

Decision No: C 136/98

IN THE MATTER of the Resource Management
Act 1991

AND

IN THE MATTER of appeal under section 120 of
the Act

BETWEEN SHIRLEY PRIMARY
SCHOOL

(RMA 343/96)

AND

TELECOM MOBILE
COMMUNICATIONS
LIMITED

(RMA 429/97)

Appellants

AND

CHRISTCHURCH CITY
COUNCIL

Respondent

BEFORE THE ENVIRONMENT COURT

Environment Judge J R Jackson - (presiding)

Mrs R Grigg

Ms N Burley

HEARING at CHRISTCHURCH on 4 - 8, 11 - 15 May 1998 and 29 June 1998

APPEARANCES

Messrs A Hearn QC and K G Reid for the Shirley Primary School

Messrs T C Gould and J Hassan for Telecom Mobile Communications Limited

Messrs A C Hughes-Johnson and A Prebble for Christchurch City Council



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DECISION

Chapter 1: Introduction

1. On 17 October 1995, Telecom Mobile Communications Limited (since amalgamated into Telecom New Zealand Limited and in this decision called ("Telecom")) applied to the Christchurch City Council ("the council") for a resource consent under the Resource Management Act 1991 ("the Act" or "the RMA") to establish, operate and maintain a cellular radio base station ("the cellsite") on land at 9 Shirley Road, Christchurch to the rear of Shirley Masonic Lodge. The legal description of the land ("the site") is Part Lot 14 D.P. 1069¹.
2. The site is located near the intersection of Shirley and Hills Roads north of central Christchurch. It is half surrounded by commercial or light industrial premises consistent with the Commercial Service zone in the Council's transitional district plan. The northern and eastern boundaries of the site are shared with the Shirley Primary School ("the school"). The cellsite itself is some 14 metres from the school grounds at the closest point. The nearest classroom is about 45m to the east of the cellsite. The school currently teaches about 270 children aged between 5 and 10 years.
3. Submissions against the proposal were lodged by, amongst other parties, the Shirley Primary School Trustees (called "SPS"). Following a hearing in March 1996, the council granted a resource consent to Telecom on 12 April 1996, subject to conditions.
4. SPS appealed against that decision requesting that consent be refused. In November 1996 the parties jointly asked the Court to defer the hearing of the appeal for six months to allow time to investigate alternative sites and to



¹ CT 503/127 Canterbury Land Registry

carry on further discussions. On 12 June 1997 and with the consent of the Court, Telecom lodged its own appeal against condition 4 of the resource consent imposing a limit on the power flux density emitted by the cellsite.

5. The reasons for Telecom seeking to establish the cellsite on the site are:
 - to improve the distance coverage for handheld phones in the Shirley/Richmond area;
 - to add capacity to a broader Christchurch network to cope with increasing customer demand; and
 - to reduce interference from the network.

6. The most visible feature of Telecom's proposal is a 20 metre mast with six antennae at the mast head. There are three sets of two antennae pointing at orientations of 90°, 210° and 330° to the north. The mast height of 20 metres is required to enable the antennae to "see" over objects in the immediate vicinity and to provide the required coverage. Each of the antennae will transmit low level radio frequency ("RF") waves between frequencies of 870 megahertz ("MHz") and 890 MHz with a wavelength of around 34 centimetres. The mast was (prior to this hearing) redesigned to make it thinner and therefore less visible.

7. It needs to be borne in mind that RF radiation is just one form of the electro-magnetic radiation ("EMR") which pervades the universe. For example, the earth is bombarded with EMR in the form of gamma rays from the sun (with much less from other stars) all the time. There are other sources of EMR such as x-ray tubes, lights, lasers, radar, microwave ovens, cellphones and transmitters, radio and television tubes and power supplies.



A diagram showing the EMR spectrum as we understand it, is shown as Figure 1².

8. The terms used in this decision are, in alphabetical order:

EMF	=	Electric, magnetic and electro-magnetic fields
GH _z	=	Gigahertz
Hertz (H _z)	=	Measurement of EMR in cycles per second
MH _z	=	Megahertz (1 MH _z = 10 ⁶ H _z)
mW	=	Milliwatt (1 mW = 10 μw)
RFR	=	Radio Frequency Radiation-part of the EMR spectrum, below non-ionising frequencies
μW/cm ²	=	Microwatts per square centimetre Loosely, the unit for measuring exposure to RFR, or <u>strictly</u> what is defined as "the power flux density"





ELECTROMAGNETIC SPECTRUM

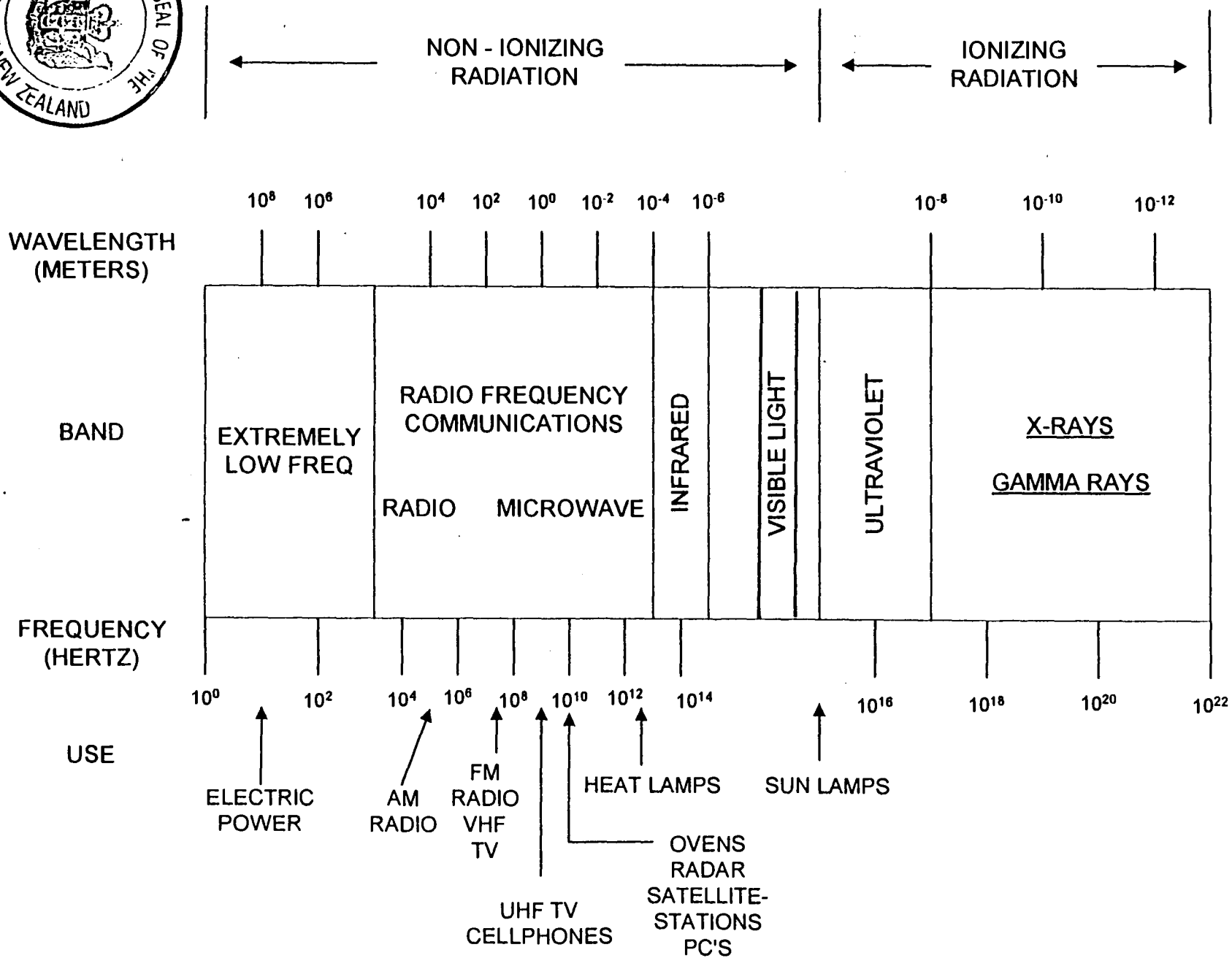


FIGURE 1

9. It was common ground that the application for the cellsite was for a non-complying activity under the transitional district plan. Although we did hear evidence and argument about whether the proposal was contrary to the relevant district plans, the most important issues in the case related to the alleged adverse effects of operating the cellsite. The four main adverse effects alleged were:

- the risk of adverse health effects from the RFR emitted from the cellsite;
- the SPS' perception of the risks and related psychological adverse effects on the pupils and teachers;
- adverse visual effects (views of mast and antennae); and
- reduced financial viability of the school if pupils are withdrawn as a consequence of a resource consent being confirmed.

10. The evidence ranged from individual statements of fear to "hard" science. The expert evidence itself ranged from the opinions of resource managers and landscape architects to the social science of psychology, to clinical science from physicians and epidemiologists and finally to bio-mechanistic studies.

11. We should explain that the hard end of scientific research into the issue of RFR occurs at two general levels, although each one in itself can then be subdivided further. The first general level is epidemiological studies.³ The second level is a study of biological mechanisms. The levels are generally hierarchical (biological mechanisms above epidemiology) in that they are perceived as having increasing power in terms of establishing cause and effect.

³ Epidemiology is the study of diseases in human populations.



12. Epidemiology consists at its lowest level of case studies, descriptive studies and professional experience. At a slightly higher level it consists of comparative studies including ecological studies. Higher again are cohort or case control studies and finally at the highest are randomised trials (experimental studies). The prime difficulty with epidemiological studies is that while one such study can show an association between facts, for example between RFR and cancer, it cannot show why or how two facts are causally linked. Epidemiological studies then give way in the perceived hierarchy to the second general level which is of biological or mechanistic studies. These in turn divide into, at a lower level, *in-vitro* studies⁴ and, at the highest level, *in-vivo* studies.⁵
13. Complicating the scientific position is that initial experimentation on biological mechanisms is usually on other animal cells (i.e. not human) - at first *in vitro* and later *in vivo*. This raises other questions: for example, can one extrapolate from a study of Chinese Hamster ovary (CHO) cells to human cells? Or from Chinese Hamsters to humans?
14. The above paragraphs summarise the issues as most of the evidence and the submissions of counsel identified them. But it does not state the main issue for the school and its concerned parents - which was how could they be sure there was no risk to their children from the cellsite. We will return to that issue later.

⁴ Literally "in glass" meaning test-tube or petri dish studies.

⁵ Literally "in life" meaning studies of live animals.



15. Our decision is set out in the following way. First we summarise the cases for the three parties in Chapters 2-4, noting that the only issue⁶ as between Telecom and the Council is whether the resource consent (if granted) should be subject to the Council's condition 4. Then because this case raises difficult evidential issues - for example, as to who (if anyone) has the onus of proving that there is no, or little, risk from exposure to RFR at athermal levels - we deal with those issues in Chapter 5. The RMA lists⁷ the matters that need to be taken into account in deciding whether a resource consent should be granted. The relevant parts of the list are identified in Chapters 6-9. We turn to the exercise of our discretion⁸ as to whether resource consent should be granted in Chapter 10, and we deal with Telecom's appeal against condition 4 in Chapter 11. Finally Chapter 12 sets out our final orders determining the appeals.

⁶ The sole subject of Telecom's appeal RMA 429/97

⁷ In section 104(1)

⁸ Under section 105(1) RMA



Chapter 2: The Case for Telecom

16. Counsel for Telecom said that two broad issues fall for consideration, these being:

- (1) whether the Council's decision to grant consent should be confirmed.
- (2) what conditions should be included in the consent (if granted) and, in particular, what conditions should govern RF emitted from the facility. (This is dealt with in Chapter 11: "Telecom's Appeal against Condition 4").

Adverse Effects

17. Mr Gould, counsel for Telecom, covered each of the adverse effects alleged by the school in turn. Counsel pointed out that in a number of cases dating back to 1991 the Tribunal has ruled that there are no health effects, actual or potential posed by RF emissions from a cellsite⁹. Counsel claimed that nothing has changed since *McIntyre* and there is no evidence, consistent with accepted scientific opinion, of actual or potential health effects from RF emissions at the levels that will be experienced from the proposed cellsite. The second part of that submission goes to the heart of the case and we return to it later. But the first part of the submission is wrong: there have been two important changes since *McIntyre*. The first is that three more years have passed and more

⁹ *Waitakere City Council v Broadcast Communications Limited and Others* A116/91 (8 November 1991), *World Services New Zealand Ltd v Wellington City Council* W90/93 (21 October 1993), 1B ELRNZ 32 *McIntyre v Christchurch City Council* [1996] NZRMA 289, *Telecom v Christchurch City Council* W165/96 (15 November 1996) ["the Telecom decision"].



relevant scientific papers have been published. The second point relates to one of those papers: that by Dr M H Repacholi published in 1997¹⁰. Dr Repacholi was one of the key witnesses for BellSouth in *McIntyre*. The Tribunal (as it was) stated:

“The opinion that harmful effects of radio frequency radiation have been established only where accompanied by heat was expressed by Dr M H Repacholi ...”¹¹

and

“[Dr Repacholi] gave the opinion that multiple exposures to sub-threshold levels of radio frequency [radiation] have not been found to have any adverse health impact; that exposure to radio frequency 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 ...”¹²

Clearly the Tribunal relied on Dr Repacholi’s evidence in its finding:

“On the totality of the evidence, our finding is that there would not be an actual or potential effect ... on the environment ... from the [RFR] that would be emitted by the proposed transmitter.”¹³

¹⁰M H Repacholi et al. “Lymphomas in Eμ-Pim 1 Transgenic Mice Exposed to Pulsed 900 MHz Electromagnetic Fields” *Radiation Research* 147:631-640 [called “Repacholi (1997)”]

¹¹*McIntyre* [1996] NZRMA 289 at 308

¹²*McIntyre* at p.309

¹³*McIntyre* at p. 315



But Repacholi (1997) states:

"I believe this is the first animal study showing a true non-thermal effect."

We can understand why the school might be concerned about the effects of RFR from cellphones after hearing of Dr Repacholi's change of mind.

18. As for the claimed psychological effects it was submitted that to the extent that evidence does show genuinely-held anxieties, this will need to be balanced against the facts that the school administration declined Dr Black's offer to speak to the Shirley school children following the council hearing and his offer to provide the school administration with scientific data on the issue. The school also refused access to enable actual RF measurements from a temporary cellsite to be taken at the school by an independent expert during the school holidays.
19. A further issue in respect to these anxieties was whether and to what extent the Court should take them into account. Mr Gould submitted that the key issue for determination of those anxieties is whether they are founded on plausible scientific evidence that the transmission of RF signals from the proposed cell site would pose a health risk. Counsel contended that there is no plausible scientific evidence of actual health risks and that the anxieties have been fed by misinformation and misconceptions. He suggested that this is not a basis for allowing the school's appeal; instead public confidence should be fostered and misconceptions addressed. Counsel was of the view that the RFR conditions included in the consent have an important function in this regard. He also submitted that in terms of the Act it is not appropriate to



regard a perception or anxiety that an activity will pose a health risk as an adverse effect when there is no plausible scientific evidence that the supposed health risk is real.

20. As for the visual amenity issues Mr Gould contended that subjective value judgments about cellsites as an activity have no place in the assessment of visual amenity or amenity value aspects of the proposal. He also said that if claims of adverse psychological effects are rejected then these claims should not be allowed in the back door dressed up as visual amenity issues¹⁴. It was submitted that the visual effects of the proposal are minor and no landscape mitigation planting is required.

Plan and Proposed Plan Issues

21. In respect to the transitional plan, counsel submitted that while the plan is silent on radio communication facilities making the proposal technically non-complying, the proposal satisfies all performance standards relevant in the zone, is compatible with commercial and industrial activities expressly contemplated in the zone and does not offend against any objectives and policies. He said that silence on this activity in the plan is understandable given the recent development of cellphones and the cellular network.
22. In the case of the proposed plan the activity is discretionary and satisfies all relevant performance standards, and complies with the relevant objectives and policies. It was submitted that the proposed plan accords no special sensitivity to the siting of cellsites near schools.



The Search for a Site

23. Telecom employees Messrs M J Moran and C E Jennings described the need for a cellsite in Shirley and its operation if installed. They also described a search for alternative sites in the area. In particular, after the appeal was lodged, Telecom with the consent of the school, obtained an adjournment of the Environment Court hearing while a search for alternative sites could take place. In all, over 27 sites were investigated by Telecom. Its basic principle was to avoid sites that were surrounded by residences because of the resistance of occupiers to having a cellphone tower near them.
24. In cross-examination by Mr Hearn, Mr Moran conceded that it would be possible (but more expensive) to service the area by a number of less powerful "micro units" and thus have no need to establish the cellsite next door to the school.

RFR From Cellsites

25. Mr M D Gledhill, a scientist at the National Radiation Laboratory of the Ministry of Health gave evidence as to the technical characteristics of the proposed cellsite. He gave the Court:
- An estimate of exposure levels in areas to which the public might have access, including areas within the school grounds.
 - An assessment of whether exposures to RFR around the site would comply with the joint Australian/New Zealand Standard 2772.1 (Int.):1998 Radio Frequency Fields, Part 1; maximum exposure levels - 3 kHz to 300 GHz (called "the ANZ Standard"). Under the



ANZ Standard there is a non-occupational¹⁵ exposure limit of $200\mu\text{W}/\text{cm}^2$.

26. He described how transmissions from the antennae are moderately directional. Each transmitting antenna emits a fan-shaped beam with the plane of the fan oriented at an angle of 2° below the horizontal extending about 60° on either side of the main transmission axis.
27. Mr Gledhill stated that when the cellsite is operating at full power each transmitting antenna will operate at a maximum of 80 watts on its sector. By comparison radio telephone sets in trucks and taxis operate at a power of around 25 watts. TV and radio transmitters operate at continuous powers considerably higher than that. On the Sugarloaf radio mast in Christchurch the total transmitter power is 64,000 watts.
28. Exposures to RFR at any point around the transmitter are quantified as the "power flux density". Mr Gledhill showed that very close to the mast RFR exposures are quite low. As you walk away from the mast along the direction of one of the beam axes, for example eastwards towards the school buildings exposure would increase to a maximum of about $1.4\mu\text{W}/\text{cm}^2$ (that is 0.7% of the non-occupational limit in the ANZ Standard) at a distance of 23 metres from the mast. Moving further away exposure decreases and then starts to increase again about 40 metres from the mast (at the closest school buildings as it happens) rising to another peak of $1.1\mu\text{W}/\text{cm}^2$ at a distance of 80 metres from the mast. At greater distances than that the exposure steadily decreases in inverse proportion to the square of the distance from the mast.

¹⁵ As opposed to "occupational". The meanings seem to be self-evident, but for a more detailed explanation of the term "non-occupational" see *McIntyre v Christchurch City Council* [1996] NZRMA 289 at 293



29. Mr Gledhill also pointed out that there can be an effect of signal reflections so that if the reflector was perfect, such as a large flat metal sheet, the maximum power flux density can be four times that predicted. He then qualified that by stating:

“The importance of reflections in affecting exposures to radio frequency radiation should not be overstated. Although levels may fluctuate markedly over relatively short distances, levels averaged over, say, a square area 30 centimetres by 30 centimetres would generally average out to be close to the level estimated from calculations. One difference between [the old standard...] and AS/NZS 2772.1 (Int.): 1998 is that the latter expressly permits such averaging ... in order to determine a power flux density which is more closely related to possible health effects than a simple point measurement ...”.

30. Mr Gledhill stated in his rebuttal evidence that at worst reflections in the vicinity of the adjacent Department of Social Welfare building might cause the power flux density in “isolated fist size spots” to reach $33 \mu\text{W}/\text{cm}^2$. However that did not affect his conclusion that if averaged in the way required by the ANZ Standard, maximum exposures in accessible areas around the site (for example the school grounds) would still only reach about $1.4 \mu\text{W}/\text{cm}^2$ (0.7% of the non-occupational exposure limit in the ANZ Standard).

Overview of Health Effects

31. Next for Telecom we heard from Dr D R Black who is a specialist physician in occupational and environmental medicine. Within his general field of expertise he has a specific interest in the biological effects of EMR,



in particular non-ionising radiation. He is an independent consultant and is a Director of the New Zealand Institute of Occupational and Environmental Medicine, as well as Senior Lecturer in Occupational Medicine in the Department of Medicine at Auckland University.

