ORIGINAL

Decision No A 15/96

IN THE MATTER	of the Resource Management Act 1991
AND	
IN THE MATTER	of two appeals under section 120
BETWEEN	J M McINTYRE and others
	(Appeal RMA 125/95)
	BELLSOUTH NEW ZEALAND
	(Appeal RMA 134/95)
	Appellants
AND	THE CHRISTCHURCH CITY COUNCIL
	Respondent

BEFORE THE PLANNING TRIBUNAL

Planning Judge DFG Sheppard (presiding)
Mrs N J Johnson
Mr IGC Kerr

HEARING at CHRISTCHURCH on 13, 14, 15, 16, 17, 22 and 23 November 1995

COUNSEL

Mr J G Fogarty QC and Ms M Perpick for the appellants in Appeal RMA 125/95
Mr P T Cavanagh QC and Ms L A McGregor for BellSouth New Zealand
Mr A Hearn QC for the respondent

THE SEAL OF THE PLANNING TRIBUNAL NEW ZEALAND

DECISION

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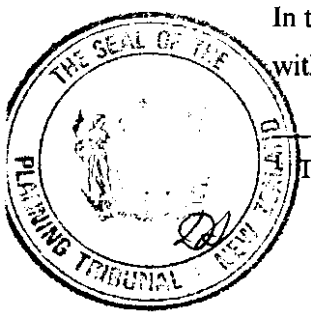
CHAPTER ONE: INTRODUCTION

The main issue in these proceedings is whether there is sufficient basis for concern about harmful health effects from base transceiver transmissions for mobile (or cellular) telephones that an application for resource consent for a base transceiver station on a property at Ilam, Christchurch, should be refused.

The resource consent application for the telecommunications facility was made by BellSouth New Zealand to the Christchurch City Council and was publicly notified. Fourteen submissions in opposition to the application were lodged with the council. The application and submissions were considered by a committee of the council which heard submissions and evidence from the applicant and submitters, and a petition signed by 223 local residents objecting to the site for the facility was tabled. By a decision made on 2 February 1995, the committee granted the application and imposed a number of conditions, including provision for review of a condition setting power flux density limits. Against that decision Appeal RMA 125/95 was lodged on behalf of seven residents[1] of the vicinity seeking that resource consent be refused; and Appeal RMA 134/95 was lodged on behalf of BellSouth New Zealand seeking amendment to the conditions to limit the incident power flux density of radiofrequency emissions from the facility to 50 microwatts per square centimetre at any point where any member of the public (including commercial users of the building on or in which the facility is located) would approach the antennas. Counsel for the City Council announced that it accepted that the conditions the subject of Appeal RMA 134/95 were not satisfactory, and considering the replacement condition proposed by BellSouth appropriate, it did not oppose the relief sought in that appeal.

The hearing therefore focused on the issue raised by the residents' appeal, and particularly the question of harmful health effects from the radiofrequency radiation from the facility. That involved evidence of conflicting opinions from expert witnesses, and legal submissions about the appropriate basis for deciding such questions where evidence considered by some to point to adverse health effects is acknowledged to be incomplete.

In this decision we address the legal question before addressing the expert evidence; but we start with a description of BellSouth's proposal.



[1] Two of them later withdrew from the appeal.

THE PROPOSAL

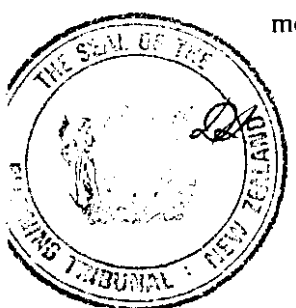
BellSouth is establishing a mobile telephone service nationwide. For that purpose it has switching centres and a network of small radio stations called cell sites or base transceiver stations. Each cell site communicates with a switching centre by low power radio transmitter and by land-line; and communicates with mobile telephones in its vicinity by sending and receiving radio transmissions.

The present proposal is to establish such a cell site at a property at 397-399 Ilam Road, Fendalton. The site is located on the northern side of that road to the west of its intersection with Clyde Road. The properties to the north and west are zoned and occupied for residential activities, as are the properties on the south side of Ilam Road. The site is occupied by a two-storey building, formerly a cinema but now used for commercial activities, and has an area of 584 square metres. The adjoining site to the west is used as a carpark.

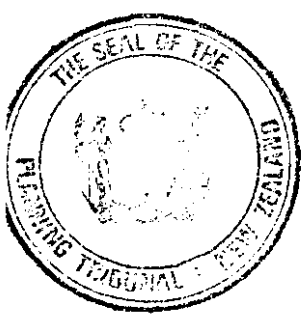
The proposal would involve seven radio antennas erected on the roof of the building, and radio equipment, a control computer, and associated equipment within the building in the former projector room on the first floor. One of the antennas would be a 300-millimetre diameter dish antenna for low power communication with the switching station. The other six antennas would be rectangular in shape, each measuring 1196 millimetres high by 374 millimetres wide and 237 millimetres deep. Three would be used for transmissions to the mobile telephones, and three for receiving signals from them. Those antennas would be mounted in pairs oriented to different directions (60, 180 and 300 degrees from true north), and tilted to 2 degrees below horizontal. The bottoms of the antennas would be at least 12 metres above ground.

The significant signals for the present purpose, being those which would emit radiation that the appellants claim could have harmful effects, are the transmissions from the cell site to mobile telephones. Those transmissions would be made at frequencies in the "TACS C" radiofrequency band between 952.5 to 959.8 megahertz.

The cell site would transmit continuously. The signal would be interrupted every 543 microseconds for up to 34 microseconds, during which the power of the transmission would reduce by up to 30 decibels before returning to full power, a form of pulsing. The signal is modulated by a method called gaussian mean shift key.



As cell phone traffic increases, there would eventually be two transmitters feeding each transmission antenna, with a total power input of 21.29 watts. The incident power flux density of the radiation reduces with distance from the antenna. For example, on axis (which is the strongest emission) at a distance of 5 metres the power flux density is calculated to be 219 microwatts per square centimetre (which would exceed the maximum recommended exposure of 200 set in the New Zealand Standard NZS 6609); at 10 metres the power flux density is 54.822 microwatts per square centimetre; at 15 metres the power flux density would be 24.365 microwatts per square centimetre; and at 25, 35, 45 and 55 metres the corresponding values would be 8.8, 4.5, 2.7 and 1.8 microwatts per square centimetre. The power decreases off the axis of the antenna in both planes.



CHAPTER TWO: BASIS FOR DECISION-MAKING

THE ISSUE

In considering resource consent applications, consent authorities are required to have regard to the actual and potential effects on the environment of allowing the activity.[2] The only effects on the environment suggested by the parties to this appeal were visual effects and potential effects of radiation on health of people in the vicinity. The duty to have regard to actual and potential effects on the environment is expressed to be subject to Part II of the Act. That implies that the duty is to yield to the provisions of that part where there is a conflict between them. However it is not suggested that having regard to any of the classes of matter listed in section 104(1) that is relevant in this case would conflict with any of the provisions of Part II. We will therefore have regard to them.

Although visual effects on the environment of the proposed antennas and their supports were raised by the applicant for consideration, it was not part of the appellants' case that those effects would be significant. The applicants called evidence of a qualified landscape architect, Mr P Rough, who deposed to the opinion that the antennas would have moderate visual effect when viewed from 100 metres or less; that beyond that range the visual impact would be minor; and that with proposed improvements to the visual amenity of the area, the proposed antennas would have a generally minor visual impact on the environment. That evidence was not contradicted, and having ourselves visited the neighbourhood, we accept it and find that there would not be significant visual effects on the environment of the proposed activity.

The applicant maintained that the radiation from the proposed transmitter would not endanger the health of any individual of any age or state of health, and that there are no proven harmful effects from radiofrequency emissions of such facilities, which are well below the maximum level set in the relevant New Zealand Standard.

However it was the heart of the appellants' case that a serious hypothesis exists that exposure to the amounts of radiation that would be emitted by the proposed transmissions is potentially harmful to health. On their behalf it was contended that the national and international standards do not address or apply the risk avoidance policy of the Resource Management Act;

[2] Resource Management Act 1991, section 104(1)(a).

that it would be an error of law to decide on the present state of scientific knowledge, on the balance of probabilities, whether there are harmful health effects from low-level radiofrequency exposure from these facilities; and that section 104 requires a consent authority to have regard to potential effects of low probability with high impact.

It was the respondent's case that where there is acceptable evidence supporting international standards they should be adopted unless there is a plausible basis for doing otherwise. Likewise counsel for the applicant submitted in reply that the appellants' case asks that the applicant's activities be restricted not on any basis of a recognised standard but on an unproven hypothesis, which had not been established in many years of research.

Although we need to examine the evidence carefully and make our findings, we first seek to identify the correct basis for making them.

COMPLIANCE WITH STANDARDS NOT DECISIVE

The New Zealand Standard

The relevant standard is New Zealand Standard *Radiofrequency Radiation Part 1: Maximum exposure levels – 100 kHz to 300 GHz* and *Part 2: Principles and methods of measurement – 300 kHz to 100 GHz* which is designated as NZS6609:1990. It was approved on 20 September 1990 by the Standards Council to be a standard specification pursuant to the provisions of section 10 of the Standards Act 1988. It is an adoption of the corresponding Australian Standard AS 2772:1990.

The general preface states:

> The purpose of the Standard is to provide guidance on the exposure of the human body to radiofrequency radiation and to set levels of exposure intended to avoid the production of effects hazardous to the body, based on current knowledge of biological effects of radiation in the frequency range of 100 kHz to 300 GHz. The Standard applies to the exposure of radiation workers due to their employment and the incidental exposure of the general public but it does not apply to patients undergoing medical diagnosis or treatment.
>
> By analogy with the approach adopted for ionizing radiation, the non-occupational (24-hour) limit averaged over a time of one minute has been arbitrarily set at one-fifth of the occupational limit, as justified in the guidelines on limits of exposure to radiofrequency electromagnetic fields in the frequency range of 100 kHz to 300 GHz developed by IRPA in conjunction with the Environmental Health Division of the World Health Organisation.

The New Zealand Standard added to the preface a comment that amendment or clarification was indicated, particularly in the area of measurement and interpretation. However, in view of the urgent need for a standard, the Australian Standard was considered adequate for use in the interim, and the project committee was to proceed with revision of the Standards.

The foreword to the Standard contains references to international sources and states:

> The standard recommends that the level of all electromagnetic fields should be kept as low as reasonably achievable.

Part 1 of the standard on maximum exposure levels contains the following passages:

> This standard is applicable wherever people may be exposed to radiofrequency electromagnetic fields as a result of their employment and wherever the general public has access to regions in which they may be exposed.
>
> The Standard is applicable to all forms of radiofrequency electromagnetic fields. Except where specified in this Standard, no distinction is made between continuous wave (CW) fields, such as a radiofrequency heater might emit, or modulated fields, such as from a radio transmitter, or modulated intermittent fields such as from a radar transmitter which regularly scans a fixed path.
>
> The limits specified in this Standard are intended to be used as a basis for planning work procedures, designing protective facilities, the assessment of the efficacy of protective measures and practices and the determination of the extent and nature of the required health surveillance. Nevertheless, because of the increasing use of equipment generating radiofrequency radiation and the potential for exposure of individuals, all possible efforts should be made to keep such exposure as low as reasonably achievable (ALARA), below the prescribed limits. The overall economic and social consequences associated with the reduction of exposure to the individual and the public in general shall be taken into account.[3]

As outlined in the preface, the standard sets separate maximum exposure levels for people exposed to radiation in the course of their occupations (referred to as occupational) and for people who may be exposed to an electromagnetic field otherwise than in the course of their occupation for periods up to 24 hours per day (referred to as non-occupational).

