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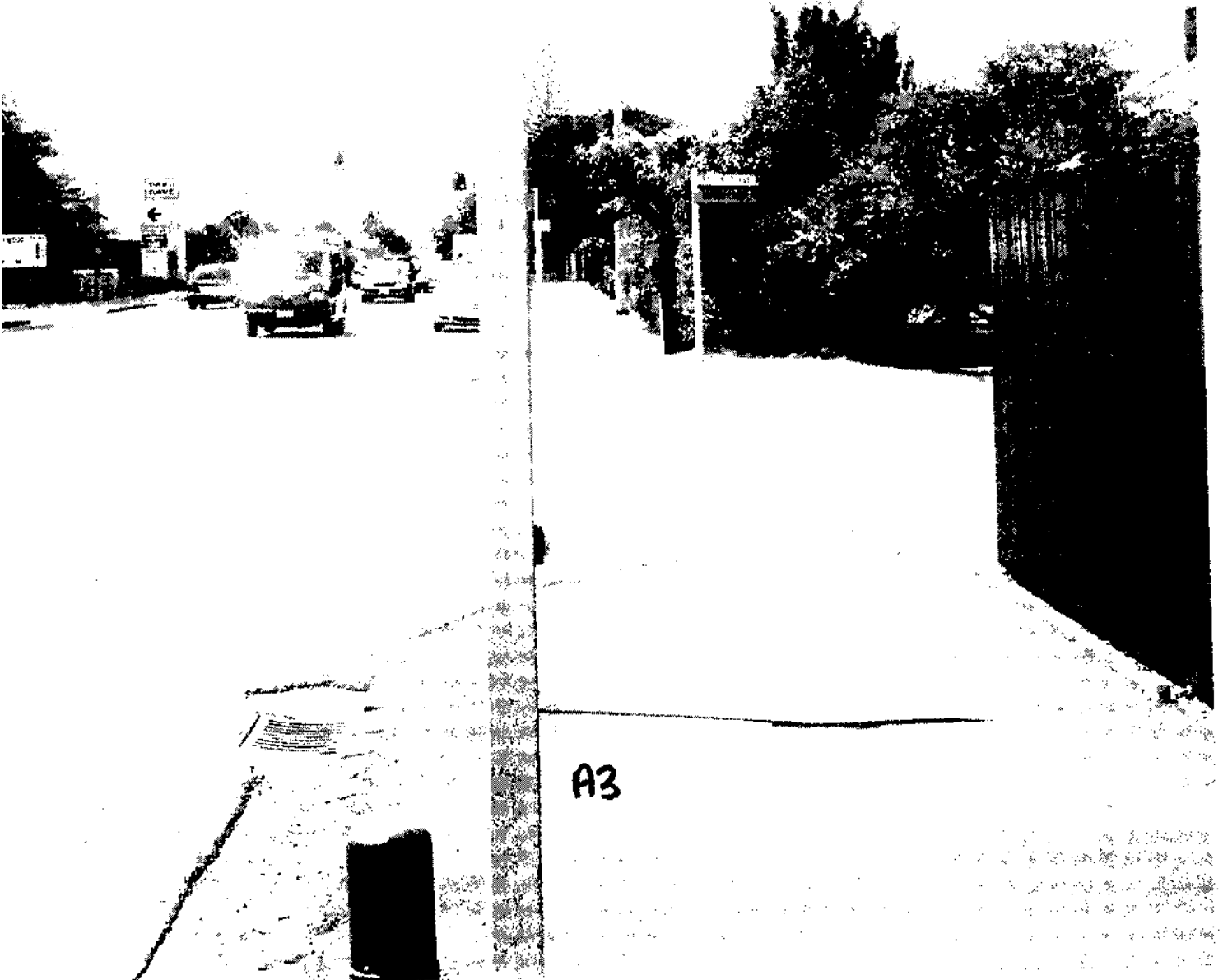
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A2



Bollard Ave

Stop	Destination	Time
1	STATION STREET	08
2	STATION STREET	14
3	STATION STREET	20
4	STATION STREET	26