32. Dr Black stated that most RF standards, including those used in Australasia are based on those recommended by what is now called the International Commission for Non-ionising Radiation Protection ("ICNIRP").¹⁶ ICNIRP has recently published a new standard for the whole spectrum of non-ionising electromagnetic fields below 300 GHz. That standard was published¹⁷ during the course of the hearing and Dr Black produced a copy to us.
33. The ICNIRP standard is based on a specific absorption rate ("SAR")¹⁸ of 0.08 watts per kilogram at VHF and above. However, it also allows for higher power flux densities at 900 MHz¹⁹ which makes the current ANZ Standard conservative by comparison. The ICNIRP standard has changed because it is now understood that human absorption of RFR falls off above 400 MHz which means that higher power flux density would be required to produce an equivalent SAR.
34. Dr Black stated that both the ICNIRP and ANZ Standards use the demonstrable and repeatable thermal effects of RFR to determine a definable threshold, which is a rise in cool temperature of 1° centigrade in a

¹⁶ This is the body that has replaced the International Radiation Protection Association ("IRPA") referred to in *McIntyre v Christchurch City* [1996] NZRMA 289.

¹⁷ Health Physics 88 Volume 74 No.4 (p.494) - called "the ICNIRP Guidelines".

¹⁸ This is the rate at which energy is absorbed in body tissues. It is a dosimetric measure that has been widely adopted for use at frequencies where absorption produces the most significant biological effects. It is measured in watts per kilogram.

¹⁹ It will be recalled that the proposed cellsite is to operate at 870-890 MHz



live animal. The ANZ Standard is defined at a $1/50^{\text{th}}$ of this threshold. That basic restriction provides for a factor much greater than is required to eliminate the possibility of any thermal effects. Further, because the ANZ Standard does not allow for the established fall and absorption of power at higher frequencies the ANZ Standard becomes almost $2\frac{1}{2}$ times lower than the internationally accepted and already conservative ICNIRP standard at cellphone frequencies.

35. Turning to the issue of adverse health effects from exposure to RFR Dr Black referred us to the ICNIRP Guidelines²⁰ which state:

“The main objective for this publication is to establish guidelines for limiting EMF exposure that will provide protection against known adverse health effects.”

He relied on these to show that the ANZ Standard and Telecom’s proposal are consistent with the science generally accepted throughout the international scientific community.

36. Dr Black stated that he was familiar from his professional experience with the range of health concerns about RFR often raised by people. He said while he could understand why people are concerned about cancer from RFR there is really no cause for concern because non-ionising radiation (which is what RFR is) does not cause cancer. Ionising radiation can cause cancer as it has sufficiently high energy levels to emit particles (free radicals) which break organic chemical bonds causing mutagens which may initiate cancers.

²⁰ Health Physics 88 Volume 74 No. 4 Page 494.



37. In its efforts to show that any potential effects from RFR on human beings are very improbable Telecom called two further scientific witnesses who gave complex evidence of considerable length.

Epidemiological Evidence

38. The epidemiologist called by Telecom was Dr J M Elwood. His primary appointment at present is as Professorial Research Fellow in cancer epidemiology within the Dunedin School of Medicine at the University of Otago. He has an impressive list of academic and professional qualifications. In addition to being an expert on aspects of cancer epidemiology he is also a specialist in the medical assessment of epidemiological evidence. He has published two books on that subject.²¹

Through reviewing published studies he assessed the association between exposure to RF emissions and:

- cancers;
- reproductive outcomes;
- sleep disturbances; and
- psychomotor deaths in children.

39. In relation to cancer he first referred to three “cluster” studies (where the number of cases of an uncommon disease are greater than average) but pointed out that these can have no causal implications since clusters occur by chance.²² At most he considered that a cluster study can raise an hypothesis worth checking.

²¹ Elwood J M 1988: *Causal Relationships in Medicine*: (Oxford University Press) and Elwood J M 1997: *Critical Appraisal of Epidemiological Studies in Clinical Trials*: (Oxford University Press).

²² A cluster is like throwing a dice 3 times and coming up with three 6's.



40. Then he considered four recent studies looking at the incidence of cancer in general populations exposed to television, radio and similar RF emissions.

These were:

- (a) a study at Sutton Coldfield in England [Dolk (1997a)]²³
- (b) a study of 20 other transmitters in the UK [Dolk (1997b)]²⁴
- (c) a study in north Sydney, NSW [Hocking (1996)]²⁵
- (d) a study in San Francisco, USA [(Selvin (1992)]²⁶

41. The Sutton Coldfield study [Dolk (1997a)] showed (amongst other things) that for all childhood cancer there were less cancers than expected but there were more leukaemia cases than expected. Neither of those results was statistically significant, i.e. the results were compatible with no association between cancer (or the lack of it) and RF radiation.

42. Dr Elwood described the Dolk (1997b) study as "*the most comprehensive such study we have*" but concluded that its results were equivocal. He quoted the authors of it as stating:

"If there were a true association with radio transmission, the lack of replication of the pattern and magnitude of excesses near Sutton Coldfield may indicate that a simple radial decline exposure model is not sufficient."

²³ J Dolk *et al.* (1997) "Cancer Incidence near radio and television transmitters in Great Britain 1: Sutton Coldfield Transmitter" *Am J Epidemiol.* 145; 1-9 [called "Dolk (1997a)"]

²⁴ Dolk (1997) "Cancer Incidence near radio and television transmitters in Great Britain 2: All high power transmitters" *Am.J. Epidemiol.* 10-19 [called "Dolk (1997b)"]

²⁵ B Hocking *et al.* (1996) "Cancer Incidence and mortality and proximity to TV Towers" *Med. J. Aust.* 165: 601-605 (called "Hocking 1996")

²⁶ S Selvin *et al.* (1997) "Distance and Risk Measures for the Analysis of Spatial Data: A study of Childhood Cancers" *Soc. Sci. Med* 34: 769-777 [called "Selvin (1992)"]



43. Hocking 1996 gave equivocal results for adult leukaemia, negative results for brain cancer in adults and children, but a positive result for leukaemia in children. Dr Elwood saw this as "*substantially different*" from the result in Dolk 1997b. He also pointed out the authors' own comment:

"confounding variables affecting individuals cannot be adjusted for"
and their conclusion:

*"more detailed studies ... are required to replicate any association and to look for dose-response relationships before any conclusions can be drawn."*²⁷

44. The Selvin (1992) study was of childhood leukaemias in San Francisco and gave negative results. We observe that if positive studies are seen as evidence that RFR causes cancer, then such negative studies as described in Selvin (1992) can, by the same logic, be seen as showing that exposure to RFR is beneficial in preventing childhood leukaemia. In fact, neither is true. At most a positive study can show an association.
45. Dr Elwood's conclusions were that the epidemiological evidence does not support a reasonable conclusion that exposure to RFR is a likely cause of human cancer. He considered that the evidence was weak because it is inconsistent; the design of the various studies is not strong; there is a lack of detail in the studies on actual exposures; the studies are limited in their ability to deal with other likely relevant factors; and in some studies there may be biases in the data used.
46. Similarly, he considered that in relation to reproductive outcomes there is no increased risk of either spontaneous abortions or congenital malformations in association with the use of RF emitting equipment. As for

²⁷ Hocking (1997) at pp. 604 and 605



sleep disturbances he considered that a study at Schwartzenburg in Switzerland (“the Schwartzenburg study”)²⁸ was important and indicated the need for other studies of this nature, but did not demonstrate a causal link between radio frequency and sleep disorders. In relation to the evidence based on the study of the Skrunda station air defence radar transmitter in Latvia²⁹ (called “the Skrunda Study”), he concluded that the limited data made it impossible to conclude that the differences were due to any effect of RF emissions rather than other reasons.

47. Dr Elwood then assessed the link between other possible causes and childhood leukaemia. He referred to a recently published study³⁰ of 22,458 children who had died of leukaemia or other types of cancer in England, Wales and Scotland between 1953 and 1980. The result showed relative excesses of leukaemias and other cancers close to 5 different types of industrial sites which could be considered as having a potential environmental hazard. These sites were:

- oil refineries and oil storage facilities;
- factories making or repairing motor cars or car bodies;
- industrial processes using petroleum products, solvents, paints, plastics and so on;
- users of kilns and furnaces, such as steel works, power stations, cement makers, brick works, crematoria, and foundries;
- airfields, railways, motorways and harbours.

²⁸ Altpeter et al. “Study on Health Effects of the Shortwave Transmitter Station at Schwartzenburg” University of Bern, BEW Publication Series No. 55, 1995.

²⁹ Kolodynski AA et al. (1996) “Motor and Psychological Functions of School Children Living in the area of the Skrunda Radio Location Station in Latvia” Sc. Total Environ. 180: 87-93

³⁰ Knox and Gilman 1977: Hazard Proximities of Childhood Cancers in Great Britain from 1953 to 1980. Journal of Epidemiology and Community Health, 51 (151-159) [called “Knox (1997)”]



48. The authors of the study concluded that the most likely hazards were in relationship to chemicals derived from petroleum, or smoke gases and effluent from kilns, furnaces and internal combustion engines. Dr Elwood then stated:

“Television transmitters were included in a list of facilities for which negative results were obtained; that is, there was no significant concentration of cancer deaths near such transmitters.

My purpose in presenting this evidence is to demonstrate that it is a very complex process to assess a single postulated causal factor, such as radio frequency radiation, in connection to a single disease. Simply listing any association which has been seen in an epidemiological study leads to a large number of varied results. ... The relevant and crucial question in regard to radiofrequency emissions and serious health effects (such as cancer), is not whether there is any evidence which suggests a hazard, but whether the total available evidence suggests a potential hazard. There are results which are consistent with the potential hazard. But there are also limitations to these results, and considerable results which argue against a hazard” (Our underlining).

Biological Evidence

49. Next we heard from Dr M L Meltz, Professor of Radiology at the University of Texas, Health Science Centre at San Antonio. He is an ionising and non-ionising radiation biologist of extensive academic and professional experience. For the last 28 years he has researched and studied the biological and health effects of ionising radiation, ultraviolet light, anti-cancer, chemo-therapeutic agents and chemical mutagens and carcinogens using in-vitro mammalian cell culture systems. He stated:



"Not only very few citizens, but also very few educators, elected officials, business people, and even other scientists know just how much effort has been put into exploring this RF safety issue around the world. I personally am aware, through my voluntary literature review activities, of over 1,000 peer reviewed articles dealing with the biological and health effects of radio frequency radiation. There are many more review articles, letters, book chapters, and technical reports dealing with this subject."

50. In his evidence he first:

- (1) presented a number of studies which showed an absence of those biological effects which, had they occurred after RF exposure, would have been closer to signalling a possible adverse health effect;
- (2) considered studies demonstrating the absence of RF induced toxicity (when excessive heating does not occur);
- (3) stated the evidence demonstrating the absence of RF induced mutagenic activity; and
- (4) stated the evidence demonstrating the absence of carcinogenic activity.

51. Then he commented on articles in the literature which are *"frequently cited to support the idea of an adverse effect of RF exposure."* His conclusion on those is that there are serious flaws or technical deficiencies in approach or inconsistencies in their results or over-extension of their interpretation and they cannot be relied on for decision making.

52. His overall conclusions were that:

"... from the available literature, and from my own extensive efforts to demonstrate that RF exposures are hazardous, -



- *that RF exposures which occur below the New Zealand standard are of no danger to individual health and public health;*
- *that the same conclusion stands for the higher levels specified for controlled environments;*
- *that the accepted, repeatable and credible evidence indicates that without the heating associated with high level exposures, no biological effect has been confirmed as indicating even a potential adverse health effect."*

Other Evidence

53. We also heard from Dr K D Zelas, a specialist psychiatrist with extensive qualifications in the field of child abuse. She is an experienced witness in New Zealand Courts. The effect of her evidence was:

- (a) that the risk of adverse health effects from the cellsite is nil;
- (b) that as a consequence of their psychological dependency the children at the school may respond with anxiety to things which adults worry about;
- (c) parents and teachers have a responsibility not to arouse unwarranted anxiety in children causing them unnecessary distress;
- (d) if children suffer psychological ill effects, which is likely, that would be a reflection of the response of the principal, teachers and parents to the cellsite. That is, fear would be generated in the children by the adults around them through emotional messages, instruction and information; and
- (e) that it would be inappropriate to decline consent on the basis of a risk to psychological health since that is preventable.



54. Another witness for Telecom was Mr D S Fougere who is the Managing Director of Phoenix Research Limited, an organisation that conducts surveys in the field of marketing and social research. Mr Fougere's responsibilities, in addition to being the Director, are to design and manage research studies and surveys. He holds a Bachelor of Science in mathematics and statistics and a Bachelor of Arts (honours) in psychology. Mr Fougere was called to give his expert opinion on the survey evidence advanced by Drs Brown and Staite for SPS.
55. On visual effects we heard from Mr D J Miskell, a landscape architect who is well known to the Court. He pointed out that the site is on a rear section and the base of the mast is not visible from the street. It was important to him that there were no close residential properties with outdoor living areas in the quadrants to the east, south and west of the proposed site where the mast could dominate views from outdoor living areas. He considered the proposal was well sited from a visual viewpoint. He described the site as being within a visually mixed environment: it has light industrial businesses such as the engineering and joinery workshops, and it also has a commercial character in the form of the shop, car yard and service station. Similarly, the proposed city plan envisages a predominantly industrial character for the site as part of the Business 4 (Suburban Industrial) zone. He considered that the mast would not change the overall character or affect the aesthetic coherence of the area. He also observed and we think there is some truth in this:

"There is nothing wrong with the structure itself, it is the activity that people have a problem with."

56. The final scientist for Telecom was Ms I L Stout who is an environmental health officer for the Council. In that capacity she gave a report to the



Council for its hearing. However because she could not support the condition imposed by the Council which is the subject of the appeal by Telecom (RMA 429/97) she was not called by the Council but, as we have said, by Telecom. Ms Stout was a careful and objective witness. We do not summarise her evidence here not because we found it unconvincing, but because it largely made the same statements of fact that the earlier Telecom witnesses had made in more detail.

57. The most useful part of Ms Stout's evidence was her production of a report to the Ministry of Health dated August 1996 ("the Woodward report")³¹. That report was reviewed by four people including two witnesses in this case, Dr Elwood and Dr Hocking. A third reviewer was Dr Repacholi who gave evidence in *McIntyre* and whose papers were referred to in this case on a number of occasions. We found the Woodward report useful and will refer to it again later.
58. The resource management consultant called by Telecom was Mr D McMahon who has 13 years experience. He concluded that the effects of the proposal were minor, and that it is compatible with the objectives and policies of the relevant statutory instruments.

³¹ A. Woodward, M. Bates, M. Hutt "*Literature View on the Health Effects of Radiofrequency Radiation*".



Chapter 3 : The case for Christchurch City Council

59. The case for the Council was in two parts: first that Telecom should be granted its consent (thus confirming the Council decision at first instance); and secondly that the condition 4 imposing a power flux density of $6 \mu\text{W}/\text{cm}^2$ at the site boundary (30 metres from the mast) was appropriate.

60. As to the first point the Council adopted all of Telecom's evidence. It was Mr Hughes-Johnson's submission for the Council that the SPS's evidence did not meet the basic threshold of reliability for evidence as defined in *McIntyre*. He submitted that the lynchpin in this case is the guideline in the ANZ Standard. He said that shows that a body of evidence had been assimilated and that people of standing in the scientific community had reached certain conclusions. In essence he argued that there are no adverse health effects but submitted that if there are then the Court should consider the following three matters in assessing that:

- the precautionary approach;
- the application of section 3(f);
- whether there was room for a policy of "*prudent avoidance*".

61. As to the second part of the case, namely that the $6 \mu\text{W}/\text{cm}^2$ in condition 4 was appropriate, he submitted that:

- (a) the condition is consistent with the ANZ Standard which imposes a limit of $200 \mu\text{W}/\text{cm}^2$ for non-occupational exposure to RFR. One has to read the standard as a whole and that clearly the $200 \mu\text{W}/\text{cm}^2$ limit is a maximum.



- (b) There is no practical problem for Telecom since its evidence was that it could meet the condition imposed by the Council.
- (c) The only potential downside is bringing the ANZ Standard into disrepute. But, he submitted, the Court can accurately give reasons for its decision so that does not happen.

62. Finally Mr Hughes-Johnson conceded that the Council has adopted a new mode of conditions which do not include a condition like condition 4 in this case. An example is the *Telecom* decision³² but he submitted that should not be followed here.
63. The only witness called for the Council was Mr D Douglas, a resource management planner. He covered the provisions of the transitional plan and the proposed City Plan. On the question of effects he pointed out that there were positive effects from the cellsite in terms of improved coverage to cellphone users in the Shirley/Richmond area. As far as health effects were concerned he conceded that he was not a health expert and his position relied on the evidence of other witnesses. He conceded that there might be psychological effects on the submitters if the cellsite is constructed and used and that there might be consequential financial effects for the school. As far as visual effects were concerned he was satisfied that because the cellsite adjoins the commercial/business zone the effects can be successfully mitigated by the light blueish grey colour of the mast and the proposed tree planting. We will deal with his discussion of the objectives and policies of the plans and plan weighting to the extent necessary when we come to consider relevant matters under section 104. As far as the contentious condition was concerned he was unable to recommend an appropriate condition on RFR levels.

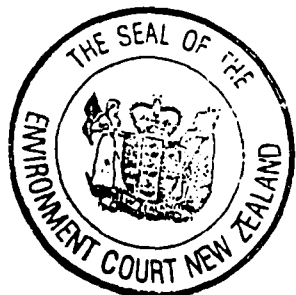


³² W165/96

Chapter 4: The Case for the Shirley Primary School

64. The school's primary position was that consent should be refused to Telecom. As a fallback position, if consent was to be granted then it should be on condition that the power flux density of RFR at the common boundary of the site and the school should not exceed $1 \mu\text{W}/\text{cm}^2$, that is even less than the $6 \mu\text{W}/\text{cm}^2$ limit imposed by the Council's condition 4.
65. It was the school's contention that young children are particularly sensitive to RF discharge. Mr Hearn, counsel for the school, submitted that the evidence demonstrated this and that the proposition was accepted in *McIntyre*³³.
66. Mr Hearn also submitted that because there will be adverse effects on the environment which are more than minor then consideration should be given to alternative sites as required in the Assessment of Environmental Effects by the Fourth Schedule to the Act. He relied on the evidence from Mr Gledhill (the witness called by Telecom) that it was possible to achieve the required telephone coverage by use of micro-sites, and then submitted it is only cost considerations which are stopping Telecom from using that method.
67. Mr Hearn said that a policy of "prudent avoidance" and the "precautionary principle" both suggested consent should not be granted. He submitted that the whole of the *Woodward Report* demonstrates the validity of the reasonable concerns of the school.

³³ [1996] NZRMA 289 at 315



Epidemiological evidence

68. The epidemiologist called by the school was Dr B Hocking. He is a medical consultant in occupational medicine in Australia. He holds postgraduate qualifications in occupational medicine, public health, general practice and radiation protection. He was a chief medical officer of Telstra for 18 years during which time he gained knowledge and experience regarding health effects of RF radiation. He has published many papers relevant to occupational and public health, including several on the subject of health effects of RF radiation. He (like Dr Black and another witness Dr Beale) is a member of the Australia and New Zealand Standards Committee TE/7.1 which sets the RFR safety standard - currently the ANZ Standard. His evidence discussed two relevant areas: the effects of RFR in causing cancer and the effects on learning.

69. He was particularly interesting on the former subject since he was the lead author of the Sydney study (Hocking 1996) of cancer in proximity to TV towers in Sydney. That paper describes an ecological study in which cancer incidence and mortality rates are compared between an inner ring of 3 municipalities which immediately surround the three TV towers in Sydney and the next ring outside those of 6 municipalities. The design of the study was on the basis that the TV signal exposure is stronger near the towers and weakens over distance (as an inverse square). The exposure was not measured but calculated to be $8 \mu\text{W}/\text{cm}^2$ at the centre of the towers, $0.2 \mu\text{W}/\text{cm}^2$ at 4 kilometres radius from the centre of the towers, which roughly encloses the inner ring of municipalities and $0.02 \mu\text{W}/\text{cm}^2$ at 12 kilometres distance which is the outer ring limit. The study found an increased risk for childhood leukaemia incidence of 58%, and for mortality an increased risk of 132% in the inner ring compared to the outer ring. Lung cancer risk was not increased. The authors concluded that there is an association between



proximity to the TV towers and increased risk of childhood leukaemia incidence and mortality.

