BEFORE THE BOARD OF INQUIRY

IN THE MATTER of the Resource Management Act 1991

AND

IN THE MATTER of applications for resource consent and notices of requirement by Transpower New Zealand Limited for the North Island Grid Upgrade Project

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STATEMENT OF EVIDENCE OF ERIC VAN RONGEN IN REBUTTAL FOR TRANSPOWER NEW ZEALAND LIMITED
(EMF and human health issues)

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Introduction

1. **MY** name is Eric van Rongen. I wish to present rebuttal evidence to the statements of evidence of:

(a) Dr Laura Bennet and Mr Adrian Kinsler;
(b) Mr Doug Parker on behalf of Hunua and Paparimu Valley Residents' Association Incorporated;
(c) Mr Robert McQueen;
(d) Dr Allanah Kilfoyle;
(e) Mr Bruce Davidson;
(f) Mr George Vercoe on behalf of Parahiwi Farm; and
(g) Mr John Makin.

2. **I** address the evidence of each submitter below.

Dr Laura Bennet and Mr Adrian Kinsler (Submission number 1085)

3. **AT** page 1 of her evidence, Dr Bennet states that: "*There is considerable international* [sic] *over the question of whether ELF-EMF has non-thermal effects on our bodies which may lead to illness*", and at page 2: "*There is widespread discussion that thermal limits are outdated, and that biologically-based exposure standards are needed. ICNIRP themselves acknowledges that current guidelines do not take into account potential non-thermal effects of ELF-EMFs (below 100 microtesla).*"

4. **THESE** statements are not all correct. First of all, it is a misconception that the current exposure limits are solely based on thermal effects, as is, for instance, implied by the BioInitiative report that Dr Bennet uses as one of her primary sources of information. I will comment later that this report is seriously flawed in many instances.

5. **THERMAL** effects start to be relevant at frequencies higher than approximately 100 kHz, and above approximately 10 MHz they are considered to be the main effects. At frequencies below 100 kHz, the exposure limits are based on the strength of the electric field that is induced in the body or the electric current that results from it. The induced electric current may result in effects on nervous tissue.

6. **ANOTHER**, very specific effect, that may occur in a narrow range of low frequencies is the induction of phosphenes. Those are the experience of flashes of light that result from direct stimulation of the retina by induced electric fields. I have described this in paragraph 15 of my evidence in chief. Although phosphenes are not considered harmful, they can result in startle effects.

7. **THESE** two types of non-thermal effects that occur at low frequencies, the induction of phosphenes and effects on nervous tissue, and the thermal effects at higher frequencies, are considered to be scientifically established effects. The exposure limits are designed to prevent health effects resulting from these biological effects, as I have described in paragraphs 22 to 31 of my evidence in chief. Some individuals and non-scientific groups indeed argue that exposure limits based on thermal effects are outdated, but all major scientific expert committees, based on continuous evaluations of new scientific evidence, still consider such limits to be valid.

8. **AT** page 1 of her evidence, Dr Bennet states that: "*No one can give an absolute assurance that magnetic fields are safe, and as yet we do not know if there is a lower limit of exposure.*" I would like to stress that it is *a priori* impossible to prove a negative and to prove that anything is absolutely safe.

9. **AT** page 1 of her evidence, Dr Bennet states that: "*The current exposure guidelines from the ICNIRP and IEEE are not precise and without controversy.*" This statement is not correct. Both the ICNIRP and the IEEE provide detailed exposure guidelines based on (the same) established health effects. There is broad consensus within the scientific community that these guidelines are adequate. There are differences between those two guidelines, as I have set out in my evidence in chief, but these are relatively minor and have to do with the exact interpretation and extrapolation of the scientific data.

10. **THE** fact that ICNIRP organises a workshop on the "puzzling" results from the research into long-term effects (the childhood leukaemia issue) does not indicate that ICNIRP has doubts on its approach to standard setting, but on the contrary shows that ICNIRP takes its responsibility for evaluating the scientific literature very seriously.

