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10 Glossary

ANSI: American National Standards Institute; a US body that accredits organisations to write industrial standards – publicly available definitions, requirements, criteria, etc – following rules established by ANSI.

Assessment of Environmental Effects AEE: text to be added here

Contaminant: As defined by the RMA, a contaminant: *includes any substance (including gases, liquids, solids and micro-organisms) or energy (excluding noise) or heat, that either by itself or in combination with the same, similar or other substances, energy or heat*. A contaminant may adversely affect health either directly because of its hazardous properties, or indirectly through contamination of the air, water, soil or food.

de minimis* principle: *de minimis non curat lex "the law does not concern itself with trifles".

Director-General of Health: the chief executive officer of the Ministry of Health, charged with a number of statutory powers, functions and duties under public health (and other) legislation.

Dose-response assessment: a determination of the degree of health effects at different doses of a hazard.

Effects: includes

- any positive or adverse effect
- any temporary or permanent effect
- any past, present or future effect
- any cumulative effect which arises over time or in combination with other effects, regardless of the scale, intensity, duration, or frequency of the effect, and including:
  - any potential effect of high probability, and
  - any potential effect of low probability which has a high potential impact.

Epidemiology: the study of the distribution and determinants of health-related states or events in specified populations

Exposure assessment: an estimation of the magnitude, duration and frequency of exposure to hazards, and the numbers of people exposed via different pathways.

Frequency: The frequency of a wave is the rate at which it vibrates. On a radio or TV tuner, the number at which you set the tuner indicates the frequency of the signal. The frequency is also correlated with some physical properties of the signal: how well it can pass through obstacles (eg, buildings) and rate at which information can be transmitted. To avoid interference, defined ranges of frequencies are allocated to different applications: FM radio, AM radio, TV, cellphones, industrial applications, etc. Frequency is measured in *hertz* . See also hertz, radiofrequency, and microwave.

GHz: Gigahertz. One billion hertz.

Hazard: a source or situation of potential harm.

Hazard identification: an assessment of the available evidence on the presence and hazards of matters likely to cause adverse effects.

Health status: A set of measurements which reflect the health of populations. The measurements may include physical function, emotional well-being, activities of daily living etc.

Hz: hertz - unit of measurement of frequency; [wave] cycles per second.

ICNIRP: International Commission on Non-Ionizing Radiation Protection, a non-governmental organisation recognised by the WHO.

***In vitro*:** laboratory studies not involving whole organisms (eg, tissue culture studies); "in glass".

***In vivo*:** laboratory studies involving whole organisms (eg, studies on rats or mice); "in life".

Legislation: Acts of Parliament (ie, statutes), Regulations, by-laws and in some cases formally recognised codes of practice, rules, standards or guidelines with legal status.

Local government: district, city and regional councils, or unitary authorities ([no entry]

MHz: megahertz, one million hertz.

Microwave: radiofrequencies greater than 300 MHz.

MoH: Ministry of Health.

Monitoring: the performance and analysis of routine measurements, aimed at detecting changes in the environment, provision of services, delivery of outputs, or health status of populations

Morbidity: illness

Mortality: death

Power flux density: the amount of radiofrequency energy passing through a given area. It is measured in watts per square metre (W/m^2) or in microwatts per square centimetre ($\mu W/cm^2$), the latter being $1/100^{th}$ of the former. The normal relationship between power flux density and electric and magnetic field strength does not apply within 100-200 m of AM transmitters.

Public health: depending on the context, either (a) the health status of populations (or sections thereof) or, (b) the science and art of preventing disease, prolonging life, and promoting health through organised efforts of society.

Radiofrequency: any frequency used for radio transmissions, normally 0.1 MHz to 300,000 MHz. Radio signals are composed of linked electric and magnetic fields which travel away from the transmitter as an electromagnetic wave. The electric and magnetic fields can be referred to as radiofrequency fields, and the energy they carry as radiofrequency radiation.

Replicable: in the case of an experiment, if other researchers come up with the same results after repeating all the **exact** details of the first experiment, then the experiment is said to have been successfully replicated. Successful replication is an essential consideration when comparing several lots of experimental data, as even miniscule differences in detail can lead to differing results.

Risk: the probability and magnitude of harmful consequences arising from a hazard. The likelihood of a specified undesired event occurring within a specified period or in specified circumstances. The probability of harmful consequences arising from a hazard. In quantitative terms, risk can be expressed in values from zero (no possible harm) to one (certainty that harm will occur). In relation to human health effects, risk is usually expressed as the probability (or likelihood) or dying or developing a disease or injury as a result of exposure to a hazard. For example, an acceptable health risk may be regarded as a one in a million lifetime risk of developing cancer.

Risk assessment: a widely used model to evaluate health hazards and conditions of human exposure to it in order to both ascertain the likelihood that exposed humans will be adversely affected, and to characterise the nature of the effects they may experience.

Risk factor: an aspect of personal behaviour or lifestyle, an environmental exposure or an inborn inherited characteristic that is associated with an increased risk of a person developing a disease.

Risk characterisation: a combination of information obtained from the hazard identification, dose-response assessment, and exposure assessment to estimate the risk associated with each exposure scenario considered, and to present information on uncertainties in the analysis for risk management to proceed.

Risk communication: the process of establishing two-way communication, recognising that people's feelings and emotions are legitimate, involving people in making decisions that directly affect them, informing and advising the community about risks and their impact, and involving the community in plans for managing the risk.

Risk management: A process of setting priorities based on risk assessment, establishing efficient and consistent risk reduction policies (taking into account public perception of risk), evaluating the range of risk reduction alternatives (including the social, economic and cultural implication of options), identifying cost-effective risk reduction measures, and identifying risk mitigation and contingency measures.

RMA: Resource Management Act 1991: an effects-based statute focusing on sustainable environmental management. It is administered by the Ministry for the Environment and implemented for the most part by territorial authorities.

Safety factor: the number of times below the harmful range at which the public exposure limit is set . A set safety factor of 50 means that a person can be exposed to 50 times that amount before there is an reasonable expectation of hazard. *Use of safety factors* is not the same thing as *minimising unnecessary exposure*.

Sampling: in this context, the process of talking microbiological, chemical, or other specimens as part of a public health programme in order to test or monitor quality or public health risk.

Specific absorption rate (SAR): fundamental unit of dose of radiofrequency actually absorbed by a body exposed to radiofrequency fields. Although difficult to measure or calculate, it is useful in comparing exposures at different frequencies (or when trying to extrapolate to people the results of experiments on the exposure of animals to radiofrequency fields). The maximum SAR in publicly accessible areas around most transmitters is about 0.005 W/kg of body weight, but generally less than this figure. The body generates 1-4 W/kg heat from its own metabolism.

Surveillance: ongoing scrutiny, generally using methods distinguished by their practicability, uniformity, and frequently their rapidity, rather than complete accuracy. Its main purpose is to detect changes in trends or distribution in order to initiated investigative or control measures.

Transmitter: in this context, the equipment used to generate and broadcast radiofrequency electromagnetic waves for communication purposes. The transmitter power is expressed in watts (W) or in kilowatts (kW = 1000 W). The frequencies of various transmitters are shown in Figure 1, Chapter 2.

WHO: World Health Organization of the United Nations.

Appendix A. Detailed summaries of issues raised during consultation meetings

A1 Key issues arising from consultation with industry

Health

- Concerned that any guidance on health effects should be based on sound scientific evidence.
- It is difficult for industry to correct misinformation as they are perceived as having a vested interest.
- People need to be provided with advice on how to determine whether or not a scientific study is robust and the results can be trusted.
- Concerned that territorial authorities do not have expertise on health issues. They can also be influenced by political considerations. They should rely on advice from the Ministry of Health on health risks.

Monitoring

- Monitoring of electromagnetic fields is a specialist area; territorial authorities may not have appropriate expertise.
- Should address issues concerning: frequency of monitoring - need - cost - relationship to modelling? (usually exceeds actual emissions). Perhaps representative sites for monitoring could be established. Would be concerned if a standard condition to monitor was on all consents.
- Any advice on monitoring should be consistent with the methodology outlined in Part 2 of the Australian/New Zealand standard (AS/NZ 2772.2).
- Arbitrary monitoring preferred. Don't support, for example, the monitoring of each site annually.
- Low power sites - detection limit. Monitoring equipment cannot detect really low exposures.

Resource Management Act 1991 processes

- Effects need to be assessed scientifically.
- Concerned that territorial authorities are setting different exposure limits. There needs to be consistency amongst territorial authorities.
- Radiofrequency fields are not a district-based issue. It would therefore seem logical for districts to follow internationally recognised standards.
- There needs to be clear distinctions between health and environmental issues. During hearing and Environment Court processes health issues can be presented in the guise of environmental issues.
- The Ministries will need to think carefully about how the guidelines will be implemented. There would be high transaction costs involved for everyone if all of the territorial authorities which have operative plans introduce a variation. Territorial authorities should adopt guidelines, but through reasonable mechanisms.

- "Community" needs to be better defined so that industry knows who to consult with in an area (eg, if no ratepayers association who should be consulted).
- Affected parties need to be better defined.
- Good practice advice on Resource Management Act 1991 (RMA) processes is required so less variation amongst territorial authorities.
- Positive effects need to be considered (ie, the demand for a cell phone network).
- Involvement in resource consent processes are expensive for industry.
- Some territorial authorities seem to be progressively reducing standards to be lower than other territorial authorities.
- Need to clarify RMA processes to reduce variation - simplify don't complicate with additional processes.
- How does the current review of the RMA fit in? Needs to be consistent with this review and with other consent processes so radiofrequency not seen as "special issue".

Other

- Scientific language needs to be made understandable for the public.
- Risk management involves educating the community about the health effects of radiofrequency fields.
- Risk assessments needs to be based on science rather than suspicion and innuendo.
- The public does not have a good understanding of the technology (eg, difference between cell sites and point to point, the bigger the microwave dish the less power used).
- There is a need for a core set of contacts which communities, territorial authorities and industry can use.
- Removing causes of concern in community will reduce transaction costs.

A.2 Key issues arising from consultation with community groups

Health

- Communities are uncertain about the health risks of radiofrequency fields. They are concerned that there are conflicting opinions within the scientific community and do not think that communities can be expected to decide whether or not radiofrequency fields are safe when the experts cannot agree.
- Under what conditions should territorial authorities approve applications for transmission facilities when there is scientific uncertainty about health effects
  (Some consider that they should take note of research which shows there are effects until scientific consensus on effects is established/others suggest that emissions should be minimised until more is known about the effects of radiofrequency fields.)
- Communities mistrust international standards, including the voluntary New Zealand standard, because they consider they are developed by scientists who work for industry. They also think standards are designed for television/radio and not cell sites and that they do not address community concerns about athermal effects.
- The National Radiation Laboratory, which should be the agency which provides independent advice on the public's behalf, is not perceived as being independent because officers present on industry's behalf in Environment Court hearings.
- People can access transmission facility sites.
- The Ministry of Health needs to review the research regularly.
- The voluntary New Zealand standard is not as restrictive as some of the standards other countries use.