70. In his evidence, Dr Hocking carefully noted that the study did not prove that RFR was causal and hence harmful, but he pointed out that it was equally true that the study did not show that RFR at low levels for long periods was harmless. He acknowledged that the study had limitations regarding confounders and exposures. For example there may be other possible causes of leukaemia that were not adjusted for: x-radiation and car exhausts are possibilities.
71. He then pointed out that there are only two other studies, in his opinion which have looked at long term exposure of civilian populations to RFR. The first of these was based on unpublished material from the Honolulu Health Department³⁴. However, the number of cases in that study was so small as to give no significant results.
72. More significantly, there are the two reports by Dolk *et al.*³⁵. Dr Dolk and her team first examined the cluster of leukaemia and lymphoma cases near the Sutton Coldfield (in England) UHF TV transmitter and VHF FM radio transmitter. Their research concerned an excess risk of adult leukaemia. They then examined in their second paper another 20 sites in the UK which also transmitted either UHF TV and/or powerful VHF FM radio. Overall, they did not find the excess noted at Sutton Coldfield and instead found only a slight increase in risk of adult leukaemia and no excess of childhood leukaemia.

³⁴ Goldsmith "Epidemiological evidence of radio frequency radiation effects on health in arbitrary broadcasting and occupational studies" *Int. J. Occup. Environ. Health.* 1995:1:47-57

³⁵ *American Journal of Epidemiology* 1997 Volume 145, 1-9 and 100-117



73. In summary, Dr Hocking felt that there was a paucity of epidemiological studies on which to make firmer statements regarding RFR exposures over the long term being harmful or harmless. He conceded that the wavelengths intended for use in the cellsite near the school are about 30cm (950 MHz) which is shorter than TV frequencies and may become even shorter if the mobile phone band changes to 1800 MHz. That may be significant because maximum human absorption of RF waves occur at the longer wavelengths (i.e. 10 MHz to 400 MHz). But he pointed out that it needs to be borne in mind *"that the whole safety standard is set on the basis of avoidance of thermal effects If one part of the spectrum is found to be unsafe then the whole standard is in doubt."*
74. He then turned to effects on learning. He regarded the possible effects of RFR on psychological (mental) processes as being particularly relevant to the school and we agree with him about that. He also referred to the Skrunda study. The station was used as an early warning radar station by troops from the former USSR in Latvia for 25 years. It operated at frequencies of 154-162 MHz. The average power at 3.7 km was 3.2 mW/cm^2 . This equates to an exposure of $0.3 \text{ } \mu\text{W/cm}^2$. The authors studied 609 pupils from the Skrunda Valley, some of whom lived in front of the radar and some behind, and compared them with 357 students from a similar rural area without exposure (the control group). They conducted tests of motor function (tapping, reaction time) attention (seeking numbers in a puzzle), and memory (remembering number sequences). They found Skrunda children who lived in front of the radar had less developed memory and attention, and their reaction times were slower than other children who lived in the Skrunda Valley, and in turn these children did not perform as well as the control group.



75. He considered the Schwartzenburg study was also of relevance to neural effects from long term low level RFR exposure. The researchers there studied concerns arising about ill health, especially sleep disturbances in the Swiss valley of Schwartzenberg. Dr Hocking's description of the study was as follows:

"In the first phase of the study residents with different levels of exposure were randomly surveyed by keeping a diary over 10 days and a relationship to the transmitter (decreasing by distance) was established, particularly for sleep disturbances. Other complaints such as nervousness were thought to be secondary to loss of sleep."

Dr Hocking stated that the importance of this report was that it described a situation in which RFR exposure was unknowingly (to the exposed parties) stopped and a response (better sleep) occurred. He regarded that result as strongly suggestive of:

"a causal effect on neural processes at low levels of RFR exposure."

76. Dr Hocking observed that while the ANZ Standard gives a table for values of maximum exposure limits for the general public (e.g. setting non-occupational exposure levels in the mobile phone frequency band at $200\mu\text{W}/\text{cm}^2$) those values should not be construed as an absolute standard. The ANZ Standard cautions:

".... exposure to workers and the public should be kept to the lowest levels that can be achieved consistent with best international contemporary practice and cost-effective achievement of service objectives"



and then states:

"SUBJECT TO THE CONDITIONS OUTLINED ABOVE EXPOSURES SHALL BE KEPT TO A MINIMUM".³⁶

77. Dr Hocking concluded by saying that he did not regard the absence of proof as to the mechanism of how low level RFR exposure could harm people, as being a bar to accepting the epidemiological studies he referred to. He pointed out that the case for smoking causing cancer had been demonstrated epidemiologically for decades before "*proven molecular mechanisms*" were discovered. He acknowledged that the literature regarding RFR and cancer or learning effects is sparse, but said that it is not possible to state that RFR is either "*harmful*" or "*harmless*".

Biological Evidence

78. At the level of biological mechanisms we heard for the school from Dr S F Cleary who is Professor of Physiology and Biophysics at the Medical College of Virginia in Richmond, Virginia USA. Amongst his credentials he holds a Doctorate of Philosophy in Biophysics from New York University. He has taught graduate level courses in biophysics, radiological health and biological effects of non-ionising radiation. He has supervised research on the effects of RF and microwave radiation on mammalian and cell systems for over 30 years.
79. Dr Cleary pointed out that until recently all the effects on living systems of exposure to RF or microwave radiation were attributed to radiation induced tissue heating. However, recent studies show in his opinion that there can

³⁶ ANZ Standard page 9 and para 9(d). The capitals are in the original.



be harmful changes under nonthermal conditions. He said that the results of such studies had been recently described in ICNIRP papers.³⁷

80. He stated:

“The overwhelming majority of studies conducted to date have involved acute (i.e. durations of a few hours or less) high intensity microwave exposure of a few mammalian species to a very limited number of microwave frequencies ... However, the few animal studies that have reported the effects of long-term low intensity microwave exposure provide evidence of deleterious nonthermally-induced alterations.”

It is of interest that he did not qualify that last statement. We infer that in Dr Cleary's opinion all of the (few) animal studies provide evidence of adverse effects.

81. Dr Cleary referred to studies by Szmigielski³⁸ and Szudzinski³⁹ on the potential tumour promoting effect of microwave exposure. Mice were exposed for 2 hours each day for a period of between 3 to 6 months to 2,450 MHz microwave radiation at power densities from 5 to 15 mW/cm². The exposure suggested a tumour-promoting effect. Other evidence along the same lines in experimental animals was reported by Chou *et al.*⁴⁰. In all those studies the microwave exposures were well below the levels that cause tissue heating.

³⁷ *Non-thermal Effects of RF Electromagnetic Fields* (ICNIRP 3/97).

³⁸ Szmigielski, S *et al.* (1982) *Bioelectromagnetics* 3, 179-188; Szmigielski, S *et al.* (1988) *Modern Bioelectricity* Murino, A Ed; Marcel Dekker: New York, N Y 861-925

³⁹ Szudzinski, A *et al.* (1982) *Dermatol Res* 274, 303-311

⁴⁰ Chou, C K *et al.* (1992) *Bioelectromagnetics* 13, 460-496



82. A more recent study referred to by Dr Cleary which has some importance in this case is by Repacholi (1997). In that study mice were exposed to 900 MHz pulse modulated radiation for 30 minutes twice a day for a maximum of 18 months. Dr Cleary stated:

"There was a highly statistically significant doubling of lymphoma incidence in mice exposed to specific absorption rates (SAR's) in the range of 0.008 W/kg to 4.2 W/kg."

83. Dr Cleary noted that:

"The microwave exposure intensities used in the animal experiments discussed above are most probably higher than anticipated from cellsite radiation emissions"

He did not say if that affected the significance of the results.

84. Dr Cleary then moved from *in vivo* experiments to some *in vitro* studies. He said he had reviewed these in detail in his article "*Electromagnetic Fields: Biological Interactions and Mechanisms*"⁴¹. He said that studies carried out under highly precise temperature control - thus ruling out heating as a causative factor in cell alterations -

"provide unambiguous scientific proof that RF and microwave radiation can induce nonthermal changes in cell physiological functions, including most significantly the rate of cell division or proliferation and neoplastic transformation."

⁴¹ Cleary, S F (1995) Blank, M.(Ed): American Chemical Society; Washington DC, 467-477.



85. Finally he referred to five articles of which he is the co-author⁴² and concluded by stating:

“Firstly, an insufficient number of studies have been conducted to determine threshold field intensities for the induction of effects such as altered cell proliferation. Cell studies have involved acute or short term exposures. Secondly, the principle of dose-reciprocity, a central tenet in cell radiation biology, states that the probability that a radiation induced alteration will occur in a living system is proportional to the product of the exposure intensity and the exposure duration. Therefore cellular effects discussed above would be expected to occur at lower and lower intensities as the duration of exposure is increased. Pending the determination of thresholds for cellular alterations, as well as thresholds for effects on experimental animals, safe microwave exposure limits for humans cannot be defined.”

86. For the school we also heard evidence from Dr I Beale, Associate Professor in Experimental Psychology at the University of Auckland. He holds a doctorate of Philosophy and has had 25 years research and teaching experience in behaviour and experimental neuropsychology. Dr Beale represents the public interest on the joint New Zealand/Australia Standards Committee TE/7 which is revising the standards and recently published the ANZ Standard. His opinion was that the operation of the cellsite could cause adverse health effects in people spending significant amounts of time on the ground and in buildings within 30 metres of the installation.

⁴² Cleary *et al.* (1990a) *Radiation Res*; 121, 38-45
 Cleary *et al.* (1990b) *Bioelectromagnetics*, 11, 47-56
 Cleary *et al.* (1992) *Annals of the NY Acad. Sci.*, 649, 166-175
 Cao *et al.* (1995) *Bioelectrochem. Bioenerg*, 37, 131-137
 Cleary *et al.* (1996a) *Bioelectrochem. Bioenerg*, 39, 167-173



87. Dr Beale referred to the same animal studies mentioned by earlier witnesses and referred to the same epidemiological studies. In addition to his evidence on the direct effects of radiation exposure Dr Beale referred to the psychological evidence on the adverse effects of unacceptable risk. On this he stated:

"Between 'scientific conservatism' and 'play it safe' lies a continuum representing a shifting of the balance between risks and benefits that accrue from the activity that causes the exposure.... The 'play it safe' school points out that, if scientific conservatism prevails, the possible risks are all borne by the public, whereas the economic benefits all go to the industry. This unequal distribution of risks and benefits is just one of a number of so-called 'outrage factors' that colour the public's view of risk from radiofrequency radiation exposure. Other factors include the involuntariness of exposure, the perceived unnaturalness of the activity, the newness of the technology, the invisibility of exposure, and the delayed appearance of adverse effects. Risks that involve these factors are called 'dread' risks, and people generally regard these risks as unacceptable even if they are unproven."

Surveys

88. Dr J Brown, a Lecturer in Statistics at the University of Canterbury gave evidence as to a survey she had carried out of caregivers for children currently enrolled at the school. The purpose of the survey was to determine whether caregivers would consider removing their children from the school should the cellsite be constructed. She said that a summary of the responses of the survey, in answer to a question to that effect, was that:



"The majority 83% (\pm 9%) of the respondents said they would remove their children from the school should a Telecom cellphone tower be erected."

The second question in the survey was:

"Does the strength of the signal to be transmitted by the proposed tower make a difference to your decision to remove, or not remove, your child/children from the school?"

Her final question was whether there were any more comments. The answers ranged from expressing concern: for the safety of their children; over what would become of the school and community; about family stress; and through to fully supporting the cellsite.

89. Dr A Staite, a psychologist who specialises in resource management and environmental issues, was called by the school to give evidence. Dr Staite informed us that the brief he received from the school's solicitor was to :
- (a) assess the social, psychological or human effects of having a cell phone tower in the Shirley Primary School Community;
 - (b) assess and document positive and negative effects (if any);
 - (c) assess people's beliefs, perceptions and emotional states in respect of the cell phone tower proposal; and
 - (d) identify and recommend measures which could be taken to reduce adverse effects (if any are identified) on the local community.
90. Dr Staite then went on and gave a literature review on how people judge risk. He identified two separate types of risk; "perceived risk", also called "subjective fear of potential negative effects", and "actual risk" which is



also referred to as “proven negative or positive effects” and relates to potential adverse effects of high probability.

91. He mentioned a study where Skolbekken (1995)⁴³ during a literature review found that there has been an increase in the use of the term “risk”. Skolbekken hypothesised that this ongoing trend (a “risk epidemic”) results from developments in science and technology that have changed professional beliefs about the locus of control.
92. After considering the literature on perceived risk, Dr Staite was of the view that while people’s emotions and perceptions should be taken into account in consideration of the cellphone tower, the community’s fears and anxieties should not form the sole basis for determining the actual risk of the tower. To do so may “export” modern technology due to the NIMBY (“not in my backyard”) syndrome.
93. He looked at a study by Walker (1995)⁴⁴ where it was found that members of the public are likely to adopt a subjective interpretation when estimating their personal risks. This may result in the community “*misunderstanding or significantly discount(ing) the relevance of (objective) risk assessment conclusions*”(ibid) by either being unrealistically positive (“unrealistic optimism phenomenon”) or unrealistically negative (“unrealistic pessimism phenomenon”). The first phenomenon is where people estimate their personal risk as lower than the risk estimations made by most other people. The second phenomenon is the opposite, in the face of minimal actual hazard or risk, people make subjective estimations that their personal risk will be significantly greater than that of other people. Studies have found

⁴³ Skolbekken, J. “The risk epidemic in medical journals.” *Social Science and Medicine*, 1995 (Feb), Vol 40(3), 291-305.

⁴⁴ Walker, VR (1995) “Direct inference, probability, and a conceptual gulf in risk communication”. *Risk Analysis*, 1995 (Oct), vol 15(5), 603-609



that gender⁴⁵, sex and age⁴⁶ can play a part in how people perceive their level of risk or vulnerability.

94. Dr Staite spoke of another matter that may contribute to people attributing high risk to something, the “contagion phenomenon”. This refers to the impact of people’s risk perception of one place (or thing) upon their perception of another place (or thing). He was of the view that there is likely to be both positive and negative cumulative effects (“contagion”) resulting from people’s perceptions of cell towers at other sites.
95. He also expressed the importance of public consultation in the form of “risk communication” and “risk compensating effects” in respect to influencing risk assessment. He regarded the process of communicating “objective risk assessment conclusions” (the data we have about actual proven negative and positive effects and impacts accruing from having a cellphone tower in an urban community) as vital to mitigation of risk. Dr Staite was of the view that communities need to be a part of the democratic process through community consultation, and not dictated to.
96. The largest section of Dr Staite’s evidence concerned a study that he had undertaken of the school. It involved a qualitative research method, requiring interviewees (pupils, parents and grandparents) to answer two different types of specific questions; investigative questions (designed to elicit descriptive and objective factual information) and evaluative questions (in interview format to tap the qualitative aspects of the beliefs, perceptions and emotional states of the interviewees). An example from his study of an

⁴⁵ Greenberg MR, and Schneider, DF (1995) “Gender differences in risk perception: effects differ in stressed vs non stressed environments”. *Risk Analysis*, 1995 (Aug), vol 15(4), 503-511

⁴⁶ Reichard, D and McGarrity, J (1994) “Early adolescents’ perceptions of relative risk from 10 societal and environmental hazards”. *Journal of Environmental Education* 1994 (Fall), vol 26(1), 16-23.



investigative question is: *What would be the social consequences of the cell tower going up even if there are no adverse physical effects?* An example of one of his evaluative questions is: *Rate the value of ... health risks to adults, pupils, through cell tower electro-radiation.*

97. Dr Staite's conclusions were:

- (1) The cell tower proposal has given rise to present social effects in the form of a "stressed environment or community". There is at present high anxiety at the school which will be having an adverse effect on people's functioning. A future social effect will be a weakening in social cohesiveness.
- (2) There are strongly held perceptions that the research on EMR is ambivalent, ambiguous and uncertain. People attribute high potential risk to EMR.
- (3) There are indicators that future health effects (after the cell tower is erected) will be experienced in the form of 'environmental somatisation syndrome' (by which he meant some kind of psychosomatic effects). He said: "The belief is strong that EMR can potentially cause a range of adverse health effects".
- (4) Many interviewees are already making adaptations and future plans in respect to their lifestyles to cope with the "environmental stressor".
- (5) The effects identified are significant adverse effects on the human environment being the Shirley community, including staff, pupils, parents and grandparents of the school.



Other witnesses

98. The principal of the school together with some parents of children attending the school and some past and present teachers of the school gave evidence at the hearing. All these witnesses expressed their concern about the safety of cell towers. The common theme running through their evidence was that there is no evidence that cellsites are completely harmless. Most if not all of them stated that they had read a lot on the issue and were still not convinced that no harm would come from the cellsite.

99. Comments from parents about the risk from the proposed cell tower included:

“until there is absolutely clear evidence about the safety of cell towers, the wider community should be extremely cautious about any proposals to erect cell towers in close proximity to schools”. (Ms F Adank)

“I believe that the effects of the microwave emission from cell towers may not be known for many years yet. Normally, parents adopt an extra cautious approach where their children are concerned.” (Ms J Lawrence)

“... because Cellular phone technology is very new, I believe that there may still be questions about the safety of cell towers. ... I am not prepared to expose my children to the cell tower.” (Ms A Morris)

100. Ms T Harrold who had been a teacher at the school but who left at the end of 1997 gave evidence that she left the school because of the possibility of the cell tower being erected. The assistant principal, Ms R Martin, also



gave evidence that she was of the view that cell towers should not be sited next to a primary school because there is no evidence they are completely harmless. Mr B Porteous who has been principal of the school for 9 years gave evidence as to the amount of research he had done on the issue including consulting experts, reading articles, listening to the radio and watching television programmes. After all his research he said he does not accept there is conclusive evidence that RFR is harmless. He also said "*I have understood it to be accepted by all experts in the field that any risk of exposure is increased for the elderly and the young.*"

101. We also heard compelling evidence of the effect on the school if the tower was erected in terms of what would happen if children, volunteers and teachers left and the picture that was painted, effectively unopposed by Telecom, was a dismal one. If all the pupils and teachers and helpers leave as they said they would, it appears doubtful that the school could survive financially.

102. The last evidence for the school which we need to mention specifically is that of Ms D J Lucas, a landscape architect. It appeared to be common ground between her and Mr Miskell - the equivalent witness for Telecom - that no residences would have their view unduly imposed on by the cellsite's tower.

103. Ms Lucas stated that:

"For children, development of a positive relationship to outdoors and space is generally considered important for well-being as a person. Consideration should therefore be given that the sight of the tower could potentially affect their play and school activities. If there is a fear of it,



the structure in the visual landscape is highly likely to affect their experience of the landscape of that place” (Our underlining).

She concluded:

“Considering the aesthetic coherence of the tower structure in the proposed context, and the perception of the tower activity, the proposal is assessed as contrary to the requirement for the design elements of a utility to reference existing character and amenity values of a locality.

The presence of the proposed cell tower has the potential to have adverse landscape, visual and amenity effects of considerable significance to those who spend their time within the visual neighbourhood of the proposed structure.”



Chapter 5: Evidential Issues

Assessment of risk

104. A fundamental aspect of this case is how far Telecom has to prove RF radiation from cellsites is safe. At one extreme there was a suggestion from SPS, both in submissions and in evidence, that Telecom has to prove that there is no danger. For example, Mr T Nealey, a parent of a child at the school stated in his evidence:

"We should not allow cellphone towers to be erected close to schools until it is proven conclusively that the cellphone towers are 100% safe."

Other examples were given in Chapter 4.

105. We must explain immediately that we cannot guarantee there is no risk⁴⁷ from the cellsite. First that is because it is impossible to do so. Everybody lives with some risk every second of their lives. Parents must realise that their children are no exception to that. Children are exposed to significant health risks on their way to and from school, e.g. the risk of traffic accident, but also more insidiously from the lead and NO_x and CO emissions from vehicles.