11. **AT** page 2 of her evidence, Dr Bennet refers to the BioInitiative report as "*an excellent primer on this complex subject*". In fact it is not. The BioInitiative report is a collection of scientific reviews of several, but by no means all, relevant subjects. These reviews have been compiled by different authors apparently without a common preset strategy. This has resulted in reviews that widely differ in depth, completeness and quality. Professor Elwood has addressed the reviews pertinent to ELF in some detail in his evidence and showed that they contain serious flaws.

12. **THE** introductory and summarising chapters have been written by the main stimulator of the BioInitiative report, Mrs Sage, who is not a scientist. The summary and conclusion of the report therefore do not appear to constitute a consensus opinion by a group of scientific experts. Clearly, the report has not been written with a view to produce an objective scientific evaluation, since it is stated on page 1 of Section 2: "*The Report has been written to document the reasons why current public exposure standards for non-ionizing electromagnetic radiation are no longer good enough to protect public health*", and on the same page objective number 6: "*To write a rationale for a biologically-based human exposure standard*".

13. **CONCERNING** the BioInitiative report, Dr Bennet states, on page 2 of her evidence, that: "*In this report they raise the issue of who determines standards and why there is debate on the subject.*" She then quotes from the report:

> "*One reason is that exposure limits for ELF and RF are developed by bodies of scientists and engineers that belong to professional societies who have traditionally developed recommendations; and then government agencies have adopted those recommendations. The standard-setting processes have little, if any, input from other stakeholders outside professional engineering and closely-related commercial interests. Often, the industry view of allowable risk and proof of harm is most influential, rather than what public health experts would determine is acceptable.*"

14. **THIS** statement reflects several misconceptions. The membership of most organisations that develop exposure guidelines, such as internationally the ICNIRP and nationally, for instance, the Health Council of the Netherlands and the former National Radiological Protection Board (presently the Radiation Protection Division of the Health Protection Agency) of the UK, is always on the basis of

personal expertise, and not as representative of an employer or professional organisation. For these committees, membership is by invitation only, with care being taken to incorporate all necessary expertise, such as engineering, physics, biology, epidemiology and medicine.[1] Experts from industry are not invited for these committees, in order to prevent any possible influence from commercial interests.

15. **FOR** IEEE, the situation is different. The IEEE's International Commission for Electromagnetic Safety (ICES), and its subcommittees 3 (Safety Levels with Respect to Human Exposure to Electromagnetic Fields, 0 - 3 kHz), and 4 (Safety Levels with Respect to Human Exposure to Electromagnetic Fields, 3 kHz – 300 GHz) that drafted the standards, are open for any interested expert and may hold representatives of public and commercial organisations.[2] As stated by ICES: "*ICES follows an open consensus process, with a balance of disciplines and a balanced representation from the medical, scientific, engineering, industrial, government, and military communities*." IEEE has formal voting procedures for approval of draft standards.

16. **DR** Bennet states, at page 2 of her evidence, that: "*A reduction in exposure is a generic recommendation from all agencies including the World Health Organisation.*" This is not correct. While it is not clear as to which particular agencies Dr Bennet is referring, there is to my knowledge no scientific organisation that has issued a 'generic recommendation' to this extent. In 2007, the WHO published the Environmental Health Criteria monograph 238, *Extremely Low Frequency Fields*, that I have discussed in my evidence in chief. In conjunction with this publication, WHO issued a fact sheet that contains the following statement: "*When constructing new facilities and designing new equipment, including appliances, low-cost ways of reducing exposures may be explored. Appropriate exposure reduction measures will vary from one country to another. However, policies based on the adoption of arbitrary low exposure limits are not warranted.*"[3]

17. **AT** page 2 of her evidence, Dr Bennet states that: "*In Europe, some government's [sic] have already acted to reduce exposure limits to below that recommended in current ICNIRP guidelines (Italy, Russia, China, Switzerland, see reference 3,*

[1] As indicated in my evidence in chief, I am member of Standing Committee II of ICNIRP.
[2] I am a member of the ICES Main Committee and of Subcommittees 3 and 4.
[3] World Health Organization. Electromagnetic fields and public health. Exposure to extremely low frequency fields. Fact sheet no 322, June 2007. (see http://www.who.int/mediacentre/factsheets/fs322/en/index.html)

table 3.3, the SAGE report state that the Netherlands and Slovenia have also reduced levels, reference 4, pg33)."