The recommended maximum exposure levels are expressed in terms of incident power flux density, that is, the amount of radiofrequency power incident per unit area. This is measured in units of watts per square metre, or in the equivalent microwatts per square centimetre. The effect of the New Zealand Standard is that for people exposed to a radiofrequency electromagnetic field at a frequency in the region of 900 megahertz otherwise than in the course

[3] NZS 6609: Part 1: page 6, paragraph 2.

of their occupation, the maximum recommended exposure is 200 microwatts per square centimetre.

It was not contested that the exposure of the general public from the proposed cell transmissions would be far below that, in the vicinity of no more than 12 microwatts per square centimetre. Further, it was not contested that the New Zealand (and Australian) Standards are very conservative compared with other standards, including those adopted by the International Radiation Protection Association , the United Kingdom National Radiological Protection Board, and the United States of America (Institute of Electrical and Electronic Engineers/American National Standards Institute).

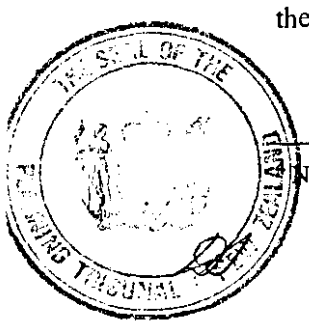
After setting the non-occupational maximum exposure levels, the standard states:

> Notwithstanding the above requirement, because the effects of such exposures to electromagnetic fields are only imperfectly understood, it is recommended that the levels of all electromagnetic fields to which people are non-occupationally exposed, should be kept *as low as reasonably achievable.*[4]

Significance of compliance with standard

For the applicant, Mr Cavanagh submitted that the New Zealand Standard is scientific, follows careful consideration and analysis, represents the present state of knowledge, is more conservative than the international scientific community's recommended threshold level, and is a plausible basis to which the proposed facility can perform. For the City Council, Mr Hearn submitted that where there is acceptable well-qualified evidence supporting international standards, they should be observed unless on the evidence there is a plausible basis for doing otherwise.

However, it was the case for the appellants that the national and international standards do not address or apply the risk-avoidance policy of the Resource Management Act. On their behalf, Mr Fogarty submitted that it is the criteria in that Act by which the effects of allowing the activity are to be judged. He contended that standards-setting organisations set standards for known effects, but that one cannot draw from the existence of a standard that there is no concern in the scientific community; and he referred to indications that there is cause for concern about effects of radiation below the standards levels, although there is no proof of them.



[4] NZS 6609: Part 1: page 9, paragraph 6.

The Standards Act 1988 provides for the preparation and approval of New Zealand standards[5], and also contains provision for regulations to be made by referring to or incorporating any New Zealand standard.[6] However neither that Act nor the Resource Management Act gives New Zealand standards any status that would bind a consent authority to use them as a basis for deciding a resource consent application. In practice, relevant New Zealand standards[7] are commonly used for that purpose, and are also referred to in district plans. Other technical guidelines and standards are also relied on.[8] The stated purpose of the New Zealand Standard NZS 6609 is, relevantly, to provide guidance, and to be used as a basis for the assessment of the efficacy of protective measures and practices.

A party to resource consent proceedings is entitled to rely on compliance with a relevant New Zealand standard as tending to show that effects on the environment of a proposed activity should be acceptable because emissions would not exceed levels set in that document. Absent challenge by another party, a consent authority may treat the standard as setting an appropriate level of emissions that would not have unacceptable effects on the environment.

However parties to resource consent proceedings are not bound to accept that compliance with a New Zealand standard would avoid adverse effects on the environment that should be taken into account in deciding whether resource consent should be granted or refused. 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.

In practice, New Zealand standards are prepared by committees of people well-qualified in the subject, and with consultation with interested sections of the community. 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

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[5] Standards Act, 1988, section 10.

[6] Ibid, section 22.

[7] Eg NZS 6802:1991 *Assessment of Environmental Sound.*

[8] Eg the Meat Industry Research Institute Standard Methods for Examination of Meat Wastes and Receiving Waters referred to in *Canterbury Regional Council v Canterbury Frozen Meat Co* Planning Tribunal Decision A14/94; 3 NZPTD 368; the Agricultural Chemical Users' Code of Practice referred to in *McQueen v Waikato District Council* Planning Tribunal Decision A45/94; 3 NZPTD 644; the USEPA Water Quality Guidelines referred to in *Peninsula Watchdog v Waikato Regional Council* Planning Tribunal Decision A 52/94; 3 NZPTD 656; the International Commission on Non-ionizing Radiation exposure guidelines referred to in *Trans Power New Zealand v Rodney District Council* Planning Tribunal Decision A85/94, 4 NZPTD [illegible]; and the Health Department Water Quality Guidelines and the Ministry of Fisheries Shellfish Quality Assurance Circular referred to in *Te Runanga o Taumarere v Northland Regional Council* (1995) 2 NZELR

consideration. A mere assertion of harm, without such support, may not be a responsible exercise of a right of appeal.

That is not the present case. The appellants' assertion of environmental harm notwithstanding compliance with NZS 6609, and the implied challenge to the sufficiency of the maximum exposure levels set in that standard, was supported by expert witnesses. In addition, although the radiation emissions would fall far short of those which would cause the maximum exposure level set in the standard, that document contains other expressions of caution. The foreword recommends that the level of all electromagnetic fields should be kept as low as reasonably achievable; the text states that "...all possible efforts should be made to keep such exposure as low as reasonably achievable ... below the prescribed limits"; and " ... because the effects of exposures to electromagnetic fields are only imperfectly understood, it is recommended that the levels of all electromagnetic fields to which people are non-occupationally exposed, should be kept *as low as reasonably achievable*". So even on its own terms, those responsible for the standard do not claim absolute reliability for it; and on adoption of the Australian standard for this country an urgent need for revision, particularly in the area of measurement and interpretation, was acknowledged.

We cannot avoid our duty to decide the resource consent application on the evidence by simply accepting the New Zealand Standard as decisive of the issue. The law does not give the standard that status. It is the Tribunal's duty to consider all the evidence and find whether or not there would be actual or potential effects on the environment of allowing the activity. We hold that compliance with the New Zealand Standard is not decisive of that question; and any challenge to the adequacy of the levels set in the standard is collateral to it.

DIFFERENCES AMONG EXPERTS

The health effects of radiation from the proposed activity is a subject on which there were clear differences of opinion between the expert witnesses called for the applicant and those called for the appellants. We refer to decisions of the Planning Tribunal describing its function in reaching findings where there are conflicts between experts on facts about which there can be no certainty.

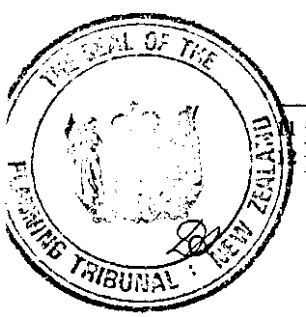
In *Darroch v Whangarei District Council* [9] differences among expert technical witnesses had arisen about discharge of wastes from a livestock saleyard. The Tribunal said [10]:

[9] Planning Tribunal Decision A18/93.
[10] Ibid, page 5.

> There was therefore a conflict of opinion among those expert witnesses, all of whom were well qualified, both in academic attainments and professional experience, to give opinion evidence.
>
> The Tribunal is obliged to make a finding on the issue. As a judicial body it would not be appropriate merely to adopt the opinion shared by three of them because of weight of numbers. It is necessary to be open to accepting the opinion of the other after examination of the evidence of those witnesses and consideration of any submissions on that evidence.
>
> The purpose of the appeal hearing is to determine whether the water and discharge permits should be granted, not to resolve technical differences. 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. We have to make a finding about the adequacy of the proposed waste water treatment system to reach a decision on these appeals. In that task we have been assisted substantially by the evidence of all those witnesses. We are grateful for the care with which each of them explained the reasons for the conclusion reached, and assisted us to understand and test the conclusion by cross-examination by other counsel and questions by ourselves.

In *Canterbury Regional Council v Canterbury Frozen Meat Co*[11], there had been a difference between expert witnesses about confidence limits to be applied to analyses of samples of waste discharged to a river. The Tribunal said[12]:

> We accept that all sampling, analysis and measurement of the determinants for the present discharge right would be subject to error, and that the results can only be taken to represent the condition of the effluent from which the samples were taken in terms of probability. We also accept that calculation of 95 per cent confidence limits for the results would conform to accepted scientific practice, and could inform our judgment about the reliability to be accorded to the results for the purpose of making our findings.
>
> 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 on the evidence before us 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.
>
> We accept that to make a finding we need to feel persuaded that it is correct; and that we ought to exclude sampling results which cannot be said with any reasonable degree of confidence to be non-complying. Further, although a finding might be made on the balance of probabilities where there was not more than 51 per cent confidence in the reliability of the evidence, in recognising the gravity of the present matter we would wish to have rather greater confidence than that.
>
> Yet we are not expected to apply to the evidence a standard of proof that reflects confidence in a finding beyond reasonable doubt. We are not to put the applicant to such a threshold.



[11] Planning Tribunal Decision A14/94; 3 NZPTD 368.
[12] Ibid at page 13.

In *Peninsula Watchdog Group v Waikato Regional Council*[13] the Tribunal agreed with the opinion that had been expressed by an expert witness that "...needless excessive protection would place operation of the applicant's mining activity at a disadvantage with no purpose served".[14]

Those passages from earlier Planning Tribunal decisions set out our understanding of the Tribunal's function in making findings where there have been differences of opinion among qualified expert witnesses. We did not understand any of the parties to this appeal to urge that the Tribunal has a different function in this appeal.

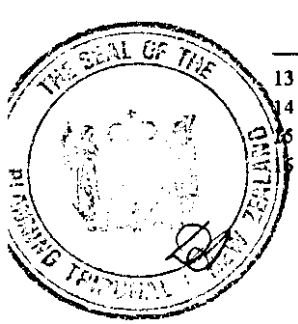
Another Planning Tribunal decision on which the parties made submissions was *Trans Power New Zealand v Rodney District Council*[15], an appeal from refusal of resource consent for extension of a high-voltage electricity transmission line in which health effects of electrical and magnetic fields created by passage of current through the line had been a principal issue.

Dr A C McEwan, a witness called for the applicant, had given opinions that there was no established mechanism which explains how biological cells might be affected by those fields, that epidemiological studies had shown a lack of consistency and had not established a causal association; and that while the evidence did not demonstrate a risk to health, if a risk does exist it would be very small. Another witness for the applicant in that case, Dr M H Repacholi (who was also called for the applicant in this case), had affirmed that it would be quite safe to live continuously under the power lines; that the intensity of the magnetic fields produced would be lower than that at which any health effect had been established; that many studies had not produced any reproducible robust result showing any adverse effect; and that if there is any effect it must be very weak. However Dr I Beale, called for the respondent, had testified that there had been systematic findings that human nervous system physiology may be affected by exposure in changed biological rhythms, and he referred to other studies (which he acknowledged had weaknesses), and referred to research work that he had conducted which was incomplete.

In that decision, the Tribunal said[16]:

> It is our duty to make findings about actual or potential effects of the proposed activity on the environment. To make a finding on a question on which there is a conflict of evidence, we have to be satisfied on the balance of probabilities, having regard to the gravity of the matter in question. The possibility of adverse effects on the health of people who may be exposed to electric and magnetic fields from

[13] Planning Tribunal Decision A52/94.
[14] Ibid at page 13.
[15] Planning Tribunal Decision A85/94; 4 NZPTD 35.
[16] Ibid at page 21.

