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4 EMFs

4.1 Executive Summary

1. The core issue raised by many of the objectors relates to the possibility that exposure to EMFs may harm health. Various specific aspects of this are advanced, for example, the evidence on childhood leukaemia, the correct method of assessing the evidence, and the views reached by various review bodies.
2. SONI is guided in this matter by scientific assessments that have been undertaken by the relevant independent authoritative scientific review bodies and which have informed the government in its establishment of relevant policy and standards. It is recognised that there are some published studies suggesting the possibility that exposure to magnetic fields may, in some limited circumstances, be associated with childhood leukaemia. None of those review bodies considers that the evidence establishes that magnetic fields cause childhood leukaemia or any other adverse health effects; they variously talk of the evidence suggesting merely a “possibility” of a risk, or of “weak evidence”.
3. A set of policies have been put in place by the UK Government (and explicitly also adopted in Northern Ireland) for the protection of the public from EMFs, principally a policy of compliance with the relevant exposure limits. The proposed Tyrone – Cavan Interconnector is fully compliant with those policies and specifically with the exposure limits.
4. Those policies were set after full consideration of the scientific evidence, including all the specific aspects of the scientific evidence referred to by the various objectors. Therefore, all the points raised by objectors have already been taken into account in consideration of the proposed development.
5. SONI has been very willing throughout the consultation process to clarify and to explain the overall scientific evidence and individual scientific points. However, in terms of the acceptability of this proposed Tyrone – Cavan Interconnector, the key issue as far as EMFs are concerned is that the determination of acceptability is not subject to the views or conclusions of

SONI, or of any other observer. The key issue is that a set of policies for the protection of the public has already been put in place by Government; those policies take full account of the science; there are mechanisms for reviewing the policies if new scientific developments warrant that; and the proposed Tyrone – Cavan Interconnector is fully compliant with those policies.

6. Other particular issues raised by objectors in their Statements of Case are responded to in this Rebuttal.
7. All issues raised by objectors relating to EMFs are covered in the Consolidated ES.
8. An Bord Pleanála Inspector's Report¹ for the North-South 400kV Interconnection Development was published on 21st December 2016. That report, supported by the Board's Direction, confirmed the planning approval of the proposed Interconnector in Ireland, which has the same design and therefore produces the same EMFs as the proposed Tyrone – Cavan Interconnector. The Inspector Report concludes (Page 617):

"The proposed development

...

would not be prejudicial to public health..."

9. The summary on public health here refers back to and incorporates the detailed consideration of EMFS in pages 196-228.
10. Nothing in the objectors' Statements of Case and representations serves to undermine the conclusions set out in the SONI Statement of Case and supporting Technical Reports. As stated in SONI's Main Rebuttal Document, the proposed Tyrone - Cavan Interconnector remains clearly acceptable in planning terms.

4.2 About the Author

11. The specialist for EMFs and compliance of lines with EMF restrictions and guidelines is Dr John Swanson. Dr Swanson holds the degrees of M.A. and D.Phil. in Physics at the University of Oxford. He has been a Research

¹ <http://www.pleanala.ie/news/VA0017.htm>

Officer and subsequently Scientific Advisor with the Central Electricity Generating Board and its successor companies The National Grid Company plc and National Grid Transco plc, since 1989. He has been specifically involved with power-frequency electric and magnetic fields and their possible environmental and health effects. He currently holds the position of EMF Scientific Advisor to both National Grid and the Energy Networks Association. He has authored or co-authored a range of scientific papers in this area and served on a range of national and international working groups or committees. He is a Fellow of the Institute of Physics and a Chartered Physicist; a Fellow of the Institution of Engineering and Technology and a Chartered Engineer; and a Fellow of the Society for Radiological Protection and a Chartered Radiation Professional.

4.3 Issues raised

4.3.1 The existence of an issue relating to EMFs

12. In the SEAT Statement of Case, Page 19, Paragraph 108 states:

“The effects policies have on health, and in particular, how they can alter the health of all people in the population must be considered as part of this application. Non-health sector proposals, where health is not the main objective, may have major effects on the health and well-being of people, particularly vulnerable groups”.