18. **TABLE** 3.3 in the BioInitiative report, to which Dr Bennet refers, is not in fact a table but a figure and shows exposure limits for frequencies of 800-900 MHz. These are not relevant for the current power line issue, where only 50/60 Hz frequencies should be considered.

19. **IN** my evidence in chief, I have discussed the policies in Italy, Switzerland, and the Netherlands, relevant to exposure to these extremely low frequencies. In brief, in both Italy and Switzerland the ICNIRP limits have been adopted, but for single sources lower exposure values are set for locations where people may be present for longer time periods. In the Netherlands, ICNIRP guidelines have not been formally adopted, but are observed in practice. For new situations relating to overhead power lines, the government recommends that a yearly average exposure of 0.4 μT is not exceeded in designated locations where children may spend significant periods of time. Supporting information of the SAGE report (Dr Bennet's reference 4b) indicates that in Slovenia a 10 μT limit pertains only to new situations.

20. **DR** Bennet states, at page 3 of her evidence, that: "*Every health agency who has assessed the effects (see the list in reference 3) conclude that the human population data (epidemiology) for some health effect such as childhood leukaemia remain valid.*" It is correct to state that the association between exposure to ELF magnetic fields and childhood leukaemia that is observed in epidemiological studies, has been found to be consistent by many health agencies. However, the wealth of supporting data from experimental studies provides no indications for a causal relationship. Thus, an increased risk of childhood leukaemia cannot be considered an established health effect from ELF magnetic field exposure. This is extensively discussed by Professor Elwood in his evidence.

21. **DR** Bennet states, at page 4 of her evidence, that: "*Critics say that without definitive experimental proof (i.e. animal or cell studies) then the epidemiological evidence is "poor or weak" and without such proof we cannot put in place satisfactory public health strategies.*" Whether scientific evidence is weak or strong, public health policies can always be considered. They just have to be tailored to the level of evidence. Several countries, discussed in my evidence in

chief and in paragraph 19 above, provide examples of this consideration.

22. **ALSO** at page 4 of her evidence, Dr Bennet states that: "*Currently, the data suggest that we need to protect against EMF exposure as low as 0.4 microtesla, and maybe lower, and that we need to consider ionisation of the air (which clumps particulates together such as pollution, pollens, other agents such as insecticides, reference 3 provides a good background on both issues).*" I have argued before that the BioInitiative report (Dr Bennet's reference 3) in general does not provide an objective scientific picture. Moreover, it does not discuss the subject Dr Bennet refers to here: the so-called 'corona ion hypothesis'. Professor Wood has discussed this hypothesis at paragraphs 56 to 62 of his evidence in chief.

23. **I** would like to reiterate here the conclusions from a comprehensive and detailed analysis of the corona ion hypothesis by the Ad Hoc Group on Corona Ions of the UK Advisory Group on Non-ionising Radiation (AGNIR) in 2004, that concluded "*the additional charges on particles downwind of power lines could also lead to deposition on exposed skin. However, any increase in deposition is likely to be much smaller than increases caused by wind.*"[4]

24. **REGARDING** the inhalation of charged particles they concluded: "*However, it seems unlikely that corona ions would have more than a small effect on the long-term health risks associated with particulate pollutants, even in the individuals who are most affected*." The WHO, in the recent Environmental Health Criteria monograph on extremely low frequency fields, came to a similar conclusion.[5]

25. **DR** Bennet states at page 5 of her evidence: "*A specific focus of action is the impact of EMF on cellular redox (respiratory) state.*" The plausibility of the various mechanisms that have been proposed for the action of ELF fields on biological structures has been discussed by Professor Wood in his evidence. The WHO has also reviewed this in its recent Environmental Health Criteria monograph on extremely low frequency fields. WHO concludes:

> "*The radical pair mechanism is an accepted way in which magnetic fields can affect specific types of chemical reactions, generally increasing*