RMA processes

- The RMA is complex; communities need to be provided with guidance on RMA processes, particularly on the opportunities for community input
- Territorial authorities are allowing transmission facilities to be sited near vulnerable populations (eg, children, old people).
- Applicants are not consulting with communities before applying for a resource consents. There is a community perception that they are not always honest about their options and technological constraints when they do.
- Communities need access to independent advice on legal and technical matters and health effects.
- Not enough applications are being notified. Communities consider that territorial authorities need to notify all resource consent applications for the siting of transmission facilities because of public concern. Also need to clearly advertise that they have been notified. They also need to better define affected parties.
- RMA processes do not provide sufficient opportunities for opposing parties to discuss issues. Hearing processes are intimidating and not enough use is made of prehearing processes.
- It is expensive to participate in hearings and Environment Court processes. Industry have a financial advantage over communities. Funding of community participation is required.
- Decision-makers need to be independent.
- Concerned that no provision for taking into account cumulative effects in radiofrequency from increased numbers of sites. Monitoring needs to occur and communities need to be given results from random monitoring.
- The conditions on the consent are really important. They need to be monitored, enforced and reviewed regularly, in line with the latest health research findings.
- Communities need to know about the key elements of case law.
- Territorial authorities need to consider visual effects and the effects on property values.
- Applicants need guidance on assessments of environmental effects (AEEs).
- Potential and established effects need to be considered.
- Are territorial authorities capable of undertaking monitoring or do experts need to be used.
- Territorial authorities need to monitor compliance with resource consent conditions.
- There is confusion between compliance and state of the environment monitoring.
- Are radiofrequency fields a contaminant?

Risk management

- What does the precautionary principle mean in practice?
- Community outrage needs to be taken seriously when risks are assessed.
- Communities want zero risk; guarantee of no risk to health.

Technology

- Communities are concerned that they are not getting an honest appraisal of the constraints of the technology. The guidelines need to outline how technology works and where it is going in the future and how change will affect the community issues.
- Concern that industry builds in safeguards for expansion in ten years' time. Question whether or not this is necessary given the rate of change of technology.
- The methodology used by industry to determine the power levels required for coverage is problematic as based on computer modelling and often the reality isn't checked.

- Territorial authorities need to further consider alternative technology which operates at lower power.

A.3 Key issues identified by territorial authorities

- Many territorial authorities lack the in-house specialist expertise needed for this issue. Particularly in relation to monitoring and interpreting scientific information.
- The RMA provides constraints which can be misunderstood by the public and applicants/industry groups.
- Preparing for hearings/appeals is expensive.
- Monitoring systems need to be developed: how, when, where, by whom.
- Territorial authorities worry about making the correct decisions as have to bear the responsibility in the future (legal and public).
- Territorial authorities have to provide evidence of consent compliance.
- Guidance is needed on best practice in relation to rules and standards. It would also be useful to be aware of the approaches different territorial authorities have taken to this issue.
- Guidance on defining affected parties is required.

A.4 Perceived benefits and risk of national guidelines

All groups consulted outlined what they perceived as the benefits and risk of national guidelines. A summary follows.

Community groups' perspective of benefits of the national guidelines
- Provides national recognition that this is an issue of significance to communities.
- Provides community groups with a voice.
- The process has the potential to reduce community concerns and stress.
- Provides an opportunity for the building of trust between communities and the telecommunications industry.
- Enables community groups to share examples of good practice with other communities.

Industry groups' perspective of benefits of the national guidelines
- Likely buy-in to the Ministry of Heath's guidance of potential health effects. This is likely to provide the public reassurance about safe use of radiofrequency in the community.
- Potential to reduce the conflict.
- Potential for delivering increased certainty and cost reductions for all concerned.
- Potential for community concerns to be allayed.
- Recognition of many advantages of radiofrequency transmission facilities.
- More efficient processes to bring services to the community.

Territorial authorities' perspective of benefits of the national guidelines
- Guidelines will facilitate a greater understanding between parties of each other's concerns.
- Guidelines will enable of number of issues to be resolved and result in the reduction of costs.
- There will be greater certainty for all concerned.
- Territorial authorities across the country will take a more consistent approach.

- Community and industry have greater confidence in territorial authorities.

Perception of risks of national guidelines

All groups considered that the potential risks were:

- Guidelines will end up not acceptable to participants, and because of earlier participation, approval of guidelines will be assumed.
- Guidelines fail to achieve the potential benefits.

Some community representatives were concerned that:

- community groups would be perceived as attempting to stifle progress.
- the guidelines would not take a risk-avoidance approach.

Industry representatives were concerned that national guidelines would:

- compound the negative image of industry.
- recommend a standard lower than international standards.
- result in recommended activities becoming prescriptive practices (eg, advice on how to handle perceptions of risk)

Appendix B. Health effects: areas of disagreement

This appendix summarises some the areas in which there has been disagreement about the results or interpretation of research into the possible health effects of radiofrequency fields. Such disagreement is a normal, and indeed healthy, part of any branch of science, and provides the stimulus for expanding and refining our knowledge.

B.1 Interpretation of epidemiology

Most reviews of the epidemiological data conclude that the results are inconsistent and the studies provide little detail on actual exposures. The study designs provide very limited opportunity for establishing cause and effect relationships, and they are limited in their ability to deal with possible confounding factors. There may also be bias in the data. Taken together, the studies do not establish a relationship between exposure to radiofrequency fields and cancer, adverse reproductive outcomes, sleep disturbance or psychological factors in children, chromosomal changes, haematological effects, eye effects, cardiovascular changes, headaches or asthma.

On the other hand, a few authors contend that the data do give good evidence of such associations, and advocate more protection than that afforded by current guidelines and standards.

Many studies have been hypothesis-generating exercises with no specific research question which screen a large number of outcomes in relation to the exposure to radiofrequency fields. These studies may produce apparently "significant" results simply because of multiple comparisons (see Section 3). They may provide important clues for further research but cannot provide strong evidence of cause and effect.

For there to be a change in the consensus opinion, there would have to be future epidemiological studies demonstrating clear, consistent associations between exposure to relatively weak radiofrequency fields and adverse health effects..

B.2 Relation to cancer

In addition to disagreement over the results of epidemiological studies, there is disagreement over the significance of results from *in vitro* and *in vivo* studies into whether radiofrequency fields may initiate or promote cancer. The disagreements cover a number of areas, such as:

- whether radiofrequency fields can cause DNA strand breakage
- significance of research on transgenic mice for human health
- results from lifetime studies of animals exposed to radiofrequency fields.

A series of experiments has investigated whether exposure to radiofrequency fields damages genetic material, either directly or indirectly. Such damage could implicate radiofrequency fields in the induction or promotion of cancer. While some experiments suggest that damage

does occur, other researchers trying to repeat the same or similar work have found no such effects at all. Where effects have been reported, exposures have been well above those that commonly occur in publicly accessible areas near radio transmitters.

Several researchers have exposed rodents to radiofrequency fields over their entire lifetime. There is no clear evidence from these studies of any carcinogenic effects in humans, although there is uncertainty about the appropriate interpretation of some results, and the possible significance for human health of research on transgenic mice (ie, mice which have been genetically engineered to predispose them to develop lymphoma).

The consensus opinion that radiofrequency fields, at the levels typically experienced in the urban environment, are not implicated in cancer development could be changed by experimental results demonstrating a consistent, replicable effect of cancer induction in experimental animals, or clear evidence of an *in vitro* effect on genetic material.

B.3 Exposure to amplitude modulated radiofrequency fields

A wide range of results have been reported on the effects of exposing cells or tissue cultures to amplitude-modulated radiofrequency fields. These include movement of calcium ions across cell membranes, and changes in enzyme activity. However, results show no consistent pattern, and there is disagreement over the possible significance for health if these effects do actually occur.

Here too, consistent, replicable results are required before such data can be incorporated into a health risk assessment.

B.4 Conclusions

There is ongoing debate about the significance of studies of athermal effects at exposures to levels below the assumed threshold for harm (based on thermal effects). Epidemiological studies of populations exposed to radiofrequency fields have generally suffered from poor exposure data, and results have been inconsistent. *In vivo* and *in vitro* studies have shown inconsistent or unreplicated results on a variety of endpoints. More consistent, and replicable, results are required before this data can add significantly to our understanding of the health effects of exposures to radiofrequency fields.

Appendix C. Health effects: summary of ongoing work

Many studies and larger projects investigating the potential for radiofrequency fields to cause health effects are still in progress, and may resolve the disagreements discussed in Appendix B. The fact that research is still going on should not be interpreted as a sign that the scientific issues are not well understood. Rather, it is in order to refine our knowledge of the possible health effects, and to be able to better meet some of the concerns which have been raised.

Some of the main programmes are outlined below.

C.1 WHO international electromagnetic fields project

In 1996, the World Health Organization (WHO) launched a five-year project (now extended to ten years) to bring together current knowledge and resources in order to derive scientifically sound recommendations for health risk assessments of static and time-varying electric and magnetic fields (EMF), including radiofrequency fields. Aims of the project include:

- provision of a coordinated response to concerns about possible health effects of exposure to EMF
- reviews of the scientific literature on biological effects of EMF exposure
- identification of gaps in knowledge needing further research to make better health risk assessments
- encouragement of focused, high quality research programmes
- facilitation of the development of internationally acceptable standards for EMF exposure
- provision of information on the management of EMF protection programmes for national and other authorities, including monographs on EMF risk perception, communication and management
- provision of advice to national authorities and others on EMF health and environmental effects and any protective measures or actions needed.

In areas relevant to these guidelines, the WHO project to date has:

- held a seminar on non-thermal effects of radiofrequency fields, publishing the proceedings and a summary of the conclusions
- held a seminar on risk perception and risk communication, publishing the proceedings
- prepared information sheets on the health effects of radiofrequency fields, cellphones and cellsites, and public perception of health risks
- held a seminar reviewing eastern European research and standards, with publication of a summary article to follow shortly.

The Ministry of Health is participating in the project through providing a representative to the meetings of the International Advisory Committee which oversees the project, provides advice

and information as required to support the project, and funding. Further information on the project can be find on the project's web page
http://www.who.int/peh-emf/index.htm.

C.2 IARC study on brain tumours in cellphone users

The International Agency for Research on Cancer (IARC) is coordinating an international study of whether mobile phone use is associated with increased incidence of brain tumours. Research is planned to begin in late 1999 or early 2000, including work to be carried out in New Zealand and Australia, with results expected in 2003 or 2004.

Although these guidelines do not cover mobile phones, this type of research can assist in the preparation of exposure guidelines by increasing our understanding of how radiofrequency fields interact with the body and whether they produce adverse effects..

C.3 Australian government research programme

The Australian government has established a four-year programme of research and public information on health issues associated with mobile phones, cellsites and other communications devices and equipment. Research must comply with protocols developed by the WHO International Electromagnetic Fields project and the European Community, in order for it to make a worthwhile contribution to the international database. Four projects have so far received funding:

- pilot epidemiological study of mobile phones and brain/salivary gland/auditory nerve tumours (links in with the IARC project)
- study of the effects of radiofrequency fields on DNA
- investigation on whether mobile phones affect users' memory, concentration or problem-solving abilities
- further study on the effects of long-term radiofrequency exposure on transgenic mice.

C.4 Finnish Technology Development Centre programme

Finland's government-run Technology Development Centre has started a three-year research programme into possible health risks from radiofrequency fields. Amongst the projects are:

- experiments on co-carcinogenic effects of radiofrequency fields
- a feasibility study for an epidemiological study on mobile phone use and cancer
- a study on radiofrequency fields from cellphones and electrosensitivity
- *in vitro* systems for studying the effects of radiofrequency fields.

Appendix D. Details of ANSI, ICNIRP, USSR and New Zealand exposure standards

D.1 American standard - ANSI C95.1

The American National Standards Institute (ANSI) has undertaken development of radiofrequency standards since 1960. Their first radiofrequency exposure standard was published in 1966, with revisions appearing in 1974, 1982 and 1991. Since 1988, the work has been coordinated by the Institute of Electrical and Electronics Engineers (IEEE). ANSI requires that Standards be revised or reaffirmed every five years, and the Standard was reaffirmed by the IEEE in 1997. A further extensive review is now in progress in order to take account of the most recent research data.