106. Since life cannot be made completely safe for anybody, a no risk approach is (logically) impossible. There is also authority that the RMA is not a 'no risk' statute and therefore it is not the role of this Court to ensure that

⁴⁷ Risk was usefully defined in the Netherlands in terms that fit with the definition of "effect" in section 3 RMA as: "the combination of the probability of occurrence of an undesired event and the possible extent of the event's consequence" as quoted by Mr R Somerville QC in "Risk Assessments and High Dams ..." [IPENZ Proceedings (1998)p.4]



Telecom's cellsite can operate with absolute safety. In *Aquamarine Ltd v Southland Regional Council*⁴⁸ the Court stated of a 'no risk' regime that:

"We do not think this is compatible with the definition of sustainable management in section 5(2) of the Act."

An observation from high authority in another jurisdiction also bears out our approach. In *AFL-CIO v American Petroleum Institute*⁴⁹ the Chief Justice of the Supreme Court of the USA stated:

"Perfect safety is a chimera; regulation must not strangle human activity in the search for the impossible."

107. Of course as soon as we say we cannot be sure there is no risk from RF radiation from the cellsites the reaction is sure to be that that means there is a risk, and therefore children at the school should not be exposed to it. But it is extremely important to realise that the second part of that sentence does not follow from the first. The risk may be so very small it is acceptable, compared with other risks parents expose their children to daily, and that is what we are to assess.

Submissions of Counsel

108. A number of legal issues relating to evidence was raised by counsel. Some were argued as traditional legal issues as to evidence: the burden of proof and standard of proof, and whether the reliability of evidence goes to admissibility or weight. Other evidential issues related to the meaning of "effect" as defined (inclusively) in section 3 of the Act. Finally we heard

⁴⁸ Decision C126/97 at p.145

⁴⁹ (1980) 448 US 607 per Burger CJ



submissions as to what should be required of surveys of public opinion, and how we should assess expert evidence generally.

109. Counsel agreed that there was no burden of proof under the RMA - relying on *McIntyre*⁵⁰. As for the standard of proof, Mr Gould for Telecom, and Mr Hughes-Johnson for the Council said this was “*on the balance of probabilities having regard to the gravity of the question.*”⁵¹ Mr Hearn differed. He said trenchantly in respect of the standard:

“to address the issue as on the balance of probabilities is self-evident nonsense... .”

110. Turning to the issue of the admissibility versus the weight of evidence, and ostensibly opposing the view of Mr Hearn, counsel for Telecom argued that there should be no question of admissibility in respect to scientific hypotheses. Instead reliability goes to the weight they should be given. In fact we do not understand Mr Hearn to be arguing for such a threshold of admissibility. Rather he was arguing that section 3(f), when inserted into section 5(2)(c) and interpreted in the context of the single purpose of the Act, entailed that the applicant should:

“place before the Court persuasive evidence that there is no possibility of an effect ever coming into being which effect has the possibility of a high potential impact.”

In respect to admissibility Mr Hearn pointed out that under the RMA the Court is not bound by the rules of evidence and may “receive anything in

⁵⁰ *McIntyre* at 306

⁵¹ *McIntyre* at 307 also *Trans Power NZ v Rodney District Council* A85/94 and also *Leatch v National Parks and Wildlife Service and Shoalhaven City Council* (1993) 81 LGERA 270



evidence that it considers appropriate to receive"⁵². Also noted was the fact that in *McIntyre* none of the evidence was found inadmissible.

111. Mr Gould quoted from *McIntyre*:

*"We are confined to evidence probative of the fact, that meets a basic threshold of reliability, and is persuasive to us on the balance of probabilities having regard to the gravity of the question."*⁵³

Counsel submitted that this weighing approach is correct and the Court should measure the probative value of the evidence by assessing the value expressed by the scientific community. Mr Gould submitted that approaching the evidence as a weighing exercise would bring it on all fours with the principles expressed in various authorities in *McIntyre* and the United States Supreme Court decision of *General Electric Company et al. v Joiner et ux*⁵⁴. Before the Court can consider effects (including potential effects) and their significance in terms of s104 and Part II the Court must be satisfied as to the reliability and probative value of the evidence claiming that such effects exist. This is particularly so when the evidence is of an hypothesis for a potential effect.

112. Counsel further submitted that if Mr Hearn was correct in law on the contentions he made about s3(f) then in any event:

- (a) There is no evidence with any acceptable basis before the Court of any possibility of an effect ever coming into being, which effect has the possibility of a high potential impact; and



⁵² Section 276 RMA

⁵³ *McIntyre* p.314

⁵⁴ 118 S.Ct 512; 1997 US Lexis 7503.

(b) The evidence has not left room for reasonable doubt that any harm, or possibility of harm, will arise from RF emissions from the proposed cellsite.

113. While we do not agree with everything that Mr Hearn submitted he has made us reconsider the Environment Court approach to evaluation of evidence on resource consent applications - and especially its approach to the "standard of proof".

Purpose and Scheme of the Act

114. Going back to basic principles of statutory interpretation we consider that the purpose and scheme of the Act have implications for the burden and standard of proof and for the assessment of evidence generally. The purpose of the Act - sustainable management⁵⁵ - and Part II generally entail that the Act is forward-looking. It is preventative, precautionary and proactive. Various other provisions in the Act suggest how those probabilistic (because looking into the future) criteria should be considered and decided. These include pre-eminently:

- section 3 - the definition of "effect"
- Part V - the provisions for policy statements and plans
- Section 105(2)(b)⁵⁶
- Section 276

115. The purpose of the Act means that in every appeal about the grant of a resource consent there is only one ultimate question to be answered, that is,

⁵⁵ Section 5: generally and in particular the reference to "... the foreseeable needs of future generations".

⁵⁶ The threshold tests as we have to consider them in this case, that is, prior to the 1997 amendment to the RMA (the Resource Management Amendment Act 1997). But section 105(2A) in the amended Act does not appear to impose an entirely new approach to non-complying activities.



will the purpose of the Act be fulfilled? As stated in *Caltex NZ Ltd v Auckland City Council*⁵⁷ citing *North Shore City Council v Auckland Regional Council*⁵⁸:

“... the Act has a single purpose, and ... an overall broad judgment is needed, allowing for comparison of conflicting considerations, the scale or degree of them, and their relative significance or proportion in the final outcome.”

116. It is important to recognize that when deciding whether natural and physical resources will be sustainably managed, decision makers under the Act are usually⁵⁹ making decisions about future events. The decision-maker has:

- (a) under section 104(1):
- to decide what the primary facts⁶⁰ are; and
 - to evaluate those facts as propositions about the future ('risks' if adverse effects, 'chances' if beneficial) - usually those propositions are given as the opinions of experts⁶¹; and
- (b) to carry out a further evaluation when undertaking the weighing and balancing exercise required under section 105(1) to decide the ultimate question.

117. There is high authority for the proposition that evaluating future events is a matter of judgment not proof, and thus the standard of proof is not relevant.

⁵⁷ A95/97; 3 ELRNZ 297 at 304

⁵⁸ (1996) 2 ELRNZ 297

⁵⁹ Two exceptions are under Part XII of the Act: declarations as to existing uses, and prosecutions.

⁶⁰ And secondary (inferred) facts

⁶¹ These two steps come under section 104. In many cases step (b) is the first step if there is no dispute about primary facts.



In *Fernandez v Government of Singapore*⁶² Lord Diplock, in giving the opinion of the Privy Council, referred to ‘the balance of probabilities’ as:

“...a convenient and trite phrase to indicate the degree of certitude which the evidence must have induced in the mind of the Court as to the existence of facts, so as to entitle the Court to treat them as data capable of giving rise to legal consequences. But the phrase is inappropriate when applied not to ascertaining what has already happened but to prophesying what, if it happens at all, can only happen in the future. There is no general rule of English law that when a Court is required, either by statute or at common law, to take account of what may happen in the future and to base legal consequences on the likelihood of its happening, it must ignore any possibility of something happening merely because the odds on its happening are fractionally less than evens.”

118. In *Commissioner of Police v Ombudsman*⁶³ the Court of Appeal was concerned with the withholding of documents by the police despite a request from the Ombudsman under the Official Information Act 1982 (“the OIA”). The Court had to interpret a forward-looking phrase in the OIA about reasons for withholding information. Section 6 of the OIA states:

“Good reason for withholding official information exists, if the making available of that information would be likely ...

(c) to prejudice the maintenance of the law ...” (Our emphasis).

⁶² [1971] 2 All ER 691, 691 (PC). This quotation is included in *Cross on Evidence* (NZ Edition) 1996 at p.214 in a very useful passage called “Evaluations of the facts”.

⁶³ [1988] 1 NZLR 385



119. One issue in the case was whether 'likely' in that section (and in section 27(1)(a) OIA) equated to 'more likely than not'. Cooke P stated:

"To cast on the Department or organisation an onus of showing that on the balance of probabilities a protected interest would be prejudiced would not accord with protecting official information to the extent consistent with the public interest, which is one of the purposes stated in the long title of the Act. ... To require a threat to be established as more likely to eventuate than not would be unreal. It must be enough if there is a serious or real and substantial risk to a protected interest, a risk that might well eventuate. This Court has given 'likely' that sense in a line of criminal cases, a recent example of which is R v Piri [1987] 1 NZLR 66.

...

Whether such a risk exists must be largely a matter of judgment. In that sense a reference to onus of proof is not fully apt: compare the observations in McDonald v Director-General of Social Security (1984) 1 FCR 354 about the inapplicability of adversary proceedings concepts, such as the onus of proof, in administrative proceedings." (Our underlining).⁶⁴

There are a number of important, if difficult, points in that passage including the reminder that in administrative proceedings (such as under the RMA) adversarial concepts may not apply; and that a standard of proof on the balance of probabilities may be unreal.

120. We respectfully follow the Court of Appeal in holding that whether a risk exists is "a matter of judgment". This distinction between evaluation and fact-finding is of crucial importance under the Act. Almost every case

At p.391.



under the Act is concerned about the evaluation of many risks and thus issues as to the standard of proof are even more misconceived. As *Cross on Evidence* states succinctly:

*"Unfortunately, Judges sometimes apply the balance of probabilities test to evaluations of fact when in truth the test has no part to play."*⁶⁵

Burden of Proof

121. While counsel were agreed and the decision in *Commissioner of Police v Ombudsman* might suggest that no party bears the burden of proof in an application for a resource consent, we are not so sure. The answer seems to depend on what is meant by a burden of proof. In a basic way there is always a persuasive burden resting on an applicant for a resource consent because it is

*"a fundamental requirement of any judicial system...that the person who desires the Court to take action must prove his case."*⁶⁶

There is also a swinging evidential burden in that:

*"As the evidence of varying weight develops..., the eventual burden of proof will, in accordance with ordinary principles of evidence, remain with or shift to the person who will fail without further evidence."*⁶⁷

122. But there are statutory reasons why there is also a legal burden on an applicant for a resource consent. Since the ultimate issue in each case is

⁶⁵ NZ Edition (1996) p.214

⁶⁶ *Cross & Tapper on Evidence* 8th Ed. p.133

⁶⁷ Donaldson L J in *Forsythe v Rawlinson* [1981] RVR 97 at 202 and see *West Coast Regional Abattoir v Westland County Council* (1983) 9 NZTPA 289



always whether granting the consent will meet the single purpose of sustainable management⁶⁸, even if the Court hears no evidence from anyone other than the applicant it would still be entitled to decline consent⁶⁹. This might occur, for example, if the face of the application (or the Fourth Schedule Assessment) showed that a matter of national importance or an issue under section 5(2)(a) and (b) or section 8 is raised and not dealt with. This is reinforced by section 276 RMA which gives the Court power to call for further evidence. Otherwise the Court would have to decide on the preferred evidence even though that falls short of a reasonable standard in terms of persuading the Court that sustainable management of natural and physical resources would be achieved.

123. There is a passage in *Cross and Tapper on Evidence* which identifies the problem (and also the link between the burden and standard of proof):

"[T]he normal standard of proof in civil proceedings is proof on the balance of probabilities. It is fundamental to that standard that it involves weighing the evidence to see if the required standard has been achieved. If it has not, the party bearing the persuasive burden loses, however little evidence his opponent has adduced. The effect of [statutory] change [making the persuasive burden neutral between the parties] is that the only standard against which evidence can be weighed is that adduced by the opponent, in other words, if neither party bears the persuasive burden, then, if the case is to be decided at all, the party who adduces the greater amount wins, however little evidence he has adduced. In future in this area a party will win if he has adduced more evidence than his opponent, even though it may

⁶⁸ *Caltex NZ Ltd v Auckland City Council* A95/97; 3 ELRNZ 297 at 304

⁶⁹ See *Baker Boys Ltd v Christchurch City Council* [1998] NZRMA 433 at 442 (para 22)



*not, seen objectively, make his contention more probable than not. This is highly unsatisfactory,*⁷⁰

124. Fortunately that is not the position under the Act for the general reasons we have given. We note that in *Trans Power NZ Ltd v Rodney District Council*⁷¹ the Planning Tribunal stated:

“The upshot is that the Tribunal has to decide an application for resource consent for the extension to the transmission line which is not now opposed by anyone. Yet the application is not to be granted in default of opposition. The Tribunal has the same power, duty and discretion as the Council had, and (subject to section 375(1)(b)) may confirm, amend or cancel the Council’s decision (see section 290). So, like the Council, the Tribunal has the duty (subject to Part II) to have regard to such of the matters listed in section 104(1) as are applicable to the case; and although the application is not now opposed, it has to exercise its own discretion (subject to section 375(1)(b)) to grant or refuse consent, and if consent is to be granted, decide what conditions (if any) should be imposed (see section 105(1)).”

The Tribunal in that case proceeded to consider the evidence and submissions notwithstanding the lack of an opposing case and, after evaluation of all relevant factors, granted consent.

125. In the case of an application for a non-complying activity the threshold tests in section 105(2)(b) suggests a burden of proof resting on the applicant for the resource consent when it refers to the consent authority being “*satisfied*”

⁷⁰ The 8th English edition at p. 142-3

⁷¹ A 85/94



that...” one of the two tests is met. Even if there were no evidence from any other party the consent authority could properly refuse consent. The practice of the Environment Court under the Act where, on an appeal under section 120, it has received a consent memorandum in which a territorial authority reverses its position, is often to require some evidence of the threshold tests having been met⁷² for example by some amendment to the proposal.

Standard of Proof

126. We discussed earlier why the purpose of the Act suggests that to apply an invariable test in respect of any issue that it is to be decided “*on the balance of probabilities having regard to the gravity of the issue*”⁷³ is inappropriate. The wording of particular sections of the Act supports that view. For example, when section 5(2)(c) refers to:

“(c) *Avoiding, remedying, or mitigating any adverse effects of activities on the environment*”

- we need to read that with the definition of “effect” in section 3 of the Act. That defines “effect” as including:

“... ”

(c) *Any past present, or future effects; and*

“... ”

(e) *Any potential effect of high probability; and*

(f) *Any potential effect of low probability which has a high potential effect” (Our underlining).*



⁷² By formal proof or affidavit or less formally by production of unsworn briefs.

⁷³ *McIntyre* at p.307

127. The use of the words “*future, potential*”, and “*probability*” emphasize how the Act asks decision-makers to attempt to look into the future rather than backwards. Of course every predicted future effect is not certain to occur and the practical problem is how to assess the probability of their occurrence and the further effects if they do. Section 3 assists decision-makers by listing some⁷⁴ of the potential effects to be considered:
128. A future effect in section 3(c) is merely one of a very high statistical probability. It is impossible to find as a stone cold 100% fact that any future effect will occur. To take one incontrovertible ‘future’ fact - that the sun will rise tomorrow. One day many millions (billions?) of years in the future the sun will (probably) not rise over the observers’ horizon - it will explode or collapse into a ‘black hole’.
129. A particularly important aspect of section 3 is the recognition in paragraph 3(f) that effects of “... low probability but high potential impact” can be taken into account. This allows for the psychological fact that intuitively humans rank probabilities differently according to their assessment of the seriousness of the impact. Consider a dice game. If you win one dollar if the dice rolls a five, but lose the dollar if anything else shows, then you might consider the probability of winning is low (1 in 6). Now consider a more serious wager: if your doctor says you have cancer and a 17% (1 in 6) chance of dying within the year you might consider the chance of dying is high even though the mathematical chance is the same in both cases.
130. We consider the effect of section 3, especially 3(f), is that the Court is required to evaluate beyond the balance of probabilities (i.e. 50-50) where

⁷⁴ The definition is inclusive: for others see *Baker Boys Ltd v Christchurch City Council* [1998] NZRMA 433 at 448



the risk (even if low) is of high potential impact. This was expressly recognised in *Trans Power*⁷⁵ where the Court appeared to arrive at a midpoint somewhere between the common law standards for civil and criminal trials when it stated:

“The possibility of adverse effects on the health of people who may be exposed to electric and magnetic fields from 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...”

131. Thus how the Court should assess the probability of an event with high impact is affected not only by the objective risk of the impact occurring but also by a necessarily less objective assessment of the nature of the impact (e.g. is human health or life at risk?) in the context of all the relevant factors.
132. Another way of approaching the standard of proof under the Act is to consider what applying a standard of “*balance of probabilities*” means in this context. At first sight it appears to be either playing with words or introducing a degree of mathematical complexity which cannot be complied with. Applying the usual civil standard of proof test to an alleged effect under section 3(f) entails making a decision about the proof on the balance of probabilities of a future effect of low probability and high potential impact. There are four possible “probabilities” in that test if one reads “potential” and “future” as implying probabilities.

⁷⁵ A85/94 at p.21



133. These issues were raised by counsel for the unsuccessful appellant in *McIntyre*⁷⁶:

“Mr Fogarty....submitted...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.”

The Court then decided the issue in this way:

“...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 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.”

134. In our view two of the most significant possible interpretations of section 3(f), and we think Parliament may have intended both, are (leaving out the first reference to their ‘potentiality’ i.e. that they are yet to happen):

- (i) an effect of low statistical probability⁷⁷ but high impact which research has reliably shown is more than 50% (perhaps 99% or higher) likely to occur to a small sample of the population (hence its low

⁷⁶ [1996] NZRMA 289 at 304

⁷⁷ e.g. dying in a plane crash which in the USA has been calculated to be 1×10^{-6} for a person who takes one trip per year, RM Mitchell quoted in S Breyer *Breaking the Vicious Cycle* (1993) p.5



probability as a cause of death for any one individual). Such effects are scientific facts.

- (ii) an effect of low scientific probability (loosely, as in plausibility) but high potential impact. Here there is none of the 'certainty' of a scientifically proven fact.

It is the effects covered by interpretation (ii) which concern the appellant in this case. We hold that those are legitimate concerns by virtue of section 3(f).

135. So we respectfully agree with the Court in *McIntyre* that it is not correct to say that it is impossible to graft a test of more probable than not onto section 3. It is possible to do so. However we make the further point that it is not particularly helpful to do so. To take a hypothetical example: if there is an alleged risk of some adverse effects of 1 in a million (i.e. 1×10^{-6}) and the Court assesses the evidence as establishing the risk on the balance of probabilities test then the risk assessed by the Court is at least 5×10^{-7} . When the calculation is completed we still have a potential effect of low probability of (assumed) high potential impact on the environment. When the numbers about risk are very small, probabilities that vary by less than a factor of 10 do not make much evaluative (or intuitive) difference. So the distinction made in the quoted passage from *McIntyre* tends to be unhelpful for small risks.

136. To summarise on the issues of onus and burden of proof under the Act:

- (1) In all applications for a resource consent there is necessarily a legal persuasive burden of proof on the applicant. The weight of the burden depends on what aspects of Part II of the Act apply.



- (2) There is a swinging evidential burden on each issue that needs to be determined by the Court as a matter of evaluation.
- (3) There is no one standard of proof, if that phrase is of any use under the Act. The Court must simply evaluate all the matters to be taken into account under section 104 on the evidence before it in a rational way, based on the evidence and its experience; and giving its reasons for exercising its judgment the way it does.
- (4) The ultimate issue under section 105(1) is a question of evaluation to which the concept of a standard of proof does not apply.

Surveys

137. Evidence of a survey was called for SPS. Speaking of one class of surveys - market surveys - in a 1987 decision of the High Court⁷⁸, Barker J. acknowledged that:

"It is now well-settled law within New Zealand that market survey evidence is admissible as proving a public state of mind on a specific question or as proving an external fact, namely that a designated opinion is held by the public or class of the public."