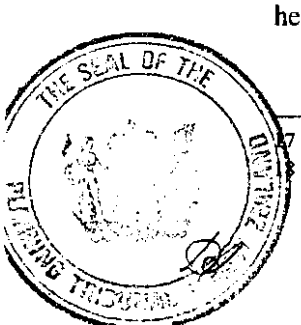


> high-voltage power lines has sufficient gravity to deserve a higher standard of proof. However we would not be justified in putting the applicant to a standard of proof beyond reasonable doubt: *Canterbury Regional Council v Canterbury Frozen Meat Company* Decision A4/94.[17]
>
> We accept the validity of statements by Dr Repacholi that it is not possible for scientists to prove that exposure to electrical magnetic fields from high-voltage transmission lines does not have adverse effects on health; and that an appropriate approach is that with open minds we carefully consider the evidence from studies that suggest that there is or is not an effect. Yet although we can accept that scientific knowledge about the potential health effects of the fields may be incomplete, it is our duty to make a decision now, on the present state of knowledge. It would be an abdication of that duty if we were to allow opponents of proposals to prevent them proceeding on the basis that science might in future discover effects that had not yet been established. That is not to reject the precautionary approach, but there needs to be some plausible basis, not mere suspicion or innuendo, for adopting that approach.
>
> We acknowledge our own personal limitations in making findings on technical scientific questions. The appropriate course for us is to be guided by the scientific community and by conclusions reached by application of scientific method.

Later in that decision the Tribunal said[18]:

> As a judicial body it would not be appropriate for us to weigh suspicion, even when expressed by one who is qualified as an expert witness, against the opinions of even better qualified experts which are consistent with the consensus of the international scientific community. There is not evidence of probative value before us that electric or magnetic fields surrounding the proposed transmission line would have any actual or potential effect on the health of anyone who may be exposed to them. On the balance of probabilities, having regard to the gravity of the matter, we find that they would not.

In the present appeal the applicant submitted that the approach described in that decision was the correct one, and should be adopted in this case. Counsel for the applicant, Mr Cavanagh, submitted that there is a necessary threshold to be crossed before scientific supposition or hypothesis reaches a confidence level where any notice should be taken of them; and that consideration of an appropriate threshold must address the present state of scientific knowledge and the onerous impact that any decision to impose restrictions might have on otherwise permissible activities of legitimate enterprises. He contended that otherwise the Tribunal would be restricting the applicant in a manner not contemplated by any recognised standard; that the level of emissions would be considerably lower than even the conservative New Zealand Standard; that compliance with that standard and the technology employed by the applicant considered together meet any need for caution; and that there is no credible risk of any adverse health effects.



[17] The decision referred to is correctly identified as Decision A 14/94.
[18] Ibid at page 22.

Counsel for the appellants, Mr Fogarty, submitted that correctly understood, the *Trans Power* decision does not support the approach BellSouth was contending for. He contended that the critical finding in the *Trans Power* decision was that there was no plausible biological mechanism which would explain a connection between magnetic fields and cancers, and that Dr Beale's contrary view was not accepted because it had not been sufficiently based on published studies subject to peer review.

Mr Fogarty acknowledged that whether or not there could be any potential effect is a question of opinion for experts. He submitted that the Tribunal needs to take into account that scientific knowledge is acquired over time during which hypotheses are verified or rejected; and that a hypothesis that warrants serious scientific attention is thereby plausible, and sufficiently significant to support any potential effect of low probability which has high potential impact, being the test resulting from reading section 104(1)(a) with the meaning given to the word "effect" in section 3(f). Counsel contended that it is antithetical to the Act to require that a hypothesis be verified before the Tribunal has regard to it; and that such serious hypotheses exist to the extent that it is regarded as important to prove or disprove them as a matter of priority. He asserted that the evidence of the appellants' witnesses exceeds the scientific standard of 0.05 probability.

STANDARD OF PROOF

For the appellants Mr Fogarty submitted that it would be an error of law to decide on the present state of scientific knowledge, on the balance of probabilities, whether there are harmful health effects from low-level radiofrequency exposure from these facilities; and that section 104 requires a consent authority to have regard to potential effects of low probability with high impact. Counsel accepted that a judgment cannot be founded upon fantasy, or superstition, or ignorance; and that there needs to be a reasonable apprehension. He also submitted that there is a distinction between the high probability that the results of experiments or studies are right, and the relative probability that in a community the effects suggested as potential by the experiments or studies may be realised.

Mr Cavanagh adopted the approach taken in the *Trans Power* decision. Mr Hearn (counsel for the City Council) submitted that the appropriate approach is to ask whether it is plausible that the likely effect of operation of the proposed activity on the health of neighbours of the proposed cell transmitter will be significant and adverse; whether health effects are likely at the level that could be emitted in conformity with the conditions of consent.

OTHER JURISDICTIONS

We were not referred to any New Zealand decisions of authority on these questions. The Tribunal invited counsel to address on the relevance of the judgment in the English case *R v Secretary of State for Trade and Industry, ex parte Duddridge*[19], and that led to references to an American Supreme Court case, a Canadian Supreme Court case, and two judgments of the Land and Environment Court of New South Wales. We consider the approach taken in those cases before returning to the specific provisions of the Resource Management Act.

England

The *Duddridge* case was an application to the English High Court for review of a decision by a Secretary of State declining to issue regulations to an electricity distributor so as to restrict electromagnetic fields from electric transmission cables. The application was brought on behalf of three children who lived in an area where a new high-voltage underground cable was being laid, and it was alleged that radiation which would be emitted from the new cables when commissioned would be such as would or might expose them to a risk of developing leukaemia. The law required the Secretary of State to judge whether there existed any dangers or risks of personal injury and whether he ought to make regulations. The Secretary of State considered whether there was evidence that exposure to electromagnetic fields does in fact give rise to a risk of childhood leukaemia. The scientific evidence did not establish that there is such a risk, and the Secretary of State concluded that he need not use his power to regulate exposure to electromagnetic fields.

The applicants argued that the Secretary of State had approached the matter incorrectly, and that he should have considered whether there was any evidence of a possible risk even though the scientific evidence was presently unclear and did not prove a causal connection. The basis of that argument was a claim that the Secretary was obliged to apply the precautionary principle.

Neither of the expert witnesses for the applicants suggested that a causal link had been established between exposure to electromagnetic fields and cancer, or their claim to limiting exposure to any particular level. The National Radiation Protection Board Advisory Group had found that studies had not established that exposure to electromagnetic fields is a cause of

[19] *The Independent* 4 October 1994 (QBD).

cancer but, taken together, provided some evidence to suggest that the possibility exists in the case of childhood cancer; that experimental studies had failed to establish any biologically plausible mechanism whereby carcinogenic processes can be influenced by exposure to low levels of electromagnetic fields to which the majority of people are exposed; that there was no persuasive biological evidence that extremely low frequency electromagnetic fields could influence any of the accepted stages of carcinogenesis; but had stressed the urgent need for large and statistically robust studies based on objective measurements of exposure.

The applicants accepted that unless the Secretary of State was bound to apply the precautionary principle, their application could not succeed; but contended that if he was under a duty to take account of the precautionary principle, the possibility of increased risk of leukaemia found by the NRPB would oblige him to apply that principle in considering whether to regulate exposures to electromagnetic fields. The Court found that the Secretary of State was not under a duty to apply it, and the application failed.

Mr Cavanagh referred to passages in the judgment which indicated that the precautionary principle is primarily intended to avoid long-term harm to the environment rather than damage to human health, and reminded us that the *Duddridge* case concerned electromagnetic fields of high-voltage power lines, not radiofrequency radiation from a cell telephone transmitter. Mr Fogarty submitted that the fundamental difference between the present case and *Duddridge* is the risk-avoidance policy of the Resource Management Act and the absence of a duty to apply the precautionary principle in the English case.

United States of America

In *Daubert v Merrill Dow Pharmaceuticals Inc*[20] the United States Supreme Court considered the standard for admitting expert scientific testimony. The case concerned birth defects allegedly sustained as a result of the mothers' ingestion of an anti-nausea drug. The Court of Appeals (9th Circuit)[21] had affirmed that re-analyses of epidemiological studies were not reliable as evidence in judicial proceedings because they had not been published, had not been subjected to peer review, and had been generated solely for use in litigation. The judgment of the Supreme Court[22] turned in part on Rules 402 and 702 of the Federal Rules of Evidence, the material parts of which read:

[20] (1993) 125 L Ed 2d 469; 113 S Ct 2786.
[21] *Daubert v Merrell Dow Pharmaceuticals* 951 F 2d 1128 (1991).
[22] Delivered by Blackmun J. Renquist Ch J and Stevens J dissented in part, considering that the Court should have left the further development of the area of law in question to future cases.

> 402. All relevant evidence is admissible, except as otherwise provided ... Evidence which is not relevant is not admissible.[23]
>
> 702. If scientific, technical, or other specialized knowledge will assist the trier of fact to understand the evidence or to determine a fact in issue, a witness qualified as an expert by knowledge, skill, experience, training, or education, may testify thereto in the form of an opinion or otherwise.

The Court held that the rules replaced the former precondition of "general acceptance", and observed that any scientific testimony or evidence must not only be relevant but reliable[24]; that the adjective "scientific" implies a grounding in the methods and procedures of science, and the word "knowledge" connotes more than subjective belief or unsupported speculation.[25] The Court acknowledged that it would be unreasonable to require that the subject of scientific testimony must be "known" to a certainty, but said:

> "...in order to qualify as 'scientific knowledge', an inference or assertion must be derived by the scientific method. Proposed testimony must be supported by appropriate validation - i.e., 'good grounds', based on what is known. In short, the requirement that an expert's testimony pertain to 'scientific knowledge' establishes a standard of evidentiary reliability."[26]

The Court acknowledged that this entails an assessment of whether the reasoning or methodology underlying the testimony is scientifically valid, and properly can be applied to the facts in issue[27]; that a key question in determining whether a theory or technique is scientific knowledge that will assist the trier of fact will be whether it can be (and has been) tested[28]. It said that another pertinent consideration is whether the theory or technique has been subjected to peer review and publication, but recognised that publication is not a sine qua non and does not necessarily correlate with reliability. The Court noted that some propositions are too particular, too new, or of too limited interest to be published, but held that submission to the scrutiny of the scientific community is a component of "good science", in part because it increases the likelihood that substantive flaws in methodology will be detected. So the fact of publication (or lack of it) in a peer-reviewed journal, while not decisive, is a relevant consideration on assessing the scientific validity of a particular technique or methodology on which an opinion is premised.[29] The judgment of the Court continued by stating that in addition, a court should consider the known or potential rate of error; that "general acceptance"

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[23] The meaning of the term "relevant evidence" is given in Rule 401 as that which has "any tendency to make the existence of any fact that is of consequence to the determination of the action more probable or less probable than it would be without the evidence".

[24] 125 L Ed 2d 480, col 2.

[25] Ibid 481, col 1.

[26] Idem. In a footnote to that passage, the Court concluded with the summary: "In a case involving scientific evidence, *evidentiary reliability* will be based upon *scientific validity*".

[27] Ibid at 482, col 2.

[28] Ibid at 483, col 1.

[29] Ibid at 483.

can have a bearing, that a "reliability assessment does not require, although it does permit, explicit identification of a relevant scientific community and an express determination of a particular degree of acceptance within that community"[30]; and continued:

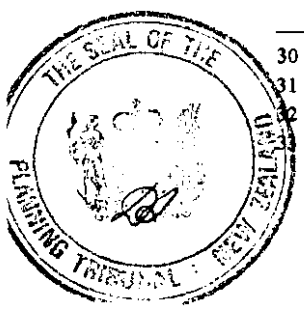
> Widespread acceptance can be an important factor in ruling particular evidence admissible, and 'a known technique that has been able to attract only minimal support within the community' ... may properly be viewed with skepticism.
>
> The inquiry envisioned by Rule 702 is, we emphasise, a flexible one. Its overarching subject is the scientific validity - and thus the evidentiary relevance and reliability - of the principles that underlie a proposed submission. The focus, of course, must be solely on principles and methodology, not on the conclusions that they generate.[31]

In rejecting submissions that abandonment of the former requirement of general acceptance would result in a " 'free-for-all' in which befuddled juries are confounded by absurd and irrational pseudoscientific assertions", the Court considered that "overly pessimistic about the capabilities of the jury, and of the adversary system generally" and observed[32]:

> Vigorous cross-examination, presentation of contrary evidence, and careful instruction on the burden of proof are the traditional and appropriate means of attacking shaky but admissible evidence ... Additionally, in the event the trial court concludes that the scintilla of evidence presented supporting a position is insufficient to allow a reasonable juror to conclude that the position more likely than not is true, the court remains free to direct a judgment ...