The IEEE committee and subcommittees include members from a range of disciplines and nationalities. Standards are developed through an open consensus process by the subcommittees, whose membership is open to anyone with an interest. IEEE membership is not required for participation or voting on the main committees or subcommittees. The only restriction is that committee membership must be balanced with regard to interest. Anyone is able to attend and contribute to meetings, whether they are committee members or not. Summaries of the interests and affiliations of the 125 members of the Safety Levels with Respect to Human Exposure subcommittee at the time the 1991 Standard was approved are given below:

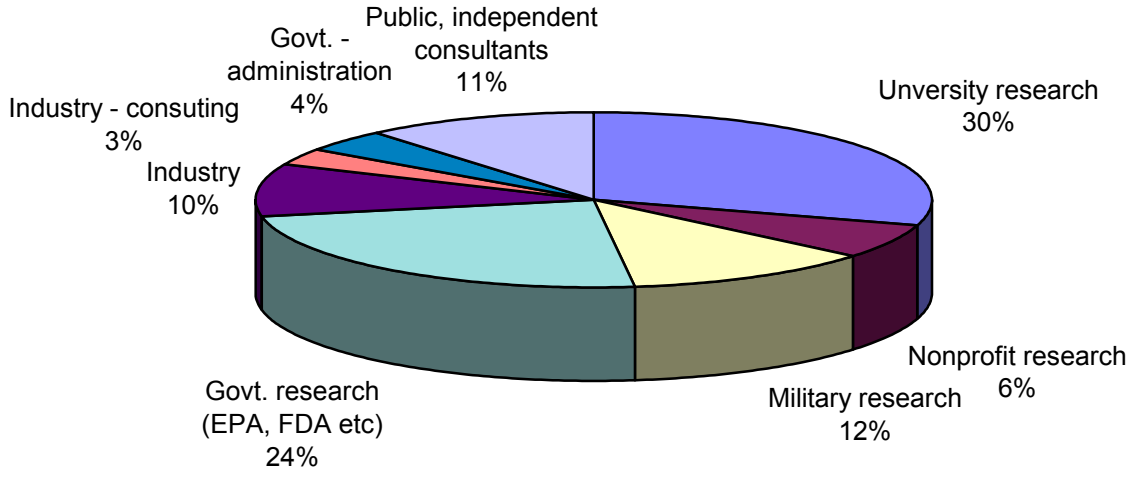

Figure D.1 Affiliations of IEEE safety levels committee

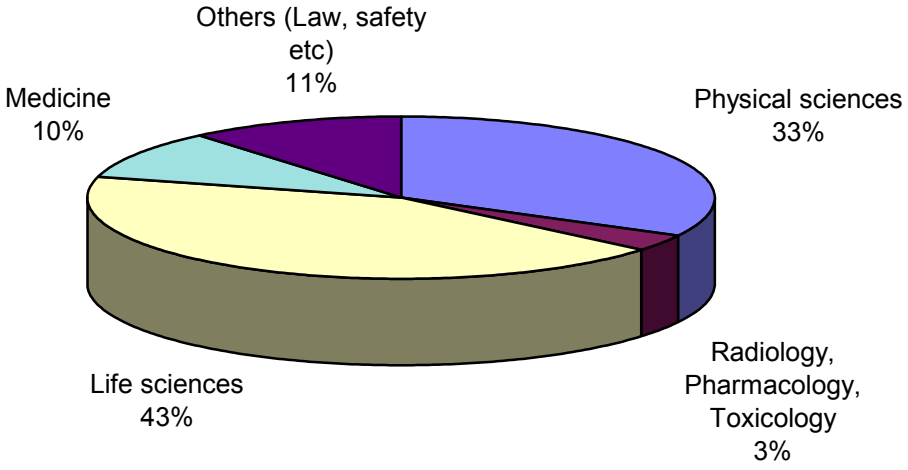

Figure D.2 Principal disciplines of IEEE safety levels committee

Standards development is based on a critical evaluation and interpretation of the research literature. Once a draft is developed there is a postal vote, in which 75 percent of the votes must be returned. An attempt must be made to reconcile every negative vote, and every unreconciled negative vote must be circulated to offer voting members an opportunity to comment, affirm or change their vote. If, following this procedure, there are still 75 percent of the votes in favour, the draft standard is subject to a further vote by the main committee following the same rules. At this point, there is coordination with other interested bodies, such as the Bioelectromagnetics Society, and finally a review by the IEEE Standards board to ensure that proper procedures have been followed. Once approved by the IEEE Board, the draft becomes an IEEE Standard and is forwarded to ANSI.

The ANSI Board of Standards Review, which also requires evidence of due process, advertises the Standard for public comment, and the standard only becomes an American National Standard once every comment has been satisfactorily addressed.

The IEEE/ANSI Risk Assessment Working Group concluded that there was a threshold level of radiofrequency power absorption in the body of 4 W/kg, above which adverse effects in humans might occur. At lower frequencies, there are also restrictions on induced current flows. Effects reported at lower levels (eg, movement of calcium ions from cells) were considered, but the consensus of the working group was that such modulation-specific "window" effects could not be related to human health.

In deriving exposure limits for "uncontrolled environments" (effectively, environments with unrestricted access), the Societal Implications Working Group recommended a safety factor of 50, to take into account the possibility of sensitive subgroups of people, potentially longer durations of exposure, voluntary versus involuntary exposures, the possibility that "athermal" effects may be a potential health hazard, etc.

Although the basic restriction on exposures is given in terms of power absorbed in the body, in practice this is difficult to measure or calculate, so the Standard gives equivalent values in terms of the power flux density, and electric and magnetic field strengths. These have been

plotted, along with the equivalent values for the other Standards discussed here, in the first part of this section.

D.2 International Commission on Non-Ionizing Radiation Protection (ICNIRP)

The International Commission on Non-Ionizing Radiation Protection (ICNIRP) is an independent scientific organisation responsible for providing guidance and advice on the health hazards of non-ionising radiation. It was chartered in 1992, and is based on the International Non-Ionizing Radiation Committee (INIRC) of the International Radiation Protection Association (IRPA).

ICNIRP was established to advance non-ionising radiation protection for the benefit of people and the environment. It is a formally recognised non-governmental organisation in non-ionising radiation for the World Health Organization and International Labour Office.

Amongst its activities are:

- development of independent, science-based international guidelines on limits of exposure to non-ionising radiation;
- provision of science-based guidance and recommendations on protection from non-ionising radiation exposure;
- establishment of principles of non-ionising radiation protection for formulating international and national protection programmes; and
- maintenance of a close liaison and working relationship with all international bodies engaged in non-ionising radiation protection.

Work is conducted in conjunction with international and national health and research organisations, as well as universities and other academic institutions. The fourteen members of ICNIRP comprises individual experts (who represent neither their countries nor their institutions) covering the disciplines of medicine, biology, epidemiology, physics and engineering. As far as possible, there is also be a balance of geographical representation.

In addition, ICNIRP has established four standing committees, covering epidemiology, medicine and biology, physics and engineering, and biological aspects of optical radiation, which draw on additional expertise from outside the Commission.

ICNIRP's predecessor (the INIRC of the IRPA) published exposure guidelines for radiofrequency fields in 1988. An updated version was published in 1998[2]. The guidelines are based on a literature review carried out by ICNIRP members and standing committees. This review is sent out to various institutions, agencies and individual scientists for comment. ICNIRP is also required to submit its recommendations for comment by the IRPA and the IRPA Associate Societies (such as the Australasian Radiation Protection Society). Although majority voting is accepted for ICNIRP decisions, it is understood that there was unanimous acceptance of the 1998 guidelines.

[2] ICNIRP (1998). Guidelines for limiting exposure to time varying electric, magnetic, and electromagnetic fields (up to 300 GHz). Health Physics 74 (4), 494 - 522.

In establishing their exposure limits, ICNIRP recognised the need to reconcile a number of differing expert opinions. The validity of scientific reports had to be considered, and extrapolations made from animal experiments to effects on humans. They note that:

> 'The restrictions in these guidelines were based on scientific data alone; currently available knowledge, however, indicates that these restrictions provide an adequate level of protection from exposure to time-varying EMF (electric, magnetic, and electromagnetic fields).'

Criteria applied in the course of the review were designed to evaluate the credibility of the reported findings, and only established effects were used as the basis for the proposed exposure guidelines. From this, ICNIRP concluded that there was a threshold for effects when the radiofrequency power absorbed in the body exceeded about 4 W/kg. They note that there is insufficient information to provide a rigorous basis for establishing safety factors, but taking into account potentially higher sensitivity in some groups, the possibility of exposure in severe environments, and the possible effects of signal reflections and differences in absorption of radiofrequency energy by different individuals, they chose a safety factor of 50 in determining public exposure limits. Thus they establish a *basic restriction* for public exposures of 0.08 W/kg. At frequencies below 10 MHz, the basic restriction is couched in terms of current density induced in the body. Because of the difficulties in assessing absorbed power and current density, ICNIRP also provides *reference levels* in terms of the more easily measured electric and magnetic field strengths, power flux density, and limb currents. Compliance with the reference levels gives assurance that the basic restrictions are not exceeded. If exposures are greater than the reference level, this does not necessarily mean that the basic restriction is also exceeded, but a more careful analysis is required.

ICNIRP considered that epidemiological studies provided only limited information on cancer risk, and generally lacked quantitative exposure information. Studies on reproductive outcomes also suffered from poor assessment of exposure and, in many cases, small numbers of subjects, and it was considered difficult to draw conclusions from them. Overall, ICNIRP concluded that the literature on possible athermal effects of electromagnetic fields was so complex, the validity of reported effects so poorly established, and the relevance to human health so uncertain, that it was impossible to use that body of information as a basis for setting exposure limits.

ICNIRP decided not to use the concept of "prudent avoidance", or a precautionary approach, in order not to diverge from their practice of founding guidelines on scientifically established studies.

The ICNIRP guidelines have been formally adopted in Holland, and have been proposed for adoption in the European Community.

D.3 Russian standard

Information on the philosophy and reasoning behind Eastern European exposure Standards, of which the (former) USSR standard is taken as an example, is not widely available. One of the goals of the World Health Organization International Electromagnetic Fields project (discussed in Appendix C.1) is to improve knowledge of both the philosophy of these Standards, and the research on which they are based, and some results from the early stages of this work should be available soon.

For environmental (ie, general public) exposures, the *Interim health standards and regulations on protecting the general population from the effects of electromagnetic fields generated by radiotransmitting equipment* were developed in the Kiev Institute for General and Communal Hygiene, and approved and promulgated by the USSR Chief State Physician in 1984. These interim measures were due for review in 1989, but no review appears to have been undertaken.

The philosophy appears to be to set limits which are a compromise between setting limits as low as possible, engineering practicalities and the costs of setting limits so low that large areas would be unusable for public activities. As knowledge about possible health effects increases, the limits may be relaxed. Any evidence of possible effects in people or experimental animals, for example, perception of exposure or a biological effect of unknown significance, is assumed to have possible health consequences. Reproducibility of any effects reported may not be an important consideration. Much of the data arises from experiments with pulsed radar sources.

The radiofrequency spectrum is divided up into bands (for example, 3-30 MHz, 30-300 MHz, with different limits (called *maximum permissible levels*)) applied within each band. There is no attempt to avoid abrupt transitions at the boundaries, and the boundaries are different for public and occupational limits. At frequencies up to 300 MHz, the limits are specified in terms of the electric field strength, and above that as power flux density.

Radio transmitters should be sited taking into account the transmitter characteristics (power, height and directionality of the antenna etc) and nature and use of surrounding areas so that exposures in populated areas do not exceed the limits.

The regulations describe *Health Protection Zones* (HPZ) and *Restricted Construction Zones (RCZ)*. An HPZ is the area surrounding a transmitter, with the boundary defined by points at which radiofrequency levels 2 metres above the ground do not exceed the exposure limit. Use of the HPZ is specified in separate regulations. There is a requirement that the HPZ be made as small as possible.