138. Judge Barker referred to the English case of *Imperial Group plc v Philip Morris Ltd*⁷⁹ in which the Court set out the requirements for the validity of survey evidence :



⁷⁸ *Auckland Regional Authority v Mutual Rental Cars* (1987) 2TCLR 141 HC [1984] RPC 293 at 294

- “1. *The interviewees must be selected so as to represent a relevant cross-section of the public;*
2. *The size must be statistically significant;*
3. *It must be conducted fairly;*
4. *All the surveys carried out must be disclosed including the number carried out, how they were conducted, and the totality of the persons involved;*
5. *The totality of the answers given must be disclosed and made available to the defendant;*
6. *The questions must not be leading nor should they lead the person answering into a field of speculation he would never have embarked upon had the question not been put;*
7. *The exact answers and not some abbreviated form must be recorded;*
8. *The instructions to the interviewers as to how to carry out the survey must be disclosed; and*
9. *Where the answers are coded for computer input, the coding instructions must be disclosed.”*

Justice Barker considered the above criteria a measuring-stick for market survey evidence but was not prepared to say that if evidence fails to meet the criteria it is necessarily inadmissible in New Zealand. In a recent decision of *Commerce Commission v Griffins Foods Ltd*⁸⁰ the Court addressed the issue of admissibility and after considering New Zealand case law held that:

“...providing a market research survey is undertaken objectively, and usually by a professional agency, provided such survey is scientifically based, it should, ordinarily be admissible as a basis upon which expert opinion evidence might be called.”



⁸⁰ [1997] DCR 799 at 806

139. While the psychological and social surveys in this case were not described as “market” surveys, we consider that the same criteria are useful benchmarks for assessing the reliability (or even admissibility) of surveys produced to the Environment Court.

Admissibility and Reliability of Evidence

140. On the general issues of admissibility and reliability of expert evidence there was substantial disagreement between counsel. In his introduction to those disagreements Mr Hearn submitted that

“concepts such as the threshold of reliability and general acceptance in the scientific community, general consensus of scientist opinion, plausible biological mechanism and so on”

are not applicable in the RMA.

141. We agree to a limited extent on one point in that there is no rigorous reliability threshold under the RMA - a concept that developed for the withholding of evidence from the jury. The concept of the Judge as a gatekeeper who stops the jury from hearing unreliable evidence is widespread in the common law jurisdictions. There is a huge debate in the USA over the Judge’s gatekeeper role triggered by the Supreme Court’s decisions in ‘toxic tort’ cases: *Daubert v Merrell Dow Pharmaceuticals Inc*⁸¹ and *General Electric Ltd v Joiner*⁸². But this debate can be of limited relevance to the Environment Court which in a sense is both Judge and jury. We hold that in the NZ Environment Court there are only very low



⁸¹ 509 US 579 (1993); 125 L Ed 2d 469; 113 S Ct 2786
⁸² 118 S.Ct 512

thresholds such as the requirement for experts to qualify themselves as such; for evidence to be relevant; and not to be so witless or lengthy as to be vexatious. While the Court retains a discretion⁸³ to receive (or refuse) anything in evidence that it considers appropriate (or inappropriate) any refusal is only exercised judicially and with extreme caution. If the evidence is relevant then it is usually heard even if unreliable, provided it relates to something higher than a "low impact" effect. The issue as to reliability is, under the RMA, much more likely to go to the weight to be given to the evidence, than to admissibility.

142. In the end whether an assessment of the reliability of evidence goes to its admissibility or weight may be academic for both a practical and a theoretical reason. The practical reason is that there is no judge/jury separation in the Environment Court. The theoretical reason is that, especially for an effect of potentially high impact, the tests may be the same or at least very similar. As we have observed, almost all evidence in the Environment Court relates to the future and thus has an hypothetical element. Before an hypothesis can be considered by any Court, there must be a basic minimum of evidence to support it. But in the case of any hypothesis about a high impact risk a scintilla of evidence may be all that needs to be established in the Court's mind to justify the need for rebuttal evidence. In other words that evidence, slight as it may be, is enough to raise a reasonable doubt in the mind.

143. However we think Mr Hearn is quite wrong in going as far as he does. The other concepts he wishes to throw out must be crucial to the weight to be given to the evidence of the various experts.



144. In assessing the expert evidence (including rebuttal and cross-examination) on any issue we have to take into account and evaluate (inter alia) the following factors:

- (1) the strength of the qualifications and the duration and quality of the experience of each witness;
- (2) the reasons for each witness' opinions (and their consistency, coherence and presentation);
- (3) the objectivity and independence of each witness and the comprehensiveness of their evidence - for example whether they have identified and taken into account matters which do not favour their opinion;
- (4) there is an identification of and general acceptance of the science of methodology involved; and
- (5) Especially for 'hard' science - the research or papers referred to by the witnesses in reaching their opinions, with respect to whether:⁸⁴
 - (a) the techniques used are reliable
 - (b) the error rates are known and published (and the research is shown to be statistically significant)
 - (c) the research or papers have been published
 - (d) the research or papers have been subject to peer review
 - (e) the research is repeatable (and has been replicated).

145. Not all those aspects or even all parts of them need to be met - they are criteria for measuring the weight to be given to the specific evidence when making findings. Factors (1)-(3) may be the only relevant ones for expert

⁸⁴ Loosely these are the *Daubert* criteria



opinions which are only 'science' in the softest sense e.g. town planning and resource management. Factor (4)⁸⁵ comes into play more for the social sciences, physicians, epidemiologists and ecologists. All of factors (1)-(5) are necessary in the evaluation of some ecological evidence and all hard science.

146. It must be borne in mind that no party alleging an effect relevant to the Act has to prove causation on the balance of probabilities as in a civil trial, (i.e. in the 'toxic tort' sense). That is because:

"Questions involving the environment are particularly prone to uncertainty. Technological man has altered his world in ways never before experienced or anticipated. The health effects of such alterations are often unknown, sometimes unknowable. While a concerned Congress has passed legislation providing for protection of the public health against gross environmental modifications, the regulators entrusted with the enforcement of such laws have not thereby been endowed with a prescience that removes all doubt from their decision making. Rather, speculation, conflicts, and theoretical extrapolation typify their every action. How else can they act, given a mandate to protect the public health but only a slight or non existent data base upon which to draw?"⁸⁶

That uncertainty entails that:

⁸⁵ For an illuminating discussion of all these factors - but (3) and (4) especially - see the dissenting opinion of Circuit Judge Davis in a decision of the Fifth Circuit of Appeals: *Moore v Ashland Chemical Inc* No. 95 - 20492 (Aug 14 1998). This opinion also has a good summary of the issues in the debate over *Daubert*.

⁸⁶ *Ethyl Corporation v Environment Protection Agency* (Federal District Court, District Court of Columbia) (1976) S.41 F.2d 1.



*"A risk may be assessed from suspected, but not completely substantiated, relationships between facts, from trends among facts, from theoretical projections, from imperfect data, or from proactive preliminary data not yet certifiable as 'fact'."*⁸⁷

147. The reason we can take into account risks assessed in such a way is the presence of section 3(f) in the Act, as we discussed earlier. To fall within section 3(f) of the Act as a potential effect of low probability and high potential impact an effect must not be simply an hypothesis: there must be some evidence supporting the hypothesis. This evidence may consist of at least one of:

- (1) consistent sound statistical⁸⁸ studies of a human population; or
- (2) general expert acceptance of the hypothesis; or
- (3) persuasive animal studies or other bio-mechanistic evidence accompanied by an explanation as to why there is no epidemiological evidence of actual effects in the real world; or
- (4) (possibly) a very persuasive expert opinion.

It is important that the evidence need only fall into one of the categories before the Court will take it into account - if there was evidence falling in all four then the hypothesis would be established 'hard' science. As we have attempted to explain, the purpose of section 3(f) and the proactive, precautionary approach of the Act is to act in anticipation where possible.

148. For legal purposes a sound statistical (epidemiological) study is one which:

⁸⁷ *Reserve Mining Co v EPA* 514 F.2d 492, 529 (8th Circuit of Appeals) 1975

⁸⁸ Epidemiological studies in human cases. Dr Elwood gave interesting evidence as to additional criteria that epidemiologists use for assessing the soundness and utility of studies in their field. We do not criticise those by omission, however such criteria would need much fuller scrutiny than they received in this case before we could apply them as general criteria.



- (a) uses reliable techniques
- (b) establishes its margins of error (and is statistically significant)
- (c) preferably has been published
- (d) has been peer-reviewed; and
- (e) preferably has been repeated and had its results replicated.

It does not have to be generally accepted because the research may be establishing a new concept. Although a scientific theory may be:

“generally accepted within the scientific community, that does not mean that a Court in making findings of fact on material of probative value should treat another scientific view outside the mainstream as without substance.”⁸⁹

For example, in this case there was a suggestion that “normal” dose-response relationships might not apply to exposure to RFR. There might be resonance phenomena so that if the wavelength of the RFR was a little smaller than the size of human cells (or cell-components) there might be a greatly increased effect on the cell or relevant part. In fact there was not nearly enough evidence of resonance phenomena for us to be persuaded they result from RF radiation. It is unlikely that one study would be sufficient, if only because the ability to repeat the study and its replication are important criteria for credibility.

149. There need not be sound statistical evidence of a hypothetical effect if there is general expert (scientific) acceptance that it will occur. Catastrophes such as earthquakes can be predicted but not yet with an accuracy that is practically helpful. If scientists were agreed that a large asteroid might hit

⁸⁹ *Daubert v Merrell Dow Pharmaceuticals Inc* 509 US 579, 125 L Ed 2d 469, 113 S Ct 2786 (1993)



the earth humans might prefer to take precautionary action against it rather than wait for Armageddon.

150. Persuasive animal studies could support a hypothesis if there is also an explanation as to why there are no symptoms actually demonstrated in human populations. This is conceivable: for example there may be a long latency period before any effects become patent. But usually there would need to be at least some epidemiological evidence in support of the studies.
151. In exceptional cases a very persuasive expert opinion might sufficiently support an hypothesis. This is unlikely to occur in respect of health issues such as we are considering here, but not all potential environmental effects have the same research lavished on them as human health effects. In such cases it might be appropriate to trust an expert notwithstanding lack of statistical evidence, although in such a case one would likely want there to be general acceptance of the methodology used within the scientific discipline involved.



Chapter 6 : Adverse Health Effects (Section 104(1)(a))

Submissions on Adverse Health Effects

152. As will be apparent from our summary of the evidence called for the parties, the issue as to whether exposure of the school community to RFR at athermal levels could induce adverse health effects was traversed both at the epidemiological level and at a bio-mechanistic level, and the latter included both *in vitro* and *in vivo* studies.

153. Counsel made wide-ranging submissions in respect to the evidence on health effects. We trust that the essential points they made are traversed in our consideration of effects that follows. However, one issue was raised in the written submissions that never arose at the hearing at all. Mr Hearn submitted that a quotation from a book by Messrs Garrick and Gekler (an interpretation of Dr Elwood's opinions presented in Elwood (1988)) was inconsistent with Dr Elwood's evidence. In response counsel for Telecom pointed out that this submission is based on two flawed assumptions on which Dr Elwood should have been cross-examined. These assumptions were that:

- (a) the text properly reflects the views of the Professor; and
- (b) the interpretation of Garrick and Gekler was fully within the knowledge of Dr Elwood.

We agree that Dr Elwood should have been cross-examined on the passage quoted by Mr Hearn in his final submissions, and in the absence of such cross-examination we are not prepared to find that the quotation affects the credibility of Dr Elwood.



Assessment of the epidemiological evidence

154. Our assessment of the witnesses on epidemiology is as follows. First, for Telecom, Dr Elwood's evidence was carefully constructed and balanced. He satisfied us - subject to any evidence on the other side of the scales and we come to that shortly - that the risks of adverse health effects on humans such as:

- sleep disturbance
- learning disabilities
- cancers, specifically childhood leukaemia
- reproductive difficulties

are very low indeed. We are reinforced in our conclusions about Dr Elwood's overall carefulness⁹⁰ and objectivity by a passage in cross-examination by Mr Hearn.

“Q. Would it be fair to say that means you are looking at [the issue of adverse health effects] on the balance of probabilities, more likely than not?”

A. No, I don't think so. The term is used less precisely and my threshold for accepting that there would be a hazard would be much less than the 50% threshold implied by your phrase.

Q. Well there may be argument and submissions about what is the appropriate phrase but I wish to put it to you whether you are saying that in your opinion it is not possible there will be harmful effects?”

⁹⁰ With two exceptions: he consistently misspelt 'Skrunda' as 'Skundra' which is more euphonious to an English speaking ear but wrong; and one or two of his references to exposure levels in studies were incorrect because he used the wrong units.



A. I have already stated that one cannot prove using that term to mean complete certainty the absence of an effect of anything but my opinion is that in the normal use of the word I am as certain as is reasonably possible that there will be no adverse health effects."

That passage shows Dr Elwood was considering potential effects of low probability but high potential impact i.e. adverse health effects as required by the Act. He was not, as Mr Hearn submitted, applying a 'balance of probabilities' test.

155. As for the SPS witnesses, Dr Beale gave an overview of some epidemiological and bio-mechanistic studies. We are however, concerned with a lack of objectivity and balance in Dr Beale's evidence. He reported some findings from research in a way that supports the hypothesis that exposure to RF radiation causes health problems when the report of the research specifically disclaims such a conclusion. For example of the Skrunda study he wrote in his evidence-in-chief:

"thus, the results supported a hypothesis that chronic radiation exposure resulted in impairment of nervous function."

But the authors' own conclusion states:

"...at present we can only state that the children living in the exposed zone in front of the Skrunda RLS performed worse in the psychological tests given than the children living behind the RLS and even worse again compared, with the control group. The validity of the statement that the RF ... field at Skrunda has caused these



differences can only be claimed with continuous and accurate assessment of dose, and close to exact standardisation of subjects."⁹¹

156. Dr Beale noted the results of the Sutton Coldfield study but did not point out that it was a cluster study, nor that the authors' conclusion was that *"no causal implications regarding radio and TV transmitters can be drawn from this finding, based as it is on a single cluster investigation."*⁹²

157. One point in Dr Beale's evidence was that because 44 out of 66 research papers show *"statistically significant effects on some aspect of nervous system or behavioural function"* we should regard the risks of the cellsite as unacceptable. There are a number of difficulties with such an approach. First, as Dr Elwood pointed out, the 67% result⁹³ referred to by Dr Beale is artificial: the 66 papers referred to investigated many more than 66 effects. Dr Beale himself recognised the other criticisms of relying on the research papers he referred to. He emphasized that the animal studies were not used in setting the ANZ Standard (or at least its predecessor) because:

- (1) Effects in animals are not necessarily indicative of health problems in humans given equivalent exposure.
- (2) It is not known how small exposure must be to avoid these effects (i.e. the threshold for these effects has not been identified).
- (3) Some of these effects have yet to be confirmed by replication.
- (4) The mechanism by which radiofrequency exposure could cause such effects is not agreed or well understood.

⁹¹ Kolodynski *et al.* (1996)

⁹² Dolk (1997b) p.8

⁹³ 44/66 = 66.67% (approx)



158. He seemed to have, in effect, three reasons for considering such studies might nevertheless be relevant:

- (a) The old NZ Standard (NZS 6609 now replaced by the ANZ Standard) referred to (only to reject) animal studies published prior to 1985. In cross-examination he accepted that that is unlikely to be correct. He also accepted that the ANZ Standard now in force, on an interim basis, was up-to-date when published.
- (b) More recent animal studies - especially Dr Repacholi's study - suggested adverse health effects might occur. We return to these studies shortly.
- (c) In conclusion it would seem premature to rule out the possibility that prolonged exposure of humans to cellsite radiation would result in cancers.

This last reason is the no-risk fallacy we referred to at the start of Chapter 5. Any scientist should know that except in a tautological (and therefore uninformative) sense we can never rule out possibilities altogether. The practical issue is always how low is the risk of cancer.

159. But we consider that the studies Dr Beale relied on cannot be useful for us for the additional reasons that:

- Dr Beale's statistics are artificial as we have said;
- there may be statistically significant results in the papers not referred to which are negative;
- there is no assessment by Dr Beale of the quality of the studies and results; and
- physiological changes do not necessarily have an adverse health effect.



160. As far as Dr Hocking's evidence was concerned, while in some ways we were impressed with his sincerity as a witness there were a number of ways in which he significantly, if unconsciously, showed bias or at least inconsistency in the matters he took into account in reaching his opinion:
- (a) He acknowledged in his paper⁹⁴ that confounders had not been adjusted for but in his evidence implied that they had.
 - (b) While he stated that "*the number of proven causes of leukaemia are few*" he did not acknowledge, or perhaps recognize that the number of factors much more likely to cause leukaemia is considerable (as Dr Elwood demonstrated to our satisfaction).
 - (c) He suggested that different frequency ranges or pulses might have different (adverse) effects, without acknowledging that, if that were true, it would remove the validity of some of the studies he relied on since, as Dr Elwood pointed out: "*only results on the precise frequency ranges used in this cell ... site could be used to predict its effects.*"
 - (d) He ignored the study of childhood leukaemia in San Francisco⁹⁵. That study was thorough, used accepted techniques, was published in a reputable journal and showed negative results.
 - (e) Similarly he stated that a study in Poland was the only study of military personnel working with radar but ignored a US Naval study which came to different conclusions⁹⁶. Dr Elwood expressed major concern about bias and inaccuracy of the Polish study⁹⁷ in his evidence-in-chief but Dr Hocking accepted it uncritically.
 - (f) Dr Hocking failed to observe any limitations of the Skrunnda study (see paragraph 46 of this decision).

⁹⁴ Hocking 1997 (p.8)

⁹⁵ Selvin 1992

⁹⁶ Robinette *et al.* (1980) "*Effects upon health of occupational exposure to microwave radiation (radar)*" *Am J Epidemiol* 112, 39-53

⁹⁷ Szmigielski (1996) "*Cancer Morbidity in subjects occupationally exposed to high frequency electromagnetic radiation*". *The Science of the Total Environment*. 180:9-17



- (g) Finally Dr Hocking recognized no weaknesses in the Schwartzenburg study (again see paragraph 46). The *Woodward Report*⁹⁸ points out that:

"[S]elf-reported insomnia is a very imprecise measure of sleep quality and is prone to reporting bias."

Nor did he acknowledge the researchers' conclusion that: *"the effect of EMF if really present however, is not very strong ..."*⁹⁹

161. In conclusion, in relation to the epidemiological evidence we hold that the papers relied on by the SPS witnesses are all flawed as to technique and many are biased. The evidence of these two SPS witnesses is weakened by the failure of the witnesses to acknowledge unequivocally in their evidence the defects in the research on which they rely. Further none of the witnesses for SPS gave a balanced picture to the Court by referring to papers which show a neutral or negative effect on human health from exposure to RFR, let alone explaining how or why such studies - Dolk (1997b), Knox (1977), Selvin (1992), should not be considered.

Assessment of biological/causative evidence

162. As for the biological causation level of adverse health effects we heard from two witnesses exclusively on this issue, Dr Meltz for Telecom and Dr Cleary for SPS. In addition Dr Beale included a brief section on this issue in his evidence. The most comprehensive and systematic evidence was that of Dr Meltz. He came across as a thorough and sincere witness

⁹⁸ Page 23

⁹⁹ Altpeter et al. (1995) "Study on health effects of the shortwave transmitter station of Schwartzenburg, Berne, Switzerland (Major Report)" Bundesamt für Energiewirtschaft (Federal Office of Energy), Berne, pp1-152



who gave an objective assessment of all important aspects of his area of research. He was criticised by SPS counsel for making an error in one of his published papers. But he acknowledged it in his evidence in chief by referring to the correction in his bibliography. We consider that one calculation error in a paper of Dr Meltz's (he was not the principal author) does not detract from his extensive qualifications and experience to comment on fundamental scientific methodology used by others in his area of expertise. We have already quoted Dr Meltz' overall conclusions. In summary they were that:

"the accepted, repeated and credible evidence indicates that without the heating associated with high level exposures no biological effect has been confirmed as indicating even a potential adverse health effect."

163. Against that Dr Cleary gave us his opinions that:

- (a) *in vivo* studies of long-term exposure to low intensity microwaves *"provide evidence of deleterious non-thermally induced alterations"*;
- (b) *in vitro* studies provide *"unambiguous scientific proof that RF and microwave radiation can induce non-thermal changes in cell physiological functions, including most significantly the rate of cell proliferation"*.

