

The ICNIRP Guidelines: RF risk assessment built on a house of cards

"When a well-packaged web of lies has been sold gradually to the masses over generations, the truth will seem utterly preposterous and its speaker a raving lunatic."

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Introduction

This paper in no way portends to be a comprehensive analysis of the radiofrequency / microwave (RF/MW) exposure guidelines published by the International Commission on Non-Ionizing Radiation and Protection (ICNIRP). What it does attempt however is to show that ICNIRP's methodology for assessing the RF epidemiological literature is inconsistent and does not measure up to accepted standards for a 'meta-analysis'¹.

The second part of this paper deals with the importance of Public participation as informed citizens in setting RF standards - from the perspective of the Australian public's involvement in Standard Australia's proposals to incorporate the ICNIRP RF guidelines for both Australia and New Zealand.

ICNIRP as a precautionary approach for the UK?

In a press statement released on 31 March 2004, the United Kingdom's National Radiological Protection Board (NRPB) recommended the adoption of the ICNIRP guidelines². These guidelines cover the man made frequencies between 0 and 300 GHz and apply to both the extremely low frequency powerline emissions and the radiofrequency/microwave sections of the electromagnetic spectrum. This recommendation follows advice from UK and international scientific experts and groups, including the UK's Advisory Group on Non-Ionizing Radiation (AGNIR).³

The ICNIRP guidelines are being presented to the UK public as state-of-the art in standard setting – an unassailable apex of scientific objectivity. The ICNIRP guidelines are being promoted as incorporating a "precautionary approach" as indicated by Sir William Stewart: "This new recommendation by NRPB to adopt ICNIRP guidelines reflects a detailed assessment of the risks involved, and also the need for

a precautionary approach when there are genuine uncertainties in our knowledge."⁴

Conversely, in Australia, in the Standards Australia TE/7 Committee (charged with setting a new RF exposure standard) the precautionary approach was a central feature of controversy for the new proposed draft⁵. The TE/7 committee failed in March of 1999 to approve the ICNIRP guidelines for RF because a significant number of committee members, after extensive consideration, **did not consider that ICNIRP recommendations followed a precautionary approach**. This was due to the viewpoint that much of the data used in ICNIRP was only relevant to short term, acute exposure studies on animals and as such, only considered thermal effects, not long term, low level, chronic effects which the many public submissions were concerned with.

As was stated in a joint committee member submission to TE/7:

"Comments on recent statements regarding the precautionary principle in the new draft

Unlike the Interim Standard [the previous Australian/New Zealand RF standard], the new draft [based on ICNIRP] does acknowledge that it is based on thermal effects only. The 'safety margin' of 50 (for the public) is based on thermal considerations only. It cannot be said therefore to constitute a precautionary measure for non-thermal effects. The public is concerned about whatever non-thermal effects may occur at exposure levels possible in accessible areas near a transmitter. These levels are of the order of a few microwatts/cm². If there are effects at such levels, clearly they are not covered by the thermally-based exposure limits."⁶

For its assurance of safety for the public from exposure to RF transmitting sources (such as mobile base stations), the ICNIRP authors reference six studies which they claim failed to find any ill effects – thus indicating a lack of any adverse effects from non-thermal chronic exposures to RF transmission sources. It is the scientific basis for ICNIRP's conclusions on the findings of these six studies that this paper examines.

¹ The accepted methodology for reaching conclusions from multiple empirical studies is 'meta-analysis'. The main steps in meta-analysis are 1) including all the relevant studies; 2) scoring all studies for methodological competence; 3) extracting 'effect sizes' from each study that represent the magnitude of influence of the experimental variable (in this case, RF exposure); and 4) combining the effect sizes of the numerous studies, taking account of methodological scores.

² Statement by the National Radiological Protection Board. Advice on Limiting Exposure to Electromagnetic Fields (0 – 300 GHz). Doc. NRPB 15 (2) 2004. ISBN 0-85951-532-X. Price £12.50. Available on NRPB website (http://www.nrp.org/publications/documents_of_nrp/abstracts/absd15-2.htm)

³ http://www.nrp.org/press/press_releases/2004/press_release_5_04.htm

⁴ *ibid.*

⁵ Pennicuik S., AS/NZS 2772 – RF Radiation – Exposure and Health Limits, Reasons for Opposing the Proposed 1999 Draft. ACTU, March 1999.