The RCZ is a larger area than the HPZ, within which radiofrequency levels at any height above the ground exceed the exposure limit. Buildings within the RCZ should be constructed so as to ensure that exposures to occupants comply with the exposure limits. Other measures to reduce exposures, such as minimising roads and paths, planting trees and shrubs etc, should also be undertaken. Radio transmitters should have a health certificate containing details such as the technical specifications, plans of the HPZ and RCZ, and radiofrequency measurement data.

Although not carried over into exposure guidelines for the public, there is an assumption in the USSR occupational limits that effects (at least at frequencies above 300 MHz) may be cumulative. The exposure limit varies in inverse proportion to exposure time, so that a high exposure for a short time is taken to be equivalent to a low exposure over a long time.

D.4 New Zealand Standard

In 1990, New Zealand adopted the existing Australian radiofrequency exposure Standard (published in 1985) as NZS 6609:1990 Part 1 *Radiofrequency Radiation - Maximum exposure levels 100 kHz - 300 GHz*. This Standard had interim status, pending further review.

In 1991 the New Zealand and Australian radiofrequency committees combined, and in March 1998 the joint committee released a revised Standard (AS/NZS 2772.1(Int):1998) which also had interim status, and was valid for one year. This was based largely on the 1988 International Radiation Protection Association (IRPA)[3] recommendations. The reason for publishing an interim Standard was to allow further time for committee consideration and public input.

The 1998 Interim Standard was reviewed by an enlarged committee (detailed below), made up of representatives of sectors of interest nominated by government bodies, industry associations, community-based and consumer organisations, trade unions and professional, technical or trade associations. While committee participation is sought through nominating organisations, Standards New Zealand and Standards Australia may also co-opt individuals who have expertise in a particular area.

There are two main opportunities for public input into the review of a Standard. Firstly, issues can be discussed directly with committee members during the preparation of a draft Standard. Secondly, once the committee has prepared a draft Standard, it is released for public comment, the comment period normally lasting two months. In New Zealand, the release for comment is announced in *Standards* magazine, and on the Standards New Zealand web site (http://www.standards.co.nz).

The draft produced by this enlarged committee was released for public comment in December 1998. Exposure limits were taken from the 1998 ICNIRP guidelines, and further sections added to aid implementation and verification of compliance. There was also a clause requiring operators to minimise exposures to the public.

Requirements for acceptance of Standards

The aim of a Standards committee is to produce a Standard that is generally accepted. Following public comment and a committee consensus on the content of a Standard, committee members hold a postal vote. If a member casts a negative vote, the committee must reconsider its position. As far as possible, the reasons for negative votes shall be discussed and attempts made to resolve differences. No Standard shall be published if it is recognised that there is a significant interest opposed to its publication. (That is not to say that unjustified views of any party motivated by self interest should be accommodated.) However, when there are negative votes still remaining unresolved, a draft can be published if a minimum of 67 percent vote in favour, and a minimum of 80 percent of votes received are affirmative.

[3] The IRPA subcommittee which developed these recommendations went on to become ICNIRP.

Members of the review committee

Mr Ian Hutchings	Ministry of Commerce NZ (Chairman)
Mr Rod Corrigan	Standards Australia (Secretary)
Dr Ivan Beale	New Zealand
Dr David Black	New Zealand Institute of Occupational & Environmental Medicine
Mr Trevor Woods	Broadcast Communications Ltd NZ
Mr Roger Matthews	Local Government New Zealand
Dr Andrew McEwan	National Radiation Laboratory (New Zealand)
Mr Andrew Corney	New Zealand Association of Radio Transmitters
Mr Simon Cooke-Willis	Telecom New Zealand Limited
Mr Cedric Gorman	Standards New Zealand
Ms Mandy Rossetto	Australian Council of Trade Unions
Dr Bruce Hocking	Australasian Faculty of Occupational Medicine
Mr Wayne Cornelius	Australasian Radiation Protection Society
Mr Robert Johnston	Australian Communications Authority
Mr Steve Guggenheimer	Australian Council of Trade Unions
Mr Bernie O'Shannassy	Australian Electrical and Electronic Manufacturers Association
Dr Ken Joyner	Australian Mobile Telecommunications Association
Mr Michael Bangay	Australian Radiation Laboratory
Mr George Georgevits	Australian Telecommunications Users Group
Mr Ian Shearman	Chairman of TE/3 (the parent committee) (Australia)
Mr Dan Dwyer	Communications, Electrical Plumbing Union (Australia)
Mr John Lincoln	Consumers' Federation of Australia
Mr Don Maisch	Consumers' Federation of Australia
Dr John Hunter	CSIRO – Division of Telecommunications and Industrial Physics (Australia)
Mr Keith Malcolm	Department of Communications and the Arts (Australia)
Mr John Pring	Department of Defence (Australia)
Mr Ken Tory	Electricity Supply Association of Australia
Mr Mike Flood	Institution of Engineers (Australia)
Dr J Leigh	National Occupational Health & Safety Commission (Australia)
Mr Andrew Corney	New Zealand Association of Radio Transmitters
Mr Jonathan Parker	Optus Communications (Australia)
Mr Vitas Anderson	Telstra Corporation Limited (Australia)
Dr David Wardlaw	Wireless Institute of Australia

Although it was understood that there was fairly widespread acceptance of the revised draft, the final committee ballot did not receive the required 80 percent votes in favour for adoption as a joint Standard. (Representatives of Standards NZ and Standards Australia do not vote.) Considering votes from each country separately, there were still insufficient votes in favour from either Australia or New Zealand.

Therefore efforts were made to resolve differences. The New Zealand representatives managed to make amendments to the Standard which, when put to a further ballot of the New Zealand representatives, received sufficient votes to be adopted. This final version, adopted

April 1999, included the ICNIRP limits, and clarified sections referring to implementation, verification of compliance, and minimisation of public exposures.

No resolution was reached in Australia, and the most likely outcome is that the Australian Communications Authority will draw up regulations based on the draft.

Appendix E. Health effects: potentially vulnerable populations

The possibility that some sections of the population may be more susceptible than others to some environmental or physical influence must always be considered in health and safety guidance. Depending on the agent under consideration, susceptible or vulnerable groups may include children, elderly people, the sick, people with particular genetic conditions etc. More stringent protection methods may be required to protect such groups against harmful effects, compared with healthy adults.

Some of these groups often congregate in well-defined areas, such as hospitals, schools or rest homes. For others there are no such areas. For protection purposes, it must be assumed that anyone who may be particularly vulnerable or susceptible could be anywhere which is reasonably accessible to any other member of the public. Therefore, exposure limits designed to protect such groups should be applied in any area normally accessible to any person.

There is no clear evidence that some sections of the public (children, or elderly) may be more or less susceptible to effects from exposure to radiofrequency fields than others. Nevertheless, many standards apply an additional safety factor of five for the public, over and above that applied for occupational exposures, for several reasons:

- people exposed occupationally should be aware of their exposures and be trained in the safety precautions that may be necessary to avoid overexposures
- people exposed occupationally are exposed for a limited part of each day and of each week. The public may be exposed continuously, and unaware of their exposures
- people exposed occupationally would normally be in good health, whereas the public may be ill and less able to tolerate exposures.

The public is often sensitive about the possibility of some groups being more vulnerable, or meriting more protection, than others, and may consider that efforts should be made to minimise or avoid exposures in areas where these people may congregate.

Appendix F. Health effects: options for information sharing

F.1 Interagency committee reporting to Ministers

This option proposes that an interagency committee be established to undertake ongoing review of the literature and other issues arising about radiofrequency fields.. This committee, comprising government agencies, consumer representatives, industry representatives and academics/scientists, would report to Ministers on the findings of the reviews.

Strengths	Weaknesses
Seen as being independence with range of interested agencies and parties.	There were concerns about whether having both industry and consumer representatives would lead to the committee becoming adversarial or make compromises to ensure agreement.
Strong support from Auckland community representatives.	Committee relies on ongoing support from Ministers to be effective and political priorities may mean this is not always the case.
Includes technical and scientific expertise	Community groups felt that the composition and source of members would need be trusted by the community.

F.2 Interagency committee reporting to the Director-General of Health

This option proposes that an interagency committee be established to undertake ongoing review of the literature and other issues arising about radiofrequency fields and comprising government agencies, consumer representatives, industry representatives and academics/scientists. This committee would report to the Director-General of Health on the findings of the reviews.

Strengths	Weaknesses
Seen as being independence with range of interested agencies and parties.	There were concerns about whether having both industry and consumer representatives would lead to the committee becoming adversarial or make compromises to ensure agreement.
Strong support from Christchurch community representatives.	Community groups felt that the composition and source of members would need be trusted by the community.
Seen as less political by community groups as it didn't rely on support from Ministers.	
Includes technical and scientific expertise.	
Reports to the Director-General of Health so feeds directly into policy development.	

F.3 Expert committee reporting to Ministers.

This option proposes that a committee of scientific and academic experts be established to undertake ongoing review of the literature and other issues arising about radiofrequency fields. This committee would report to Ministers on the findings of the reviews.

Strengths	Weaknesses
Technical and scientific expertise.	Community groups felt that the composition and source of members would need be trusted by the community.
	Committee relies on ongoing support from Ministers to be effective and political priorities may mean this is not always the case.

F.4 Preferred option

The Ministry of Health recommends adoption of the second option, that is, an interagency committee reporting to the Director-General of Health. The reasons for this are that it includes representatives from all interested and affected organisations and groups. By meeting together and sharing issues of concern, analysing the scientific literature and forming conclusions, it is hoped that people will reach understandings of the range of views as well as an understanding of the process the committee uses to reach its conclusions.

The Ministry of Health also believes that this process is open and transparent and notes that documentation relating to the deliberations and findings of the committee would be available to the public and other interested individuals or organisations. By including representatives from a range of interested parties, the Ministry also expects that the findings of the committee will reach a wider audience and be more accepted than a committee comprised only of experts. Through having representatives participate in such meetings, it is also expected that community groups and industry organisations will gain an appreciation of the reasoning and logic behind the advice promulgated.

The Ministry would emphasise that funding for such a committee is not currently available but notes that similar interagency committees are operated on a self-funding basis, that is those attending meet their own costs to do so and are not reimbursed for their expenses and time. This would however be likely to disadvantage community representatives, and may weight the composition of the committee to those people based in Wellington. Depending on the strength of support for this option, the Ministry will investigate what funding options are available.

Appendix G. Summary of key Environment Court cases

G.1 The importance of case law

The New Zealand courts, and to some extent councils, when making decisions on resource consent applications, operate on a precedent-based system.

This means that when the Environment Court makes decisions it is required to be consistent with the decisions of any higher Court, ie the High Court, Court of Appeal, and Privy Council (in the United Kingdom). It endeavours to be consistent with its own decisions, and the UK House of Lords' decisions are also regarded as highly persuasive.

Councils are not bound by their previous decisions, but they are bound by decisions of the Environment Court. Precedent-setting Environment Court decisions should be followed by councils, otherwise there is a risk that the council's decision will be successfully overturned on appeal.

However, precedent-setting decisions may be *distinguished* from a case at hand if the facts are considered to be different in a material way.

G.2 Introduction to cellsite case law

Very few cellsite cases have actually proceeded to Environment Court hearings. The cases relating to health issues have generally related to cellsite base stations. There are likely to be even fewer in the future, given the firmness of the Environment Court's decisions in *McIntyre v Christchurch City Council* [1996] NZRMA 289 and *Shirley Primary Schoolv Telecom Mobile Communications Limited* [1999] NZRMA66.

To date, the Environment Court has ruled that there are no established adverse health effects arising from the emission of radio waves from cellular facilities.