164. The fundamental difference between Dr Meltz and Dr Cleary was that the first referred to both research which suggests there are adverse health effects from long-term exposure to RFR and that which do not. By contrast, Dr Cleary in his evidence-in-chief referred only to papers which suggest there are adverse health effects. In cross-examination Dr Cleary was asked:



"Would you characterise your evidence as being fair and balanced in terms of an examination of the issue of RF exposure and risk?"

He replied:

"It is difficult for me to answer the question in terms ... of ... fair and balanced. The information I summarised in my statement of evidence was directed towards a scientific question. Now whether this involves concepts of fairness and balance - I cannot relate to those terms. The information that I summarised again is addressing the issue of non thermal effect of microwave radiation have been reported in the literature."

165. We were concerned about that answer because it sounded evasive. In addition, insofar as his evidence related to the hypothesis that exposure to RFR causes adverse health effects at athermal levels, there are two other aspects he should have looked at:

- (a) if testing the hypothesis scientifically, he should have looked at the research indicating it is not true, as well as the research indicating that it is; and
- (b) adequate research should be able to show some sort of dose-response relationship (even if it is not in a straight line).

166. Dealing with those points in the context of this case, none of the studies relied on by Dr Cleary show any sort of dose-response relationship - as he acknowledged. Secondly, even if he did not understand what a 'fair and balanced' approach to the scientific data would require he should have understood the need to look at data which does not confirm the hypothesis



that at certain athermal levels of exposure to RFR adverse health effects will occur. Dr Cleary did not do that.

167. In passing we should note that Dr Cleary quotes Dr Repacholi as writing¹⁰⁰:

"I believe this is the first animal study showing a true non-thermal effect."

That was quoted without any explanation of the apparent inconsistency with the Chou (1992)¹⁰¹ study or those of Szmigielski *et al.* (1989)¹⁰² already relied on by Dr Cleary.

168. There have been two recent studies which he did not refer to in his evidence-in-chief. One was by M.R. Frei *et al.*¹⁰³ who exposed 100 cancer prone mice to RFR of 2450 MHz (in circularly polarised waveguides) over 18 months for 20 hours per day. The whole body SAR was 0.3W/kg. Another 100 mice were sham-exposed. According to Dr Meltz the results reported in Frei (1992) were that the chronic exposure did not affect:

- mammary tumour incidence;
- latency to mammary tumour onset;
- mammary tumour growth rate; and
- animal survivorship when compared with the sham-irradiated controls.

¹⁰⁰ Repacholi (1997)

¹⁰¹ C K Chou *et al.* (1992) *Bioelectromagnetics*, 13, 460-496

¹⁰² S. Szmigielski *et al.* (1989) In *Electromagnetic Biointeraction* Ed. G. Franceschetti *et al.*, Plenum Press, New York, NY81-98

¹⁰³ M.R. Frei *et al.* "Chronic Exposure of Cancer Prone Mice to Low Level 2450 MHz, Radiofrequency Radiation" *Bioelectromagnetics*, 19, 20-31 [called Frei (1992)]



When the Frei (1992) paper was referred to Dr Cleary in cross-examination he did not criticise the methodology but said that the experiment it described was conducted under conditions different in terms of frequency of irradiation. While we understand that - the Frei mice were exposed to 2450 MHz as opposed to the 870-890 MHz which the cellsite will emit - that answer is almost a throwaway in that it suggests only evidence of experiments at 870-890 MHz could be relevant. Yet neither Dr Cleary nor any other witness for the school claimed that, presumably because they relied on other studies at different exposures in support of their opinions.

169. An illustration of why Dr Cleary did not claim that, and another example of Dr Cleary only considering evidence for his hypothesis, was his statement in his written rebuttal evidence relating to the question whether children exhibit heightened sensitivity to adverse health effects from microwave exposure. He said:

"... there has been a consistent association of residential exposure to 50 or 60 Hz magnetic fields and leukaemia incidence in children. This is not the case for residential exposure of adults to such fields."

There are apparently 9 or more studies which show such an association, although these have been criticised for the unreliability of their techniques. A recent study by M.S. Linet *et al.*¹⁰⁴ and known to Dr Cleary summarised its results as being that the risk of childhood leukaemia was not linked to magnetic fields. Again when that was put to him in cross-examination he said:

¹⁰⁴ M.S. Linet *et al.* "Residential Exposure to Magnetic Fields and Acute Lymphoblastic Leukemia in Children". *The New England Journal of Medicine* 337:1 ["Linet (1997)"]



"I don't think the outcome of one study changes my view in terms of the consistency of the findings"

and, rather inconsistently:

"[Linnet (1997) should be given] the same weight as placed on all research in this particular area."

We consider a much fairer and more considered assessment of Linet 1997 is in the ICNIRP guidelines¹⁰⁵:

"The size of this study is such that its results, combined with those of other studies, would significantly weaken (though not necessarily invalidate) the previously observed association."

Further it needs to be remembered that power lines and electric cabling transmit at extra low frequency (ELF) which is very far from the cellsite frequencies.

170. Turning to *in vitro* research Dr Cleary's own research may show evidence of RFR induced change, but not that it is harmful. However, his studies are nearly incomprehensible to us and despite being given time to file a rebuttal statement and the opportunity to explain his views to us after Dr Meltz's evidence, Dr Cleary failed to articulate his methodology in a way we could understand. Dr Meltz criticised Dr Cleary as redefining science in his description of the cell-cycle of mammalian cells, and that is how it looked to us. Again Dr Cleary did not refer to any paper which showed results consistent with his.

171. Dr Cleary concluded that:

¹⁰⁵ p.499



“recently conducted epidemiological studies as well as studies of microwave radiation effects on experimental animals and on mammalian cells provide consistent and convincing evidence of nonthermal exposure effects.”

But we have to consider the limited material that lead him to this conclusion. It is also of concern that he referred to epidemiological studies when in his introduction he stated that he would leave those studies to other witnesses, and consistent with that he does not refer in his evidence-in-chief to a single epidemiological study. His final reliance on unspecified epidemiological studies undermines the objectivity of his evidence.

172. Dr Meltz criticised Repacholi (1997) (mentioned by Dr Cleary for the school) concluding that the study should not have used the methodologies or the strain of mice it did. His criticisms were:

- (1) *Within one year after initiating treatment with the chemical carcinogen used on the Eμ-Pim 1 strain of mice it has been reported lymphoblastic lymphomas appear in a large number of the animals. However the study by Repacholi et al. continued the treatment for up to 18 months. As the animals aged a different type of tumour, a follicular lymphoma (known to occur with age in inbred mice strains), appeared in the mice. With more of those tumours arising in the RF exposed animals the conclusion could be drawn that this was due to RF exposure. It appears to have been overlooked that after one year of the treatment the authors of the study did not see a statistically significant difference in the number of lymphoblastic lymphomas in the RF exposed group as compared to the control group.*
- (2) *There was no positive control treatment group. Without a positive control and without historic negative controls (which would indicate the appearance of follicular lymphomas with age in the mice) the study results (other than the absence of lymphoblastic lymphoma induction) are meaningless.*



- (3) *There should have been a full histopathological examination of all those animals terminated at the end of the study. This may have shown the expression of the follicular lymphoma in a way that may have eliminated any statistical difference between the RF exposed groups and the control groups.*
- (4) *It is important in animal studies to make sure the animals are pathogen free however there was evidence of a lethal renal disease in the mice. The bedding should have been changed more frequently to minimise the stress to the animals due to ammonia build-up and there should not have been five animals in a cage during exposure. Stress can lead to an earlier appearance of follicular lymphomas. Closer monitoring should have occurred so that dead animals could have been removed soon enough to allow successful pathological examinations.*
- (5) *The exposure of each animal in the cage was dependent on reflections and scattered radiation from the other animals in the cage. When animals died, they were removed and not replaced, making the dose to the other animals different than originally calculated.*

There was no good answer to any of these criticisms from the witnesses for SPS.

173. Mr Hearn, for SPS, criticised Dr Meltz for only considering a small proportion of the total of bio-mechanistic studies of the effects of exposure to RFR. This criticism has some force especially since Dr Meltz himself had criticised Dr Cleary for only considering ten papers out of 17 referred to in Dr Cleary's evidence in chief. However, Dr Meltz himself had considered many more papers and his evidence was balanced in that he went out of his way (so it appeared to us) to examine the research which suggests there may be effects from exposure to RFR.

Is there a significant risk of adverse health effects from the proposed RFR?



174. If there are adverse health effects from the RFR discharge then they can only be effects within section 3(f) of the Act - that is potential effects of

low probability but high potential impact. It was common ground that ordinary risk assessment showed “no risk”. Applying the tests for section 3(f) effects which we set out in Chapter 5 we find there are hypotheses that exposure of the school community to the proposed RF radiation might cause:

- leukaemia or other cancers
- sleeplessness
- learning disorders
- harm to foetuses.

175. Is there enough evidence to establish these hypotheses to the very limited extent we require to establish them as effects within the meaning of section 3? It will be recalled that the alternative evidential criteria include:

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

176. No one claimed that there was general acceptance of the idea that RFR causes athermal effects at the intensity emitted by the cellsite. The most that SPS could claim are the careful concessions by Dr Black in his rebuttal evidence. He said:

“6. ... Dr Beale states that there are ‘numerous studies on animals that show adverse effects of brief radiofrequency exposure at levels much lower than the thermal threshold and which appear to be unrelated to the significant whole-body heating that occurs at higher levels of radiation’. I agree with that statement. It underscores why Standards are set at a large



margin below this 'thermal threshold' which occurs at a specific absorption rate ('SAR') of 4 watts per kilogram. For example, the NZ Standard is set at 1/50th of that thermal threshold.

7. *The vast majority of these animal studies show effects which occur at levels above 1/10th of the thermal effect threshold, which accounts for some Standards (like those in the UK and Japan) that are set at this level.*
8. *It is also important to note that the vast majority of experimental results showing effects at levels below 1/10th of the threshold (i.e. below 0.4 watts per kilogram) are not studies on whole animals. The effect of a signal falling on a isolated tissue sample is altogether different from that on a whole animal, and accordingly the levels are meaningless in terms of whole body exposure."*

We find that Dr Black accurately portrays the general scientific view of the research, for example as portrayed by ICNIRP and, directly to us, by Dr Meltz. There was no expert witness who persuaded us that the mainstream of thought is wrong and that their research is right. So the only doors left open for the finding of adverse health effects from athermal RFR at cellsite levels are the presence of sound epidemiological studies and/or the bio-mechanistic studies.

177. On the epidemiological evidence given to us we find that all the studies quoted to us as support for the various hypotheses of adverse health effects were flawed¹⁰⁶ although at least the authors of the Sutton Coldfield study¹⁰⁷ admitted the limitations of that study which is why they delayed publication until they published their later study. The leukaemia studies

¹⁰⁶ Hocking (1996), Dolk (1997a)

¹⁰⁷ Dolk (1997a)



in particular were far less convincing than the studies which showed no significant association between RF discharges and cancer.¹⁰⁸

178. As for the existence of animal studies these suffered from a number of defects also. There was no attempt to explain why there was no or little epidemiological evidence of actual adverse health effects. In the absence of such explanation the usefulness of animal studies is very doubtful.¹⁰⁹ In addition, as we have already pointed out, the existence of effects does not necessarily mean they are harmful. As Dr Repacholi himself has recently written of animal studies:

"It is questionable whether reported 'effects', even if substantiated, can be considered to represent evidence of a hazard simply because the significance of the effect for the organism is not understood.

*... Not all biological effects of exposure are necessarily hazardous; some may be beneficial under certain conditions."*¹¹⁰

179. It was a key part of the school's case that there may be adverse effects within the meaning of section 3(f), that is "potential effects of low probability but high potential impact". As we suggested in Chapter 5, the first use of the word "potential" shows that it is not proven actual effects that need to be considered but also scientifically possible effects established to our satisfaction under the criteria listed in paragraph 147. It is at this point that Mr Gould's submission, that there is no evidence of adverse effects, falls down. We hold:

¹⁰⁸ Selvin (1992), Dolk (1997b), Knox (1977)

¹⁰⁹ There is a significant jurisprudence on this in the USA – see for example: *General Electric Ltd v Joiner* 118 S.Ct 512

¹¹⁰ M H Repacholi "Low-Level Exposure to Radio Frequency Electromagnetic Fields. ..." *Bioelectromagnetics* 19: 1998 (pp.1-19) at p.5 [Repacholi (1998)]



- (a) that there is very tenuous epidemiological evidence of some possible adverse health effects (effects on learning and sleep);
- (b) that on our subjective assessment these effects are of very low probability; and
- (c) that the effects may be of relatively high potential impact (but not of the devastating impact that cancers would have).

So there are adverse 'effects' within the meaning of section 3(f) but only in a very weak sense.

180. In conclusion we hold that:

- (a) the risk of the schoolchildren or teachers at the school incurring leukaemia or other cancer from RFR emitted by the cellsite is extremely low;
- (b) the risk to the pupils of exposure to RFR causing sleep disorders or learning disabilities is higher but still very small.¹¹¹

To avoid confusion we emphasize that this is not a scientific assessment of risk. That is impossible in the present state of knowledge. We respectfully agree with ICNIRP that¹¹²:

"Overall, the literature on athermal effects ... electromagnetic fields is so complex, the validity of reported effects so poorly established, and the relevance of the effects to human health is so uncertain, that it is impossible to use this body of information as a basis for setting limits on human exposure to these fields."



¹¹¹ Taking a relatively arbitrary figure, just to give an idea of what we mean: very small = 1 in a million (i.e. 1×10^{-6})

¹¹² ICNIRP Guidelines p.507

Our assessment is of the risk which we must assess as an effect (or product of effects) under section 5(2) of the Act. It is a reasonable assessment of the risks on the evidence presented to us.



Chapter 7 : Other Effects [Section 104(1)(a) continued]

Adverse Psychological Effects

181. In respect to claimed psychological effects the principal evidence for the school was that of Dr Staite, and to a lesser extent that of Dr Beale. With respect to Dr Staite's evidence Mr Fougere set out the requirements for survey validity (see Chapter 5 above and the discussion of *Imperial Group plc v Philip Morris Limited*) and then stated that none of the required criteria were met by Dr Staite's survey. Mr Fougere recommended that the Court exercise "extreme caution" in considering this evidence. His main concerns about the survey were:

- "(1) The methodology did not describe that the sample used represents any wider community. In fact Dr Staite clearly approved of the concept of focusing on "information-rich" cases - in this case that meant interviewing those with the strongest concerns about the tower. This approach may be correct for research designed to develop a theory but not to make a conclusion on the widespread adverse psychological effects;*
- (2) The sample size was small. There were only a few interviews;*
- (3) There is no copy of all the questions asked in the survey nor all the results obtained. It is not known whether he asked all those interviewed the same questions;*
- (4) If he did ask all those interviewed the same questions then he was asking standard 3 and 4 pupils very complex questions and it would be safe to assume their comprehension of the questions would be jeopardised;*



- (5) *From the way Dr Staite presented his evidence it was impossible to determine whether the questions he asked in his survey were leading. He says that one question was "What negative psychological states such as anxiety and depression, in your mind, will be experienced by you along with your fear of future illness in respect of the cell tower?". This is a leading question assuming "negative psychological states";*
- (6) *The presentation of results is too unstructured to allow formal evaluation by a third party which is unsatisfactory; and*
- (7) *There is no dependable data to make conclusions on wide-spread effects."*

182. In Chapter 4 we covered Dr Staite's evidence in some detail to give its flavour but we have to say we are troubled by it. This is not only because of the dubious validity of the survey on which it is based but for other reasons as well. Examining it as a whole and including the cross-examination, it has three rather disconnected parts: a theoretical review of some relevant psychological literature; a long summary of his survey of the parents; and a short final overview. In particular there was little apparent connection between his review and his survey.

183. In addition many pages of his evidence about his survey were full of hearsay. He included many comments from parents, teachers and children, sometimes in quite colourful language, giving their perceptions of the Telecom proposal. As far as his summary was concerned, he did not attempt to link his theoretical evidence with his survey. There was a major implicit assumption that there are adverse effects from the cellsite.



184. Telecom's counsel submitted that the Court should be guided by the *Telecom* decision¹¹³ where the Court said that it did not think that "*social angst and lack of well-being in the community affected by the proposal*" was a material consideration in coming to its decision. Counsel also quoted Dr Zelas who said:

"... if a child is anxious or fearful of going to school when there is determined to be no "real" reason for this, educators do not propose that the child avoid the perceived threat and remain at home."

185. In respect to Dr Staite's assertion that "*... a psychological effect did in fact exist in the minds of the people and community*" counsel pointed out the criticisms by Dr Zelas and Mr Fougere of Dr Staite's study. Mr Gould also referred to the opinion of Dr Beale that the Shirley community would suffer "*indirect effects mediated by stress*". He submitted that should be given little weight as the hypothesis lacked any foundation of fact or actual research. In contrast he said there was the evidence of Dr Black and Mr Jennings who made enquiries in schools close to where cell sites are located and found evidence of a lack of anxiety and concern.

186. Counsel opined that to the extent that claimed anxieties and fears do exist there is evidence of misinformation and therefore *Telecom* should be followed and anxieties and fears not founded on any plausible health risks ought not to be taken into account. Counsel submitted that Mr Hearn was not correct in suggesting that it would have been valuable for Dr Zelas to speak to those in the community. The purpose of her evidence was to deal with broad issues not to express opinion on the state of mind of any person.



¹¹³ W165/96 at pp 11-12

Mr Hearn cited the case of *Meadow Mushrooms Ltd v Paparua County Council*¹¹⁴. He referred to the passage¹¹⁵ where the Board¹¹⁶:

“observe[d] that the health of the community, which is one of the factors mentioned in s.18 of the Town and Country Planning Act 1953, is not necessarily restricted to physical health. Whether or not it is psychological there is no question that a large number of the residents of Prebbleton appear to fear methyl-bromide gas and associate illnesses they have suffered with the proximity of that gas. Fear of exposure to a cumulative poison, whether physical damage is or is not caused thereby, is a very real factor in relation to normal health and wellbeing.” [Our emphasis]

Counsel for Telecom submitted that case is different on the key matter at issue: the fact that with cellsites any anxiety is not based on any scientifically plausible health risk.

187. There is an issue as to whether fear or other psychological effects are effects we can take into account. *Duncan v Thames Coromandel District Council*¹¹⁷ recognised that under the Town and Country Planning Act 1977:

*“It is proper to pay some regard to fear of the unknown. Fear for safety, and of the unknown, impinges upon psychological health, and that is part of total health.”*¹¹⁸

¹¹⁴ (1977) 6 NZTPA p.327

¹¹⁵ The same at p.333

¹¹⁶ The Town and Country Planning Board: a predecessor of the Environment Court

¹¹⁷ (1980) 7 NZTPA 233

¹¹⁸ The same at p.240



That passage was quoted in a leading town planning case under the Town and Country Planning Act on the introduction of LPG tanks to Auckland: *Liquigas v Manukau City Council*¹¹⁹. That decision stated:

*"We accept that a land use which causes so great an extent of fear or worry about danger and stress as to effect the mental health of members of the community generally (rather than individual persons who may be more fearful than people generally) may properly be a consideration in land use planning. However, there was no evidence on which we could find such circumstances in this case. ... We will concern ourselves directly with the question of the safety of the community, in the expectation that if safety is properly provided for, the mental health of the community will not be affected."*¹²⁰

188. We have to consider whether that is the appropriate approach under the RMA or whether the more robust position adopted in the *Telecom*¹²¹ decision is correct when it stated:

"social angst and lack of well-being in the community affected by the proposal ... cannot be a material consideration."

189. One aspect of the Town and Country Planning Act cases (especially *Liquigas*) which is clear is that the importance of the fear or psychological element is very dependent on the objective assessment of the risk:



¹¹⁹ (1983) 9 NZTPA 193

¹²⁰ The same at p. 218

¹²¹ W165/96 at pp 11-12

*"What is called for is an assessment of the risk and the consequences of the proposal before us. In making that assessment we must endeavour to hold a balance between being unduly timorous in the face of danger, however remote, and being callous about other people's safety."*¹²²

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

191. This, as we understand it, was the approach taken in *Department of Corrections v Dunedin City Council*¹²³. That case concerned the location of a periodic detention centre in South Dunedin which was opposed by local businessmen. The Court stated¹²⁴:

"We accept that as a matter of law, the concerns expressed by the several members of the South Dunedin Business Association who

¹²² *Liquigas* at p.220

¹²³ Decision C131/97

¹²⁴ *Department of Corrections* at p.21



gave evidence in this case, can be regarded as giving rise to adverse effects on the environment, if they are substantiated. Consequently, it is relevant to have regard to these concerns and the evidence about them.