⁶ Beale I., Maisch D., Lincoln J., Joint Submission to TE/7 Committee by the Australian & New Zealand Community / Consumer Committee Representatives, March 3, 1999

ICNIRP

The International Commission on Non-Ionizing Radiation Protection (ICNIRP) was formed in 1992, taking over from the International Radiation Protection Association and its committee, the International Non-Ionizing Radiation Committee (IRPA/INIRC). It is a body of independent scientific experts consisting of a main Commission of 14 members, 4 Scientific Standing Committees covering Epidemiology, Biology, Dosimetry and Optical Radiation and a number of consulting members. This expertise is brought to bear on addressing the important issues of possible adverse effects on human health of exposure to non-ionising radiation. The ICNIRP is responsible for both developing health based standards for human exposure to non-ionizing radiation and disseminating information and advice on the potential health hazards of exposure to non-ionizing radiation.⁷

In evaluating scientific studies ICNIRP is supposed to set a strict standard for its evaluation criteria. To quote:

“Quality criteria for evaluating scientific studies:

Development of guidelines on exposure limits requires a critical, in-depth evaluation of the established scientific literature using internationally accepted quality criteria. . . . When evaluating epidemiological studies, quality criteria are based on the need to evaluate, reduce or adjust for the influence of chance, bias and confounding. Cases of disease should be identified independent of exposure, and exposure should be assessed in a way not related to disease status. The influence of other variables should be handled in the design or in the analysis of the study. Any data on which the conclusions are based should be reported. . . . The final overall evaluation of the evidence should include the assessment of the strength and consistency of the association between EMF exposure and biological effects from both epidemiological and experimental studies, as well as the plausibility that biological systems exposed to EMF fields could likely manifest biological effects. It is also necessary to identify which EMF-induced biological effects are to be considered a hazard to the human health.”⁸

This high standard in acceptance, or rejection, of scientific studies unfortunately does not appear to be reflected in four epidemiological studies referenced in the 1998 ICNIRP Guidelines and included in the section “Cancer studies” on page 504 of the Guidelines as published in *Health Physics* April 1998.⁹

To quote (in part):

⁷ <http://www.icnirp.de/>

⁸ <http://www.icnirp.de/documents/use.htm>, March 31, 1999

⁹ *Guidelines For Limiting Exposure To Time-Varying Electric, Magnetic, And Electromagnetic Fields (Up To 300 GHz)*, International Commission on Non-Ionizing Radiation. *Health Physics*, Vol. 74, No. 4, pp 494-522, April 1998. (Subsequently referred to as (ICNIRP 1))

"Studies on cancer risk and microwave exposure are few and generally lack quantitative exposure assessment. Two epidemiological studies of radar workers in the aircraft industry and in the U.S. armed forces found no evidence of increased morbidity or mortality from any cause (Barron and Baraff 1958; Robinette et al. 1980; UNEP/WHO/IRPA 1993). Similar results were obtained by Lilienfeld et al. (1978) in a study of employees in the U.S. embassy in Moscow, who were chronically exposed to low-level microwave radiation." Selvin et al. (1992) reported no increase in cancer risk among children chronically exposed to radiation from a large microwave transmitter near their homes. More recent studies have failed to show significant increases in nervous tissue tumors among workers and military personnel exposed to microwave fields (Beall et al. 1996; Grayson 1996)¹⁰.

The Barron and Baraff 1958 study examined the radar exposed personnel at Lockheed Aircraft Corporation and concluded: "No acute, transient, or cumulative physiological or pathological changes attributable to microwaves have been revealed in this study."¹¹

The Robinette (1980) and Lilienfeld (1978) studies featured prominently in previous ICNIRP documents, notably the 1995 and 1996 ICNIRP paper *Health Issues Related To The Use Of Hand Held Radiotelephones And Base Stations* by Michael Repacholi¹². To quote:

1) Robinette et al, 1980: "A large scale study of radar workers involving over 40,000 people exposed for two years and followed up for twenty years failed to identify any increased incidence of illness or mortality associated with exposure."¹³

2) Lilienfeld et al, 1978: "studied 1,800 employees and 3,000 dependants of the United States embassy in Moscow who were exposed to low level RF radiation in the embassy. They did not find significant adverse health effects in that population."¹⁴

The referencing of the six studies; Barron and Baraff 1958, Robinette et al 1980, Lilienfeld 1978, Selvin et al 1992, Beall et al 1996 and Grayson 1996 as finding no evidence of ill health effects cannot be regarded as justified in light of subsequent analysis of these studies by Dr. John Goldsmith, Ben Gurin University of the Negev, Israel, and Dr. Neil Cherry, Lincoln University, New Zealand. It was these errors in ICNIRP that constituted a significant part of the opposition to ICNIRP within the Standards Australia TE/7 Committee, mentioned above.

¹⁰ *ibid.* page 504

¹¹ Barron, C.I., Baraff, A.A. *Medical considerations of exposure to microwaves (radar)*. *J.Am.Med. Assoc.* 168, pp.1194-1199, 1958

¹² *Health Issues Related To The Use Of Hand Held Radiotelephones And Base Transmitters*, ICNIRP, *Health Physics*, Vol 70, No 4 April 1996

¹³ *ibid.*

¹⁴ *ibid.*

An inability to change?