Gladstone School

Route Destination

0017 31 001 1000

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A4

## Urban Bus Stops on Council Roads in Henderson Ward

137 Te Atatu Rd*	110 Edmonton Rd
4305 Great North Rd*	134 Edmonton Rd
448 Old Te Atatu Rd*	158 Edmonton Rd
106 Taikata Rd*	180 Edmonton Rd
136 Te Atatu Rd*	187 Edmonton Rd
204 Te Atatu Rd*	295 Edmonton Rd
29 Awaroa Rd*	211 Edmonton Rd
100 Barrys Rd*	East side of Edmonton Rd 142 metres south of Central Park Drive
110 Farquar Rd*	41 Flanshaw Rd
98 Flanshaw Rd*	200 Great North Rd
47 Glendene Ave*	287 Great North Rd
4197 Great North Rd*	328 Great North Rd
4261 Great North Rd*	108 Henderson Valley Rd
112 Sunnyside Rd*	310 Henderson Valley Rd
667 Te Atatu Rd*	158 Hepburn Rd
63 Waipani Rd*	7 Lincoln Rd
100 Wharf Rd*	118 Railside Ave
43 Barrys Rd*	West side of Railside Avenue 328 metres north of intersection with Bruce McLaren Road
72 Butterworth Rd*	East side of Railside Avenue 62 metres north of intersection with Edsel Street
107 Hepburn Rd*	7 Ratanui St
99 Awaroa Rd*	West side of Sabulite Road 78 metres north of intersection with Butterworth Drive
60 Glendene Ave*	23 Sturges Rd
34 Hepburn Rd*	60 Sunnyside Rd
136 Hepburn Rd*	46 Swanson Rd
55 Matipo Rd*	2 Taikata Rd
142 Railside Ave*	18 Te Atatu Rd
18 Sunhill Rd*	35 Te Atatu Rd
40 Te Atatu Rd*	60 Te Atatu Rd
117 Te Atatu Rd*	114 Te Atatu Rd
9 Te Atatu Rd*	175 Te Atatu Rd
4 Tirimoana Ave*	273 Te Atatu Rd
29 Waipani Rd*	305 Te Atatu Rd
89 Awaroa Rd*	412 Te Atatu Rd
11 Sunnyside Rd*	595 Te Atatu Rd
157 Edmonton Rd*	699 Te Atatu Rd
74 Flanshaw Rd*	Opposite 243 Te Atatu Rd
97 Te Atatu Rd*	35 View Rd
243 Te Atatu Rd*	66 View Rd
236 Te Atatu Rd*	67 View Rd
148 Henderson Valley Rd*	160 View Rd
85 Farquar Rd*	171 View Rd
42 Flanshaw Rd*	East side of Vitasovich Ave outside Hart Domain
99 Flanshaw Rd*	AS East side of Vitasovich Avenue 115 metres south of intersection with Edsel Street
79 Henderson Valley Rd*	15 Waari Ave
80 Henderson Valley Rd*	97 Barrys Rd
84 Hepburn Rd*	108 Parris Cross Rd*
108 Hepburn Rd*	43 Nui Mana Pl*

223 Hepburn Rd*	112 View Rd*
51 Sunnyside Rd*	9 Millbrook Rd*
129a Sunnyside Rd*	5 Barrys Rd*
3 Taitua Dr*	Barrys Rd outside Glendene School
33 Tirimoana Ave*	East side of Flanshaw Road 41 metres south of intersection with Cole Place
3 Vodonavich Rd*	East side if Flanshaw Road 78 metres north of intersection with Te Atatu Road
4 Vodonavich Rd*	6 Flanshaw Rd*
35 Vodonavich Rd*	18 Henderson Valley Rd*
81 Vodonavich Rd*	88 Vodonavich Rd*
22 Waari Ave *	40 Awaroa Rd
151a Farquar Rd*	7 Butterworth Dr
99 Henderson Valley Rd*	29 Butterworth Dr
38 Vodonavich Rd*	113 Farquar Rd
197 Te Atatu Rd*	263 Great North Rd
378 Te Atatu Rd*	298 Great North Rd
15 Royal View Rd*	320 Great North Rd
16 Royal View Rd*	4156 Great North Rd
425 Te Atatu Rd*	4202 Great North Rd
451 Te Atatu Rd*	4339 Great North Rd
104 Beach Rd*	South side of Great North Road 318 metres west of the intersection with Glenview Road outside Waikumete Cemetery
59 Kokiri Ave*	33 Henderson Valley Rd
4169 Great North Rd*	Henderson Valley Rd outside Henderson High School
East side of Hepburn Road 73 metres south of the intersection with Akatea Road	6 Lincoln Rd
East side of Hepburn Road 34 metres south of the intersection with Hepburn Road	23 Matipo Rd
West side of Vitasovich Avenue 90 metres north of the intersection with View Road	106 RAILSIDE AVE
West side of RAILSIDE Avenue 128 metres north of the intersection with Bruce McLaren Road	West side of RAILSIDE Avenue 68 metres south of the intersection with View Road
543 Te Atatu Rd*	51 Sturges Rd
18 Barrys Rd*	5 Sunhill Rd
South side of Great North Road 91 metres east of the intersection with Ararua Road outside Waikumete Cemetery	10 Sunnyside Rd
Tirimoana Avenue outside Cron Reserve	60 Taikata Rd
Vitasovich Ave Opposite Waitakere Plaza*	69 Te Atatu Rd
Opposite 15 Henderson Valley Rd*	80 Te Atatu Rd
39 Border Rd	342 Te Atatu Rd
11 Bruce McLaren Rd	526 Te Atatu Rd
51 Butterworth Dr	48 View Rd
32 Edmonton Rd	103 View Rd
60 Edmonton Rd	14 Butterworth Rd
73 Edmonton Rd	16 Phelps Pl