[4] AGNIR - Advisory Group on Non-Ionising Radiation. Particle deposition in the vicinity of power lines and possible effects on health. Chilton, National Radiological Protection Board, 2004 (Documents of the NRPB, Vol. 15, No. 1). (see http://www.hpa.org.uk/radiation/publications/documents_of_nrpb/pdfs/doc_15_1.pdf)

[5] World Health Organization. Extremely low frequency fields. Environmental Health Criteria 238. Geneva: World Health Organization, 2007, p.117. (WHO EHC 238; see http://www.who.int/peh-emf/publications/elf_ehc/en/index.html)

reactive free radical concentration in low fields and decreasing them in high fields. [...] it is suggested that power frequency fields of much less than the geomagnetic field of around 50 μT are unlikely to be of much biological significance." [6]

26. **ALSO** at page 5 of her evidence, Dr Bennet states that "*Cell proliferation and differentiation can be influenced*". This is a correct statement insofar as that in some studies effects on cellular proliferation and differentiation have been observed, while in others no such effects were found. Overall, the scientific evidence does not present an unequivocal picture. The WHO concludes: "*Many other cellular studies, for example on cell proliferation, apoptosis, calcium signalling, intercellular communication, heat shock protein expression and malignant transformation, have produced inconsistent or inconclusive results.*"[7]

27. **DR** Bennet remarks, at page 6 of her evidence: "*However, within the fotus* [sic] *the induced current densities do not comply with basic restrictions, either from single reference-level electric fields or from simultaneous exposure to electric and magnetic fields. Basic limits were considerably exceeded (reference Cech). Similar findings have been made by others (reference Dimbylow 1 and 2) who suggests that the ICNIRP public reference level is a conservative predictor of local specific absorption rates in the fetus* [sic]."

28. **IN** recent years, great progress has been made with the development of mathematical models that can be used to calculate the internal electric fields, current densities, or specific absorption rate (SAR), induced in the human body by external electric and magnetic fields. Adequate models are now available for humans of different ages and size and for both sexes. Modelling the pregnant female provides a major challenge, because of the development of the foetus during the gestational period, and because the position of the foetus in the womb is not fixed due to the movements of the foetus.

29. **THE** papers cited by Dr Bennet provide some of the first attempts to assess the effects of exposure to the foetus in terms of induced fields, currents, or SAR, although it should be pointed out that the SAR is not relevant in the case of exposure to low frequency fields, as is the case with power lines. The two research groups have taken different approaches to modelling the foetus, but both

[6] WHO EHC 238, p.116.
[7] WHO EHC 238, p.347.

use very simple and homogeneous models, whereas for the pregnant female itself, detailed information on organs and tissues is incorporated.

30. **THE** calculations presented in the paper by Cech that is cited by Dr Bennet indicate that under worst case conditions at the reference levels for the electric fields given by ICNIRP, the basic restriction might be exceeded in the foetus. This would indicate that, although ICNIRP has used a very conservative method to derive reference levels from the basic restrictions, this might not be adequate for the foetus. The Dimbylow paper cited by Dr Bennet, however, does not show a discrepancy between basic restrictions and reference levels.

31. **THE** basic restriction ICNIRP proposes at 50 Hz for the general public is an induced current density of 2 mA/m^2. From this basic restriction, reference levels have been derived using fairly simple mathematical models, not taking a foetus into account, but using a conservative approach. The reference level at 50 Hz for the electric field is 5 kV/m for the general public and that for the magnetic field is 100 µT.

32. **THE** paper by Cech indicates that at the general public reference level of 5 kV/m the induced current density in the foetus may be as high as 3.34 mA/m^2 and therefore exceeds the basic restriction of 2 mA/m^2. In that case the basic restriction would correspond to an electric field reference level of 3 kV/m. The calculations by Dimbylow, however, indicate that at 5 kV/m the maximum induced current density in the foetus is 1.28 mA/m^2 and therefore does not show exceeding of the basic restriction. For magnetic field exposure both papers indicate compliance of the ICNIRP reference levels and basic restrictions for the foetus.

33. **IN** conclusion, there is one indication using the more sophisticated models currently under development that for the special case of the foetus the derivation of the reference levels from the basic restrictions as has been given by ICNIRP might not be adequate, but this is not corroborated by another paper. Therefore, at this moment it cannot be concluded that the current ICNIRP reference levels might have to be revised.