Response

13. SONI agrees on the importance of considering health issues during the planning and design and as part of the process leading to determination of this application. That is why SONI has provided extensive information on EMFs in the Consolidated ES (Chapter 7).

4.3.2 SONI's approach to the EMF issue

14. In the SEAT Statement of Case, Page 20, Paragraph 114 states:

“The Applicant repeatedly refers to compliance as a shield and equates it with safety”.

15. In the SEAT Statement of Case, Page 17, Paragraph 86 states:

“Chapter 7 of the Consolidated Environmental Statement (Volume 2) (Electric and Magnetic Fields) seeks to address the concerns regarding impacts from EMF, by reference to various publications and research in the public arena. Bland statements are made to the effect that there are no harmful effects anticipated. All over the world opinion polls have shown that the overwhelming majority of people believe that long term exposure to electrical and magnetic fields are injurious to health”.

16. In the SEAT Statement of Case, Page 19, Paragraph 101 states:

“Around the world many local communities only need anecdotal evidence to be convinced of adverse health effects. In some areas cancers are more prevalent than others and are blamed (rightly or wrongly) on powerlines and mobile mast radio masts. If one examines the technical literature over the last five years one could tend to err on the side of anecdotal evidence as being good enough. There is however, a compelling and substantial body of peer-reviewed scientific publications available to err on the side of caution”.

17. In the SEAT Statement of Case, Page 19, Paragraph 103 states:

“Whilst most people in the scientific community now accept this as being “no longer of any reasonable doubt” (California Department of Health), SONI still argues that there are no proven health risks. This is not accepted by SEAT”.

Response

18. SONI's approach to managing the EMF issues raised by the proposed Tyrone – Cavan Interconnector, as set out in the Consolidated ES (7.1.4), is that mandated by policy: the Interconnector must comply with the policies put in place for the protection of the public by Government in fulfilment of its responsibility to protect public health. Those policies are in turn based on the assessment of the scientific evidence performed by the relevant authoritative independent bodies. The policies that have been put in place by Government comprise, primarily, compliance with the relevant exposure limits, plus certain specific precautionary policies. Thus:
- SONI's approach of designing the proposed overhead line to comply with the exposure limits is not evading SONI's responsibilities. Rather, it is discharging those responsibilities by ensuring the appropriate level of safety for the public, as determined by independent authoritative experts;
 - The relevant verdicts on the scientific evidence are not those of the public as reflected in opinion polls, nor of any individual scientists, nor, indeed, of SONI or its experts themselves, but of the relevant authoritative independent review bodies;

- SONI is not aware of any evidence that “*the overwhelming majority of people believe that long term exposure to electrical and magnetic fields are injurious to health*”, but, whether or not this were true, it would have no bearing on the appropriate policies to be followed in relation to this proposed Tyrone – Cavan Interconnector; and
- When SONI makes or quotes statements that no harmful effects of EMFs are established, or that no harmful effects are anticipated from the proposed Tyrone – Cavan Interconnector, the authority for such statements stems from the authoritative independent review bodies, and not from SONI itself. The views of those bodies, which SONI is reflecting, are considered in 4.3.3 below.

19. In the Armagh City Banbridge and Craigavon Borough Council Statement of Case, page 3, Section 1 states that the Environmental Health Department:

“... has regard to the exposure limits provided by the International Commission on Non-Ionizing Radiation as cited by Public Health England and adopted by the UK Government as protective of the health of the general population”.