Addressing submissions that a screening role that allows for the exclusion of "invalid evidence" would sanction a stifling and repressive scientific orthodoxy, inimical to the search for truth, the court said[33] :

> It is true that open debate is an essential part of both legal and scientific analyses. Yet there are important differences between the quest for truth in the courtroom and the quest for truth in the laboratory. Scientific conclusions are subject to perpetual revision. Law, on the other hand, must resolve disputes finally and quickly. The scientific project is advanced by broad and wide-ranging consideration of a multitude of hypotheses, for those that are incorrect will eventually be shown to be so, and that in itself is an advance. Conjectures that are probably wrong are of little use, however, in the project of reaching a quick, final, and binding legal judgment - often of great consequence - about a particular set of events in the past.



[30] Idem.
[31] Ibid at 483, col 2 to 484, col 1.
[32] Ibid at 484, col 2.
[33] Ibid at 485.

Canada

In *R v Mohan*[34] the Supreme Court of Canada upheld a trial judge who had ruled as inadmissible a psychiatrist's testimony that an accused did not fit psychological profiles of the perpetrators of the alleged offences. After considering Canadian and English authorities on expert evidence, Justice Sopinka (delivering the judgment of the Court) said[35]:

> In summary therefore it appears from the foregoing that expert evidence which advances a novel scientific theory or technique is subjected to special scrutiny to determine whether it meets a basic threshold of reliability and whether it is essential in the sense that the trier of fact will be unable to come to a satisfactory conclusion without the assistance of the expert.

New South Wales

Leatch v National Parks and Wildlife Service and Shoalhaven City Council[36] was an appeal to the Land and Environment Court of New South Wales against a decision by the Director-General of the National Parks and Wildlife Service granting the Shoalhaven City Council a licence to take or kill endangered fauna in the course of making a new road. The relevant legislation required the Court to take into account any public submissions received by the Service. Two of the submissions raised the application of the precautionary principle. The learned Judge referred to international instruments and Commonwealth and State legislation incorporating that principle[37], and said[38]:

> In my opinion the precautionary principle is a statement of commonsense and has already been applied by decision-makers in appropriate circumstances prior to the principle being spelt out. It is directed towards the prevention of serious or irreversible harm to the environment in situations of scientific uncertainty. Its premise is that where uncertainty or ignorance exists concerning the nature or scope of environmental harm (whether this follows from policies, decisions or activities), decision-makers should be cautious.
>
> I have earlier referred to the factors the Court must take into account on an appeal under section 92C of the Act. These include the submissions made ... some of which argued that the precautionary principle was appropriate to the case; any other matter the Court considers *relevant* ... and the circumstances of the case and the public interest ... The issue then is whether it is relevant to have regard to the precautionary principle or what I refer to as consideration of whether a cautious approach should be adopted in the face of scientific uncertainty and the potential for serious or irreversible harm to the environment.

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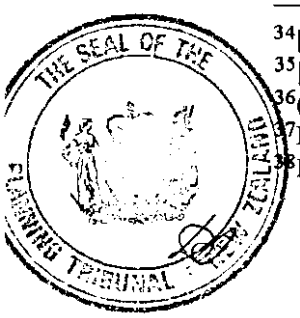
[34][1994] SCR 9; 89 CCC (3d) 402.
[35][1994] SCR 25; 89 CCC (3d) 415.
[36](1993) 81 LGERA 270.
[37]Ibid at 281 per Stein J.
[38]Ibid at page 282.



After finding that making the road was likely to involve adverse effects on vulnerable rare fauna, the Judge found that an alternative route had been screened out too early in the process to be properly considered, and said[39]:

> I am not satisfied that a licence to take or kill the Yellow-bellied Glider, or any of the other species discussed in the fauna impact statement, is justified. The applicant for such a licence needs to satisfy the Court, on the civil standard on the balance of probabilities, that it is appropriate in all the relevant circumstances to grant the licence.

The appeal was upheld and the licence refused.

In *Duddridge*, Smith J observed that in the *Leatch* case, Stein J

> ... had the power to take [the precautionary principle] into account and he chose to do so. The decision is of no relevance in English law and in any event gives no support for the proposition that the Secretary of State (or any other decision-maker) is obliged to take the principle into account in all decisions involving environmental or health considerations. I find the suggestion that the Secretary of State's decision may be impugned on Wednesbury grounds, because he has failed to apply the principle under the dictates of commonsense to be a startling proposition and I have no hesitation in rejecting it.[40]

Greenpeace Australia v Redbank Power Company[41] was an appeal to the Land and Environment Court of New South Wales against consent for a new power station on the ground that emission of carbon dioxide would contribute to the greenhouse effect. In her judgment, the learned Chief Judge[42] referred to Greenpeace's contention that scientific uncertainty should not be used as a reason for ignoring the environmental impact of carbon dioxide emission, in other words that the Court should take into account the precautionary principle, observed that there were instances of scientific uncertainty on both sides of the issues in that case, and said[43]:

> The application of the precautionary principle dictates that a cautious approach should be adopted in evaluating the various relevant factors in determining whether or not to grant consent; it does not require that the greenhouse issue should outweigh all other issues.

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[39] Ibid at page 286.

[40] *R v Secretary of State for Trade and Industry, ex parte Duddridge* The Independent 4 October 1994 (QBD) at page 16.

[41] (1994) 86 LGERA 143.

[42] Pearlman CJ.

[43] 86 LGERA 154.

THE RESOURCE MANAGEMENT ACT 1991 AND THE PRECAUTIONARY PRINCIPLE

It was BellSouth's case that the precautionary approach does not require that the transmission be constrained on the basis of mere suspicion or innuendo.

Mr Fogarty analysed the relevant provisions of the Resource Management Act - section 104(1)(a), section 3, and the definition of the term "environment" in section 2(1)[44] - and submitted that it is logically impossible, and would be an error of law, to apply the statutory test after being satisfied on the preponderance of probabilities on evidence from past studies that prove there is or is not an effect; that one cannot graft a test of "more probable than not" on to the provision in section 3 for an effect of low probability, which includes a proven potential effect. After distinguishing between the understanding in the law of probabilities and the understanding of scientists of high and low probabilities, and the difference between a caution and a precaution, counsel submitted that the concept of sustainable management includes accommodating the fact that reasonable scientific hypotheses may take time to be proved or disproved but warrant attention, and if need be precaution, in the meanwhile. He described that as the risk-avoidance policy, or precautionary policy, of the Act.

We did not understand Mr Fogarty's submissions to be relying on the general precautionary principle of environmental law referred to in the *Leatch*, *Duddridge*, *Redbank* and *TransPower* cases, but to specific provisions of the Resource Management Act that he contended amount to a precautionary or risk-avoidance policy of the Act. Even so, the imposition of a threshold based on the present state of scientific knowledge[45] would of course be inconsistent with the application of the policy contended for by Mr Fogarty.

We distinguish between the policy of the Resource Management Act and a general precautionary principle of environmental law. The policy of the Act advanced for the appellants was derived from the specific provisions already mentioned. Taken together, those provisions relate to a consent authority's duty under section 104 to have regard to certain matters "when considering an application for a resource consent and any submissions received[46]". Applying those provisions is the way to give effect to the policy of the Act. That is to be done when considering the application and submissions.

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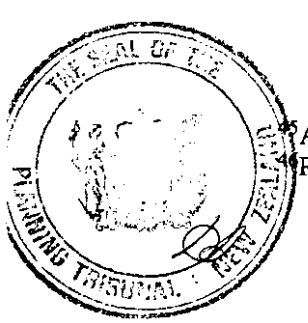
[44] "Environment" includes -

(a) Ecosystems and their constituent parts, including people and communities; and
(b) All natural and physical resources; and
(c) Amenity values; and
(d) The social, economic, aesthetic, and cultural conditions which affect the matters stated in paragraphs (a) to (c) of this definition or which are affected by those matters:

[45] As scientific knowledge was explained in the *Daubert* case.

[46] Resource Management Act 1991, section 104(1).



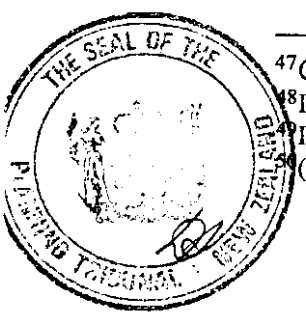
The discretionary judgment whether to grant or refuse resource consent is provided for by the succeeding section 105(1) of the Resource Management Act. That is prescribed to be done after considering the application.

The relationship with the duty to have regard to various matters listed in section 104(1) seems plain. A consent authority is to have regard to them **when** considering the application and the submissions; and **after** having considered the application and submissions and having regard to the matters listed, it is to make the judgment whether consent is to be granted or refused.

As was explained by Chief Judge Pearlman in the *Redbank* case[47], the general precautionary principle of environmental law is an approach to "be adopted in evaluating the various relevant factors in determining whether or not to grant consent"[48]. So in the course of the decision-making process, the step of having regard to potential effects on the environment is earlier than the step at which any application of that principle is to occur.

If the two are distinguished, it is evident that Mr Cavanagh's contention for a threshold applies to the second, the general precautionary principle. Apart from the "basic threshold of reliability" referred to by the Canadian Supreme Court[49], there is no place for introducing a threshold for the first, which involves a consent authority giving effect to a duty imposed on it by the Act. As explained in *Daubert's* case[50], the general law about standard of proof and finding facts on material of probative value applies to that fact-finding.

The influence of the general precautionary principle on the evaluation and ultimate judgment is a matter of discretion. None of the cases supports the application of a formal threshold. 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 on 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.



[47] *Greenpeace Australia v Redbank Power Co* (1994) 86 LGERA 143.
[48] Ibid at page 154.
[49] In *R v Mohan* [1994] SCR 9, 25; 89 CCC (3d) 402, 415.
[50] (1993) 125 L Ed 2d 469; 113 S Ct 2786.

POTENTIAL EFFECTS AND HYPOTHESES

It was the case for the appellants that sustainable management would be best advanced by avoiding the potential risk where it is possible to do so.

Mr Fogarty submitted that a hypothesis that warrants serious scientific attention is thereby plausible and sufficiently significant to support a finding of a potential effect of low probability which has a high potential impact; and that it is antithetical to the Act to require that a hypothesis be verified before the Tribunal has regard to it. Counsel relied on evidence of a hypothesis that exposure to radiofrequency radiation at the levels that result from the proposed cell site is potentially harmful to health, and that it is regarded as important to prove or disprove that hypothesis.

On low risk and high impact, Mr Hearn distinguished cases such as the LPG cases[51], the Te Aroha rendering plant[52], and Meadow Mushrooms[53]. In those cases, there was no doubt that if the LPG was ignited, there would be danger from an explosion; if the rendering odour was discharged, it would be nauseating and noxious; and if the methyl bromide was ingested at a sufficient concentration, it would be toxic. Here the transmissions are known to emit radiation much lower than the health effects threshold, and the real issue is whether those emissions are likely to have a significant adverse effect on health. There has been 40 years of research, and nothing justifying refusal has been identified, and he warned against being frightened of shadows.