On April 30, 1997 this writer wrote to Ms. M. Mandic, Secretary of EME Research Priorities at DOCA and supplied her with the Goldsmith critiques on the Robinette and Lilienfeld studies and suggested that these studies were biased and not of the quality one would expect for acceptance from ICNIRP.¹⁵

On May 10, Dr. Michael Repacholi, one of the authors of the ICNIPR guidelines replied to this letter, importantly **not refuting** the Goldsmith analysis but merely stating that "reference to the Robinette and Lilienfeld studies is largely irrelevant following the recommendations by an ICNIRP/WHO International Seminar on low-level RF fields held in Munich (November 1996).¹⁶

If these two studies were "irrelevant" by Nov. 1996 and in 1997 Dr Repacholi was aware of serious concerns being raised about the validity of these studies without making any attempt to defend them, why are they still being referred to in the current ICNIRP Guidelines?

A critical look at those ICNIRP studies in question

Robinette et al 1980:

Known as the Korean War Study, the Robinette team studied the health and mortality records for about 40,000 technically trained sailors who had served on U.S. Naval ships during the Korean War. A job exposure matrix survey was conducted for 5% of three occupational groups thought to be more highly exposed. Equipment operators were placed in the low exposure group while equipment repairers were considered high exposure. The abstract reported that "No adverse effects...could be attributed to potential microwave exposure..." This finding is now discredited as it was later discovered that in the original analysis, one occupational group, Aviation Electrician's Mate (repairer-high exposure) was placed in the equipment operator's group (low exposure) thus diluting the statistical significance of the findings.¹⁷

As reported by Dr. Neil Cherry, both groups, equipment operators and repairers, were moderately exposed to RF/MW radiation and hence the low exposure group shows higher mortality rates than unexposed groups of the same age.¹⁸

Re-analysis of the data finds that radar exposure causes many other significant increases in mortality. Comparing rates for the two groups there is a significantly higher rate of cardiovascular illness,

¹⁵ Maisch D., The case for a strong Precautionary Approach, and statement of intent, which takes into account possible non-thermal effects, to be included in the Australian Standard, Discussion paper (B). Submission to Standards Australia?New Zealand Committee TE-7: Human Exposure to Electromagnetic Fields, Wellington N.Z. Nov.4-5, 1998. Also:

<http://wwwmembers.dodo.com.au/~maisch/emfacts/papers/submissions.html>

¹⁶ *ibid.*

¹⁷ Cherry N, *Probable health effects associated with mobile base stations in communities: the need for health studies* , pp 2-4, June 2000 (Subsequently referred to as (Cherry 1))

¹⁸ *ibid.*

psychophysiologic disorders, and muscular, bone and joint illness including bone and muscle cancer.¹⁹

According to Goldsmith, "The correct interpretation of this report is that among the group expected to have highest exposure there is a significant excess of hematological and lymphatic cancers' ... "The negative statement in the summary is a misrepresentation of the findings. **All reviews which cite it are biased.**"²⁰

Lilienfeld et al, 1978 Moscow Study:

In 1962 the US Defence department learned that since 1953 Soviet authorities were beaming microwaves from across the street directly into the US embassy in Moscow. Measurements taken at the time found that though the intensity reaching the Embassy was approximately 500 times less than the US standard for occupational exposure, it was twice the highest limit allowed in the Soviet standard. This created a quandary for the US for if they truly believed their standard was safe they could hardly conclude that the level of microwaves at the embassy was undermining the health of the embassy staff. However at a Superpower summit in June 1967, the irradiation of the Moscow embassy was the subject of a confidential exchange between the US president Lyndon Johnson and Soviet Prime Minister Alexi Kosygin. Johnson asked that the Soviet Union stop irradiating its Moscow embassy with microwaves and harming the health of American citizens.²¹

In 1966 a covert study, called *Project Pandora* was commenced to study the possible effects on health from the microwave irradiation of the Moscow embassy staff, who were not told the true reason for the investigation. In a related study, *Project Bizarre*, a primate was exposed to microwaves at half that permitted by the US standard. The findings of this study concluded, "There is no question that penetration of the central nervous system has been achieved, either directly or indirectly into that portion of the brain concerned with the changes in work functions".^{22 23}

At this time there was a US Congressional radiation inquiry underway and the department of Defence was arguing that the US RF/MW Standard was already strict enough. They argued that there was no scientific evidence for the Soviet Standard being set at a level one thousand times lower than the US standard.²⁴

In such a political climate, in the midst of the Cold War any scientific evidence that brought into question the adequacy of the US RF/MW standard was not welcome, to say the least.

An initial study was done on the Moscow personnel in 1967 and examined a group of 43 workers, (37 exposed

¹⁹ *ibid.*

²⁰ Correspondence with Professor John Goldsmith , October 1997.

²¹ Dalton L. *Radiation Exposures* , Scribe Publications, pp 31, ISBN 0 908011 19 9.1991.