Response

20. This is supportive of the approach set out in the Consolidated ES and followed by SONI. The Council very properly has regard to the limits as protective of the health of the general population.
21. As explained in SONI’s Statement of Case (TR5), the Strategic Planning Policy Statement (SPPS) for Northern Ireland incorporates UK policy on EMFs into Northern Ireland Planning Policy:

“16 The SPPS para 6.249 advises that “In relation to power lines current Government policy is that exposures to power-line Electro Magnet Fields (EMFs) should comply with the 1998 International Commission on Non-Ionizing Radiation Protection (ICNIRP) Guidelines. A voluntary Code of Practice Power Lines: Control of Microshocks and other indirect effects of public exposure to electric fields A Voluntary Code of Practice (DECC, July 2013) has been agreed by the Department of Energy and Climate Change, the Department of Health, the Energy Networks Association, the Welsh Government, the Scottish Government, and the Northern Ireland Executive. It sets out what is regarded as compliance with those aspects of the EMF exposure guidelines that relate to indirect effects as far as the electricity system is concerned. Further Government policies relating to EMFs from overhead power lines, advise that as a precautionary measure they should, where reasonable, have optimum phasing. This is the subject of a

companion Code of Practice 'Optimum phasing of high voltage double-circuit power lines'. This Code of Practice applies in England, Wales, Scotland, and Northern Ireland".

17 SPPS para 6.250 states "Any proposal for the development of new power lines should comply with the 1998 International Commission on Non-Ionizing Radiation Protection (ICNIRP)"

22. SEAT quote this section of SPPS in their own Statement of Case (paragraphs 19 and 20), thereby implying their recognition of the fact that this is the relevant policy. Likewise, in paragraphs 109 and 110 (considered in more detail in 4.3.17 below), SEAT accept that the proposed overhead line is compliant with these exposure limits.

23. In the SEAT Statement of Case, Page 19, Paragraph 107 states:

"SEAT view the refusal to accept the inherent physical dangers of powerlines on human and animal health as reckless endangerment should the proposal gain approval".

Response

24. SONI's views on the EMF aspects of the proposed Tyrone – Cavan Interconnector are based on the authoritative views of the relevant independent bodies. Thus, SONI does accept that there is some scientific evidence suggesting the possibility of health effects, as discussed further in 4.3.3 below, but SONI does not accept the suggested *"inherent physical dangers of powerlines on human and animal health"*. Far from constituting *"reckless endangerment"*, SONI's position of ensuring full compliance with relevant policy is in fact the responsible position to adopt..

4.3.3 General concerns about health

25. In addition to various specific issues raised in the SEAT Statement of Case and addressed below, the general issue of concern about health effects is raised in the SEAT Statement of Case, and in Appendix 18 by Fergal Woods, Anne Mallon, Tom McNally, Mr and Mrs Todd, Paul Huges, Jim Lennon, Benson George, and Raymond Hughes.
26. In the Statement of Case of the Armstrong family, the first page references various individual studies and reviews.

27. In the Statement of Case of Boyd Eagleson, the first page states:

“Other concerns regarding the submitted proposal include:

...

The health risk posed to both animals and humans within 500 metres of this high voltage line”.

28. In the Statement of Case of Liz Drew, the first page states:

“Other concerns regarding the submitted proposal include:

...

The health risk posed to both animals and humans within 500 metres of this high voltage line”.

29. In the Statement of Case of Robert White, the first page states:

“Firstly there is a large body of researched based evidence, which concludes living in close proximity to high voltage electricity pylons, can cause serious illness such as cancers. As a farmer working on the land I would be exposed to the effects of high EMF's on a daily basis. My family and neighbours who live close to my farmland, would also be exposed to these dangers. This is something I am not willing to accept...”

Response

30. As explained above and in the Consolidated ES, SONI does not dispute that some scientific evidence exists suggesting a link between possible health effects and EMFs, and therefore that some degree of concern is natural. However, the policies for the protection of the public with which this proposed Tyrone – Cavan Interconnector complies were set in the full knowledge of that scientific evidence and provide the appropriate level of protection in the light of the scientific evidence.

