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19981214

SHIRLEY PRIMARY SCHOOL V CHRISTCHURCH CITY COUNCIL

Case Summary

[1999] NZRMA 66

Environment Court, Christchurch, C136/98

14 December 1998

Judge Jackson

(43pp)

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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 DP 1069 [CT 503/127 Canterbury Land Registry].
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.

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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 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 degrees, 210 degrees and 330 degrees 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 1 [p 6 of this decision].

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

EMF = Electric, magnetic and electro-magnetic fields

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Ghz = Gigahertz

Hertz (Hz) = Measurement of EMR in cycles per second

Mhz = Megahertz (1 MHz = 10⁶ Hz)

mW = Milliwatt (1 mW = 10³ μw)

RFR = Radio Frequency Radiation — part of the EMR spectrum, below non-ionising frequencies

μW/cm² = Microwatts per square centimetre. Loosely, the unit for measuring exposure to RFR, or **strictly** what is defined as “the power flux density”

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

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- * 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. [Epidemiology is the study of diseases in human populations]. 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.
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 studies [literally “in glass” meaning test-tube or petri-dish studies] and, at the highest level, in-vivo studies [literally “in life” meaning studies of live animals].
13. Complicating the scientific position is that initial experimentation on biological mechanisms is usually on other animal cells (ie 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.
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 issue [the sole subject of Telecom’s appeal RMA 429/97] 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 lists [in s 104(1)] 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 discretion [under s 105(1) RMA] 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.

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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 cellsite [*Waitakere CC v Broadcast Communications Ltd* A116/91 (8 November 1991), *World Services NZ Ltd v Wellington CC* W90/93 (21 October 1993), 1B ELRNZ 32 *McIntyre v Christchurch CC* [1996] NZRMA 289, *Telecom v Christchurch CC* W165/96 (15 November 1996) ["the Telecom decision"]]. 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 relevant scientific papers have been published. The second point relates to one of those papers: that by Dr MH Repacholi published in 1997 [MH 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)"]]. 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 MH Repacholi ..."

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 ..." [*McIntyre* at p309]

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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." [McIntyre at p315]

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 issues [Telecom Ltd v Christchurch CC W165/96 at p 33]. It was submitted that the visual effects of the proposal are minor and no landscape mitigation planting is required.

Plan and Proposed Plan Issues

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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 MJ Moran and CE 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 MD 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-occupational [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 CC* [1996] NZRMA 289 at 293] exposure limit of 200µW/cm².

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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 degrees below the horizontal extending about 60 degrees 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 percent 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.
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 percent of the non-occupational exposure limit in the ANZ Standard).

Overview of Health Effects

31. Next for Telecom we heard from Dr DR 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

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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"). [This is the body that has replaced the International Radiation Protection Association ("IRPA") referred to in *McIntyre v Christchurch City* [1996] NZRMA 289]. ICNIRP has recently published a new standard for the whole spectrum of non-ionising electromagnetic fields below 300 GHz. That standard was published [*Health Physics* 88 Vol 74 No 4 (p494) – called "the ICNIRP Guidelines"] 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") [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.] of 0.08 watts per kilogram at VHF and above. However, it also allows for higher power flux densities at 900 Mhz [it will be recalled that the proposed cellsite is to operate at 870-890 MHz] 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 degree centigrade in a live animal. The ANZ Standard is defined at a 1/50th 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 2½ 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 Guidelines [*Health Physics* 88 Vol 74 No 4 p 494] 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.

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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 JM 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 [Elwood JM 1998: *Causal Relationships in Medicine*: (Oxford University Press) and Elwood JM 1997: *Critical Appraisal of Epidemiological Studies in Clinical Trials*: (Oxford University Press)]. 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. [A cluster is like throwing a dice 3 times and coming up with three 6's.] At most he considered that a cluster study can raise an hypothesis worth checking.

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)] [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)"]]

All

- (b) a study of 20 other transmitters in the UK [Dolk (1997b)] [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)"]]
- (c) a study in north Sydney, NSW [Hocking (1996)] [B Hocking et al (1996) "Cancer Incidence and mortality and proximity to TV Towers" Med. J Aust. 165: 601-605 (called "Hocking 1996")]
- (d) a study in San Francisco, USA [(Selvin (1992))] [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)"]]

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, ie 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."

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." [Hocking (1997) at pp 604 and 605]

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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 sleep disturbances he considered that a study at Schwartzenburg in Switzerland ("the Schwartzenburg study") [Altpeter et al "Study on Health Effects of the Shortwave Transmitter Station at Schwartzenburg" University of Bern, *BEW Publication Series* No 55, 1995] 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 Latvia [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] (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 study [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)"]] 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;

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* airfields, railways, motorways and harbours.

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 emphasis).

Biological Evidence

49. Next we heard from Dr ML 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;

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- (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 KD 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;

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- (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 DS 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 DJ 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 IL 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.

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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") [A Woodward, M Bates, M Hutt "Literature View on the Health Effects of Radiofrequency Radiation"]. 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.

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 s 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.

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- (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* decision [W165/96] 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 s 104. As far as the contentious condition was concerned he was unable to recommend an appropriate condition on RFR levels.

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* [[1996] NZRMA 289 at 315].
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.

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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.

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 percent, and for mortality an increased risk of 132 percent 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 Department [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]. 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 [*American Journal of Epidemiology* 1997 Vol 145, 1-9 and 100-117]. 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.

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 (ie 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/cm². This equates to an exposure of 0.3 µW/cm². 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 Schwartzberg 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 Schwartzberg. 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 (eg setting non-occupational exposure levels in the mobile phone frequency band at 200 µW/cm²) those values should not be construed as an absolute standard. The

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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”. [ANZ Standard p 9 and para 9(d). The capitals are in the original.]

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 SF 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 be harmful changes under nonthermal conditions. He said that the results of such studies had been recently described in ICNIRP papers. [Non-thermal Effects of RF Electromagnetic Fields (ICNIRP 3/97)].
80. He stated:

“The overwhelming majority of studies conducted to date have involved acute (ie nonthermally-induced alterations.” 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

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of deleterious non-thermally 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 Szmigielski [Szmigielski, S et al (1982) *Bioelectromagnetics* 3, 179-188; Szmigielski, S et al (1988)] and Szudzinski [Szudzinski, A et al (1982) *Dermatol Res* 274, 303-311] 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 [Chou, C K et al (1992) *Bioelectromagnetics* 13, 460-496]. In all those studies the microwave exposures were well below the levels that cause tissue heating.
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” [Cleary, SF (1995) Blank, M (Ed): American Chemical Society; Washington DC, 467-477]. 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.”

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85. Finally he referred to five articles of which he is the co-author [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] 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.
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:

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“The majority 83 percent (\pm 9 percent) 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) [Skolbekken, J “The risk epidemic in medical journals.” *Social Science and Medicine*, 1995 (Feb), Vol 40(3), 291-305] during a literature review

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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) [Walker, VR (1995) "Direct inference, probability, and a conceptual gulf in risk communication". *Risk Analysis*, 1995 (Oct), Vol 15(5), 603-609] 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 that gender [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], sex and age [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] 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 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.

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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 psycho-somatic 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 cell sites 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 cell site.
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

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