Mr Cavanagh described the appellants' position as being that a scientific hypothesis, which may be totally unsupported by any actual scientific evidence to prove or support that hypothesis, is sufficient to raise a threshold concern to bring into play the precautionary principle where a risk of serious harm to human health is postulated. He submitted that there is a necessary threshold to be crossed before scientific supposition or hypotheses have reached a confidence level where any notice should be taken of them, and argued that the Tribunal was being asked to restrict BellSouth's activities in a manner not contemplated by any recognised standard. Mr Cavanagh contended that the evidence for the appellants had come nowhere near establishing that there is a credible risk to human health; that in vivo endorsement is necessary for all in vitro research, but in vivo research has not been done, and in 20 years of research, no proven health effect had been found, and epidemiologists had not been able to reach conclusions with a confidence level that justifies any present concern of a perceived risk of serious injury to human health.

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[51] Eg *Liquigas v Manukau City Council* (1983) 9 NZTPA 193; *Environmental Defence Society v Manukau City Council* Decision A 11/86.
[52] *Te Aroha Air Quality Appeal Group v Waikato Regional Council (No 2)* (1993) 2 NZRMA 574
[53] *Meadow Mushrooms v Paparua County Council* (1977) 6 NZTPA 327.

CONCLUSIONS

The submissions summarised above raise three issues. The first issue is a definition of the question of fact on which the Tribunal has to make a finding required by section 104(1)(a); the second issue is the standard of proof by which the Tribunal is to be satisfied about the existence of the fact to support a finding of it; and the third issue is the influence of the precautionary principle in making a discretionary judgment whether consent should be granted or refused.

On the first, it is our understanding of the law that on a resource consent application, like a planning application under the former regime, there is not a burden of proof on any party, but that there is an evidentiary burden on a party who makes an allegation to present evidence tending to support the allegation.[54] In this case, the applicant has asserted that there would not be an actual or potential effect on the environment from the radiation emitted from the cell phone transmitter; and it has adduced evidence tending to establish that. The appellants have challenged the applicant's assertion, and have adduced evidence which they claim will satisfy us that there is a potential of an effect of low probability but high impact on the environment from the health effects of radiation from the transmitter. Therefore we have to consider whether on all the evidence we find that there will or will not be an actual or potential effect (including any potential effect of low probability which has a high potential impact) on the environment (a term which is defined to include people) from radiation that would be emitted by the proposed transmitter. In that regard, the word "potential" is not defined, and can be understood in its ordinary meaning as an adjective of "capable of coming into being or action"[55], "possible but not yet actual; capable of being or becoming"[56].

On the second issue, the Planning Tribunal 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.[57] Even so, the basic principles of evidence developed by the general courts provide a valuable guide for fact-finding by the Tribunal. It is our understanding that there are three requirements for us to make a finding on a question of fact. There needs to be material of probative value, ie, tending logically to show the existence of facts consistent with the finding.[58] Also, the evidence must satisfy us of the fact (ie that there will or will not be such an effect) on the balance of probabilities and having regard to the gravity of the question; but we are not to

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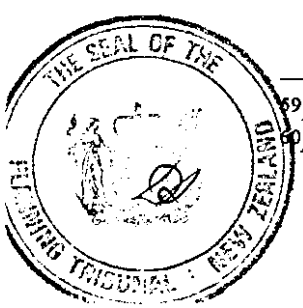
[54] *West Coast Regional Abattoir v Westland County* (1981) 10 NZTPA 297.
[55] *Concise Oxford Dictionary*, 8th edn, 1990.
[56] *New Collins Concise English Dictionary*, NZ edn, 1982.
[57] Resource Management Act 1991, section 276.
[58] *Re Erebus Royal Commission: Air New Zealand v Mahon* [1983] NZLR 662, 671.

put either party to having to prove its assertion of fact beyond reasonable doubt. Further, the heart of a finding of fact is that we ourselves need to feel persuaded that it is correct.

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 (as discussed in *Daubert*'s case[59]) and scrutinised to determine whether they meet a basic threshold of reliability (as discussed in *Mohan*'s case[60]) to assist the Tribunal to weigh the evidence and make a finding one way or the other.

On the general precautionary principle, we note that a consent authority is entitled to have regard to any other matter not listed in section 104(1) which it considers relevant and reasonably necessary to determine the application; and that the definition in section 2(1) of the term "environment" extends to include people. The purpose of the Act is to promote the sustainable management of natural and physical resources. The term "sustainable management" is described by reference among other things to enabling people to provide for their health and safety.

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. In the context of the Resource Management Act the principle can apply to people and their health as well as for the rest of the natural and physical environment. So a consent authority may allow its discretionary judgment to grant or refuse consent to be influenced by the precautionary principle to the extent consistent with the statutory purpose of promoting the sustainable management of natural and physical resources and with judicial exercise of that discretion.



[59] *Daubert v Merrill Dow Pharmaceuticals Inc* (1993) 125 L Ed 2d 469; 113 S Ct 2786.
[60] *R v Mohan* [1994] SCR 9; 89 CCC (3d) 402.

CHAPTER THREE: MATTERS NOT FOR ADJUDICATION

There were several matters raised in the evidence of some of the witnesses on which we consider that we do not need to make findings as a basis for our reasons for our decision on the outcome of these appeals. Believing that findings on them are not necessary to our decision, we prefer not to express any view on them.

THERMAL AND NON-THERMAL SCHOOLS

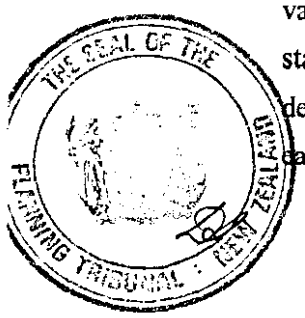
It was the evidence of Dr N Cherry, a witness called for the appellants, that there are two schools of thought among radiation scientists which he described as the thermal school (to which, he maintained, the applicant's witness Dr Repacholi belongs) and the non-thermal school, which he (Dr Cherry) supported.

Dr Cherry maintained that scientists in the thermal school are burying their heads in the sand and refusing to consider relevant scientific data.

Other expert witnesses did not support Dr Cherry's claim about the two schools of thought, and it is our concern that treating a scientist as belonging to one or another school of thought could result in his or her scientific work being given less or greater weight than it deserves on its own merit. We agree with the opinion expressed by Dr Goldsmith, another witness called for the appellants, that such classifications do not help understanding of the problem. We therefore decline to make any finding on the validity of the supposed differences between the thermal school and the non-thermal school, or on whether those schools may be said to exist.

ADEQUACY OF STANDARDS

Some of the evidence was directed to showing the inadequacy of various radiation exposure standards, including the New Zealand Standard NZS 6609, the international standard and various other national standards. We distinguish between the adequacy or inadequacy of a standard as such, and the weight that a consent authority might place on that standard in deciding a particular resource consent application. For the reasons that we have already given earlier in this decision, we accept that a consent authority is free to make its own judgment



about the weight to be given to such a standard. However as none of the standards has status that binds a consent authority, we do not accept that evidence questioning the adequacy of any standard as such is relevant or helpful for deciding this appeal.

REASONS FOR PAUCITY OF NON-THERMAL STUDIES

In his evidence Dr Cherry suggested reasons why there has been a paucity of scientific studies showing non-thermal effects of radio frequency radiation.

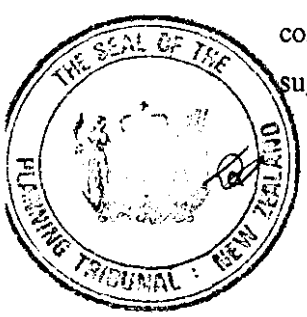
However a consent authority has to make a decision on the evidence before it. It would not be right for a resource consent decision to be made on the basis that if other research had been done different results might have been found. In our opinion suppositions about the reasons for the relatively fewer studies showing non-thermal effects are for our present purpose no more than time-wasting speculation. We do not find it necessary to make any findings on them.

QUALITY OF EASTERN BLOC RESEARCH

There was some difference among the expert witnesses about whether or not scientific work that had been carried out in the USSR and Eastern Europe on the health effects of radiofrequency radiation had in general been carried out properly, and presented reliable results. However we were not persuaded that generalisations of that kind can assist us in making the findings necessary in this case. We should not decline to consider the results of relevant scientific work merely because it was carried out in the Eastern Bloc. We should consider carefully what has been discovered about any particular piece of relevant research (wherever conducted) and the way in which it was carried out, in order to assess the reliability of the results.

DR REPACHOLI'S PERVASIVE INFLUENCE

It was Dr Cherry's evidence that Dr M H Repacholi (a witness called for the applicant) has had a pervasive influence on the content and conclusions of many of the international reports and standards committees on radiation effects. Dr Repacholi responded that other members of the various committees are scientists in their own rights, that conclusions reached by those committees are debated at length, and that no one person could have such profound influence as suggested.



Although we find Dr Repacholi's response persuasive, we consider the question of Dr Repacholi's influence on other members of the various scientific committees to be an unhelpful distraction. We decline to make any finding on that point.

NEED FOR FURTHER RESEARCH

Another question that arose in the evidence was whether or not there is a need for further epidemiological or other studies in health effects of radiofrequency radiation. We remind ourselves that the Tribunal's function in these proceedings is not that of a broad ranging commission of inquiry. Our task is to decide, on the evidence before us and by reference to the purpose and provisions of the Resource Management Act, whether resource consent should be granted or not for the proposed cell site, and if so upon what conditions. We have to make our judgment on considerations relevant to that task. We leave to others, whose responsibility it is, the decision whether further researeh is needed.

Likewise we consider that it is outside the Planning Tribunal's function, in deciding this appeal, to adopt an interim public radiation exposure standard of general application, or to require cellphone companies to fund an independent monitoring programme of exposure levels and the health status of people living or working near cell sites.

UNDER-REPORTING AND SUPPRESSION

For similar reasons we decline to consider claims that there is under-reporting of possible adverse health effects of radiofrequency radiation; and that evidence of adverse health effects of exposure to radiofrequency radiation does exist but is being suppressed or ignored by so-called thermal school scientists and by cellphone companies.

WHETHER RADIO FREQUENCY RADIATION IS A CONTAMINANT

Finally, there was some argument and evidence about whether radiofrequency radiation is a contaminant within the meaning of the Resource Management Act. We have concluded that a finding on that question is not necessary to our reasoning for the outcome of this appeal. Furthermore, the question was not fully argued, and is one on which the Canterbury Regional Council would have an interest, but was not a party before us. For those reasons we decline to make a finding on that question in this decision.

CHAPTER FOUR: EFFECTS ON THE ENVIRONMENT

As mentioned in Chapter Two of this decision, we are to have regard to actual and potential effects on the environment of allowing the cellsite.

RADIATION

The only effect on the environment raised by the appellant was effects on health of radiofrequency radiation from the cellsite transmissions. In Chapter Two of this decision we outlined the cases for the parties in that respect. In summary, the applicant (supported by the respondent) maintained that there would not be any effects on the environment from that radiation, and the appellants maintained that there is a serious hypothesis that exposure to the radiation is potentially harmful to health.

The heart of the difference lay in distinguishing between thermal and non-thermal effects from radiofrequency radiation. The experts relied on by the applicant maintained that there is no reliable evidence of any harmful effects from that kind of radiation except where it is experienced at an intensity that generates heat, described as thermal radiation. However the experts relied on by the appellants maintained to the contrary, that there is some evidence of harmful effects from radiation at or near radiofrequencies at sub-thermal intensities which, while inconclusive in itself, is sufficient to support a serious hypothesis of potential harm from the radiation emanating from the proposed cellsite transmissions. Their opinions were challenged by the experts for the applicant.