²² *ibid.* pp31-32

²³ Steneck N.H. et al. *The Origins of US Safety Standards for Microwave Radiation* , Science, Vol.208,pp.1230-7, 1980

²⁴ Dalton L. *Radiation Exposures* , as above, p 32

and 7 not exposed) tested for abnormalities in chromosomes on stimulated division. 20 out of the 37 were above the normal range among the exposed, compared to 2/7 among the non-exposed. In a final report, the scientists urged a repeat and follow-up study which was clinically indicated for 18 persons, but was not undertaken by the end of the contract period, June 30, 1969.²⁵

An unpublished 1975 hematologic study on the embassy employees and dependents by J & S Tonascia²⁶ compared blood counts among exposed persons at the embassy to comparable examinations conducted on personnel stationed in Washington DC. In just about every parameter there were highly significant differences in blood counts between the two groups.^{27 28}

The Moscow embassy employees and dependents were studied for possible health effects of microwave irradiation by a team from John Hopkins University under the direction of epidemiologist Professor Abraham Lilienfeld. Dr Lilienfeld noted that the study group was quite small and that the follow-up time too short to generally identify significant health effects such as cancer. He recommended that continued health status surveillance should be carried out but this was not done. The incidence of sickness and death were compared with employees & dependents in other Eastern European embassies, and with the average US rates.²⁹

The incidence of multiple-site cancers was far more frequent in the Moscow embassy group than in any other population studied. It was noted that while multiple-site cancers are characteristic of older populations, the Moscow embassy group was relatively young. Concerns of the John Hopkins team were "downgraded" by the state department and the wording of the team report altered to lessen its impact. Lilienfeld strongly recommended that additional follow up studies be undertaken since the latency periods for some types of cancer had been insufficient for cancer to occur if indeed it were to result from microwave exposure. Nevertheless, the overall findings were consistent with excess cancer incidences both in the Moscow embassy cohort and in the other Eastern European embassy personnel. As there were suspicions that the reference group of personnel in other eastern European embassies were also being irradiated with microwaves, any negative finding would have been invalid.³⁰

Data on exposure and occurrence of some cases of cancer were withheld from Prof Lilienfeld until after his report was completed and it was too late to include

in the results. Reviews of the work done by contract investigators were interpreted as inconclusive because the State Department had failed to complete the necessary follow-up work which was recommended by the Lilienfeld team.³¹

Prof. Goldsmith concludes about the Moscow study that evidence was suggestive for four health effects, (a) chromosomal changes, (b) hematological changes, (c) reproductive effects, and (d) increased cancer incidence from the microwave irradiation in Moscow.³²

In Doctor Neil Cherry's re-analysis of the Robinette et al. (1980) and Lilienfeld et al (1978) he finds that "an elevation in the rates of a wide range of sicknesses, neurological and cardiac disease and death and cancer incidence and mortality were observed in the Korean War Study."³³

Barron and Baraff, 1958:

In the 1950's there was considerable controversy over the possible health implications of microwave exposure with some companies such as Hughes Aircraft and Lockheed looking for serious answers. In 1958 Lockheed commissioned a study of radar exposed personnel working at their factories³⁴. The researchers compared 226 radar-exposed and 88 non-exposed persons; the source of exposure was not identified. In the extended study 109 new workers were added placing them generally in the 2 to 5 year exposure group. This is far too short a time for most cancers to appear, with latencies between 8 to 30 years.³⁵ The research team concluded: "No acute, transient, or cumulative physiological or pathological changes attributable to microwaves have been revealed in this study."³⁶ The researchers reported significantly higher red blood cell counts, lower monocytes, elevated white cell counts, and reduced eosinophils and polymorphonuclear cells in the radar-exposed group compared to the control group but dismissed the findings as "a variation in the interpretation by a laboratory technician."³⁷

Goldsmith reported that there was an earlier study by the same team in *J. Aviat. Med.*, Vol.122, p 442, 1955 which also reported some deviant blood counts. Referring to the 1958 study Goldsmith states: "Table 4 shows a lot of abnormal eye examination findings, and guess what? There are no control data, merely the statement, "In our opinion not a single finding can be attributable to radar exposure". Finally, in Table 3, note the occurrence of 7 cases of peptic ulcer in their 353 subjects, but not a single case in the 86 controls. In the casual data on mortality on p. 1197, why only one year and what did microwave-exposed persons die of? Recalling that this also was published during the "cold

²⁵ Goldsmith J. "Where the trail leads..." *Eubios Journal of Asian and International Bioethics* Vol5, pp93, July 1995.

²⁶ Tonascia JA, Tonascia's. Hematology Study. October 7, 1976, Report Declassified under FOI (Freedom of Information) Act.

²⁷ Goldsmith J "Epidemiologic Evidence of Radiofrequency Radiation (Microwave) Effects on Health in Military, Broadcasting, and Occupational Studies", *International Journal of Occupational and Environmental Health*, Vol 1/No 1, Jan-Mar 1995.

²⁸ Goldsmith J "Epidemiologic Evidence Relevant To Radar (Microwave) Effects", *Environmental Health Perspectives*, Vol 105, Supplement 6, Dec 1997.