The Court has found that there are potential adverse health effects of low probability (in *Shirley*), but only *in a very weak sense* (and this was not a reason for declining resource consent). Such potential effects of low probability can be taken into account under the Act, because section 3(f) defines *effect* as including:

> *Any potential effect of low probability which has a high potential impact.*

G.3 The leading New Zealand cases

The leading New Zealand cases are *McIntyre and others v Christchurch City Council* (referred to as *McIntyre*) and *Shirley Primary School v Telecom Mobile Communications Limited* (*Shirley*). In both cases, and in particular in *Shirley*, detailed evidence was presented to the Court on health, psychological and other effects. With the benefit of that evidence, and legal argument on both sides of the issues, the decisions in these cases, in particular *Shirley*, have significant importance in the New Zealand context.

The decision in *Telecom v Christchurch City Council* is also often cited, but in that case the Court did not have the benefit of experts espousing both points of view.

The following discussion outlines the facts of the leading cases, *McIntyre and others v Christchurch City Council*, *Telecom v Christchurch City Council* and *Shirley Primary School v Telecom Mobile Communications Limited*, followed by a discussion on the guidance which those cases, and others, give on the following issues:

- The relevance of the New Zealand Standard (NZS)
- The precautionary approach
- Health effects: evidential matters
- Types of evidence
- Assessment of evidence generally: the judicial function.
- Admissibility and reliability of evidence
- Burden of proof and standard of proof
- Other factors in the assessment
  - Psychological effects
  - Visual/landscape/amenity effects
  - Effects on property values
  - Reduced financial viability of schools and whether alternative sites are available
  - Positive effects
- Imposing a condition lower than the NZS and precedent value of decisions.

G.4 *McIntyre and others v Christchurch City Council*

In *McIntyre,* Bell South applied for a resource consent for a base transceiver station to be erected in Fendalton, Christchurch. The activity was a non-complying activity under the Transitional District Plan.

The Christchurch City Council granted the consent, subject to conditions.

Residents' objections concerned harmful health effects from radiofrequency radiation. In particular, they argued it would be an error of law to decide on the present state of scientific knowledge that there were no harmful health effects from low-level radiofrequency exposure levels.

It was also argued that the Resource Management Act 1991 (RMA) contains a precautionary policy and that section 104 requires a consent authority to have regard to potential effects of low probability but high impact, in considering an application.

The Planning Tribunal (now the Environment Court) considered residents' objections and heard experts' opinions as to potential health effects, and granted the consent subject to conditions. It was found that there would be no adverse health effects from the low levels of radiation from the proposed transmitter, not even effects of low probability but high potential impact. The relevant parts of the decision are discussed below.

G.5 *Telecom v Christchurch City Council*

Telecom applied for a resource consent to establish and operate a cellular network site from Colombo Street in Christchurch, adjacent to the Archer Memorial Home. The activity was non-complying under the Transitional District Plan.

The Christchurch City Council refused the application on the grounds of adverse visual effects. Telecom appealed the Council's decision. The case would have been confined to visual issues, however a Mr Haliday joined as a party to the appeal, opposing the activity on the grounds of adverse health effects.

The Court granted the consent, subject to conditions including:

> *That the cell site facility shall at all times be operated in accordance with the New Zealand Standard for Radio Frequency Levels (NZS 6609:1990 or any subsequent amendment thereof) and the level of radio frequency fields be kept as low as reasonably achievable.*

The Court gave a strong indication that it had hoped *McIntyre* would have resolved the issue of health hazards from cellsites (page 3):

> *We question the value of inviting this Court to continue to entertain and make findings in respect of detailed technical and medical evidence in order to decide in each case whether or not a health hazard exists in relation to these facilities. We would have thought that by now the findings in cases such as* McIntyre and others v the Christchurch City Council *Decision 15/96 dated 5/3/96 would have been sufficient, in the absence of any fresh evidence to allay the concerns of residents about possible health hazards emanating from cell sites such as that proposed in this case. The cost to the community involved in the need to deal repeatedly with these issues is becoming a matter for concern.*

The Court concluded that there were no adverse effects, or if there were, that they were no more that minor (pages 35 - 36).

G.6 *Shirley Primary School v Telecom Mobile Communications Ltd*

This case also involved a decision of the Christchurch City Council. Telecom applied to the Christchurch City Council for a resource consent to establish, operate and maintain a cellular base station on land at Shirley Road, Christchurch, adjacent to the Shirley Primary School. Again, the activity was non-complying under the Transitional District Plan.

The Council granted consent subject to conditions. The school appealed the decision, alleging four main adverse effects:

- the risk of adverse health effects from the radiofrequency radiation emitted from the cellsite
- the school's perception of the risks and related psychological adverse effects on pupils and teachers
- adverse visual effects
- reduced financial viability of the school if pupils were withdrawn.

Telecom also appealed against a condition imposed by the Council (condition 4) imposing a limit on the power flux density emitted by the cellsite. Telecom's appeal against condition 4 was successful.

This case emphasises a *risk assessment* approach (and this approach is a common thread throughout the case). The Court started by the premise that no one can guarantee that there is

no risk from cell sites (page 97) - a no risk approach is logically impossible. Everybody lives with some risk every day of their lives. However, the risk may be so very small that it is acceptable, compared with other risks that parents expose their children to daily (page 97).

In addition, the Court emphasised that radiofrequency radiation is just one form of radiation that pervades the universe (pages 72 and 138).

It was held (at page 89):

> *(a) that there is very tenuous epidemiological evidence of some possible adverse health effects (effects on learning and sleep);*
> *(b) that on our subjective assessment these effects are of very low probability; and*
> *(c) that the effects may be of relatively high potential impact (but not of the devastating impact that cancers would have).*
>
> *So there are adverse 'effects' within the meaning of section 3(f) but only in a very weak sense.*
>
> *In conclusion we hold that:*
> *(a) the risk of the schoolchildren or teachers at the school incurring leukaemia of other cancer from radiofrequency radiation emitted by the cellsite is extremely low;*
> *(b) the risk to the pupils of exposure to radiofrequency radiation causing sleep disorders or learning disabilities is higher but still very small*.'*
>
> *'* Taking a relatively arbitrary figure, just to give an idea of what we mean: very small = 1 in a million…*

The Court concluded (at page 141):

> *In the end we are persuaded to the very high standard that we require, by the evidence of scientists called by Telecom and by the view of ICNIRP, that the risks to the Shirley Primary School community are very low and are acceptable and accordingly we consider that the Telecom proposal should be allowed to proceed as achieving the purpose of the Act.*

The relevant parts of the decision are discussed further below.

G.7 The relevance of the New Zealand Standard

In *McIntyre*, it was not disputed that the activity complied with the NZS (NZS 6609: 1990). However, the residents argued that the Standard was set for **known** effects, whereas their concern was for the **unknown** effects of radiation below the levels in the Standard (page 294).

The Court stated that compliance with the Standard is not decisive or compulsory. Parties to resource consent proceedings are not bound to accept that compliance with the Standard would avoid adverse effects on the environment. The Court said (page 295):

> *Because New Zealand standards are not given particular status by law, parties must be free to assert that significant adverse effects on the environment would occur despite compliance with the standard. …*
>
> *The standards are generally accorded respect. So opposition to a resource consent application based on an assertion of significant environmental harm despite compliance with a relevant New Zealand standard would usually need to be supported by expert opinion to be worthy of serious consideration.*

In *Shirley* the Court considered the two new standards published in 1998 (AS/NZ S 2772.1 (Int.): 1998 Radio Frequency Fields, Part 1 and the standard recommended in the ICNIRP Guidelines. Those standards were considered under section 104(1)(i) of the Act (page 136). The following points summarise how the Court viewed these two standards (pages 131-132):

- Although the ANZ standard states that there has been no **conclusive** evidence that athermal effects from radiofrequency radiation constitute a health hazard, this did not guide the Court because **conclusive** evidence is not required under the Act.
- The Court was reassured by statements in the ICNIRP standard that the risk of health effects from low-level exposure is very low, and that at cellphone frequencies the ANZ Standard becomes almost two and a half times lower than the international standard in the ICNIRP guidelines.

G.8 The precautionary principle or approach

Although the precautionary principle was recognised as a matter to be taken into account in *McIntyre* and in *Telecom,* the Court in *Shirley* rejected the need to take into account the precautionary principle as a separate concern. The reasoning was that the RMA already embodies a precautionary approach.

In *McIntyre* the residents argued that the Resource Management Act 1991 (RMA) is about risk avoidance – ie, it has a precautionary principle in it.

The Court however made a distinction between:
- the policy of the RMA; and
- a general precautionary principle of environmental law.

The policy of the RMA is given effect to by applying the RMA's provisions in the decision-making process. These include:
- having regard to the factors in section 104(1) when considering an application and submissions; and
- exercising the discretionary judgment whether to grant consent, under section 105 of the RMA.

The general precautionary principle is for the evaluation and ultimate judgment, and the influence of the principle in that final evaluation is a matter for discretion (page 305). The principle can apply, under the Act, to people and their health as well as the rest of the natural and physical environment (page 307). The Court also considered that (page 305):

> *Like all elements that contribute to the ultimate judgment, the weight to be given to the precautionary principle would depend on the circumstances. The circumstances would include the extent of present scientific knowledge and the impact of otherwise permitted activities. However we think that in an appropriate case they would also include the gravity of the effects if, despite present uncertainty, they do occur.*

These comments would seem to indicate that the precautionary principle is to be taken into account under the section 105 evaluation. However at page 307, the Court appeared to accept that the principle can be a relevant factor to take into account under section 104(1) stating:

On the general precautionary principle, we note that a consent authority is entitled to have regard to any other matter not listed in s 104(1) which it considers relevant and reasonably necessary to determine the application…

There may be resource consent applications in which a consent authority may consider it relevant and reasonably necessary to have regard to the precautionary principle.

It was noted (at page 315) that the RMA provides other ways of addressing adverse effects which become apparent at a later date. The relevant provisions are:

- section 17 (which provides for a general duty on every persons to avoid, remedy or mitigate adverse effects on the environment)
- section 128 (which provides for the circumstances where resource consent conditions can be reviewed)
- section 319(2) (which provides that enforcement action can be taken against a person acting in accordance with a resource consent, where the adverse effects in respect of which the order is sought were not expressly recognised by the person who granted the resource consent, and the enforcement action is considered appropriate having regard to the time that has elapsed or the change in circumstances since the grant of the consent).

In summary, the Court in *McIntyre* considered that the precautionary principle may be relevant under section 104(1) of the RMA. The precautionary principle may also be a factor to be weighed when the decision-maker exercises discretion under section 105 whether or not to grant consent.

In applying this to the case, the Court said (page 319):

In approaching the exercise of the discretionary judgment to grant or refuse resource consent, we bear in mind the conclusion we reached earlier in this decision about the precautionary principle. We have considered the application of that to the circumstances of this case. We have concluded that the low power of the proposed transmissions, the condition that we would impose limiting the incident power flux density to 2 microwatts per square centimetre at any dwelling, and the relationship between that limit and the relevant standards referred to ... all illustrate the application of a precautionary approach to this proposal.

In *Telecom*, the Court agreed with the approach in *McIntyre* that the precautionary principle is a matter for the ultimate judgment, and can be taken into account as a matter of discretion (page 11, *Telecom*). The Court said (page 21):

It would be wrong in principle for the Court to fly in the face of that body of accumulated knowledge merely because it is not yet possible to demonstrate beyond any doubt that this technology is safe. No human activity can go forward on that basis and it would be a misuse of our discretion to reject this application by approaching the matter in that way. Our clear obligation is to evaluate the evidence, satisfy ourselves, as far as we are able, that the methodology and factual basis for the view currently held by the scientists carries conviction, and having done that then to take those matters into account in considering the overall exercise of our discretion under s.104.

