paradigm, originally established by the military in the 1950s and embodied in the IEEE C95.1 standard (Ch 3) through to the current ICNIRP guidelines (Ch 4), was the central issue of conflict in the development of the Australian standard. An examination of this development makes a convenient case study to explore the restrictions placed on the scientific risk assessment of RF bio-effects by vested interests working through standard setting committees. A driving factor in the various revisions of the Australian RF standard from the 1970s to the 1990s was the introduction of new wireless technological innovations operating at increasingly higher frequencies. Australian governments had relied on the Standards Association of Australia, later Standards Australia (SA), to advise on the setting of RF standards. During this time CSIRO had played an active role, essentially acting in the public interest and recommending areas that urgently needed research.

P194 In 1979 SAA established a committee (renamed the TE/7 Committee in 1984) to draft an Australian RF exposure standard. After 7 years it finally reached an uneasy agreement in 1985 when AS2772-1985 was established.

P195 Hollway, the CSIRO's representative on the SAA committee, pushed for a standard that gave protection against low level RF exposures. He stated then that "The proper course to adopt in setting a standard of this kind, where the effects of 'low' levels of radiation are largely controversial, is to give first priority to the safety of people." One of the factors in Hollway's stand was his awareness of the divergence in thinking between the US and Russian standards. During the 7 years of debate in the SAA committee Hollway was outnumbered by the representatives of institutions and industry who were opposed to restrictions.

P196 Representing CSIRO's stance, Hollway initially proposed 40 $\mu\text{W}/\text{sq cm}$ for the general public, based on the possibility of non-thermal effects. This was unacceptable to the military and industry representatives, so 100 $\mu\text{W}/\text{sq cm}$ was initially set for the public. The allowable 'safe' level for the public was then increased to 200 $\mu\text{W}/\text{sq cm}$ to accommodate all the requirements of the various SAA committee members.

P198 The important feature of the 1985 RF standard was that it recognised the possibility of non-thermal effects, although it was basically a thermal standard. The Standards Australia TE/7 Committee: Human Exposure to Electromagnetic Fields was established in 1984, with essentially the same membership as the SAA committee. It became a joint Australia- New Zealand committee in 1992. According to CSIRO scientist Alexander Doull, one of the CSIRO representatives on TE/7, after the 1985 Standard, the industry, military and government representatives pushed for much higher levels of exposure (up to the ICNIRP limits), to delete any references to fundamental principles of radiation safety, to minimise any explicit reference to harmful effects and to delete the previous acknowledgement of the existence of non-thermal effects on living organisms. He thought the changes sought would effectively protect industry from litigation.

P199 The alternative viewpoint on TE/7 came from 8 committee members representing organisations which were against relaxing standards. Standards were reviewed every five years and from 1984 to its demise in 1999 the TE/7 committee published three interim RF standards.

P200 There was ongoing pressure from the majority of committee members of the TE/7 committee and the chairman to relax standards. A continuing restriction within TE/7 was that existing RF literature was not to be reviewed and only new research not previously seen before could be considered by the committee.

P203 At the beginning of the 1998 TE/7 committee meeting to consider the then interim standard, the chairman sought a show of hands to determine how many members were in favour of incorporating the ICNIRP Guidelines into the interim standard. If 80% agreed, the interim process would be a quick process. There were 20 in favour, 6 against and 2 open to consider the proposal. These were the two community representatives representing the Consumers' Federation of Australia (CFA), of whom Don Maisch was one. These two were concerned over the high level of uncertainty that existed in the RF literature base in relation to safety from prolonged, low level (non-thermal) RF exposures. This was reinforced by their reading of a 1994 report by CSIRO scientist.

P204 The two CFA representatives adopted the pragmatic approach that ICIRP limits would eventually be approved because of the overwhelming number of industry representatives. They therefore sought to introduce a suitable precautionary approach into discussions. They wanted the standard to state that it only gave protection from RF thermal effects and did not address the issue of possible low-level, long term exposures, namely that this standard was not the final word and liable to change as the science progressed. The members of the committee opposed to the proposed standard were hostile to the community members 'doing a deal'. A precautionary approach statement that was sent out for public comment did partially acquiesce to the CFA's requests.