²⁹ *ibid.*

³⁰ *ibid.*, pp53-54.

³¹ Goldsmith J, *Where The Trail leads...* *Eubios Journal of Asian and International Bioethics*, Vol 5, pp.93. July 1995.

³² *ibid*

³³ Cherry N, *Criticism of the Proposal To Adopt The ICNIRP Guidelines For Cellsites In New Zealand & Australia. Radiofrequency and Microwave Radiation (100kHz - 300 GHz)* pp 14, 25 April 2000. (Subsequently referred to as (Cherry 2))

³⁴ Barron, C.I., & A.A. Baraff (as above)

³⁵ Cherry N, (Cherry 2), pp 85.

³⁶ Barron, C.I., & A.A. Baraff, (as above)

³⁷ *ibid*

war", hunkering down behind the "thermal only hypothesis" was the policy, and anything else was likely to be involved in a cover-up. In their summary, the word "attributable" is a fudge word, with many subjective elements. Read carefully yourself. Ask who has reported the long-term follow-up of these workers? (No one) ³⁸

Interestingly, cancer is not one of the paper's chosen outcomes so it is quite misleading to include this paper in the ICNIRP Guideline cancer assessment and to cite it as somehow showing that there are no cancer risks from exposure to radar.

Selvin et al (1992)

Professor Steve Selvin and his colleagues were interested in developing a statistical method to identify, in a residential area, those who were characterised as "exposed" compared with those who were "unexposed". The investigation was examining the incidence of childhood leukaemia with proximity to the Sutra Tower which is the primary radio and TV broadcast facility for the San Francisco, California area. The research team made a major error in assuming that the tower's radiation pattern varied linearly with distance from the tower. This has been found not to be true with the strongest UHF signals occurring between 2 and 4 km, and the main beam peaks outside 10 km, around 11 to 15 km from the base of the tower.³⁹ Contrary to the conclusions of Selvin, who claimed that his study found no evidence of adverse effects, extensive re-analysis clearly found that "the spatial data when related to actual radial radiation exposure patterns forms significant linear dose-response relationships with All Cancer and Brain Tumour having extremely significant dose-response relationships."⁴⁰

Beall et al. 1996 and Grayson 1996

The ICNIRP Guidelines state that " More recent studies have failed to show significant increases in nervous tissue tumours among workers and military personnel exposed to microwave fields (Beall et al. 1996; Grayson 1996)

Beall et al 1996 studied the increase in brain tumours with exposure to computer monitors and, as shown by Dr Cherry in his analysis, the abstract of the Beall paper reports significant increases in brain tumours: "The data in the paper show that for engineering/technical jobs there is a dose-response for brain tumour death and years of work, $p=0.07$, and for computer programming, $p=0.04$. Thus, the paper does show significant increases in brain tumour death from EMR exposure with dose-response increases and one significant dose-response relationship."⁴¹

A confounder with this study is that exposure to computer monitors also exposes the operator to extremely low frequency (ELF) and very low

frequency (VLF) from the computer monitor. So even if an effect is seen is it due to microwaves, ELF or VLF?

Grayson (1996) investigated a large number (880,000) of US Air Force personnel, some of whom were occupationally exposed to both non-ionizing and ionizing radiation. Exposure was assessed through a job exposure survey. From this population only 275 were exposed to radiofrequency/microwave radiation, 94 of whom developed brain tumours. This yielded OR= 1.39, 95% CI: 1.01-1.90 a statistically significant result.⁴²

According to Dr, Cherry: "ICNIRP's statement about Beall et al (1996) and Grayson (1996) is demonstrably scientifically wrong and misleading. **It reveals a strong predetermination to dismiss evidence of effects**".⁴³

The cavalier attitude of ICNIRP in uncritically accepting epidemiological studies that claimed to have found no effects is not matched by the critical analysis of apparent weaknesses of studies that did claim to have found effects. To quote from the ICNIRP Guidelines:

"There has been a report of increased cancer risk among military personnel (Szmigielski et al. 1988), but the results of the study are difficult to interpret because neither the size of the population nor the exposure levels are clearly stated. In a later study, Szmigielski (1996) found increased rates of leukaemia and lymphoma among military personnel exposed to EMF fields, but the assessment of EMF exposure was not well defined. A few recent studies of populations living near EMF transmitters have suggested a local increase in leukaemia incidence (Hocking et al. 1996; Dolk et al. 1997a, b), but the results are inconclusive. Overall, the results of the small number of epidemiological studies published provide only limited information on cancer risk."⁴⁴

To include the above six studies in a cancer risk assessment as negative findings is highly misleading and deceptive. This level of bias and error is inexcusable for an international group charged with the role of conducting 'best-practice' risk assessments of the highest calibre.