31. The actual extent of the scientific evidence was considered in depth in the Consolidated ES (7.4.2) with extensive quotations from the relevant independent authoritative review bodies. The conclusions of the then National Radiological Protection Board, the UK's designated authoritative review body, can be summarised by the following quotation (Consolidated ES 7.4.2.2):

“158 In 2004 the NRPB published new “Advice on Limiting Exposure to Electromagnetic Fields (0-300GHz)” (NRPB 2004a) and accompanied it with a “Review of the Scientific Evidence for Limiting Exposure to Electromagnetic Fields (0-300GHz)” (NRPB 2004b). The former summarises epidemiological evidence as follows (p15):

54 “In the view of NRPB, the epidemiological evidence that time-weighted average exposure to power frequency magnetic fields above 0.4 μ T is associated with a small absolute raised risk of leukaemia in children is, at present, an observation for which there is no sound scientific explanation. There is no clear evidence of a carcinogenic effect of ELF EMFs in adults and no plausible biological explanation of the association that can be obtained from experiments with animals or from cellular and molecular studies. Alternative explanations for this epidemiological association are possible: for example, potential bias in the selection of control children with whom leukaemia cases were in some studies and chance variations resulting from small numbers of individuals affected. Thus any judgements developed on the assumption that the association is causal would be subject to a very high level of uncertainty.

...

60 “NRPB concludes that the results of epidemiological studies, taken individually or as collectively reviewed by expert groups, cannot currently be used as a basis for restrictions on exposure to EMFs”.

32. The other relevant authoritative review bodies reach similar conclusions, although expressed in different terminology. For example, the International Agency for Research on Cancer and the World Health Organization classify magnetic fields as “possibly carcinogenic”, the middle classification of a five-point scale, and a lower classification than “established carcinogen” or “probably carcinogenic”.
33. Further explanation of why these authoritative review bodies have reached the conclusions they have was provided in the Consolidated ES (7.4.3.4):

“7.4.3.4 Why The Evidence on Causation of Childhood Leukaemia Is Not Regarded As Conclusive

170. The epidemiological evidence suggesting a risk for childhood leukaemia is stronger than that for any other health effect. But the relevant authoritative review bodies do not regard the evidence even on childhood leukaemia as establishing causation. For the purposes of this ES, it is sufficient to note that fact; the reasons why are secondary.

171. However, NIE’s understanding of what lies behind this judgement is:

172. Firstly, however strong the epidemiology is or is not, it is unsupported by the laboratory evidence, which is largely negative, and no plausible mechanism has been identified; and

173. Secondly, in the expert judgement of epidemiologists who are very familiar with the workings of epidemiology, “bias” and “confounding” have not been excluded and remain credible possible explanations. Bias is when some aspect of the design of a study makes it systematically prone to producing a distorted result. Confounding is when the health effect detected by a study is real, but is

not caused by the agent under investigation but by some other agent that happens to vary in the same way, so that people are exposed to both agents at once. There is in fact evidence that bias operates in at least some of the studies”.

34. It is this authoritative view of the science – that the evidence for adverse health effects of magnetic fields at levels of exposure encountered by the public is weak and amounts to no more than a “possibility” of health effects – that informs the policy that has been set for the protection of the public. The policies that Government have put in place – compliance with quantitative exposure limits plus specific additional precautionary measures – are the appropriate policies in the light of the scientific evidence and already take account of that evidence.
35. As demonstrated in the Consolidated ES (7.3.1.2), the fields produced by the proposed overhead power line are highest directly underneath the line and fall rapidly to the sides. Even directly under the line, they are compliant with the relevant exposure limits, so, for example, a farmer such as Mr White working directly under the line will not be exposed to emissions beyond those determined by the policies to be safe. However, as explained in the Consolidated ES (7.3.5.3), most people, including children, will spend most time to the sides of the line, where the fields will be considerably lower. Likewise, the fields at any school to the sides of the line will have dropped off to a considerably lower level than directly under the line and therefore will be compliant with the relevant exposure limits by a large margin.
36. An Bord Pleanála Inspector’s Report² for the North-South 400kV Interconnection Development was published on 21st December 2016. That report, supported by the Board’s Direction, confirmed the planning approval of the proposed Interconnector in Ireland, which has the same design and therefore produces the same EMFs as the proposed Tyrone – Cavan Interconnector. The Inspector’s Report states (Page 207):

“To conclude, the relevant scientific literature has been repeatedly and systematically reviewed by a number of international and national health, scientific and governmental agencies, all of which conclude that the available evidence does not confirm the existence of any health consequence from exposure to ELF EMF. The proposed development will be designed and operated to comply with ICNIRP guidelines to ensure protection of public health”.