P205 However, in the final statement, any mention of uncertainties, limitations of the standard limits or incomplete data bases were removed, so no compromise eventuated.

P208 With such a situation, where 2 groups within TE/7 had such irreconcilable differences, an 80% consensus could not be reached and gridlock occurred.

P212 The deadline was extended to try to work through differences, but to no avail. At a 2001 Senate Inquiry R.Lyle, a TE/7 committee member stated that in the previous seven years he could remember the committee reaching consensus and he called the lack of consensus a “rare event”. A detailed summary of the seven submissions from TE/7 members who voted “no” against accepting the proposed ICNIRP based RF standard is included on P243.

P218 TE/7's failure to approve the 1998 interim standard left the Australian Government with a major dilemma, just at a time when they planned to sell further parts of the electromagnetic spectrum in the higher microwave range for new wireless technology. To solve the government and industry's problem the job was given to the newly created Australian Radiation Protection and Nuclear Safety Agency (ARPANSA). This was seen as a pair of 'safe hands' by the Government (my words). It gave the job to its Radiation Health Committee (RHC). When RHC convened, to carry on the work of TE/7, CSIRO was asked to name a representative. Dr S.Barnett, from CSIRO, attended the first meeting. After discussions with CSIRO management he resigned stating “The purpose of the new committee seemed to be the way to push through a Standard that had failed to reach consensus under SA processes... My concern was that there was no benefit to CSIRO in continuing in its involvement... There was a very high risk that the exercise would be more of a public relations activity than a genuine attempt to pay attention and properly deal with the issues of 'non-thermal bio-effects' and the 'Precautionary Principle'... There was to be an agreed standard and the CEO of ARPANSA seemed to hold sway over whether this was accepted or rejected...”. The final recommendation of the working group to the RHC was in favour of the proposed ICNIRP based RF Standard. Having no input from the public, other than the token representation of only one community representative on its non-voting working group, ARPANSA's RHC was able to simply ignore the many scientific and public submissions to the previous TE/7 Committee. Using virtually dictatorial powers the CEO of the Health Research Council and ARPANSA was able to push through the Standard.

P220 Political considerations ended CSIRO's involvement with telecommunications. In 2003 Barnett, from CSIRO's Telecommunications and Industrial Physics Department, circulated a letter to announce that he had been forced to accept “voluntary redundancy” and that his division had been told by senior management to cease all further research into the bioeffects and safety of ultrasound and non-ionising radiation (RF). He stated “... “It seems that research for the good of the community is not considered a priority area unless it is politically attractive or able to attract funding from industry. Clearly this is not the case for safety related research in a taxpayer-funded research organisation.”

P223 It is concluded that the long push to increase Australia's RF exposure standard's limits had little to do with better science and all to do with the 'realpolitik' of pushing through ICNIRP's thermal effects only paradigm in order to advance economic interests. As has been pointed out earlier, the standards of the Western capitalist world, led by the US, have been far less stringent than those in Russia and China. The pressure on relaxing radiation exposure standards that entrenched military and industrial

interests bring to bear on the political scene were illustrated in the case of the Czech Republic when it joined Western Europe. (P173).

P225 In conclusion. The marginalisation of criticisms of the validity of thermal approach to RF standard setting has been an important issue and is what is called the Procrustean Approach, where all scientific evidence not in conformity with the thermal bed of knowledge is simply cut off from consideration.

P226 Future directions. There is obviously an immense problem in seeking to recommend how to reform an existing RF standard setting process that has been controlled from the start by individuals who have staked their scientific credibility, and careers, on defending the existing thermal paradigm for standard setting. There is also the problem whether or not biologically relevant standards that address chronic low-level non-thermal exposures are even compatible with the continuing wireless revolution. But public health problems need addressing.