34. **IT** should also be pointed out that slightly exceeding the basic restrictions does not result in immediate health hazards, since ICNIRP has incorporated a safety factor of 50 in the exposure guidelines for the general population. This means that the

basic restrictions are set a factor of 50 below the exposure level above which health effects may occur.

Mr Doug Parker on behalf of Hunua and Paparimu Valley Residents' Association Incorporated (Submission number 0748)

35. **AT** paragraph 14 on page 8 of his revised evidence, Mr Parker quotes from a report by Connell Wagner: "*However, in applying the guidelines, it appears that Transpower has used the "Reference Value" of 5 kV/m rather than the actual "Basic Restriction", which has been shown to approach 9 kV/m*".

36. **ICNIRP** has proposed an induced current density of 2 mA m^{-2} as basic restriction for the general public. If a reference level is directly calculated from this, then indeed this will be around 9 kV m^{-1}. However, ICNIRP has also taken into consideration the probability of the occurrence of indirect effects. Such effects may result from the touching of large ungrounded metallic objects that may be charged when present in an electric field. Upon touching, a discharge current may flow and this may result in perception of current or painful stimulation (electric shock).

37. **IN** order to prevent such effects, ICNIRP has used data on the perception and stimulation thresholds in adults and children to lower the reference levels. This has resulted in the value of 5 kV m^{-1} at 50 Hz. Following a similar approach, the Health Council of the Netherlands arrived at a reference level of 8 kV m^{-1} at 50 Hz, as I have described in my evidence in chief. In the Health Council's report, the process of deriving the reference levels has been clearly described.[8]

38. **AT** paragraph 42 on page 21 of his revised evidence, Mr Parker states that: "*On the issue of potential EMF effects, which has largely been dismissed by the medical and scientific community despite some recently emerging understanding of possible mechanisms ...*". In view of the large number of scientific papers on possible effects of EMF on biological structures, most of which were compiled and reviewed in the recent 519-page WHO Environmental Health Criteria monograph,[9] it is not correct to state that the issue "*has largely been dismissed*" by the scientific community.

[8] Health Council of the Netherlands - ELF Electromagnetic Fields Committee. Exposure to electromagnetic fields (0 Hz - 10 MHz). The Hague: Health Council of the Netherlands, 2000 (publication no. 2000/06E). (see http://www.gr.nl/pdf.php?ID=25&p=1)

Mr Robert McQueen (Submission number 1076)

39. **MR** McQueen states, at paragraph 9 of his evidence, that: "*The reference materials attached to this evidence are peer reviewed academic papers published by leading, reputable academic researchers in academic journals or conference proceedings of high professional standing.*" The list of papers and proceedings Mr McQueen provides on page 5 of his evidence does not contain any comprehensive weight of evidence reviews, such as those of the WHO, IARC, ICNIRP, IEEE, NIEHS, NRPB and Health Council of the Netherlands that are discussed in my evidence in chief and in that of Dr Black, Professor Elwood and Professor Wood.

40. **MR** McQueen's reference 3 (Dickenson) is an editorial and his references 5 (Henshaw and Reiter) and 8 (O'Carroll), are proceedings from WHO workshops. These non-peer-reviewed papers are basically opinions of individuals and do not carry the weight of proper peer-reviewed scientific papers.

Dr Allanah Kilfoyle (Submission number 0498)

41. **DR** Kilfoyle has provided a handout of the slides which she is apparently going to use as her evidence. On slide 4 on page 1 of her evidence, she refers to two papers on epidemiological studies on the relationship between living near power lines and the incidence of childhood leukaemia that have been published after the comprehensive evaluation of the IARC in 2002 of the possible carcinogenicity of ELF electric and magnetic fields.[10]

42. **IN** its Environmental Health Criteria monograph, WHO has discussed two studies published after the IARC analysis.[11] One of these was the study of Draper[12], the other a Japanese study by Kabuto et al (2006).[13] WHO concluded that the results of these papers did not alter the general conclusion of IARC, that ELF magnetic fields are classified as 'possibly carcinogenic for humans'. Professor Elwood has