The evidence for the appellants on that topic comprised the opinions of their expert witnesses, together with two classes of material relied on by them for their opinions. The first class was reports in scientific papers or journals of particular pieces of research that had been carried out into health effects of radiation, being in vitro research (laboratory study of cells or tissue removed from living organisms) or epidemiological (statistical) research. The second class was reviews of the research that had been carried out by other scientists.

We accept that in considering what findings we are able to come to, it is necessary for us to scrutinise the material produced in the first class, and consider its scientific validity and

reliability, and the extent to which it is probative of the fact on which the appellants seek that we make a finding. The evidence of the expert witnesses who testified in the appeal hearing may assist us in those assessments of the studies reported.

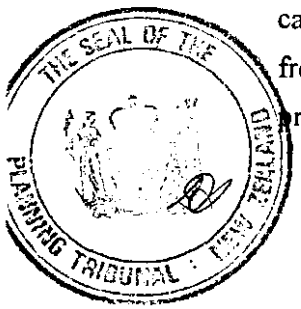
However we do not consider that the material in the second class is necessarily helpful in the task that has fallen on us. We acknowledge the value of peer review of scientific work, while recognising that new understandings can be valid before they are accepted by the relevant scientific community. Yet for the present purpose the value of those reviews is limited because of the absence of opportunity for cross-examination of the authors of the reviews. In particular, where the reviewer has re-interpreted the results to come to a conclusion different from that reached by the original researcher, we do not consider that the substitute conclusion has sufficient weight or reliability to be probative of a fact on which we need to make a judicial finding.

Thermal effects

The opinion that harmful effects of radiofrequency radiation have been established only where accompanied by heat was expressed by Dr M H Repacholi, Chief Scientist of the Royal Adelaide Hospital, Chairman of the International Commission on Non-Ionizing Radiation Protection, and a Consultant to the World Health Organisation.

The witness referred to a number of reports of experiments and studies of molecules and cells; (in respect of animals) of genetic effects, effects on reproduction and development, central nervous system, behaviour, endocrine system, cancer studies; and (in respect of humans) thermal considerations and epidemiological studies. In respect of each he gave his reasons for not accepting the result as reliable evidence of health effects on humans from radiofrequency radiation at the proposed frequency from the cell site. He summarised his opinion that to produce any adverse health effect, radiofrequency exposure above a threshold level needs to occur, the threshold being the exposure that would increase tissue temperature by at least 1 degree celsius.

Dr Repacholi asserted (and this was not challenged) that the low radiofrequency power levels from base transceiver stations cannot cause that temperature rise. He also gave the opinion that multiple exposures to sub-threshold levels of radiofrequency have not been found to have any adverse health impact; that exposure to radiofrequency fields has not been established to cause cancer; that there is no scientific evidence to suggest that at the level which would be emitted from the proposed facility there would be any influence on cancer initiation, promotion or progression; and that no accumulation of damage occurs to tissues from low level (sub-



threshold) radiofrequency exposures. The witness affirmed that there is no evidence that there are any effects on pregnancy from radiofrequency emissions as low as those from the proposed facility and that children, pregnant mothers or other sensitive groups are not at risk from it. He also explained that it was only at specific absorption rates of between 1 and 4 watts per kilogram that even transient changes in animal behaviour had been established, and that even at an absorption rate of 4 watts per kilogram where the human body temperature increases by one-half of a degree celsius, there is no health consequence.

In cross-examination Dr Repacholi asserted that because many studies reported in the scientific literature had not been replicated or had been conducted poorly or had obvious flaws, his approach had been to try to ensure that rigid scientific criteria are used in development of the literature on which exposure limits are based. He also affirmed that the view that he was taking was the view of the national and international scientific consensus; and that the current epidemiological studies do not show that there are adverse health effects from radiofrequency fields. He explained the wish for more research as being that there is always a need to provide fine tuning to a health hazard assessment.

Counsel for the appellants asked Dr Repacholi what would be wrong with a cautionary principle, or saying We don't know, but we can do it another way which we know is much safer. The witness replied that scientists have been researching this area for over 40 years, the consistency of the database has not changed significantly in the last 15 years, a lot is known about the effects of radiofrequency fields on human and biological systems, and to say it is not ignores the 5,000 to 6,000 items in the scientific literature which has been reviewed. He testified that since the early days, researchers had been trying to see if non-thermal effects occur, and if they do, whether they have any impact on human health; and in over 20 years' research non-thermal effects have not been established.

Dr Repacholi stated that the epidemiological studies had not been conducted with the dosimetry he would like to see, that it is very difficult in epidemiological studies to assess the dosage that people receive from radiofrequency fields; and he deposed that indices or similar measures to determine the dose can be quite incorrect. The witness gave the opinions that in science, epidemiology is a very blunt instrument; it could not consistently indicate causal associations; and it has many methodological problems in identifying significant associations, so that for risk ratios less than about three, one needs laboratory support, and epidemiology alone is not sufficient to be predictive.

Dr Repacholi also gave the opinion that re-analysis of epidemiological studies that had been conducted by others cannot produce valid conclusions, but only a hypothesis that could be

validated by a separate study designed specifically to test it. However he agreed that such re-analysis could raise a hypothesis that may be worthy of serious scientific investigation. He affirmed that the only way to say whether an association pointed to by results of epidemiological research is positive, is to test it in a separate study; and that until it is confirmed by such a study it has no validity.

Dr Repacholi expressed his disagreement with a statement by Dr Luben (a witness called for the appellants) that the effect of extremely low frequency (ELF) fields is similar to the interaction of modulated microwave signals, and he told the Tribunal that as the frequency of a field increases, the amount of absorption in the body decreases. Dr Repacholi explained that in the low frequency range of 300 hertz up to about 100 kilohertz the predominant mechanism of interaction is induction of currents in the body; that in the frequency range between 100 kilohertz to 10 megahertz there are two predominant mechanisms by which an electromagnetic field interacts with the body, induced currents and heating within tissue; but that at above 10 megahertz the overwhelming mechanism is heat, and at 900 megahertz that is effectively the only established mechanism by which radiofrequency fields interact with the body. The witness acknowledged that there is valid concern within the community that there may be promotion of cancer from radiofrequency fields. He affirmed that the bulk of the evidence suggests that there is no effect, but he accepted that there have been some conflicting results and there should be more experiments to determine that.

Subthermal physiological effects

Dr Repacholi described findings of movement of calcium and other ions across cell membranes caused by radiofrequency fields at levels too low to produce significant heating. He deposed that no health effects had been established from those effects, and that many researchers had tried to replicate those effects but had not been able to. He also referred to a report[61] that modulated microwave exposure of chromosomally abnormal cells which were treated with x-rays and a chemical promoter had shown an accelerated rate of change from normal to cancer cells. Dr Repacholi observed that the study needed independent confirmation, that the implications for carcinogenesis in humans are not clear, and that radiofrequency fields are not modulated by cellular telephone base stations. (We find that the latter remark reflects a misunderstanding to the extent that the radiofrequency transmissions from the proposed cell site would be modulated).

[61] *Balcer-Kubiczek and Harrison* (1991): Neoplastic Formation following exposure to 120 Hz modulated 2.45 GHz microwaves and phorbol ester. Radiat. Res. 126:65-72.

Dr Repacholi deposed that a large number of studies had been conducted into various somatic cells and that most had reported a lack of effect on chromosome aberrations and single or double strand breaks in DNA; that studies on germ cells had suggested that acute or chronic exposure to radiofrequency does not result in increases in mutation or chromosome aberration frequency when the temperature is maintained within physiological limits; that where increased frequencies of chromosomal aberrations had been reported, those studies had not been successfully replicated; and that chronic exposure experiments had not produced any evidence of chromosomal aberrations in rodents exposed to specific absorption rates of 1 to 5 watts per kilogram. The witness referred to two studies of effects on mice. In one[62], mice had been exposed to 2.45 gigahertz fields at 1 milliwatt per square centimetre (a specific absorption rate of 1.18 watts per kilogram) for two hours per day, from which there had been an indication of structural genomic rearrangement in brain and testes cells. In the other[63], it was reported that rats exposed to pulsed or continuous wave 2.45 gigahertz fields with specific absorption rates of 0.6 or 1.2 watts per kilograms for two hours increased the number of strand breaks in brain DNA. Dr Repacholi remarked that both those papers had quantitative data subject to sources of inter-trial variation and experimental error, so the experiments should be replicated before the results are used in any health risk assessment; and that mobile phones do not operate at the pulsed frequency used in those experiments.

Appellants' evidence

The appellants called three expert witnesses to support their case about the possibility of non-thermal effects of radiofrequency radiation on human health. The first was Dr N Cherry, a senior lecturer in agricultural meteorology at Lincoln University whose academic training and professional experience is in other areas of physics, but do not include health effects of radiofrequency radiation. The second was Dr R A Luben, an associate professor of biomedical sciences and biochemistry at the University of California, Riverside, whose research specialities include biomedical effects of electromagnetic fields on mammalian cells in tissue culture. The third was Dr J R Goldsmith, professor of epidemiology at Ben Gurion University of the Negev, Beer Sheva, Israel, who had written, among others, an article published in the International Journal of Occupational and Environmental Health entitled *Epidemiologic Evidence of Radiofrequency Radiation (Microwave) Effects on Health in Military, Broadcasting and Occupational Studies.*

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[62] *Sarkar et al* (1994) Effect of low power microwave on the mouse genome: A direct DNA analysis. Mutation Research 320: 141-147.

[63] *Lai and Singh* (1995): Acute low-intensity microwave exposure increases DNA single-strand breaks in rat brain cells. Bioelectromagnetics - in press.

The witnesses for the appellants referred to a number of particular reports of scientific studies on which they relied in supporting the appellants' case. In some cases we were provided with copies of the reports in scientific journals. In respect of others, we have the witnesses' evidence describing the conclusions of the reports. In total there were more than 50 such reports referred to by the appellants' witnesses.

We have carefully considered the evidence concerning them, but we have found that a number do not have probative value for the purpose of making the findings required in this case.

First, over 20 of the reports refer to exposure to electric or magnetic fields at frequencies remote on the electromagnetic spectrum from that of the transmissions from the proposed cell site, or where signals were modulated in different ways from that proposed. Many of them referred to experiments with extremely low frequency (ELF) fields, and a few related to exposure to radiation in excess of 2 gigahertz. Dr Luben expressed the opinion that studies of the effect of extremely low frequency fields may be relevant for the present purpose. Dr Repacholi and Mr M D Gledhill (a scientist at the Ministry of Health's National Radiation Laboratory) gave contrary opinions.

We have carefully reviewed the evidence that Dr Luben gave in that respect in cross-examination by Mr Cavanagh. Dr Luben acknowledged that at a level of primary interaction of the field with the human body the mechanisms would be different, but he expressed the opinion that at the level of cell mechanisms they appear to be similar. He acknowledged that this would need to be tested by research before a conclusion could be drawn. However he also agreed that for frequencies below 100 kilohertz the predominant mechanism is induced currents in the body, but that at frequencies above 100 kilohertz the only established mechanism is thermal. He remarked that this did not close the door on other possible mechanisms, but that he had no evidence of others.

Having considered Dr Luben's evidence, we have not been persuaded that the reports of effects of extremely low frequency fields, or of radiation at frequencies in excess of 2 gigahertz, are probative of likely or potential effects of transmissions from the proposed cell site. We prefer the contrary opinions in that respect of Dr Repacholi and of Mr Gledhill.