The question remains however, whether this evidence establishes that there are likely to be such adverse effects on the environment."

We consider the last sentence shows the difference between this case and *Meadow Mushrooms* as relied on by Mr Hearn. In the latter case the accumulation of heavy metals is a known hazard to humans and other animals. So the fear of that hazard may properly be taken into account. It was different in *Department of Corrections* where the existence of adverse effects on the environment had yet to be established, and in fact was not.

192. To summarise on the psychological evidence – on the SPS side – we have the evidence of Dr Staite which we find methodologically unreliable, partially incomprehensible (his answers in cross-examination tended to be repetition of psychological jargon) and inconsistent. On the other hand we have Dr Zelas' evidence which, while clearer and consistent, is based on the assumption that there will be no adverse physical health effects from exposure of the school community to RFR. Parents who read her evidence might be offended because it suggests they are irrational in their concerns for their children. Dr Zelas' approach seems both a little unfair, and simplistic. We cannot agree that there is no risk to the school community. There is some risk (although very small, or extremely small for leukaemia and other cancers).

193. In the end we find all the expert psychological evidence unhelpful. We had direct evidence about people's fears of exposure to RFR from enough



parents and teachers to be sure that a significant part of the school community is genuinely concerned about, even fearful of, the effects. But whether it is expert evidence or direct evidence of such fears, we have found that such fears can only be given weight if they are reasonably based on real risk.

Social and Financial Effects

194. We have described Dr Brown's evidence as to the probability that parents would withdraw their children from the school. For Telecom, Mr Fougere was highly critical of that evidence. He was of the view that generally her survey failed to comply with the requirements of a proper reliable survey. The first question in Dr Brown's survey was whether parents would consider moving their child from the school, however when she came to interpreting the results she spoke of parents who would move their children. Mr Fougere said that invalidated the remainder of the survey as this same confusion is implicit in the logic of the two questions that followed.

195. He was also of the view that the sample was almost certainly biased in that more of those who would consider moving their child(ren) than other parents are likely to have responded to the survey. Mr Fougere considered that since less than half the parents to whom the survey was sent actually replied the potential for bias in the sample (in overstating concern about the tower) is important. Mr Fougere suggested we attach minimal weight to Dr Brown's evidence and we agree. Accordingly the evidence of Mr Shand and Mr Walsey on financial issues which was based on Dr Brown's evidence can also be given little weight.



Visual Effects

196. In relation to visual effects, we accept that subjective value judgments about the safety of cellsites have no place¹²⁵ in the assessment of visual amenity. There is a chimney on the school grounds that will loom larger than the cellsite mast from some viewpoints. Further Ms Lucas, who gave evidence for the school, did not appear to have taken into account the new slimmer mast. Her evidence was based on the proposal as put to the Council. We prefer Mr Miskell's evidence over Ms Lucas's both for those reasons and also because we consider the tower will not be an undue imposition on the view from the school grounds. There is no visual conflict with surrounding development. We record that we would not necessarily come to the same conclusions if the cellsite was surrounded by houses. Its scale might then make it completely out of proportion, and therefore inappropriate.

Beneficial effects

197. Finally we should mention that there will be some beneficial effects e.g. improved mobile phone coverage on the Telecom network from the presence of the cellsite. As the Telecom witnesses pointed out, the RF spectrum is a limited physical resource under section 5 of the RMA. These advantages would be nearly¹²⁶ insignificant if a scientific assessment of risk showed that there was a real and unacceptable danger to the school community. The advantage of recalling the benefits is that they remind us of the wider context of this application which we should take into account - that is the general exposure of the wider population (including the school



¹²⁵ See the *Telecom* decision W165/96

¹²⁶ The RMA may still require a cost/benefit analysis under sections 5(2)(c) and 7(b).

community) to RFR from all sources. We will return to this issue in our assessment under section 105(1)(c) of the Act (Chapter 10).



Chapter 8 : Statutory Instruments (Section 104(1)(d))

The Transitional Plan

198. In the city section of the transitional district plan (“the transitional plan”) the site is zoned Commercial Service (“C/S”). This zone covers approximately seven separate titles (comprising approximately 5570m²) on the north eastern intersection of Hills Road and Shirley Road. Shirley Primary School is located to the north east of the site. It is zoned Residential 1 and designated for “Primary School” purposes. Diagonally opposite the site is a Commercial 1 zone which has been recently developed with a new shopping centre called “The Dates”. The zone statement for the C/S zone states:

*“These zones generally adjoin shopping centres and are designed to provide for service and small scale industrial activities which mainly, although not exclusively, serve local needs and which provide some local employment. These uses are often associated with uses within adjoining Commercial 1 and 2 zones.”*¹²⁷

199. Activities permitted in the C/S zone include administrative, commercial and professional offices, medical and community facilities, service industries, places of assembly , parks and recreation grounds, local taverns, service stations, public utility substations and exchanges.¹²⁸ As the zone rules do not mention radio communication facilities such as the proposed cell site, the proposal is non-complying under section 374(4) of the Act.



¹²⁷ Transitional Plan, Para 43 [p119]

¹²⁸ Transitional Plan, Ordinance, 43.1 Para 43.1A-F [pp119-120]

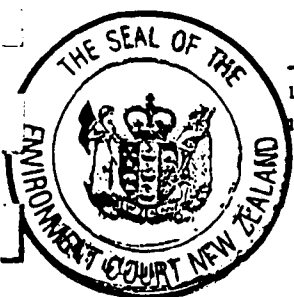
200. There are a number of performance standards in the C/S zone relating to floor space, visual amenity, sunlight outlook and amenities, access, parking and loading. Height is controlled indirectly by recession planes where the site adjoins two of the residential boundaries of the school.
201. The transitional plan sets out what the development of commercial centres shall have regard to in respect to design. The list includes avoiding visual conflict with surrounding residential development and providing landscaping to act as a buffer between residential and non residential uses where necessary.¹²⁹
202. We find that the proposed cellsite sits comfortably within the objectives and policies of C/S zone of the transitional plan. It is the wire-less equivalent of a public utility such as a telephone exchange which is a permitted activity. As we have found in relation to visual effects there is no conflict with surrounding residential development. We appreciate that the school is zoned "*Residential*" – although as a public work it is obviously not used for residential purposes – but we understand the recession planes for the cellsite are met in respect of the school's boundaries.

The Proposed Plan

203. Under the Proposed Christchurch City Plan ("the proposed plan") the site is zoned Business 4 which is a suburban industrial zone. Any activity can establish in this area as a permitted activity providing it complies with all the development standards and all the community standards.¹³⁰ Height is

¹²⁹ Transitional Plan, Scheme Statement, Clause 26 [p23]

¹³⁰ Proposed Plan, Vol 3, Rule 4.1.1, [p3/17]



again controlled by recession planes and these are relevant to the two boundaries adjoining cultural zones.¹³¹

204. Chapter 9 of the proposed plan makes specific provision for utility structures:

Rule 4.2.1 reads:

“Application of these rules

(a) These rules on utilities replace any zone rules which may otherwise apply to utilities in zones through which utilities pass, or within which they are sited unless specifically stated to the contrary.”¹³²

So rather remarkably, the utilities rules generally replace all other zone rules.

205. Under Chapter 9 the facility is a discretionary activity:

“ 4.4.2 Telecommunication and radio communication facilities

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 300m of the boundary of any living zone



(ii) so designed and operated as to emit more than 50 microwatts per square centimetre at any time within any zone or within 300m of a living zone... ”¹³³

206. In the “Reasons for Rules” for the utilities it says:

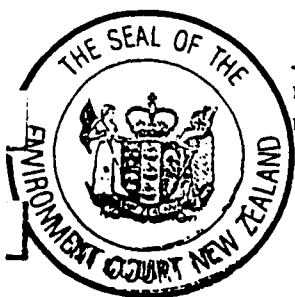
“Pending the review of the New Zealand Standard 6609 (1990) in respect to microwave and ultra high frequency emissions, a conservative approach has been adopted having regard to the potential effect of such facilities on the health of persons in the vicinity. ”¹³⁴

The proposed plan thus turns risk into a key element when considering the approval of the cellsite as a discretionary activity. Risk is not spelled out clearly as an objective or policy but we assume that an objective or policy about it can be inferred from the reason for the rule stated above. So whether or not the cellsite proposal is consistent with the objectives and policies of the proposed plan depends on whether there is a significant risk to persons in the vicinity of the cellsite. In other words the proposed plan does no more than refocus on the principal issue in the case: whether there is a risk from exposure to RFR at athermal levels.

207. Little weight should be given to the proposed utilities section of the plan because there are submissions to the Council challenging aspects of the section – including submissions from both appellants in these proceedings.

¹³³ Proposed Plan, Vol 3, [p 9/22]

¹³⁴ Proposed Plan, Vol 3, Paragraph 4.6, [p9/23]



Chapter 9 : Other Matters (Section 104(1)(i))

Introduction

208. There are a number of other matters we have to consider in this case:

- the application of the ANZ Standard and the ICNIRP Standard
- whether alternative sites for the cellsite should have been considered, and if so, were adequately covered by Telecom;
- the application of the “*precautionary principle*”; and
- whether the “prudent avoidance” principle or the policy of ‘as low as reasonably achievable’ (“ALARA”) is relevant.

The Standards

209. We have to consider the two new standards both published in 1998. The ANZ Standard¹³⁵ states that the variables considered when developing the safety factors were:

- “(a) Absorption of electromagnetic energy by humans of various sizes, with particular reference to whole body or partial body resonant absorption of energy.*
- (b) The lack of knowledge of the relationship between peak SAR and biological effects.*
- (c) Environmental conditions - the exposure limits should be protective under adverse conditions of temperature, humidity and air movement.*
- (d) Reflection, focusing and scattering of the incident fields in such a way that enhanced absorption occurs.*
- (e) Possible altered response of humans taking medicines.*

¹³⁵ The ANZ Standard is AS/NS2772.1 (Int) :1998 expires on 5 March 1999



- (f) Possible combined effects of RF electromagnetic energy with chemical or other physical agents in the environment.
- (g) The possible effects of modulated microwave fields on the central nervous system and the possible existence of 'power' and 'frequency' windows for such effects.
- (h) Possible non-thermal effects."¹³⁶

This list shows that the Committee which set the standard was aware of the types of (potential) risk which have been raised in this case.

210. The Foreword then compares the standard with that endorsed by ICNIRP:

*"At frequencies between 400MHz and 2GHz the ICNIRP literature gives progressively rising derived levels and thereafter a level which is constant with frequency. This Interim Standard does not, however, follow this methodology and requires a lower and constant level to be met across the entire frequency range above 400MHz. Furthermore, a lower spatial peak SAR is prescribed for all parts of the body except hands, feet, wrists and ankles. This approach was followed because of the existence of ongoing research projects by WHO and public concerns about RF radiation, particularly from cellphone systems. The higher ICNIRP derived levels in the frequency range above 400MHz are given in this Interim Standard for information only."*¹³⁷

The standard itself then states:

¹³⁶ AS/NZS 2772.1 (Int): 1998 Part 1, p.25

¹³⁷ AS/NZS 2772.1 (Int): 1998 (p.4)



“6.1 General

The exposure limits have been developed on the basis of there being a threshold of 4W/kg whole body SAR before any adverse health consequences are likely to appear. Whilst occupational limits are based on reducing exposure by a factor of 10 below the 4W/kg threshold, non-occupational exposure limits are derived from values one fifth (or less) those of clause 5.2 [Clause 5.2 refers to the new limiting values for persons exposed to RF in the course of their occupation]. The non-occupational limit is therefore 0.08W/kg whole body average SAR.”¹³⁸

211. On the issue of whether there could be athermal effects from RF radiation the ANZ Standard states:

“The Committee responsible for this Interim Standard considered both thermal and non-thermal effects of RF exposure. The Committee found that, when established scientific literature is used, exposure limits can only be based on thermal effects at frequencies above about 10 MHz. This is consistent with the findings of organisations developing standards in all Western countries. The Committee noted that while some researchers had found effects at body cell levels, there has been no conclusive evidence that such effects constitute a health hazard to humans” (Our underlining).¹³⁹

The use of the word ‘conclusive’ in the last sentence is likely to cause some concern about the ANZ Standard amongst lay people. It suggests a very high standard of proof before standards would be altered. For example if

¹³⁸ AS/NZS 2772.1 (Int): ;1998 (p.13)

¹³⁹ AS/NZS 2772.1 (Int): 1998 Foreword (p.4)



there was merely a 'significant' but not conclusive evidence of a health hazard would the standard be altered?

212. Most causes of cancer (to take one hazard as an example) were initially recognized as a result of epidemiological studies, even though the causes cannot be 'proved' by such studies. Bearing that in mind we would have thought that if there are such studies suggesting a link between low-level (i.e. athermal) chronic RF exposures and cancer then their significance should have been discussed, rather than simply summarising the issue by stating that athermal effects had been considered but that there were no 'conclusive' results. Because we consider the public is entitled to ask for action taken under the Act if the impact of the potential hazard is sufficiently severe even if the effect has

- not been conclusively proved (including an explanation of the biological mechanism)
- possibly not even been significantly established at an epidemiological level
- the ANZ Standard cannot guide us on this issue.

213. Turning to the ICNIRP Standard, the individuals who comprise ICNIRP including Dr Repacholi as Chairman Emeritus explain that:

"These guidelines for limiting exposure have been developed following a thorough review of all published scientific literature. The criteria applied in the course of the review were designed to evaluate the credibility of their various reported findings (Repacholi and Stolwijk 1991; Repacholi and Cardis 1997). Only established effects were used as the basis for the proposed exposure restrictions. Induction of cancer from long term EMF exposure was not considered to be established and so these guidelines are based on short-term, immediate health effects



such as stimulation of peripheral nerves and muscles, shocks and burns caused by touching conducting objects and elevated tissue temperatures resulting from absorption of energy during exposure to EMF. In the case of potential long-term effects of exposure, such as an increased risk of cancer, ICNIRP concluded that available data are insufficient to provide a basis for setting exposure restrictions, although epidemiological research has provided suggestive, but unconvincing, evidence of an association between possible carcinogenic effects and exposure at levels of 50/60 Hz magnetic flux densities substantially lower than those recommended in these guidelines.

.....
Transient, cellular and tissue responses to EMF exposure have been observed, but with no clear exposure – response relationship. These studies are of limited value in the assessment of health effects because many of the responses have not been demonstrated in-vivo. Thus in-vitro studies alone were not deemed to provide data that could serve as a primary basis for assessing possible health effects of EMF.”

214. The ICNIRP standard was the last word in scientific consensus on the issue of athermal effects from chronic exposure to RFR at the time we heard the case. We are reassured to find that it confirms our findings on the other evidence before us that the risk of adverse health effects on humans of chronic low-level exposure to RFR is very low. Strengthening our reassurance is the fact that at cellphone frequencies the ANZ Standard becomes almost 2½ times lower than the international standard in the ICNIRP guidelines.



Alternative Sites

215. In response to the argument by Mr Hearn that Telecom was obliged to consider alternatives, counsel for Telecom responded that there is no onus on Telecom to give evidence or provide information regarding alternative sites unless:

- (a) A matter of national importance is at issue with regard to the selected site¹⁴⁰; or
- (b) There is a likelihood of significant adverse effects - clause 1(b) of the Fourth Schedule¹⁴¹; or
- (c) The activity is a non-complying activity and granting consent for the activity within the zone would reduce public confidence in the administration of the district plan¹⁴².

Counsel for Telecom was of the view that none of these applied.

216. Referring to the evidence given on behalf of Telecom by Messrs Moran, Jennings and Gledhill, counsel for Telecom emphasised that in practical terms the proposed site is realistically the only one available to achieve Telecom's service objectives. He also pointed out that in response to questioning from Mr Hearn, Telecom's witnesses, Mr Moran, Mr Gledhill and Dr Black explained that micro cells (as opposed to the macro cells as proposed in this case) as an alternative are not realistic as they are not the correct technology for the engineering purpose sought to be achieved. Further Telecom witnesses, Doctors Elwood, Black and Meltz all denied the contention made by Mr Hearn that the proposed site is "unsuitable" due to

¹⁴⁰ *TV3 Network Services Limited v Waikato District Council* [1997] NZRMA 539 at 551

¹⁴¹ *Trans Power and Dumbar v Gore District Council* W189/96

¹⁴² *Stark v Auckland Regional Council* [1994] NZRMA 126 and *Manos v Waitakere City Council* (1993) 2 NZRMA 226.



its close proximity to a primary school attended by children aged 5-10 with a special sensitivity to RFR discharges. Counsel for Telecom pointed out that in *McIntyre* consent was granted despite the relative proximity of the site to dwellings and a creche, as the Tribunal found no evidence of effects, actual or potential.

Additional Principles and Policies

217. Mr Gould submitted there are three further matters that arise for consideration under s104(1)(i):

- the 'precautionary principle';
- the policy of prudent avoidance; and
- the concept of keeping RFR "as low as reasonably possible".

218. Mr Hearn relied on the general 'precautionary principle' of environmental law referred to in *McIntyre*. The Court then considered the principle under both section 104(1)(i)¹⁴³ and then because it was relevant in its overall evaluation under section 105(1)(c) where it stated:¹⁴⁴

"The influence of the general precautionary principle in 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 of otherwise permitted activities. However we think that in an appropriate case they would also include

¹⁴³ *McIntyre* at p.304

¹⁴⁴ *McIntyre* at p. 305



the gravity of the effects if, despite present uncertainty, they do occur."

219. There is some confusion apparent over the applicability of the precautionary principle. We hold that the correct position is that the RMA is precautionary and thus justifies a precautionary approach¹⁴⁵. We consider, without deciding, that the precautionary principle is a limited consideration introduced by international law. The precautionary principle, a subset of the precautionary approach, derives from the *Rio Declaration*¹⁴⁶ principle 15 which states:

"In order to protect the environment, the precautionary approach shall be widely applied by states according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to protect environmental degradation."

220. It will be seen that the precautionary approach applies where there is a threat of 'serious or irreversible damage' and entails that just because it is not, say, 99% certain that the threat will materialise, or perhaps that the damage will be irreversible, does not mean that no step should be taken to minimise risk. To paraphrase in the language of section 3 of the RMA the principle is, if a potential effect is only of high (and not very high) probability and high potential impact that is no reason for failing to take

¹⁴⁵ *Trans Power* used the words "precautionary approach" and so did the Australian case of *Greenpeace Australia v Redbank Power Company* (1994) 86 LGERA 143. Other New Zealand cases that have used "approach" rather than "principle" have been cases involving the New Zealand Coastal Policy Statement which specifically mentions a precautionary approach: *Clyma v Otago Regional Council* W64/96; *North Shore City Council v Auckland Regional Council* [1997] NZRMA 9 and *Trio Holdings v Marlborough District Council* 2 ELRNZ 353

¹⁴⁶ *Rio Declaration on Environment and Development adopted at the United Nations Conference on Environment and Development, Rio de Janeiro, 3-14 June 1992, [1992] International Legal Materials 876, 879*



action to guard against the effect. The position facing us of course is quite different in that the alleged effect is clearly one of low probability and of unknown potential impact.

221. The reason we doubt why a wider "*precautionary principle*" is useful is precisely because a precautionary approach is inherent in the Act. As a result of the wording of section 3(f) - as discussed earlier - we are to have regard to potential effects of low probability but high potential impact. In our view this is precisely what the precautionary approach is about. Nor does the "*principle*" help (any more than does section 3(f)) by indicating how much weight is to be given to it.

222. Reference to principles or policies outside the Act which can already be found inside it is simply confusing. We think Occam's razor should apply and reference to the precautionary principle either eschewed or, if used, should be recognized as a restatement of section 3(f) and the precautionary approach. That position is encouraged by the fact that in this case we were also referred to the "*prudent avoidance*" policy or principle; and to the ALARA policy ("*as low as reasonably achievable.*") In our view all of these are simply ways of expressing concern about future effects of low probability (so that we do not know whether they will occur) and high potential (again because we do not know) impact.