A house of cards

As mentioned previously, Dr. Michael Repacholi admitted in 1997 that "reference to the Robinette and Lilienfeld studies is largely irrelevant following the recommendations by an ICNIRP /WHO International Seminar on low-level RF fields held in Munich [November 1996]". Then why are these two "irrelevant" studies still being referenced in the current ICNIRP guidelines **eight years** after the Munich Seminar?

³⁸ Private Correspondence with John Goldsmith, October 1997.

³⁹ Cherry N (Cherry 2) p. 98

⁴⁰ Cherry N (Cherry 1) pp. 14-17

⁴¹ Cherry N (Cherry 2) p. 28

⁴² *ibid.*

⁴³ *ibid.*

⁴⁴ (ICNIRP 1)

Unfortunately for ICNIRP, their self-proclaimed role as the international expert group puts them in a self-perceived 'Catch 22' situation. To continue to forge ahead regardless of the contradictory science exposes ICNIRP to the risk of losing credibility and trust with the public. However, ICNIRP also apparently fears that to change their 'science based' guidelines in light of an incorrect risk assessment would be to lose credibility by an admission that they are not infallible after all. In either case ICNIRP's claim to be able to assess the scientific literature objectively refutes itself and exposes their risk assessment as a very shaky house of cards. By refusing to acknowledge their human fallibility ICNIRP's authors have ignored a fundamental lesson about the evolution of scientific knowledge.

As Ulrich Beck, the German sociologist observed, the history of scientific discovery was always less a history of the pure acquisition of knowledge than one of learning from mistakes and practical lapses in scientific objectivity. Scientific 'knowledge', 'explanations', and practical 'suggested solutions' have contradicted each other over time, at different places, in different schools of thought, and cultures. Beck points out that this need not imply any loss in the credibility of scientific rationality claims so long as the sciences can succeed in handling the mistakes, errors and criticism of their methods within science.⁴⁵

To quote Beck on "Infallibility or Ability to Learn":

"If side effects [health hazards] are no longer to be accepted, techno-scientific development must guarantee the ability to learn at every stage, at its pace and through the ways it advances. This presupposes that developments which create irreversible situations will be avoided. What is important, in contrast, is to reveal and work out those variants of techno-scientific development that leave room for mistakes and corrections. Technological research and policy must proceed from the 'theory' that has to this point proven most confirmed and most attractive: *that of the entrapment of human thought and actions in mistakes and errors.* Where technological developments begin to contradict this one certainty . . . they encumber humanity with the unbearable burden of infallibility. As risks multiply, the pressure grows to pass oneself off as infallible and thereby deprive oneself of the ability to learn."⁴⁶

Public participation as informed citizens: An Australian perspective

In the Australian TE/7 Committee meetings, mentioned previously, the majority of government representatives as well as all of the varied industry members gave the impression that they considered the ICNIRP guidelines as the 'gold standard' that

accurately reflected the conclusions of the vast body of scientific literature on RF biological effects.

These members dismissed the many public submissions, many very detailed in highlighting shortcomings of the proposed guidelines, as being based on unfounded fears and not reflecting the weight of expert scientific opinion. This dismissal ignored the fact that many of the public submissions did in fact rely on expert scientific opinion that could not be so easily dismissed.

Rather than being based on groundless fears, concerned members of the Australian public were able to draw upon a wealth of scientific resources that were often referenced in public submissions to TE/7.

Public resources

* The Commonwealth Science and Industrial Research Organisation's (CSIRO) Division of Radiophysics. The CSIRO had in fact conducted in 1994 their own risk analysis of the RF literature, titled: "*CSIRO Report on the Status of Research on the Biological Effects and Safety of Electromagnetic Radiation: Telecommunications Frequencies*".⁴⁷ Unlike the ICNIRP guidelines which dismissed low level exposures as beyond the scope of the guidelines, the CSIRO report highlighted the high level of uncertainty in the RF literature in its inability to address the issue of chronic environmental level exposures to radiofrequency and microwave radiation. It was this issue that was of concern to the public. During its involvement in TE/7, the CSIRO called for the inclusion of the public in the decision making process⁴⁸ and opposed the adoption of the ICNIRP guidelines because of this level of uncertainty. The CSIRO therefore advised TE/7 when its representative voted against ICNIRP, "to set exposure limits as far below levels known to cause adverse biological effects as is technically, economically, and socially feasible."⁴⁹

* A January 1994 report by CSIRO scientists A. Doull & C. Curtain, titled "*A Case for Reducing Human Exposure Limits Based on Low Level, Non Thermal Biological Effects*" was widely circulated to the concerned public. This report gave a general overview on the history of RF standard setting internationally and in Australia, examined the possible health effects and called for reducing the exposure limits. For the lay public it served as an essential primer to introduce the issues.⁵⁰

* Dr, Neil Cherry, from Lincoln University, New Zealand, widely circulated a report: "*Potential and Actual Adverse Effects of Cell Site Microwave*

⁴⁷ Report on the Status of Research on the Biological Effects and Safety of Electromagnetic Radiation: Telecommunications Frequencies, CSIRO Division of Radiophysics, S. Barnett, June 1994.