During most of the hearing it was assumed that the maximum exposure of people to radiation from the proposed cell site would be to incident power flux density as great as 12 microwatts per square centimetre. As appears later, we find that it would not be as great as that. However, even if we accepted that the exposures might be as high as 12 microwatts per square centimetre, several of the scientific studies relied on by the appellants' witnesses involved exposures in

excess of that, or (expressed in specific absorption rate) at greater than 1 microwatt per kilogram. We do not find that experiments or reports of effects of exposure substantially more intense than 12 microwattts per square centimetre can assist us to determine the likely or potential effects of radiation from the proposed cellsite. Therefore, we do not take these reports into account in reaching our finding.

Published reports of several of the studies relied on by witnesses for the appellant were not presented to us, and we can only rely on the witnesses' own description of these studies. In the case of several of them, the witness did not provide us with details of the frequency and exposure intensity that are sufficient to enable us to assess whether the results can have probative value for the present purpose, or to assess how much weight we could place on them. We have therefore not felt able to take those studies into consideration.

There are four particular studies on which the hearing focused: the Korean War Veterans[64], the United States Foreign Service Workers[65], the Physical Therapists[66] and a study by Dr L Von Klitzing of the effect of electroencephalograph (EEG) traces in students' brains[67].

We were not provided with the frequency or intensity of the radiation to which the Korean War veterans had been exposed. Dr Goldsmith informed us that no actual exposures are available; that the results had not been analysed for the ages of the subjects; and he acknowledged that association had not been proved. Dr Cherry informed us that both exposed and control groups had been exposed. The study had been re-analysed by Dr Szmigielski and others, but one of them, Dr Silverman, had later resiled from that report. All in all, we do not consider that we can have sufficient confidence in the results of that study for them to be a reliable basis for a judicial finding.

The exposure intensity to which the foreign service workers had been exposed is not known, but was estimated as being 5-18 microwatts per square centimetre. Dr Goldsmith told us that follow-up studies had not been done. He had himself re-analysed the results and concluded that they had been understated. However, we share the reservations expressed by the United States

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[64]Effects upon Health of Occupational Exposure to Microwave Radiation (Radar) by C Dennis Robinette, Charlotte Silverman and Seymour Jablon, American Journal of Epidemiology vol 112, p 39.

[65]Foreign Service Health Status Study by A M Lilienfeld et al. Final report, Contract 6025-619073, Department of State, Washington DC, 1978.

[66]Miscarriages among Female Physical Therapists who Report Using Radio - and Microwave-frequency Electromagnetic Radiation by Rita Ouellet-Hellstrom and Walter F Stewart American Journal of Epidemiology vol 138, p 775.

[67]This work was described by Dr Cherry following personal communications with Dr Von Klitzing, but does not appear to have been the subject of a report published in a peer-reviewed scientific journal.

Court of Appeals[68] and by Dr Repacholi and Mr Gledhill concerning re-analysis of epidemiological studies. We do not consider that the reported experience of the foreign service workers provides us with a reliable basis for a finding in this case.

Dr Cherry and Dr Goldsmith were both cross-examined by Mr Cavanagh concerning the study of miscarriages among physical therapists in the United States. There is no evidence that the actual exposures experienced by the respondents to that study had been measured. We infer that they had merely been estimated. Dr Goldsmith acknowledged that the odds ratio was just barely above the margin of significance, and in the circumstances we do not consider that study reliable (in the sense referred to by the Supreme Courts of the United States of America and Canada) for our present purpose either.

Mr Cavanagh challenged Dr Von Klitzing's study on the ground that the Hall sensor equipment which had been used was not able to measure in the 150 hertz frequency range down to the level reported, and because of 17 subjects studied, the results in respect of only one were reported. Apparently, the values experienced had been calculated, but the method of calculation is not known. In any event, the report showed changes in EEG traces, but no evidence of health effects. In the circumstances, we consider that the evidence before us of Dr Von Klitzing's work is not sufficient to provide a reliable base for our findings.

In another study relied on[69], neuroblastoma cells had been exposed to radiation at 915 megahertz modulated at 16 hertz with a specific absorption rate of 0.05 watts per kilogram. It was reported that there had been efflux of calcium ions in cultured brain tissue. However, the experiment has not been replicated using signals modulated differently. Bearing in mind that the proposed transmissions would be modulated in a different way, by the gaussian mean shift key method, we do not find that report helpful in deciding about cellsite transmission effects. Similarly a report by Dr C V Byus[70] of tumour promotion enzyme activity as a result of exposure to a field at 450 megahertz with 12 to 20 hertz sinusoidal modulation cannot assist us because again the modulation was of a different kind. We do not have enough detail of the studies by Dr R L Davis and F K Mostotfri and others on traffic police using hand-held radar for traffic monitoring. A study by Dr M C Shandala and colleagues[71] concerned microwave exposure at 10, 50, and 500 microwatts per square centimetre, and reported that at 10 and 50

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[68]In *Daubert v Merrell Dow Pharmaceuticals* 951 F 2d 1128 at 1131.

[69]*Microwave induced calcium efflux from brain tissue in vitro* by S K Dutta et al Bioelectromagnetics vol 5 p 71 (1984)

[70]*Alterations in Ornithene Decarboxylase Activity* by C V Byus, published in Papers of 1993 Radiofrequency Radiation Conference.

[71]*Study of non-ionising microwave radiation effects upon the central nervous system and behaviour reactions* by M G Shandala et al. Environmental Health Perspectives vol 30 p 115, 1979.

microwatts per square centimetre, exposure stimulated the brain at the initial stage of irradiation. Dr Cherry commented that exposure to 10 microwatts per square centimetre for seven hours a day would give an average exposure of 2.9 microwatts per square centimetre. However, there is no evidence of health effects from exposures to radiation at or below 10 microwatts per square centimetre.

Finally, a report by Dr A W Guy[72] that rats exposed to pulsed radiofrequency radiation producing a specific absorption rate at 0.4 watts per kilogram showed induction of benign growths does not appear to have been replicated, and we have insufficient particulars to enable us to assess its reliability or its significance to the present case.

In the foregoing passages we have summarised our attitude to the reports and studies relied on by the appellants' witnesses. The summary should not obscure the fact that we have considered in detail all of the evidence related to those studies.

Finding on radiation effects

We refer back to the conclusions that we reached in Chapter Two of this decision. The question of fact for our decision is whether there would or would not be an actual or potential effect (including any potential effect of low probability which has a high potential impact) on the environment (as defined) from radiation that would be emitted by the proposed transmitter.

On the evidence that we have been analysing we have now to consider what finding we come to. We are confined to evidence probative of the fact, that meets a basic threshold of reliablity, and is persuasive to us on the balance of probabilities having regard to the gravity of the question.

We recognise that the question is a grave one, in that if the transmissions turn out to be harmful, people who had no choice about being exposed to radiation, including members of more vulnerable sections of the community, may suffer ill-effects. Yet, as Mr Fogarty submitted, there needs to be a reasonable apprehension.

Even so, we have to 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 deciding whether, on the balance of probabilities, there would be a potential effect

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[72] *Dosimetry associated with exposure to non-ionizing radiation: very low frequency to microwaves.* Health Physics vol 53 p 569, 1987.

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 not understand that to be the question on which we have to make a finding.

We also bear in mind that the Resource Management Act provides other ways of addressing adverse effects on the environment that later become apparent but which are not recognised when resource consent is granted.[73]

The hearing of the appeal proceeded on the basis that people would not be exposed to radiofrequency radiation from the cellsite transmissions greater than about 12 microwatts per square centimetre. However a technical witness for the applicant, Mr M J Lancaster, was recalled at the end of the hearing to provide additional evidence about the way in which the radiation emitted from the transmission antennas is disseminated. He produced technical specifications from the manufacturer of the equipment, and diagrams to illustrate the exposure that would be experienced at the residence of one of the appellants, Ms J M Macintyre.

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. We therefore consider effects of the proposed radiation on homes in the vicinity, on the understanding that if there are not adverse effects on residents, there will not in general be adverse effects on other people.

Although Ms Macintyre's home is near the site, it is approximately 60 degrees off the main transmission axis, and the intensity of the radiation that would be experienced at her home would be reduced accordingly. We find that the most vulnerable dwelling is another one, to the north-west of the site. It is on the main transmission axis from the antenna that would be oriented at 300 degrees, and is at least 55 metres from that antenna. From Mr Lancaster's unchallenged evidence we find that at that distance it would not be exposed to radiofrequency radiation greater than 1.8 microwatts per square centimetre at the elevation of the transmission, namely a 2 degree downtilt from the antenna at 12 metres above ground level. Applying the information shown in exhibits L and Q produced by Mr Lancaster, the exposure of that dwelling at 3 metres above ground level would be 3 decibels less, about 1.2 microwatts per square centimetre.

[73] See for example sections 17, 128, and 319(2).

We have not overlooked that people would be employed in business premises in the building on which the transmitter would be located, and others nearby. However the decrease in the intensity of the radiation in the vertical plane, as illustrated in exhibits L and P, produced by Mr Lancaster, shows that they would not be exposed to greater radiation than the occupants of the dwelling to the north-west of the site. We find that to be the greatest exposure.

There is no basis in the evidence before us for finding that exposure to radiofrequency radiation at the predicted intensity of about 1.2 microwatts per square centimetre would have a potential effect on people, not even an effect of low probability but of high potential impact. Although there are some scientists who maintain that there is a serious hypothesis that exposure even to low densities of radiofrequency radiation may be harmful, there is not general acceptance of that in the scientific community. On the totality of the evidence, our finding is that there would not be an actual or potential effect (including any potential effect of low probability which has a high potential impact) on the environment (as defined) from the radiofrequency radiation that would be emitted by the proposed transmitter.

VISUAL EFFECTS

We have included in Chapter Two of this decision our finding that there would not be significant visual effects on the environment.

CHAPTER FIVE: PLANNING INSTRUMENTS

Section 104(1) of the Resource Management Act also directs that in considering a resource consent application a consent authority is to have regard to various instruments under the Act. The only such instruments applicable to this case that were brought to our attention were the transitional district plan and the proposed district plan. It was not suggested that the contents of any national or regional instrument could assist in our consideration of this application.

DEEMED (TRANSITIONAL) DISTRICT PLAN

By the transitional district plan, the site is in the Commercial L zone, and the adjoining carpark is in the Residential GP (General Parking) zone. The activities permitted in the Commercial L zone do not include telecommunication facilities, and the applicant acknowledged that the application has to be treated as a non-complying activity in respect of the transitional district plan.

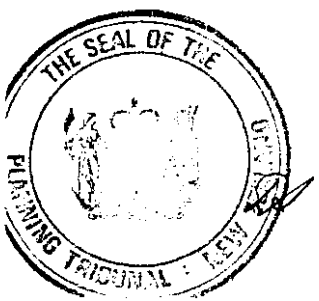
PROPOSED DISTRICT PLAN

A proposed district plan was publicly notified by the City Council on 24 June 1995 (after these appeals were lodged). The time for making submissions on it lapsed on 30 November 1995, so at the end of the appeal hearing, the time for further submissions had not yet commenced.

The term "utilities" is defined in the proposed district plan (paragraph 4.2.2) as including (among other things) telecommunication and radio communication facilities including transmitting/receiving devices such as aerials, dishes and associated equipment as well as support structures.

Rule 4.4.2 of the proposed plan declares that:

> Any utility is a discretionary activity where it involves any of the following:
> (a) Erecting any telecommunication or radio communication facility above ground level (including any mast, antenna, tower, or support structure) which is :
> (i) so designed and operated as to emit microwave or ultra high frequency emissions of any type within any living zone, or within 300 metres of the boundary of any living zone.



(ii) so designed and operated to emit more than 50 microwatts per square centimetre at any time within any zone except a living zone, or within 300m of a living zone, on the basis of measurements undertaken in accordance with New Zealand Standards of microwave or ultra high frequency emissions which must be provided following installation at the commencement of operation and at the time of any change in repeater capacity.

...