This passage indicates that the precautionary principle should be taken into account under section 104 of the RMA.

Following these two cases, there was some confusion about whether the precautionary *principle* or *approach* should be taken into account under section 104, or section 105 of the RMA, and how it should be applied.

In *Shirley*, as in *McIntyre*, the Court broke down the decision-making process into components. It said (following comments on the "risk assessment" approach at page 100):

> *The decision-maker has:*
> *(a) under section 104(1):*
> - *to decide what the primary facts* are; and*
> - *to evaluate those facts as propositions about the future ('risks' if adverse effects, 'chances' if beneficial) - usually those propositions are given as the opinions of experts**; and*
>
> *(b) to carry out a further evaluation when undertaking the weighing and balancing exercise required under section 105(1) to decide the ultimate question.*
>
> * *And secondary (inferred) facts*
> ** *These two steps come under section 104. In may cases step (b) is the first step if there is no dispute about primary facts.*

However the Court took a different view to *McIntyre* on the precautionary principle. Unlike the Court in *McIntyre*, the Court in *Shirley* did not think it appropriate to take into account a precautionary principle as a separate consideration either under section 104 or 105 of the RMA.

The Court said (at page 134):

> *There is some confusion apparent over the applicability of the precautionary principle. We hold that the correct position is that the Resource Management Act 1991 is precautionary and thus justifies a precautionary approach. We consider, without deciding, that the precautionary principle is a limited consideration introduced by international law. The precautionary principle, a subset of the precautionary approach, derives from the Rio Declaration principle 15… .*

After quoting the Rio Declaration, the Court continued:

> *It will be seen that the precautionary approach applies where there is a threat of 'serious or irreversible damage' and entails that just because it is not, say, 99 percent certain that the threat will materialise, or perhaps that the damage will be irreversible, does not mean that no step should be taken to minimise risk. To paraphrase in the language of section 3 of the Resource Management Act 1991 the principle is, if a potential effect is only of high (and not very high) probability and high potential impact that is no reason for failing to take action to guard against the effect. The position facing us of course is quite different in that the alleged effect is clearly one of low probability and of unknown potential impact.*
>
> *The reason we doubt why a wider* "precautionary principle" *is useful is precisely because a precautionary approach is inherent in the Act.*
>
> *…Reference to principles or policies <u>outside</u> the Act which can already be found inside it is simply confusing. We think Occam's razor should apply and reference to the precautionary principle either eschewed or, if used, should be recognized as a restatement of section 3(f) and the precautionary approach. That position is encouraged by the fact that in this case we were also referred to the* "prudent avoidance" *policy or principle; and to the ALARA policy… . In our view all of these are simply ways of expressing concern about future effects of low*

probability (so that we do not know whether they will occur) and high potential (again because we do not know) impact.

In summary, we do not consider it is appropriate to apply the "precautionary principle" or the other policies suggested by witnesses and supported by counsel, for three reasons. First a precautionary approach is already implicit in the Act and emerges in the flexibility of the standard of proof applied by the Court and (as we shall see) in the weight given to evidence that has only been "proved" to a low standard (probability). Secondly such a "principle" is an unnecessary complication in an already complex statutory and factual matrix. Thirdly, application of the precautionary principle (or any of the other rules of thumb) to our decision under section 105(1) would lead to double-counting of the need for caution. If the appropriate standard of proof is on a sliding scale between the balance of probabilities and beyond reasonable doubt, depending on the impact of the effect, the fact is that the appropriate caution has been exercised when deciding under section 104(1)(a) what the effects are to be considered under section 105. If the Court applies the "precautionary principle" as another matter under section 104(1)(i) then the need for caution will have been considered twice.

This passage has been quoted at length because there are a number of important points which can be made from it, including that:

- the precautionary principle is a principle introduced by international law
- the precautionary principle is a subset of the precautionary approach
- it is doubtful whether a wider precautionary principle is useful in the context of the Resource Management Act 1991, which already embodies a precautionary approach (in section 3(f), in the flexibility of the standard of proof to be applied, and in the weight given to evidence that has only been proved to a low standard)
- it is inappropriate to apply the precautionary principle to the final evaluation under section 105, *or* as another matter under section 104(1)(i), because this would lead to double-counting of the need for caution.

Below is a discussion on the Court's references in *Shirley* to the flexibility of the standard of proof to be applied, and the weight to be given to evidence that has only been proved to a low standard.

G.9 Health effects: evidential matters

Evidential matters that arise in these cases are important because, on the issue of whether there are health effects from low levels of radio frequency radiation, experts put forward evidence to support differing views. As explained below, often the type of evidence presented is only hypothesis evidence. The Court must decide how to deal with the possibility that the state of current knowledge is incomplete (an issue which closely related to the "precautionary approach"). These legal issues about how the Court or a council goes about assessing evidence, become important in the final outcome of a case.

In addition to the following discussion, the cases (particularly *Shirley)* should be referred to for more general comments on what should be considered when preparing and evaluating evidence.

Types of evidence

In *Shirley*, the Court discussed the different types of evidence that could be presented (pages 73-74).

At the "hard" end of scientific research are the following types of studies:

- *epidemiological studies (epidemiology is the study of diseases in the human population) which can include:*
- *case studies, descriptive studies and professional experience;*
- *cohort or case control studies; and*
- *randomised trials (experimental studies).*
- *[b]iological or mechanistic studies, which can include:*
- in-vitro *studies (meaning test-tube or petri dish studies); or*
- in-vivo *studies (meaning studies of live animals).*

The types of studies in this list progressively increase in terms of power to establish cause and effect.

Assessment of evidence generally: the judicial function

In *McIntyre* the Court discussed the function of the Environment Court (or a council) where there are differences among experts. The Court (at page 296) followed the reasoning from *Darroch v Whangarei District Council* A18/93 where it was said:

> *The Tribunal does not conduct a scientific inquiry to discover absolute truth, nor is it judging between the expert witnesses, and our findings should not be seen in that way.*

The Court also upheld the approach taken in *Canterbury Regional Council v Canterbury Frozen Meat Company Limited* A14/94, 3 NZPTD 368 where the Court had stated:

> *However we need to remember that our function is not so much to find the condition of the effluent in the sense that scientists might seek after absolute truth about a subject. Our function is a judicial one, to make findings based on the evidence before us based on the balance of probabilities, and having regard to the gravity of the matter, on the question whether the discharge has been exceeding the limits prescribed by the conditions of the discharge permit.'*

The Court in *McIntyre* later said (at page 307), *'the heart of a finding of fact is that we ourselves need to feel persuaded that it is correct.'*

Admissibility and reliability of evidence

Evidence presented on health effects is often on the *weak* end of the spectrum (usually hypothesis evidence). This attracts arguments that the evidence is not admissible, or is unreliable. The Court must assess whether the evidence can be admitted, and, if it can be admitted, the Court must assess to what extent the evidence is reliable (and accordingly what weight should be given to the evidence). These become key issues in the cases.

In *McIntyre*, Bell South argued that (at page 298) there is a threshold to be crossed before scientific supposition or hypothesis evidence reaches a confidence level where notice should be taken of it. This argument followed the decision in *Trans Power New Zealandv Rodney District Council* 4 NZPTD 35 where it was said that there needs to be some plausible grounds

put forward, not mere "*suspicion or innuendo*" (this case related to the alleged effects of high-power transmission lines).

In *McIntyre*, the Court considered other jurisdictions (England, USA, Canada and New South Wales). It was held (at page 306) that the Tribunal (now the Court) is free to receive anything in evidence that it considers appropriate, and is not bound by the rules of law about evidence that apply to judicial proceedings (section 276 of the RMA). However, in order to make a finding there needs to be some evidence of probative value ie. tending logically to show the existence of facts consistent with the finding (page 307).

The Court concluded:

> *We do not accept that the existence of a serious scientific hypothesis, or even one that is regarded as deserving priority for testing, is necessarily sufficient by itself to establish a potential effect, even a potential effect of low probability which has a high potential impact. Nor do we accept that the Tribunal should impose a threshold based on current scientific knowledge before taking notice of a scientific hypothesis. We hold that like any other evidence tending to establish a contested fact, the grounds for the hypothesis have to be exposed to testing… to assist the Tribunal to weigh the evidence and make a finding one way or the other.*

Further, at page 314 of the decision, the Court said:

> *…we have come to our finding on the basis of the evidence before us, and not on the basis of a possibility that further research might (or might not) show something that has not already been shown by previous research. That would be to decide a different question. It would not be to decide whether, on the balance of probabilities, there would be a potential effect of low probability but high potential impact on the environment. It would be to decide whether there is a potential, even of low probability, that there would be an effect of high potential impact on the environment. We do no understand that to be the question on which we have to make a finding.*

In *Shirley*, the Court appeared to follow the *McIntyre* approach on whether evidence is admissible. The Court agreed with the Primary School that there is no rigorous reliability threshold under the RMA, stating (at pages 107-108):

> *We hold that in the NZ Environment Court there are only very low thresholds such as the requirement for experts to qualify themselves as such; for evidence to be relevant and not to be so witless or lengthy as to be vexatious. ... The issue as to reliability is, under the Resource Management Act 1991, much more likely to go to the weight to be given to evidence, than to admissibility.*
>
> *...Before an hypothesis can be considered by any Court, there must be a basic minimum of evidence to support it. But in the case of any hypothesis about a high impact risk a scintilla of evidence may be all that needs to be established in the Court's mind to justify the need for rebuttal evidence. …*

The Court also listed criteria for measuring the *weight* to be given to the specific evidence when making findings (at page 108).

Following from earlier comments on different types of evidence, *hypothesis-based* evidence (as distinct from *hard science*) was discussed. The Court said (page 109):

> *To fall within section 3(f) of the Act as a potential effect of low probability and high potential impact an effect must not be simply an hypothesis: there must be some evidence supporting the hypothesis. This evidence may consist of at least one of:*

(1) consistent and sound statistical studies of a human population; or
(2) general expert acceptance of the hypothesis; or
(3) persuasive animal studies or other bio-mechanistic evidence accompanied by an explanation as to why there is no epidemiological evidence of established effects in the real world; or
***(4)** (possibly) a very persuasive expert opinion.*

It is important that the evidence need only fall into <u>one</u> of the categories before the Court will take it into account…

The Court went on to discuss these criteria, and gave guidance as to elements of a "sound" statistical (epidemiological) study for legal purposes (page 110: the criteria are repeated on page 120 and applied to the facts). It was held that there were adverse effects within the meaning of section 3(f) but only *"in a very weak sense"* (at page 121).

In summary, it can be seen from both the cases that there is a difference between a hypothesis which is supported by some form of evidence (forms were listed in *Shirley*), and a hypothesis which is unsupported, but where it is argued that evidence to support the hypothesis may come to light in the future. The latter is insufficient.

Burden of proof and standard of proof

Although the following discussion is a legal discussion, it has practical importance in these cases, because it examines to what extent:

- an *objector* must show that there are adverse health effects from radiofrequency radiation
- the *applicant* has to show that radiofrequency radiation from cell sites is safe.

Burden of proof

The party who has the burden of proof in a case has to demonstrate the truth of what they are saying. In *McIntyre*, the Court considered that there was no legal burden of proof on either party, but there was a burden on the party who makes an allegation to present evidence tending to support the allegation; that is, there is an evidential burden: (page 306).

In *Shirley*, the Court went further than this, stating(pages 101, 106) that there is:

- a legal and a persuasive burden resting on an applicant for resource consent;
- a swinging evidential burden; as evidence of varying weight develops, the evidential burden will remain with or will shift to whichever person would fail without further evidence.

These two approaches differ.