[9] The summary of this report is included in the common bundle of exhibits at tab 9.
[10] IARC Working Group on the Evaluation of Carcinogenic Risks to Humans. Non-ionizing radiation, Part 1: Static and extremely low-frequency (ELF) electric and magnetic fields. Lyon, IARC, 2002 (Monographs on the Evaluation of Carcinogenic Risks to Humans, 80).
[11] WHO EHC 238, p.268
[12] Draper G et al. (2005). Childhood cancer in relation to distance from high voltage power lines in England and Wales: a case-control study. Br Med J, 330(7503):1290.
[13] Kabuto M et al. (2006). Childhood leukemia and magnetic fields in Japan: a case-control study of childhood leukemia and residential power-frequency magnetic fields in Japan. Int J Cancer, 119(3):643-650.

elaborated on the Draper, Kabuto and Lowenthal studies at paragraphs 249 to 251, 253, and 332, respectively, of his evidence in chief and came to a similar conclusion.

43. **ON** the 6th slide on page 1 of her evidence, Dr Kilfoyle states that the mechanism for carcinogenesis of ELF fields is not known. This is correct. She further states that some studies have shown that ELF magnetic fields may alter the flow of calcium ions through cellular membranes, change hormone production and alter cell growth. These and other effects have been extensively reviewed by WHO in the Environmental Health Criteria monograph. WHO concludes that the data are not consistent across studies and that no established effects can be inferred from them.

44. **ON** the first slide on page 2 of her evidence, Dr Kilfoyle mentions 'ionised particles' as a possible mechanism for carcinogenesis. Presumably she refers to the so-called 'corona ion hypothesis'. I have commented upon this in paragraphs 22-24 above.

45. **MOST** of the remaining slides of Dr Klifoyle's handout discuss epidemiological evidence. The two pooled analyses she discusses, Ahlbom et al (2000) and Greenland et al (2000), are the basis of the current weight of evidence conclusions made by international review groups such as IARC and WHO. The Draper and Lowenthal studies have been published after these pooled analyses, but do not alter the general conclusions on the association between ELF exposure and childhood leukaemia. The Feychting et al (1993) study is just one of the approximately 20 studies used for the pooled analyses and carries in itself less weight than the aggregate analyses. Professor Elwood discussed this at some length in his evidence in chief and further discusses the issue in his evidence in rebuttal.

Mr Bruce Davidson (Submission number 0874)

46. **MR** Davidson states at paragraph 4.7 of his evidence that: "*The literature indicates that a number of national and international bodies have studied these possible health effects, and in so doing they have apparently come to a variety of conclusions. There are no universally agreed and accepted conclusions.*" This is not correct. In fact, the conclusions of the national and international expert groups that studied this subject have been remarkably similar.

47. **THERE** is general agreement within the scientific community that health effects may occur from exposure to ELF electric and magnetic fields, if the field strengths are high enough to result in acute effects. Various groups have proposed largely similar exposure limits to prevent such effects.

48. **THERE** is also general agreement on the conclusion that ELF magnetic fields may possibly be carcinogenic to humans. This conclusion is built upon the epidemiological data on childhood leukaemia. Finally, there is also wide agreement that the wealth of experimental studies has provided no support for a causal relationship between ELF magnetic field exposure and childhood leukaemia.

49. **AT** paragraph 4.12 of his evidence, Mr Davidson states that the SAGE report[14] is a significant source of his evidence. However, this report is not drafted by an independent group of scientific experts, but by a stakeholders group from the United Kingdom. On the 2nd page of their report, the SAGE group gives a note and states:

> "*The remit of SAGE is to provide advice to Government. It is for Government to take decisions on policy relating to EMFs and health, based on this advice and whatever other inputs it deems necessary. This Assessment represents a record and a distillation of the discussions that have taken place within SAGE. It is not a single definitive set of universally agreed conclusions and recommendations, but rather captures the point our evolving discussions have reached.*"

Mr George Vercoe on behalf of Parahiwi Farm (Submission number 1129)

50. **MR** Vercoe states at sub-paragraph 2(a) of his evidence that: "*there is a proven health issue living close to transmission lines*". As has been discussed in my evidence in chief and this rebuttal evidence, and in the evidence in chief and rebuttal evidence of Dr Black, Professor Elwood and Professor Wood, and supported by a number of analyses from national and international expert groups, there are no proven health effects of living near overhead power lines.