(v) over 12 metres in height, or has a support structure with a diameter greater than 0.4 metres located within 20 metres of a residential unit in any living zone.

(b) Erecting any telecommunication or radio communication facility which includes any dish antenna which is more than 1 metre in diameter within any living zone and which is:

(i) within 400 metres of any other dish antenna which is more than 1 metre in diameter; or

(ii) over 3 metres above ground level; or

(iii) visible from the street;

(c) Erecting any telecommunication or radio communication facility which includes any dish antenna, which is more than 3 metres in diameter in any other zone.

Rule 4.5.2 sets out matters to be considered in assesssment of discretionary applications. Those which may be relevant to this application are:

(a) The visual impacts of the utility in terms of likely effects on :

(I) residential or recreational use of land in the vicinity, including land in living, cultural, conservation or open space zones

...

(iii) design elements in relation to the locality, with reference to the existing character of the locality and amenity values.

(b) Screening or landscaping of the utility and any modifications to its colour and design, to ensure reasonable compatibility with the character of the surrounding environment.

(c) The practicality of screening or landscaping the utility with regard to its operational requirements (excluding overhead lines and towers which cannot be screened).

(d) The siting of any building or other structure in relation to existing dwellings, and the effect on views of, or from such dwellings.

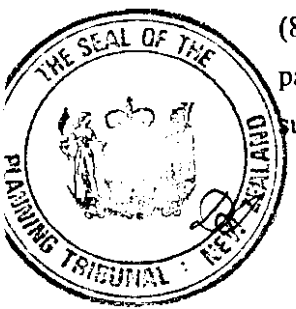
...

(g) The cumulative visual effects with respect to existing facilities within an area, particularly radio communication and telecommunication facilities.

(h) The appropriateness of, and necessity for the scale and height of buildings or other structures proposed, in terms of their intended function.

(i) The likely effect of any increased level of microwave emissions on the health of persons in the vicinity of a facility, with regard to its location.

The proposed plan refers to control of utilities on the basis of their effects, contains an objective (8.3) of minimisation of the adverse effects of utilities on their surrounding environments, particularly those in living areas; a policy (8.3.1) that radio and telecommunieation facilities are subject to specialiscd controls; a policy (8.3.3) of ensuring that utilities are provided in a



manner that takes account of adverse effects having regard to the character of the local environment; and another policy (8.3.4) of taking account of operational needs in assessing the location, design and appearance of utilities.

The proposed plan contains no explanation of the 300-metre prescription in rule 4.3.1(a)(i). As the emissions from the proposed cellsite would fall within the descriptions in subclauses (i) and (ii) of clause (a) of that rule, the proposal is a discretionary activity in respect of that plan. The assessment criteria in rule 4.5.2 do not raise new issues, but are particular aspects of actual and potential effects in the environment of allowing the activity. Addressing them, we find that there would be no significant visual effects; screening and landscaping would be inappropriate; the design of the antennas and support structures are necessary for their function but their proposed colour would ensure reasonable compatibility with the character of the surrounding locality; they would be located so as to minimise visibility from dwellings nearby; they are appropriate for their function; and there would not be any likely effect of increased level of microwave emissions on the health of persons in the vicinity of the facility with regard to its location. We have also considered the extent to which granting consent would serve the relevant objective and policies of the proposed district plan. We find that the facility has been designed to minimise adverse effects on its surrounding environment; and would not conflict with any of its objectives, policies or rules.

CHAPTER SIX: THE THRESHOLD TEST

Section 105(2)(b) provides that a consent authority is not to grant a resource consent for a non-complying activity unless it is satisfied that the adverse effects on the environment will be minor, or that granting the consent will not be contrary to the objectives and policies of the plan or proposed plan.

As the activities permitted by the transitional district plan in the Commercial L zone do not include telecommunicatioin facilities, BellSouth's proposal has to be treated as a non-complying activity.

We have already considered the actual and potential effects on the environment of allowing the activity and have found that it would not have any significant visual effect nor any actual or potential effect on human health. We find that the adverse effects on the environment would be minor.

Our attention was not drawn to any objective or policy of the transitional district plan with which granting the consent would be contrary. We have also found that the proposal would not conflict with any of the objectives or policies of the proposed district plan.

We are therefore satisfied that both of the conditions stipulated in section 105(2)(b) on which a consent authority can grant resource consent for a non-complying activity are fulfilled.

CHAPTER SEVEN: CONDITIONS

If resource consent is granted, the consent authority has authority to impose conditions of consent that it considers appropriate[74], provided that they are not for an ulterior purpose, fairly and reasonably relate to what is authorised by the consent, and are not unreasonable[75].

In its decision granting consent, the City Council imposed six conditions. BellSouth's appeal against the City Council's decision sought deletion of conditions 3 and 4 and replacement of a condition worded as follows or to the like effect:

> That any radio frequency emissions from the antennas in the facility do not exceed 50 microwatts per square centimetre at any point where any member of the public (including commercial users of the building on and in which the facility is located) would approach the antennas.

The council did not resist that appeal, and agreed to that amendment to the conditions. Although BellSouth did not resile from that amendment, a witness called for it, Mr Gledhill of the National Radiation Laboratory, expressed criticisms that the condition is ambiguous as no measurement position is defined; and that there is no rationale for the 50 microwatts value. The council acknowledged the position that the limit of 50 microwatts per square centimetre was considered by some to be unnecessarily restrictive, but submitted that it would not affect the proposed operation, and that it would cause no harm for it to apply.

It was suggested by the appellants that the Tribunal should take this appeal as an opportunity to set a general standard for radiofrequency radiation from cellsite transmitters. We are aware of the possibility that a decision on an individual appeal may have a normative effect. However a decision on a particular resource consent application is not an appropriate occasion for setting a general standard. The Resource Management Act contemplates other ways in which that might be done, such as by national policy statements and in regional policy statements or district plans. The processes for settling instruments of those kinds are better suited for the purpose, because they allow participation by those with a general interest. In addition, as mentioned earlier in this decision, the New Zealand Standards Association has already issued a relevant

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[74] Section 108(2)

[75] *Newbury District Council v Secretary of State for the Environment* [1981] AC 578 [1980] 1 All ER 731.

standard and doubtless keeps it under review. Therefore it is sufficient for the purpose of deciding this appeal for us to set conditions that are specific to the particular circumstances.

Applicants for resource consent are required to assess the actual and potential effects that the proposed activity may have on the environment[76]. The consent authority, and anyone who may be forming an attitude to the application, should be able to rely on such an assessment. For an applicant's environmental assessment to have its intended value, an applicant must expect to be held to the effects stated in it.

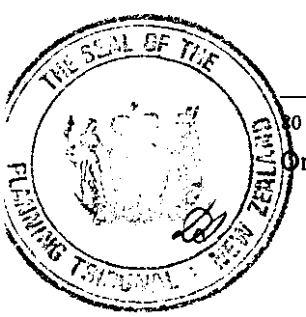
In this case the applicant has given evidence to the Tribunal about the proposed arrangement of the transmission antennas and the expected radiation effects on the environment from the proposed cellsite transmissions. It is in reliance on that evidence that we have found that there would not be actual or potential adverse effects on the environment of allowing the proposed activity. We consider that if the application is granted, the community is entitled to have the grantee held to the applicant's assessment of the radiation effects. That can be done in two ways. First , we can impose a condition restricting the installation and the incident power flux density to that described in the evidence. The City Council can monitor the installation and the actual emissions and if necessary take enforeement action to prevent excessive radiation. Secondly, we can expressly identify the limits of the radiation effects that we recognise in granting consent, so that as contemplated by section 319(2) anyone can apply for an enforcement order if (contrary to our finding on the evidence that we heard) the emissions prove to have adverse effects on human health.

Using the technical information produced in evidence, we have estimated that the power flux density at the most vulnerable dwelling would be about 1.2 microwatts per square centimetre. Because that is an estimate, and because the grantee would be bound by law not to exceed the maximum set by the condition, it would be appropriate to allow a tolerance. We consider it would be reasonable to round that value up to the next whole number. A maximum of 2 microwatts per square centimetre (equivalent to a specific absorption rate of 0.2 milliwatts per kilogram) measured at any dwelling would be a hundredth of the standard of 200 microwatts per square centimetre set in the New Zealand Standard 6609 and the Australian Standard from which it was derived, which is considerably more conservative than those adopted in the United Kingdom[77] and the United States of America[78], and that adopted by the International Radiation Protection Association[79]. It would respond to the recommendations in the New Zealand Standard NZS 6609 to keep exposure as low as reasonably achievable. It would also ensure

[76] Section 88(4)(b)
[77] 3,300 microwatts per square centimetre
[78] 600 microwatts per square centimetre
[79] 450 microwatts per square centimetre

that a specific absorption rate experienced by a member of the public would not exceed the level of 2 watts per 100 grams recommended in the World Health Organisation report[80] to protect more sensitive parts of the body from excessive local temperature elevations. We are as confident as we can be in the circumstances that transmissions complying with such a condition would cause no harm to anyone.

We will therefore consider whether resource consent for the proposal should be granted or refused on the footing that if it is to be granted, conditions 3 and 4 imposed by the City Council would be replaced by a condition to that effect.



[80] *Electromagnetic Fields (300 Hz to 300 Ghz)* Environmental Health Criteria 137, World Health Organisation, Geneva, 1993, pages 21, 23 and 177.

CHAPTER EIGHT: CONCLUSION

In considering this application for resource consent, we have had regard to any actual and potential effects on the environment of allowing the activity, and have found that there would be no adverse effects. We have also had regard to the relevant provisions of the district plan, and have found that consenting to the proposal would not conflict with any of its objectives, policies or rules. 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 in the preceding chapter, all illustrate the application of a precautionary approach to this proposal.

The exercise of the discretionary judgment is to be informed by the statutory purpose of promoting the sustainable management of natural and physical resources[81]. The elaboration of the term "sustainable management" in section 5(2) refers to enabling people and communities to provide for their social, economic, and cultural wellbeing and for their health and safety. The extension of BellSouth's cellphone service would contribute to enabling the people and community of Fendalton to provide for their social and economic wellbeing. Even so it could not be contemplated if it imperilled anyone's health or safety. However, this case focused on the possibility of adverse health effects from the radiofrequency radiation, and after careful consideration of the evidence we have found that the transmissions would not have any actual or potential adverse effect on the public, not even a potential effect of low probability which has a high potential impact. That can be assured by the amended condition that we would substitute, and by the provisions of the Act that could be invoked if it should turn out, contrary to the evidence before us, that the transmissions have an adverse effect, including the ability to review the condition.

The objective of sustainable management already addressed is subject to achievement of the matters described in paragraphs (a), (b) and (c).

[81] Section 2(1).

In our judgment, establishing and operating the proposed cellsite would not imperil the values described in paragraphs (a) and (b); and if done in compliance with the proposed conditions of consent, would avoid or sufficiently mitigate any adverse effects of the activity on the environment.

The remaining provisions of Part II amount to elaboration, for particular aspects of the environment, of the general purpose of sustainable management of natural and physical resources. None of those particular aspects arises for specific consideration in the circumstances of this case.

We conclude that granting the consent sought, subject to the conditions imposed by the City Council, amended as we propose, would serve the statutory purpose; and that the application deserves to be granted.

The Tribunal's determinations are therefore:

1. That the respondent's decision is amended by deleting conditions 3 and 4 of the conditions of consent, and by substituting the following condition 3:

    3. That the incident power flux density of radiofrequency radiation emitted by the facility, measured at any dwellinghouse, is not to exceed 2 microwatts per square centimetre.

2. In all other respects the respondent's decision is confirmed.

3. The appeal is disallowed.

4. The question of costs is reserved.

DATED at AUCKLAND this 5th day of March 1996

DFG Sheppard
Planning Judge