Standard of proof

The standard of proof refers to the extent to which the person bearing the burden of proof must show something to be true. This is sometimes expressed as a probability.
In civil cases, the standard of proof is usually the balance of probabilities. Someone must prove something beyond a 50 percent probability, whereas in criminal cases the standard is usually "beyond reasonable doubt", which is a higher standard.

The decisions in the two cases also differed on this issue.

The Court in *McIntyre* took the more conservative view (following the cases *Canterbury Regional Council v Canterbury Frozen Meat Co Ltd* A14/94; *Peninsula Watchdog Group Inc v Waikato Regional Council* and *Trans Power New Zealand v Rodney District Council*) that (pages 296-297):

- the standard of proof is generally the balance of probabilities taking into account the gravity of the matter
- one might wish to have greater confidence than 51 percent confidence where a matter is grave, but
- the applicant should not be put to the threshold of having to show a matter beyond reasonable doubt (which is a much higher standard).

The Court recognised that the question of whether there are adverse health effects from radiofrequency radiation is indeed a grave one (page 314), indicating that greater confidence than a 51 percent probability is required in these cases.

Residents argued that the balance of probabilities test does not apply to section 3(f) of the RMA, because one cannot graft a test of *more probable than not* on to the provision in that section for an effect of *low probability* (page 304, *McIntyre*). However the Court appeared to reject that argument (at page 314).

In *Telecom*, the Court also adopted the standard of the balance of probabilities having regard to the gravity of the matter (pages 8-9).

In *Shirley*, the Court took quite a radical approach to the standard of proof, diverging from previous Planning Tribunal and Environment Court cases on the issue. The Court considered that the concept of standard of proof, although relevant to evaluating whether past facts had occurred, was not relevant to evaluating future facts. In evaluating future facts, the approach is one of assessing risk, rather than 'fact finding'. Whether a risk exists is a matter of judgment. The Court said (at page 101):

> *This distinction between evaluation and fact-finding is of crucial importance under the Act. Almost every case under the Act is concerned about the evaluation of many risks and thus issues as to the standard of proof are even more misconceived…*

Much emphasis was placed on this *risk-assessment* approach in the judgment.

The Court cited section 5(2)(c) and the definition of effect in section 3 of the RMA as supporting this rather novel approach to the standard of proof. The Court agreed with the *McIntyre* decision in that it is not correct to say that it is impossible to graft a test of more probable that not onto section 3. But although it is possible to graft a test of balance of probabilities onto section 3 *"it is not particularly helpful to do so"* (page 105).

In summarising the standard of proof matters, two propositions were expressed in *Shirley* as follows (page 106):

> *There is no one standard of proof, if that phrase is of any use under the Act. The Court must simply evaluate all the matters to be taken into account under section 104 on the evidence*

before it in a rational way, based on the evidence and its experience; and giving its reasons for exercising its judgment the way it does.

The ultimate issue under section 105(1) is a question of evaluation to which the concept of a standard of proof does not apply.

Further, in discussing causation, the Court said that it is not necessary to prove causation on the balance of probabilities in giving evidence of an effect, because under section 3(f), effects of low probability can be taken into account.

However, in the Court's reasons for rejecting the precautionary principle as a separate consideration, it described:

The standard of proof as "*on a sliding scale between the balance of probabilities and beyond reasonable doubt, depending on the impact of the effect…"*It is unclear whether that description is back-tracking from earlier more radical comments.

G.10 Other factors in the assessment

This section discusses other effects that a Court or a council might take into account, other than physical health effects.

Psychological effects

Prior to the radio frequency cases, there were cases where fear was raised as an effect to be taken into account (under both the Town and Country Planning Act 1977 and theRMA). This case authority indicated that fear may be considered to be an adverse effect on the environment pursuant to sections 104(1)(a) or 105(1)(a) of theRMA.

The main cases in which fear is a factor relate to concerns over discharge of a contaminant or escape of something dangerous: see *Meadow Mushrooms Ltdv Paparua County Council* (1977) 6 NZTPA 327; *Duncan v Thames Coromandel Counci*l (1980) 7 NZTPA 233;*, Liquigas v Manukau City Council* (1983) 9 NZTPA 193; *Shell Oil New Zealand v Auckland City Council* [1993] NZRMA 363; *Trans Power v Rodney District Council* A85/94; *Zdrahal v Wellington City Council* [1995] NZRMA 289; *Ammon v New Plymouth District Council* W27/97; *Department of Corrections v Dunedin City Council* C131/97); *Kapiti Coast District Council v Raika* [1997] NZRMA 218.)

These cases indicated that fear will be a relevant consideration when the fear is well-founded, based on what a reasonably well-informed member of the community might think, and if there is some opportunity to prevent apparent danger – for example, the escape of something considered to be a possible threat. When something is new or when the probability of its escape is high, then fear will be greater, butnote that this case law is not sympathetic to the public's fear of new technology.

Psychological effects were raised in the *Telecom* and *Shirley* cases (in *McIntyre* psychological effects were not argued).

In *Telecom*, Telecom presented evidence that any fear was unfounded. The Court said (page 12):

> *It must be considered in terms of s.104 whether there are any adverse actual or potential effects on the environment of allowing the activity. If it decides there are not then the fact that persons living in the vicinity of it may remain fearful and unpersuaded by the weight of scientific evidence cannot in our view be a relevant matter for the Court to take into account in the overall exercise of its discretion. To do so would in effect be to set aside the whole weight of the body of scientific evidence and to substitute for it an apprehension which cannot be shown to have any factual basis. That in our view would be to take into account a wholly irrelevant consideration and therefore an invalid exercise of the discretion inferred upon the Court*.'

In *Shirley*, the Court reviewed the cases decided under the TCPA, as well as the Court's statements in *Telecom*. The Court criticised the survey evidence on psychological effects presented on behalf of the School (page 123). It concluded (at page 125):

> *In our view if a Council or the Court finds that there is an unacceptable risk of adverse physical health effects then it is likely to refuse consent anyway. If the risk is acceptable then the fears of certain members of the community or even of sufficient people to be regarded as a 'community' would be unlikely to persuade the Council or at least the Court that the consent should be refused, because the individual's or the community's stance is unreasonable. Thus we do not go quite as far as the* ***Telecom*** *case in saying that fear is not an effect to be taken into account. We consider it is, but whether it is an effect which should be given any weight depends on the assessment of the risk.*

The Court said further (at page 126):

> *...whether it is expert evidence or direct evidence of such fears, we have found that such fears can only be given weight if they are reasonably based on real risk.*

Visual/landscape/amenity effects

In *Telecom*, the Council had declined the consent at first instance on the grounds of visual effects. Evidence was presented from both sides, regarding the visual/landscape/amenity effects on the surrounds, taking into account the mitigation proposals put forward by *Telecom.* (Telecom proposed planting trees around the mast.) The Court accepted that the scale and height of the mast was necessary for the applicant to achieve the purpose (pages 31-32). The Court granted the consent subject to conditions regarding the colour of the mast and a planting programme.

The Court said (page 33):

> *...it is clear from the evidence in opposition that to some extent the fears concerning the adverse effects on the visual amenity are in part actuated by the perception that the technology which goes with the structure is in some way damaging to the health and general wellbeing of people living in the immediate area. We have made our findings in respect of the health issue and we think it would be quite wrong to allow in by the back door what has been rejected by the front door. Care needs to be taken to ensure that opposition on visual amenity grounds is just that, and not a cloak for opposition on some other grounds.*

In *Shirley* this statement was referred to with approval. The Court said (page 127):

> *In relation to visual effects, we accept that subjective value judgments about the safety of cellsites have no place in the assessment of visual amenity.*

The Court there found that there would be no visual conflict with surrounding development (although that conclusion might be different if the cellsite were surrounded by houses).

Although these cases provide some guidance as to the approach to visual/landscape and amenity effects, such effects must generally be assessed on a case-by-case basis.

Effects on property values

The Environment Court has not developed a consistent line on whether or not diminishing property values can be taken into account as an adverse effect on the environment. Those judgements which say diminishing property values should be taken into account include *Goldfinch v Auckland CC* 1996 NZRMA 97, *MacTavish v Dunedin CC* CP53/96, *Prestige Print (1965) Ltd v Wellington CC* W94/95*, Bunnick v Waikato DC* A42/96. Those who reject the proposition (whether directly or indirectly) include *Faulkner v Gisborne DC*, [1995] 3 NZLR, 362, *Imrie Family Trust v Whangarei DC* [1994] NZRMA 453, *Queenstown Property Holdings Limited v Queenstown DC* [1998] NZRMA.

Where diminished property values have been taken into account, the issue has largely been noted in passing rather than being the central issue. The debate also predominantly concerns resource consent applications for activities in residential areas. The most persuasive cases in favour of taking property values into account is *Goldfinch*, where the Court took into account likely diminution in property values in holding that the adverse effects of the building on the immediately neighbouring properties would be more than minor.

This approach was upheld in *MacTavish*. It was said that the Court does not consider the amenity of an area on a narrow and restricted basis, but looks at the question in a rounded way including having regard to the effect on immediate neighbours.

In *Prestige Point*, diminishing property values were held to be an adverse effect on the environment which could be mitigated so that the effects were no more than minor.

It is clear therefore that the Environment Court has given some consideration to diminution of property values when considering resource consent applications. However, none of these cases dealt with the issue head on but rather treated it more in passing. In contrast, a recent case, *Queenstown Property Holdings*, involved considered argument and conclusions directly on the issue of whether diminished property values can be taken into account as an adverse effect on the environment.

This case strongly indicates that diminution of property values should not be taken into account as an effect on the environment. In this case, the Court considered that protection of property values has no obvious connection with sustainable management of natural and physical resources.

This case included comments on the RMA not being a licensing statute; it does not concern itself with ensuring the economic viability or prosperity of existing businesses.

However, the case concerned a retail rather than a residential situation. Given the RMA's concern with communities' as opposed to businesses' well-being, this may be cited as a reason to distinguish the *Queenstown Property Holdings* case.

Reduced financial viability of schools and whether alternative sites are available

A matter which was influential in *Shirley* was the need to protect the school community from harmful health effects. The Court said (at page 141):

> *In our final balancing of all the factors, we place a very heavy weighting (under section 5(2) RMA on the need to protect the school community from harmful health effects.'*

Similarly, in *McIntyre*, the need to protect people's homes was considered to be very important. The Court said (at page 315):

> *It is accepted that the greatest protection should be given to people's homes. They may be occupied by people, such as children and the elderly, who may be more vulnerable to radiation effects. They are occupied for longer periods than other premises, and people do not have the same choice as they do about where they work or shop or take recreation.*

The location of the facilities near such places as schools and homes raises the question of whether there is an obligation on an applicant to consider alternative, less "sensitive" locations. This has been discussed in the cases, together with the issue whether the a drop in school rolls (and reduced financial viability of a school) should be taken into account.

In *Shirley*, the school argued that Telecom was obliged to consider alternative sites. Telecom argued that it did not have an obligation to consider alternative sites, but that in any case, the site was realistically the only one available. Although another sort of technology (microcells) was available, Telecom argued that that technology would not be suitable from an engineering perspective (page 132).

The Court was satisfied that (at page 139):

- there was no other available site; and
- although moving to micro cell-sites would be possible, the need to move to that new technology had not been demonstrated (because the risk to the school was assessed as very little, or extremely low).

Therefore, the Court did not need to make a firm ruling on whether there was any obligation to consider alternative sites.

In *Shirley*, the school also argued that the financial viability of the school would be reduced if the resource consent for the cellsite was granted and that pupils would be withdrawn. The Court considered that this was the other side of the argument that Telecom should find an alternative site. The Court made the following points (at page 139):

- the school suffering financially or shutting down is a problem of the school's own making (*"If SPS has generated an atmosphere of fear and distrust amongst parents, teachers and pupils then it might have to live with the consequences of that."*)
- the school could fence off and not use an area within 30m of the cellsite if they thought it necessary.