² <http://www.pleanala.ie/news/VA0017.htm>

And (Page 228):

“Significant research has been carried and published opinions consistently find that exposures to EMF does not represent a health risk if the exposure remains below the existing limits set by the European Council’s recommendations”.

4.3.4 The sources of authoritative advice

37. In the SEAT Statement of Case, Page 20, Paragraph 114 states:

“The Applicant repeatedly refers to compliance as a shield and equates it with safety. It is indisputable that there is a risk to health from EMF emitted from EHV powerlines:

“The link between (EMF) and childhood leukaemia is statistically significant and is robust”. (US National Radiological Committee.).

‘It is indeed unfortunate that the question of health effects of exposure to EMFs well below current exposure guidelines has not received the highest level of scientific or public health attention that it deserves.’

‘In the case of high voltage overhead powerlines, these should not be built close to houses or farms where cattle and poultry are housed.’

‘We really are past the stage where we should be erecting overhead powerlines close to houses and centres of population’ (Prof Henshaw, University of Bristol)”

38. In the SEAT Statement of Case, Page 19, Paragraph 103 states:

“Whilst most people in the scientific community now accept this as being “no longer of any reasonable doubt” (California Department of Health), SONI still argues that there are no proven health risks. This is not accepted by SEAT”.

39. The Statement of Case of the Armstrong family also references the California Department of Health review:

“The California Department of Health reviewed over 200 international studies on overhead powerlines and found links to adult/childhood leukaemia, brain tumors, motor neurone disease, heart arrhythmias, breast cancer, miscarriage, Alzheimer’s, depression and suicide”.

Response

40. The Consolidated ES (7.4.2) clearly sets out that the relevant authoritative bodies in relation to EMFs are the officially designated health protection and review bodies of each of the political structures relevant to the UK, that is, the UK itself, the EU, and (in the shape of the World Health Organization and its agency the International Agency for Research on Cancer) the United Nations:

“145. The question of possible health effects of environmental power-frequency fields has been thoroughly reviewed in recent years by a number of national and international bodies. The principal such bodies that have authoritative relevance in the UK are the National Radiological Protection Board/Health Protection Agency, the International Agency for Research on Cancer and the World Health Organization, and the official scientific advisory committee for the EU, SCENIHR, the Scientific Committee on Emerging and Newly Identified Health Risks.

146. In setting their guidelines, ICNIRP also performs its own reviews of the science. When Government forms EMF policy for the UK, it takes into account all relevant reviews of the science“.

41. Other bodies and individuals, including those cited by SEAT, clearly exist (as discussed in the Consolidated ES 7.4.3.1) and in some instances take different views of the state of the science. However, such views from other bodies and from individuals do not have authoritative relevance to determining the appropriate approach within the UK and in particular for this proposed Tyrone – Cavan Interconnector.
42. In relation to references to California: the “California Department of Health” review (strictly speaking, a review written for the California Department of Health Services, but not constituting the official view of that Department) is one such review that has no authoritative status in the UK, and is clearly out of line with the conclusions of those bodies that do have authoritative status.
43. In relation to references to the US National Radiological Committee: SONI has been unable to identify a body called the “US National Radiological Committee” and speculates that the quotation is actually taken from the National Research Council’s 1997 Report. If so, SONI notes:
 - the body in question has no authority in the UK context;
 - several of the key epidemiological studies on childhood leukaemia were published between 1997 and 2000, so were taken into account by, for example, the IARC review (2001), but would not have been considered by this review, casting doubt on its current relevance; and
 - the overall conclusion was: *“Based on a comprehensive evaluation of published studies relating to the effects of power-frequency electric and magnetic fields on cells, tissues, and organisms (including humans), the conclusion of the committee is that the current body of evidence does not*

show that exposure to these fields presents a human-health hazard. Specifically, no conclusive and consistent evidence shows that exposures to residential electric and magnetic fields produce cancer, adverse neurobehavioral effects, or reproductive and developmental effects" (emphasis added), thereby conveying a markedly different and markedly more positive message to the quotation provided by SEAT, if that was indeed the origin.