223. In summary, we do not consider it is appropriate to apply the "precautionary principle" or the other policies suggested by witnesses and supported by counsel, for three reasons. First a precautionary approach is already implicit in the Act and emerges in the flexibility of the standard of proof applied by the Court and (as we shall see) in the weight given to evidence that has only been "proved" to a low standard (probability). Secondly such a "principle" is an unnecessary complication in an already complex



statutory and factual matrix. Thirdly, application of the precautionary principle (or any of the other rules of thumb) to our decision under section 105(1) would lead to double-counting of the need for caution. If the appropriate standard of proof is on a sliding scale between the balance of probabilities and beyond reasonable doubt, depending on the impact of the effect, the fact is that the appropriate caution has been exercised when deciding under section 104(1)(a) what the effects are to be considered under section 105. If the Court applies the “precautionary principle” as another matter under section 104(1)(i)¹⁴⁷ then the need for caution will have been considered twice.



¹⁴⁷ As *McIntyre* suggests at p.305

Chapter 10 : Section 105*Threshold Tests*

224. Since the proposed cellsite is deemed to be non-complying¹⁴⁸ we have to consider whether it passes either of the threshold tests in section 105(2)(b).

This states:

“(2) A consent authority shall not grant a resource consent –

...

(b) Notwithstanding any decision made under section 94(2)(a), for a non-complying activity unless it is satisfied that –

- (i) The adverse effects on the environment (other than any effect to which s104(6) applies) will be minor; or*
- (ii) Granting the consent will not be contrary to the objectives and policies of the plan or proposed plan;”*

In our extensive coverage of the adverse effects we have already come to the conclusion that none of them are more than minor. Hence the first threshold test is met.

225. Although we do not strictly need to consider the second threshold test under section 105(2)(b) we find that the proposal is not contrary to the objectives and policies of the proposed City plan. That is hardly surprising given that the use of the cellsite is a discretionary activity in that plan. And there is nothing in the transitional district plan to which the proposal is contrary.



¹⁴⁸ Section 374 RMA

The Ultimate Test

226. Since the application passes the threshold tests we now turn to the exercise of our discretion under section 105(1)(c). The overall test to be applied when exercising that discretion is stated in *Baker Boys Ltd v Christchurch City Council*¹⁴⁹ as follows:

"[109] As for our discretion under s 105(1)(c) we have to make an overall judgment to achieve the single purpose of the Act. This is arrived at by:

- *taking into account all the relevant matters identified under s 104*
- *avoiding consideration of any irrelevant matters such as those identified in s 104(6) and 104(8)*
- *giving different weight to the matters identified under s 104 depending on the Court's opinion as to how they are affected by application of s 5(2)(a), (b) and (c) and ss 6-8 of the Act to the particular facts of the case, and then*
- *in the light of the above*

allowing for comparison of conflicting considerations, the scale or degree of them, and their relative significance or proportion in the final outcome." North Shore City Council v Auckland Regional Council (1996) 2 ELRNZ 297."

¹⁴⁹ [1998] NZRMA 433 paragraph [109]



227. Mr Hearn submitted that Part II of the RMA was the essence of this case especially that part of the definition of sustainable management which refers to the health and safety of people and communities.¹⁵⁰ In a sense he is right but then almost every relevant factor under the RMA can be brought back to some part of the definition of sustainable management. However, we do accept that because the health of the people potentially affected by the RFR discharge is an element of sustainable management we must place a great deal of weight on that issue.

228. The main factors we have to balance in this case, but overlooking neither the other issues raised, in particular under section 104(1)(i), nor the purpose of the Act, are:

- (1) The very low risk, subjectively but reasonably assessed, of adverse learning effects and/or sleeplessness from exposure of pupils at the school to RF radiation;
- (2) A very low risk to pregnant women of miscarriages;
- (3) The extremely low risk of exposure to RFR causing cancer, e.g. leukaemia in humans;
- (4) The minor adverse visual effects from the cellsite mast¹⁵¹;
- (5) The provisions of the city plans¹⁵²;
- (6) The ANZ Standard, and the ICNIRP standard;
- (7) The fear of some teachers, pupils and parents of RFR;
- (8) The possibility that the school might close (but acknowledging that such a possibility derives from SPS' own actions); and
- (9) The context given by other sources of RFR and public acceptance of them¹⁵³.

¹⁵⁰ Section 5(2) RMA

¹⁵¹ Points 1-4 come under section 104(1)(a)

¹⁵² Point 5 arises under section 104(1)(d)

¹⁵³ Points 6-9 come under section 104(1)(i) and Part II of the Act



229. There is nothing else we need to say about considerations (4) and (5) in that list. They are either of little weight or (in the case of the proposed plan) subsumed in later considerations. When allotting the weight to be attached to the key considerations (1)-(3) we have to recognize that there is no objective risk assessment of these because it is common ground that it is impossible, on current knowledge, to say that there is a causal connection between RFR exposure and the adverse effects mentioned, or that there is a dose-response relationship, or that there is a threshold beyond which athermal harm will occur. In the end the weight given by the Court to the issue depends to a substantial extent on how far it is persuaded that there is a risk of really severe injury, or ultimately death.

230. Measuring the proposal against the other relevant issues we found first that the cellsite is not contrary to the objectives and policies of the plans. Rather it is recognized by the proposed plan. It is consistent with the ANZ Standard and the ICNIRP standard. Finally, the purpose of the Act is met in that the use by Telecom of its resource (part of the EM spectrum) is managed in a way which enables Telecom and its subscribing community to provide for their wellbeing, while not in any significant way putting at risk the health and safety of children and teachers at the school.

231. The last (ninth) consideration - the overall circumstances of the case - is important. We have to recognize how much EMR citizens of New Zealand are exposed to both voluntarily and involuntarily. As we pointed out in Chapter 1, everyone in the whole world is exposed to EMR all the time. That includes exposure to the most dangerous EMR which is high-frequency ionising radiation (such as cosmic rays). At lower frequencies there is ultraviolet light and then the narrow band of visible light with frequencies of between 10^{14} and 10^{15} Hertz. The important and conspicuous



EMR we all receive is direct from the sun. Sunlight gives each and every living thing a continuous exposure of about 80,000 $\mu\text{W}/\text{cm}^2$. Below the frequencies of visible light there is no danger from ionising radiation. This radiation can of course still be dangerous - it contains enough energy to cause heating or thermal effects. However, greater exposures are needed at lower frequencies to cause those effects.

232. So there is nearly nothing special about radio frequency (RF) radiation - it is just one of the many forms of EMR that humans have evolved to live with. However, the background natural level of RFR is very low. It is only in the last 100 years that we have become exposed to much more "unnatural" i.e. human-generated RFR. Now we receive it from televisions, microwave ovens, electric blankets, visual display units and of course cellphones.

233. As a link between the adverse (physical) health effects as we have found them, and the psychological effects discussed in Chapter 7 we observe that there is often a large gap between scientists and the public's assessment of risk. Scientists attempt to calculate risk on a probabilistic basis, whereas the public is swayed by other factors or, possibly, by the same factors viewed in a different way. One aspect of this is that¹⁵⁴:

"Most people have considerable difficulty understanding the mathematical probabilities involved in assessing risk ... People consistently overestimate small probabilities. What is the likelihood of death by botulism? (One in two million). They underestimate large ones. What is the likelihood of death by diabetes? (One in fifty thousand). People cannot detect inconsistencies in their own risk-related choices."



¹⁵⁴ Justice S Breyer: Breaking the Vicious Circle (1993) p.35

234. There is a useful discussion of the public perceptions of risk in part B of the *Woodward Report*. Most of the items in the report's list, except for suspicion of multinational companies, were exhibited by one or other of the individual witnesses for the school in this case, for example:

- concern for vulnerable groups (e.g. children)
- uncertainty of knowledge
- lack of confidence in the standard-setting process
- imposition of involuntary risk
- (to which we add) scepticism about scientists.

235. In this case there is definitely concern for a vulnerable group - the children who go to the school. But we note that their vulnerability is because they are children not because they are exposed to RFR. There was no evidence given to us (only speculation) that children are more vulnerable to exposure to RFR.

236. As for uncertainty of knowledge, while it is true that we cannot be 100% sure that RFR does not cause adverse health effects there is no demonstrable basis for saying that it does either. There is so little evidence for an adverse health effect that it cannot be scientifically calculated as a percentage probability in small fractions of a percent. And it must be remembered that many health effects such as cancers are stochastic. For example, one can expose a group of animals to a known carcinogen and only a percentage of them will get cancer.

237. There are of course well-documented cases of scientists approving technology that turns out later to be harmful, e.g. thalidomide or growth hormone. The birth defects caused by thalidomide were referred to in this case; and the deaths from Creutzfeldt-Jakob Disease (CJD) transmitted



through growth hormone are well known. The public in general and the school in particular are entitled to ask whether microwave RFR could also have unpredicted effects in the future, possibly years into the future. The answer is that it possibly could, but we find that the possibility is very, very remote having assessed all the evidence as carefully and sceptically as we could.

238. As for the possibility that the school might suffer financially or even have to shut down, we consider the first is probable. However, that is a problem of SPS' own making. The possibility of closure is also there, but the other side of that argument is that Telecom should find an alternative site. We are satisfied there is no other available site on which Telecom could place the cellsite in the Shirley area, so its options are to keep the cellsite as proposed or move to other technology e.g. micro cellsites that are not next to the school. Although the latter would be possible (as Mr Moran for Telecom conceded), we consider it unfair to force Telecom to move to this new (and apparently expensive) technology when the need has not been demonstrated. In the situation as we assess it there is very little (or extremely low) risk to the school from the presence of the cellsite.

239. For these reasons, we consider that SPS should have to make the accommodation. If SPS has generated an atmosphere of fear and distrust amongst parents, teachers and pupils then it might have to live with the consequences of that. Having said this, SPS does have a practical remedy available to it in the light of its witness Dr Beale who said in his evidence-in-chief:

"the operation of this cellsite could cause adverse health effects in people spending a significant amount of time on the ground and in buildings within 30 metres of the installation." (Our underlining).



The obvious answer for those who still consider the cellsite will cause adverse health effects is for the school to fence off and not use the area within 30m of the cellsite. We consider that step is entirely unnecessary, but obviously it is within the SPS' capacity to undertake and they should do so if they consider that prudence requires it.

240. To explain why the parents and teachers at the school held some of the opinions they did, counsel for Telecom suggested they had been fed misinformation. We heard insufficient evidence to establish whether that was so, or who may have been responsible. However, the information (as produced to us) circulated to the school and the wider Christchurch community does have a very subjective and unbalanced tone to it. As Dr Black pointed out in his evidence there are a number of published fallacies about exposure to RFR and the ANZ Standard controlling such exposure. He mentioned three of these:

"For example, it has been said that the Australasian Standard is set at "1/50th of the lowest level at which any harmful effects occur." This is quite wrong because the SAR of 4 watts per kilogram is nothing more than a benchmark. It is a threshold of effect, not a threshold of harm.

Others who criticise the standard [in the ANZ Standard] of 0.08 W/kg claim that because the standard is based on a heating effect only, it is purely a thermal standard and does not take into account any other possible effects (e.g. athermal effects). This is also incorrect. The thermal benchmark was chosen only because it is a definite, repeatable level. By setting the non-occupational standard for RF at 1/50th of this thermal benchmark, any detectable thermal effects have long vanished. Indeed thermal effects are not observable at 1/5th of 4 watts per



kilogram and this level (0.8 watts per kilogram) has formed the basis of some Standards overseas.

Moreover, the [ANZ] Standard takes into account both thermal and non-thermal effects of RF exposure.” (our underlining)

241. In the end we have to say to the members of the school community that we consider they have greatly exaggerated the risks of exposure to RFR. We do not find SPS or the school community to be irrational, but we do find that they have assessed Telecom’s proposal unreasonably. Perhaps there is a psychological analogy with the risk of an asteroid - we refer to the lines in Les Murray’s poem *Corniche* which read:

*“The rogue space rock is on course to snuff your world,
Sure. But go acute, and its oncoming fills your day.”*

242. Looking at the issue that the wider public is also concerned with – whether exposure to RFR is very safe - we have concluded that the argument over cellsites is different from other health scares such as the fiasco in England over mad cow disease (BSE) and its human equivalent nv CJD. The differences are:

- So far as we can judge the scientists and doctors who gave evidence to us for Telecom did so honestly and conscious of their responsibilities;
- RFR is not new – it is not like tampering with food by feeding previously vegetarian animals with bits of other animals (the cause of BSE) or the modification of plants by insertion of ‘alien’ genes (the debate over genetic modification);
- Humans are exposed to RFR (indeed EMR in all its forms) all the time;



- While the school and its inhabitants may have isolated themselves from other sources of 'unnatural' RFR (microwaves, cellphones, electric blankets etc) the rest of the community has not. If we are to stop the cellsite from operating where would this issue stop?
- There is international agreement by responsible scientists in the ICNIRP Guidelines that exposure to less than $450\mu\text{W}/\text{cm}^2$ is very likely to be safe; and
- There is no sense of an international conspiracy of scientists hiding information from us (or the public). On the contrary, there appear to be wide attempts to spread information dispassionately (for example via the *Woodward Report* which we strongly recommend to everyone interested in the issue) and to continue research into various hypotheses about possible adverse health effects.

243. In our final balancing of all the factors, we place a very heavy weighting (under section 5(2) RMA) on the need to protect the school community from harmful health effects. In the end we are persuaded to the very high standard that we require, by the evidence of scientists called by Telecom and by the view of ICNIRP, that the risks to the Shirley Primary School community are very low and are acceptable and accordingly we consider that the Telecom proposal should be allowed to proceed as achieving the purpose of the Act.



Chapter 11 : Telecom's Appeal as to Condition 4

244. The appeal by Telecom asserts that condition 4 as inserted by the Council in its decision is neither a necessary or appropriate condition for dealing with RF emissions. The condition reads:

"4. The total power flux density of radio frequency radiation emitted by the facility, measured in accordance with the principles and methods of measurement set out in Part 2 of NZS 6609:1990:

(a) at 30 metres from the mast at 2 metres above ground level (in the 90 GN sector) shall not exceed 6 microwatts per square centimetre; and

(b) in addition at the nearest outside wall of the residence at 222 Hills Road at 2 metres above ground level, if permission from the owner and the occupier can be obtained, shall not exceed 6 microwatts per square centimetre."

245. Counsel for Telecom acknowledged that in terms of fostering public confidence, consent conditions can serve a valid purpose but was however of the view that condition 4 (which is similar to the condition imposed in *McIntyre*) sets an arbitrary limit different from (and much lower than) the ANZ Standard¹⁵⁵ and would:

- (1) serve to undermine public confidence in the ANZ Standard and any standard setting process;
- (2) contravene the principle of "prudent avoidance" as expressed in that standard;
- (3) tend to suggest there is a health issue above but not below that level (thereby fostering community anxiety);



¹⁵⁵ 200 $\mu\text{W}/\text{cm}^2$

- (4) possibly expose the consent holder to jeopardy for technical breach for no environmental purpose; and
- (5) serve no valid purpose under the RMA.

246. Dr Black explained that prudent avoidance in the context of the ANZ Standard requires:

- (a) All other things being equal, the way in which people most comfortably behave is to take the apparently safer course of action;
- (b) RF should be kept as low as possible (notwithstanding the maximum limiting values in the new Standard) but not limited to the point that there is detriment to the desired performance of the installation, or excessive additional cost to the operators;
- (c) Prudent avoidance can be readily attained with cellphone technology, as the use of "just enough but no more" power is inherent in the basis of technology; and
- (d) Prudent avoidance is not to place reliance on arbitrary levels, but to require best contemporary practice (as stated in the standard) to achieve minimum exposure. To set specific limits sends the message to the community that there are health effects above that limit.

247. Counsel for Telecom was of the view that there was no real inconsistency between how the *Woodward Report* and Dr Black and other witnesses describe "prudent avoidance", but to the extent inconsistency is perceived, he submitted that the evidence of Dr Black be preferred. This is because the *Woodward Report* was published in 1996 and although commissioned by the Ministry of Health is not the policy of the Ministry; it did not take into account the ANZ Standard or the 1998 ICNIRP Guidelines; and the authors were not witnesses in this case.



248. For the Council in support of condition 4, Mr Hughes-Johnson's submissions have been summarised in Chapter 3 of this decision. For SPS, Mr Hearn argued that, far from justifying the approach to prudent avoidance given by Dr Black, a proper understanding of the policy as explained in the *Woodward Report* would mean that, if the Court was to grant consent it should be subject to a condition that the total power flux density at the boundaries of the school be no more than $1\mu\text{W}/\text{cm}^2$. Such a condition would provide for certainty, clarity and public confidence in the application of the principle of prudent avoidance.

249. For the reasons given in Chapter 9 we are reluctant to apply yet another principle not already stated in the Act. We consider the idea of prudent avoidance is simply an aspect of the Act's inherent precautionary approach. Further we are concerned that the ANZ Standard contains the seeds of inconsistency. The recommended conditions of operation for RF discharges can be seen as ways of staying within the standard. Or they can be seen as Dr Black suggested as an aspect of an extra prudent approach. But if they are seen as the latter then any undermining of the standard is of its own making. There is some discussion of the difficulties with the prudent avoidance and ALARA (as low as reasonable achievable) approaches in the *Woodward Report*. This reinforces our conviction we should disregard them. As does the fact that the ICNIRP guidelines do not contain any reference to the prudent avoidance principle.

250. Turning more directly to the appropriateness of condition 4, we bear in mind that:

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



- (a) in the ANZ Standard the level for non-occupational exposure to RFR is set at $1/50^{\text{th}}$ of the exposure level at which thermal effects occur;
 - (b) ICNIRP imposes a maximum level of exposure of 0.08 W/kg (which translates to $450 \mu\text{W/cm}^2$) at the cellsite's frequency.
- (2) we have not considered condition 4 as necessary for mitigation of any effects – principally because we consider the effects of (or the risk which is the combination of them) exposure to RFR to be so minor that they do not require mitigation. Thus any argument over the level is essentially irrelevant so long as the ANZ Standard is met.

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

- (a) There is no reasonable defect in the ANZ Standard's non-occupational limit of $200 \mu\text{W/cm}^2$ (or SAR equivalent) except perhaps that it is too low at the cellsite frequencies (see the ICNIRP standard which is equivalent to $450 \mu\text{W/cm}^2$);
- (b) The Council has, in the *Telecom* case and since, adopted a policy of not imposing a "condition 4" type of limitation, and we can see sense in consistency of conditions across consents;
- (c) Imposing a limit lower than the ANZ Standard would tend to undermine the credibility of the standards;
- (d) Imposing the lower limit of condition 4 would suggest that exposures of more than $6 \mu\text{W/cm}^2$ do cause adverse health effects.
- (e) Any limit such as $6 \mu\text{W/cm}^2$ is arbitrary and arbitrary figures serve no purpose;



- (f) The words "*SUBJECT TO*" in the ANZ Standard mean what they say, that is, any lower figures dictated by prudence or caution are subservient to the ANZ Standard for enforcement purposes¹⁵⁶; and
- (g) This decision may be referred to by communities elsewhere in New Zealand, so it may have some precedent value. Thus we should not undermine the Standards for no good reason if, as we have found, that the risk of adverse health effects from chronic exposure to athermal RFR at the levels to be emitted from the cellsite is very low.

252. Weighing those aspects up, we hold that both condition 4 and SPS' suggested amendment are inappropriate and that condition 4 should be deleted.



¹⁵⁶ Applying the principle in *Environmental Defence Society v Manganui County Council* [1989] 13 NZTPA 197 at 202 (CA)

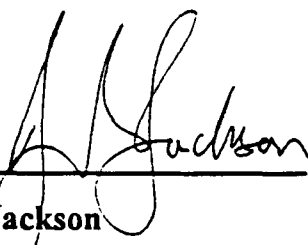
Chapter 12 : Outcome

253. The outcome of these proceedings is that the SPS appeal (RMA 343/96) fails, and the Telecom appeal (RMA 429/97) succeeds. No party sought that costs be reserved, and indeed we consider this an inappropriate case for any order as to costs. Accordingly we make the following orders:

- (1) Under section 290 of the Act, the decision of the Council granting resource consent is confirmed, except that it is varied by:
 - (a) the deletion of condition 4; and
 - (b) corresponding deletions to the remaining conditions where necessary to reflect the deletion of condition 4.

- (2) There is no order for costs.

DATED at CHRISTCHURCH this 14th day of December 1998



J R Jackson
Environment Judge