On this basis, reduced financial viability of the school was not a matter which the Court took into account.

Positive effects

It is legitimate to consider positive effects under the RMA since the definition of "effect" includes positive effects, and the purpose of the RMA includes enabling *"people and communities to provide for their social, economic and cultural well being and for their health and safety"*.

Positive effects were influential in the *Telecom* case. In that case, the Court took a "wider perspective" in deciding whether or not the proposal was adverse to the environment. The court concluded that the adverse effects would not be more than minor "*when balanced against thje need for technology and the conditions which are imposed* (pg 36).

h In *Shirley*, the Court also considered the beneficial effects including improved mobile phone coverage, and stated (at page 127):

> *The advantage of recalling the benefits is that they remind us of the wider context of the application which we should take into account - that is the general exposure of the wider population (including the school community) to radiofrequency radiation from all sources.'*

G.11 Imposing lower conditions: setting a precedent?

In *McIntyre*, the hearing proceeded on the basis that people would not be exposed to radio frequency radiation from the cell site transmissions greater than about 12 μW/cm². However, on evidence of Bell South's technical witness, it was found that residents and occupants of business premises nearby would only be exposed to about 1.2 μW/cm² (and, at most, 1.8 μW/cm²).

The *McIntyre* decision may not have much precedent value where the exposure to radio frequency fields is greater than this amount. The Court said (page 317):

> *…a decision on a particular resource consent application is not an appropriate occasion for setting a general standard.*
>
> *...it is sufficient for the purpose of deciding this appeal for us to set conditions that are specific to the particular circumstances*.

The Court considered that could either impose a condition restricting the installation and incident power flux density to that described in the evidence, or else expressly identify the limits in the conditions. It took the latter, more transparent, approach, commenting that in that way anyone can apply for enforcement action if the limits are exceeded.

The condition imposed (rounding up the 1.2 μW/cm² estimate) was (page 319):

> *that the incident power flux density of radio frequency radiation emitted by the facility, measured at any dwellinghouse, is not to exceed 2 microwatts per square centimetre.*

It was thought that this condition would respond to the ALARA (as low as reasonably achievable) principle in NZS 6609.

In the *Telecom* case, Telecom presented evidence that the site would deliver less that 1 μW/cm² to adjacent premises, but that to impose a limit lower than the NZS would:

- be to set an arbitrary level which would actually contravene the ALARA principle

- send the wrong message to the community (suggesting that there is cause for concern with higher levels)
- inevitably lead to confusion;

where the necessary safeguards are built into the standard.

Rather, Telecom suggested that a monitoring process should be adopted, with results being made available to the public, to both regularly check that the emissions are at the level presented in the evidence, and raise the level of public understanding and debate.

The Court agreed with evidence that it is wrong in principle for the Court to set arbitrary limits of radiofrequency emissions from cell sites below those set by the relevant NZS *"unless there is compelling evidence given in individual cases that the public interest requires such a course"* (page 37). In addition to a condition requiring compliance with the NZS, a monitoring condition was imposed.

In *Shirley*, the Court took a similar view to the Court in the *Telecom* case, and did not follow *McIntyre* on this issue. Telecom had appealed against condition 4 of the resource consent granted by the Council, which provided for a lower limit than the NZS (6 μW/cm² at 30 m from the mast at 2 m above ground level and at the nearest outside wall of a certain residence). The Council argued that this condition was appropriate because:

- it was consistent with the ANZ Standard, which imposed 200 μW/cm² as a maximum
- there would be no practical problem for Telecom, since it could meet that condition
- the Court would not bring the standard into disrepute if it gave accurate reasons for its decision to impose a lesser standard.

These arguments were not accepted. The Court gave the following reasons for refusing to impose a level lower than the ANZ Standard (pages 143-144):

(1) *a precautionary approach is already inherent in the ICNIRP and ANZ Standards:*

(a) in the ANZ Standard the level for non-occupational exposure to radiofrequency radiation is set at 1/50th of the exposure level at which thermal effects occur;

(b) ICNIRP imposes a maximum level of exposure of 0.08 W/kg (which translates to 450μW/cm²) at the cellsite's frequency.

(2) we have not considered condition 4 as necessary for mitigation of any effects - principally because we consider the effects of (or the risk which is the combination of them) exposure to radiofrequency radiation to be so minor that they do not require mitigation. Thus any argument over the level is essentially irrelevant so long as the ANZ Standard is met.

Given that background, and all our findings in the previous chapter we now find that:

(a) There is no reasonable defect in the ANZ Standard's non-occupational limit of 200 μW/cm² (or SAR equivalent) except perhaps that it is too low at the cellsite frequencies (see the ICNIRP standard which is equivalent to 450 μW/cm²);

*(b) The Council has, in the **Telecom** case and since, adopted a policy of <u>not</u> imposing a "condition 4" type of limitation, and we can see sense in consistency of conditions across consents;*

(c) Imposing a limit lower than the ANZ Standard would tend to undermine the credibility of the standards;

(d) Imposing the lower limit of condition 4 would suggest that exposures of more than 6 μW/cm² <u>do</u> cause adverse health effects.

(e) Any limit such as 6μW/cm² is arbitrary and arbitrary figures serve no purpose;

(f) *The words "SUBJECT TO" in the ANZ Standard mean what they say, that is, any lower figures dictated by prudence or caution are subservient to the ANZ Standard for enforcement purposes; and*

(g) *This decision may be referred to by communities elsewhere in New Zealand, so it may have some precedent value. Thus we should not undermine the Standards for no good reason if, as we have found, that the risk of adverse health effects from chronic exposure to athermal radiofrequency radiation at the levels to be emitted from the cellsite is very low.'*

This last point (g) should be noted, because, unlike the *McIntyre* decision, the Court in *Shirley* contemplates that its decision will set a precedent.

Appendix H. Bridging different views of risk and communicating information

Technological progress has always been associated with various hazards and potential risks, and radiofrequency technology is no exception. Experience has shown that one of the reasons for public concern is disregard for differences in the way different groups (scientists, government agencies, industry and the public) perceive risks.

Risks can be analysed and described in different ways. The differences originate primarily in the way that different groups assess and describe risks. For example, a scientific or technical assessment of risk (as might be used by scientists, government agencies or industry) involves groups or individuals who bring specialised knowledge to bear on a risk issue, usually by referring to published scientific literature and technical terminology. This assessment may be couched in terms of probability and statistics, comparison with other risks, and averages over large populations. It may well contain assumptions and uncertainties (which themselves may or may not be acknowledged). Examples of such assessments are the reviews and standards discussed in Section 4.

The non-specialist public, however, may view matters from a different perspective. They may look at potential harm to individuals, with some types of harm or disease feared more than others. They would expect more certainty in expert judgements, and less inconsistency in the scientific data. The view is often that if something cannot be proven safe, then it should not be allowed. They may also feel that the distribution of possible risks and benefits may not be equitable, and that the scientific assessment may not have addressed the particular concerns that they have.

Different perspectives on risk may also be reflected in the way different people judge the acceptability of risks. Acceptability may also be affected by other factors, such as whether exposures are voluntary or involuntary, whether they arise from an unfamiliar or novel source, whether the risks are natural or man-made etc.

Risk communication is the process used to try and bridge these two viewpoints, and to decide how possible effects of physical or chemical agents should be addressed. It should be a two-way process, carried out so that people are informed and guided in the actions that they take, while knowing that central and local government agencies are taking account of, and acting on, their concerns. The process includes:

- informing the public about current and proposed actions
- advising people of environmental and public health risk assessments in language understandable by lay people
- understanding and respecting people's concerns
- dealing with concerns over which agencies have control, and identifying how other concerns may be managed

- providing opportunities for public involvement in risk management processes and decisions.

The following are good practices for risk communication.:

Recognise the importance of trust

Trust is a key factor for fruitful communication. Establishing trust depends not only on the individuals responsible for communication, but also on how the organisation they represent is seen to behave overall. Trust depends on many factors, such as perceived competence, objectivity, fairness, consistency and goodwill. In many cases, actions are more important than words. Trust is fragile, and once lost can be very difficult to re-establish.

Accept the public as a legitimate partner

One of the most effective ways to build trust with a community is to include them as partners, and be open in dealings with them. Groups consulted should be representative of the affected population, and their members should be clear about expected roles in the process. Groups and individuals should be able to identify where their contributions influence decision-making, and never be made to feel that they are mere props to decisions made by others.

It should be made clear from the outset what information can be provided, and what can be achieved without going elsewhere. Nothing should be promised which cannot be delivered.

Communicate early, often, and in full

This involves both timing and amount. Risk communication processes should start as soon as possible. More information is usually better than less, but communication should be tempered by the recognition that most people do not have the time or expertise to sift through extensive technical reports. Nevertheless, making all types of information available to the public shows good faith and so helps build trust.

Deal with uncertainty directly

Failure to identify or acknowledge uncertainties in risk assessments, or gaps in scientific understanding, may destroy trust.

Simplify language and presentation, not content

Using simple language to communicate effectively should not involve eliminating information that may seem overly technical. All technical information can be understood by lay audiences. They may not understand it in the same manner as experts, but enough to make informed decisions. On the other hand, only limited amounts of information can be processed at once, so presentation of too many different messages, even if in simple language, should be avoided.

Use risk comparisons with caution

Risk comparisons can be used to help people understand probabilities by seeing how a new risk may compare to more familiar ones. However, such comparisons should be used with caution, and may not be accepted if the other dimensions of the risk (such as voluntariness,

controllability, unfamiliarity) under consideration are not acknowledged. Comparisons with risks seen as irrelevant may be perceived as trivialising the risk, and this may destroy trust.

Appendix I. Further information

Technical and scientific

Web pages

- Dr John Moulder – http://www.mcw.edu/gcrc/cop/cell-phone-health-FAQ/toc.html
- World Health Organization – http://www.who.int/peh-emf/index.htm
- Bioelectromagnetics Society – www.bioelectromagnetics.org/
- Dr Black – http://www.enviromedix.co.nz/papers
- http://www.nt.chalmers.se/BioEMgroup/research.html
- http://www.microwavenews.com
- http://www.aeci.com/coops/nothark/emf.htm
- Ministry of Health – http://www.moh.govt.nz

Print publications

- *Microwave News*
- *Bioelectromagnetics*

Independent expert advice

- National Radiation Laboratory
  (108 Victoria Street)
  PO Box 25-099
  Christchurch.
  Telephone. (03) 366-5059.

Resource Management Act

During consultation many community members advised that they did not understand the Resource Management Act 1991 process and needed guidance on when they could have input into the process and how. The Ministry for the Environment has recently updated its *Guide to the Resource Management Act*. This is available from the publications section of the Ministry for the Environment and should be of assistance.

Web pages

- Ministry for the Environment - http://www.mfe.govt.nz

Print publications

- Ministry for the Environment (1998), *Guide to the Resource Management Act*
- Royal Forest and Bird Protection Society of New Zealand (1993). *Handbook of Environmental Law*, ed. C Milne, GP Publications Limited.

- DAR Williams (1997). *Environmental and Resource Management Law*, 2nd Edition, Butterworths, Wellington.

Ministry for the Environment pamphlets

- *Making submissions on notified resource consents*
- *Making resource consent applications*
- *Making submissions on proposed district and regional plans*
- *Introduction to the Resource Management Act*
- *Awarding of costs by the Environment Court*

Independent expert advice

- District or city councils

- The Ministry for the Environment,
  (Grand Annexe, 84 Boulcott Street)
  PO Box 10-362
  Wellington
  Telephone (04) 917 7400
  Fax (04) 917 7523.