\* Indicates stop is currently not signposted with regulatory signage

## Locations for Electronic Real Time Passenger Information Signage in Henderson Ward

21 Edmonton Rd near Henderson Town Centre	4261 Great North Rd
32 Edmonton Rd near Henderson Town Centre	4305 Great North Rd
60 Edmonton Rd	4339 Great North Rd Glendene Shops
73 Edmonton Rd	South side of Great North Road 318 metres west of the intersection with Glenview Road outside Waikumete Cemetery
110 Edmonton Rd	South side of Great North Road 91 metres east of the intersection with Araroa Road outside Waikumete Cemetery
134 Edmonton Rd	North side of Great North Road 70 metres east of intersection with Edsel Street Henderson town centre
157 Edmonton Rd	South side of Great North Road 90 metres east of intersection with Edsel Street Henderson town centre
158 Edmonton Rd	6 Lincoln Rd
180 Edmonton Rd	7 Lincoln Rd
187 Edmonton Rd	East side of Railside Avenue 62 metres north of intersection with Edsel Street
253 Edmonton Rd	West side of Railside Avenue 110 metres north of intersection with Edsel Street
211 Edmonton Rd	East side of Ratanui Street 125 metres south of the intersection with Alderman Drive in Henderson Town Centre
East side of Edmonton Rd 142 metres south of Central Park Drive	18 Te Atatu Rd Glendene Shops
North side of Edsel Street 63 metres east of intersection of Railside Avenue in Henderson Town Centre	136 Te Atatu Rd
North side of Edsel Street 235 metres east of intersection of Railside Avenue in Henderson Town Centre	137 Te Atatu Rd
200 Great North Rd near Glendene Shops	243 Te Atatu Rd
263 Great North Rd	273 Te Atatu Rd
287 Great North Rd	288 Te Atatu Rd
298 Great North Rd	305 Te Atatu Rd
320 Great North Rd	342 Te Atatu Rd
4156 Great North Rd	9 Te Atatu Rd Glendene Shops
4169 Great North Rd	21 Edmonton Rd near Henderson Town Centre
4197 Great North Rd	
4202 Great North Rd	

A7

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Databases > Resource Management > Resource Management Cases and Materials > RESOURCE MANAGEMENT CASES > ENVIRONMENT COURT/PLANNING TRIBUNAL > 19981214 SHIRLEY PRIMARY SCHOOL V CHRISTCHURCH CITY COUNCIL

19981214

**SHIRLEY PRIMARY SCHOOL V CHRISTCHURCH CITY COUNCIL**

Case Summary

[1999] NZRMA 66

**Environment Court, Christchurch, C136/98**

**14 December 1998**

**Judge Jackson**

(43pp)

INDEX:

Chapter 1: Introduction (pp 3-9)

Chapter 2: The Case for Telecom (pp 10-27)

Chapter 3: The Case for the Christchurch City Council (pp 28-29)

Chapter 4: The Case for the Shirley Primary School (pp 30-46)

**198**

Chapter 5: Evidential Issues (pp 47-71)

Chapter 6: Adverse Health Effects [Section 104(1)(a)] (pp 72-90)

Chapter 7: Other Effects [Section 104(1)(a) continued] (pp 91-100)

Chapter 8: Statutory Instruments [Section 104(1)(d)] (pp 101-104)

Chapter 9: Other Matters [Section 104(1)(i)] (pp 105-114)

Chapter 10: Section 105 (pp 115-124)

Chapter 11: Telecom's Appeal against Condition 4 (pp 125-129)

Chapter 12: Outcome (p 130)

## **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.

199

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

**A10**

Ghz = Gigahertz

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

Mhz = Megahertz (1 MHz = 10<sup>6</sup> Hz)

mW = Milliwatt (1 mW = 10<sup>3</sup> μw)

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

μW/cm<sup>2</sup> = 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;

**All**

- \* 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. [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.

**AIQ**

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

A14

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/cm<sup>2</sup>.

**AIS**

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

**A16**

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

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  $\frac{1}{2}$  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 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.

A17

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:

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- (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)”]]

- (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]

**A19**

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 Schwartzburg in Switzerland ("the Schwartzburg study") [Altpeter et al "Study on Health Effects of the Shortwave Transmitter Station at Schwartzburg" 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;

A20