⁴⁸ Discussions with CSIRO committee member Dr. John Hunter, 12 August 1998

⁴⁹ CSIRO, Ballot Draft Australian/New Zealand Standard DR98627 Radiofrequency Fields. Part 1: Maximum exposure levels-3 kHz to 300GHz, WP ID Number 17067.cdr.doc dated March 2, 1999.

⁵⁰ Doull AH and Curtain Dr. C, *A Case for Reducing Human Exposure Limits Based on Low Level, Non Thermal Biological Effects*, January 1994.

⁴⁵ Ulrich Beck, *Risk Society: Towards a New Modernity*, Sage Publications, p. 159, 1992

⁴⁶ *ibid.* page 177.

Radiation"(April 1995). This report consisted of his own review of the RF literature which highlighted shortcomings in the ICNIRP guidelines, as well as detailing possible adverse effects from mobile phone base stations⁵¹.

* Due to many public inquiries to his office, Australian Democrat Senator Robert Bell commissioned a background report: *"Mobile Phones and Their Transmitter Base Stations: The Evidence For Health Hazards - A local Government and Community Resource Document"* that was tabled in the Senate in April of 1996 and made available to the public.⁵²

These four reports, all specific to Australia and New Zealand, gave the public access to a wealth of detailed scientific information to draw upon for their submissions to TE/7 on the ICNIRP guidelines.

Public awareness in New South Wales

Besides the above mentioned reports, the concerned public had access to Dr Ross Adey's research material through him directly and other research material on RF from the information retrieval system and Library of Sydney County Council (NSW) and the industry watchdog newsletter Microwave News (newsletter).⁵³

The scientific expertise of a concerned citizenry, based on this material was ably demonstrated by the residents of Waterfall, NSW, who were well prepared to protest vigorously against construction of the mobile base station close to the Waterfall school in 1993. At a community meeting with Telecom (now Telstra) officials and scientists, one was overheard to remark to his colleagues "How did these people get to know so much".⁵⁴ As a result of public pressure Telecom dismantled and removed the base station. The official reason given by Telecom was "the base station was relocated for technical reasons."

At a subsequent meeting chaired by the then Spectrum Management Agency a representative of SMA remarked that they had no idea that the public were so interested and concerned about the RFR issue until they received an extensive submission from the Sutherland Shire Environment Centre.⁵⁵

It was after this meeting comprising the Council, Telecom, Sutherland Shire Environment Centre, Spectrum Management Agency and Waterfall community representatives that the public first heard of the commissioning of the CSIRO Report. SMA had initially classified the report as 'confidential' until a letter on the report, detailing attempts to keep it out of the public domain was received by the Australian

Democrats in March of 1995.⁵⁶ Slowly distributed at first, the Report was the public's first concise and comprehensive document on the RFR health issue. On advising the NSW Local Govt Association of the availability of the CSIRO Report the President, Peter Woods, issued instructions for every local Council in NSW to receive a copy. The public concern regarding RFR exposure and the potential health threat was therefore based, not on fear and ignorance but on reliable information regarding the state of the science, which they were obliged to seek out in the interest of family health.⁵⁷

In spite of the many detailed public submissions sent into TE/7 during the public submission phase, there was an attempt to dismiss the public's right to have their concerns aired in the committee. On at least two occasions the chairman actually proposed to vote on the proposed standard BEFORE public submissions were even considered. The Telstra representative best summed up the industry perception of public concerns by mentioning the need to "comfort the community". This apparently meant mounting a public relations campaign to shine the 'light of science' on their irrational fears so that they would stop worrying and be able to benefit fully, as consumers, from the many innovations provided by telecommunications.

Public trust in the experts

Such a dismissive, condescending attitude towards public concerns, coming from both industry and government regulatory agencies, did little to engender trust, to say the least. Add the conflicting views on the expert's science and the regulator's exemptions from community planning laws enjoyed almost universally by the telecommunications industry, and it is fully understandable why concerned members of the public can lose trust in the regulator's determinations of acceptable risks for the community⁵⁸. In this case the concerned public have no recourse but to do their own informal risk assessment based on their own experience – including their negative experience dealing with the experts and telecommunications carriers.

Such a risk assessment, though it may contain many subjective elements, should not be ignored as it reflects valid concerns of those who are being exposed, not just the views coming from those who, directly or indirectly are responsible for the exposures. Such an informal risk assessment may include vastly different definitions of acceptable and unacceptable risks than those of industry. For example: Risks perceived by the public as the possibility of adverse health effects from technology, versus an industry that considers their

⁵¹ Cherry N., *Potential and Actual Adverse Effects of Cell Site Microwave Radiation*, 28 pages, 17 April 1995.

⁵² Maisch D, *Mobile Phones and Their Transmitter Base Stations: The Evidence For Health Hazards - A local Government and Community Resource Document*" Australian Senate Hansard, April 1996.