[14] Stakeholder Advisory Group on ELF EMFs (SAGE). Precautionary approaches to ELF EMFs. First Interim Assessment: Power Lines and Property, Wiring in Homes, and Electrical Equipment in Homes. (see http://www.rkpartnership.co.uk/sage/ for the report and supporting papers).

Mr John Makin (Submission number 0781)

51. **MR** Makin states, at page 6, third paragraph of his evidence, that: "*In the UK, the NRPB (National Radiological Protection Board) was charged by their government to give advice on safe levels of EMF's. Suffice to say that the 1993 NRPB "safe exposure" guidelines are considerably higher than the 1998 ICNIRP ones.*" This is correct. However, it should be added that in an updated review of the scientific evidence in 2004, the NRPB recommended to adopt the 1998 guidelines of the ICNIRP and that the UK government followed this advice.[15]

52. **AT** page 6, fifth paragraph of his evidence, Mr Makin states: "*Others like Italy, Slovenia, Switzerland and the Netherlands have exposure targets significantly below ICNIRP guidelines.*" In my evidence in chief, I have discussed the exposure limits observed in Italy, Switzerland, and the Netherlands. In paragraph 19 of this rebuttal I have briefly repeated this information and added that the 10 µT limit in Slovenia applies to new situations only.

53. **IN** the same paragraph Mr Makin also states: "*There is in fact an increasing belief that these guidelines are not adequate for reasonable levels of safety, as expressed in the abstract of a paper delivered by A. Davidson in the UK.*" The paper by Mr Davidson has not been published in a peer-reviewed scientific journal, but originates from the website www.tetrawatch.net.[16] This website has been set up to oppose the development of TETRA (Terrestrial Trunked Radio), the communication system of the emergency services that is being rolled out in the UK and, under different names, also in several other European countries, such as the Netherlands. TETRA is not an extremely low frequency type of signal, such as the 50 Hz fields generated by power lines. Instead, it uses a 380-400 MHz base frequency which is transmitted in low-frequency pulses.

54. **OPPONENTS** of TETRA argue that there are actually low frequency signals being transmitted and that these may cause adverse health effects. Both premises are incorrect, as has been explained by the Health Council of the Netherlands in its Annual Update 2003 on Electromagnetic Fields.[17] A full explanation of this is

[15] NRPB – National Radiological Protection Board. Advice on limiting exposure to electromagnetic fields (0 – 300 GHz). Doc NRPB 15(2), 2004.
[16] See http://www.tetrawatch.net/papers/icnirp_inadequate.pdf.
[17] Health Council of the Netherlands. Electromagnetic Fields: Annual Update 2003. The Hague: Health Council of the Netherlands, 2004; publication no. 2004/01.

outside the scope of the present evidence. However, in the paper, Mr Davidson expresses his belief that the ICNIRP guidelines are inadequate with respect to pulsed low frequency fields, but he does not provide any scientific substantiation to this. Moreover, this discussion is not at all relevant with respect to power lines.

Other matters

55. **FINALLY**, I note that the report I referred to in paragraph 45 of my first statement of evidence, has now been finalised. The Health Council of Netherlands has recently published a report on High Voltage Power Lines and states as one of its conclusions in that report:

> "*All the studies involved people who had lived for at least one year at the location where the field strength was determined. On the basis of this, 'long-term' may be deemed to mean 'for at least one year involving a stay of at least around 14-18 hours per day.'* "

56. **IN** my first statement of evidence (at paragraph 45) I stated, based on the Health Council's preliminary report: "*This implies long term exposure, which is operationally defined in the report, based on two pooled analyses of the epidemiological data, as exposure during 3 months to one year and during 14 to 18 hours per day.*"

57. **IN** light of the finalised report, that statement should now read "as exposure for *at least one year* and during *at least 14 to 18 hours* per day."

Eric van Rongen
30 April 2008