⁵³ Interview with Betty Venables, convener of the The Electromagnetic Radiation Alliance of Australia (EMRAA) Sutherland Shire Environment Centre, Sutherland, NSW.

⁵⁴ *ibid.*

⁵⁵ *ibid.*

⁵⁶ As published in *Fields of Conflict: The EMF Health Hazard Controversy* by D. Maisch, page 57-58, August, 1995

⁵⁷ *ibid.*

⁵⁸ This situation was summed up by Daniel Westall From the Australian Radiation Protection & Nuclear Safety Agency (ARPANSA) at the Sept. 2001 Annual Conference of the Australasian Radiation Protection Society where he stated, in regards to the regulators, "To avoid us being seen as irrelevant, we need to move from dictatorship to leadership of the community in developing radiation regulation as a meaningful contribution to the improvement of society in general." Of course Westall may have more to the point if he had used 'involvement' instead of "leadership".

primary risk (to the speedy rollout of new technology) as being the concerned public.

Besides the issue of health risks that may be associated with RF exposures, which is an issue outside the aims of this paper, the industry and government, by their tendency to label community concerns as public irrationality, are imposing another level of unacceptable risk on the public - psychological stress. There is abundant research showing the creation of psychological stress in people who are chronically exposed to uncertain environmental risks.^{59 60} In other words, events impacting on people can contribute significantly to the development of physical or psychological disorders. Well-established stress reactions include changes in blood and urine chemistry, changes in cardiovascular reactivity, muscle potential, skin conductance and sleep patterns. Environmental stressors on the immune system can make the victim less resistant to infectious diseases. Stress reactions also include psychological symptoms such as depression and anxiety.⁶¹

These psychological risks which can be directly associated with the siting of a particular technology, say a mobile phone base station tower next to a school or residential community, **are not a consideration** in expert risk assessments of the 'impact' of that particular technology. For example, in Australia the only 'impacts' on the community that are considered in siting base stations are 'visual impacts'.

Foundation building

One way to reduce actual and potential risks to society, and to start the process of building a better foundation for communication between the experts and the public, is to include the public as valid stakeholders in all stages of planning and siting of facilities. – And this of necessity would include adequate⁶² public representation on RF standard setting committees.

Such a proposal however is anathema to many in both the RF industry and government regulatory bodies. From the experience of TE/7 it was apparent they considered their main problem as having to deal with a public that they perceived as being infantile, emotionally charged and incapable of properly grasping the nature of complex technical issues. However, from the high level of 'expertise' exhibited by the concerned public in Australia, perhaps what was more feared was having to negotiate with a public well versed in the pertinent scientific issues and

therefore immune from being swayed by an aura of infallible expertise.

While this situation continues, the loss of public faith in science as promulgated by both industry and regulatory bodies such as ICNIRP will continue to be a factor calling for corrective action.

All is not lost however as there is a recognition of the advisability of involving the public in the decision making process. At an International OECD Nuclear Energy Agency workshop at Villigen, Switzerland in 2001, leaders of the radiation protection and regulation community discussed the involvement of the public in regulatory decision making. It was acknowledged by an Australian representative from ARPANSA⁶³ that interaction, not information, was needed, and that the public should be a part of the decision making process – and it must be genuine.⁶⁴

The various national RF standard setting bodies that rely on the ICNIRP guidelines have tried to perpetrate ICNIRP's flawed risk assessment by maintaining an aura of expert infallibility devoid of any public critique of its decision making process. – A process that largely represents the viewpoint of those responsible for the exposures and not those who are exposed.

The Australian experience of public participation, both in membership on expert committees and in public submissions to those committees, has demonstrated that the mystique of expert infallibility cannot be maintained when a concerned and well informed public becomes involved in the process. When all is said and done, it is only by this process that the foundations for a true and trustworthy risk assessment for society can be laid.

⁵⁹ Paul Martin, *The Sickening Mind: Brain, Behaviour, Immunity & Disease*, (Mind and Immunity) Flamingo Press (Harper Collins) 1998, page 81-105.

⁶⁰ Beale IL, The Effects of Electromagnetic Fields on Mental and Physical Health, *Journal of Child and Family Studies*, Vol.6. No.3, pp. 273-288, 1997

⁶¹ *ibid.*

⁶² As is all too often the case in Australia, public (or 'consumer') representation on the various Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) EMF committees amounts to one representative who has little, if any, practical power to affect change when compared to the overwhelming numbers of industry representatives. In this case the only role of the community representative seems to be solely so that the organisation can later claim that the public was directly involved in the decision making process.

⁶³ The Australian Radiation Protection and Nuclear Safety Agency which took over from the Standards Australia TE/7 Committee in RF standard setting.

⁶⁴ Westell D., *Will Radiation Regulation Matter in the 21st Century?* 26th Annual Conference of the Australasian Radiation Protection Society (ARPS), 17-20 Sept. 2001.