4.3.5 SONI's own expertise

44. In the SEAT Statement of Case, Page 20, Paragraph 113 states:

"SONI/EirGrid has no expertise on the matter of health effects from exposure to EMF. The chapter on health makes no reference to any expertise used. No specialist medical expertise was employed in the compilation of the Health and EMF section of the planning application in ROI".

Response

45. SONI's approach is based on following the policy for the protection of the public put in place by Government, which in turn is based on independent authoritative scientific review bodies. Therefore, SONI's approach to EMFs does not ultimately depend on SONI's own scientific knowledge of health effects from exposure to EMFs. However, SONI's expert on EMFs does in fact have very considerable expertise in these subjects, having been involved in several different epidemiological studies of EMFs and health, including at least one referred to by SEAT in support of their case when they say in paragraph 94 of their Statement of Case *"The literature includes at least four studies showing increased leukaemia risk up to 600 metres from powerlines..."*, having published scientific papers on various aspects of EMFs including exposures (specifically including assessment of exposures from overhead power lines), mechanisms, risk assessment and risk management, precautionary approaches, etc, and having participated in various national and international scientific committees and other groups.
46. In relation specifically to medical expertise, medical expertise is, of course, highly relevant to the diagnosis and treatment of disease. However, when it comes to the identification of causes of disease, this is a specialist field of

study in its own right. In that respect, medical expertise is not the most important expertise for assessing scientific evidence on possible causes of health effects; expertise in epidemiology and in biology and biochemistry are more relevant, and, whilst many medically qualified individuals work in this area, such expertise is not restricted to medically qualified individuals. The ultimate and definitive source of the scientific views that inform SONI's assessment of EMF issues is the various authoritative review bodies, and those bodies have drawn upon medical expertise, alongside other expertise, to the extent they have considered appropriate.

4.3.6 The nature of the scientific evidence relating to childhood leukaemia

47. In the SEAT Statement of Case, Page 17, Paragraph 87 states:

"The reality is that EMF was classified by the International Agency for Research on Cancer (IARC) as a Class 2B possible carcinogen in 2002. The average exposure to power frequency magnetic fields in the home is only 0.05 microtesla (μT) or 50 nanotesla (nT). However, close to certain appliances, levels can be tens of μT . Under powerlines MFs can be several μT or evens tens of μT ".

48. In the SEAT Statement of Case, Page 20, Paragraph 112 states:

"The reality is that Electrical and Magnetic Fields (EMF) were classified by the International Agency for Research on Cancer (IARC) as a Class 2B Possible carcinogen in 2002. The average exposure to power frequency magnetic fields in the home is only 0.05 microtesla (μT) or 50 nanotesla (nT). However, close to certain appliances, levels can be tens of μT . Under powerlines MFs can be several μT or evens tens of μT ".

49. In the SEAT Statement of Case, Page 17, Paragraph 88 states:

"Crucially a doubling of childhood Leukaemia risk is associated with average exposure of 0.3 -0.4 μT ".

Response

50. SONI broadly agrees with these statements of the scientific position and set out the same facts itself in the Consolidated ES (7.4).

- The terminology used by SEAT differs in detail from that used by SONI (the correct expression of the IARC classification in Group (not "class") 2B is "possibly carcinogenic to humans" not "a possible carcinogen", and it was made and published in 2001, though the full

Monograph was not published until 2002) but this does not affect the substance.

- “*Possibly carcinogenic*” is a lower classification than either “*established carcinogen*” or “*probably carcinogenic*”, indicating that the evidence linking magnetic fields to childhood leukaemia is in fact quite weak, suggesting only the possibility of a link, and that a causal relationship is unlikely.
- This classification indicates that there is uncertainty in the scientific evidence concerning EMFs, as indicated by the word “*possibly*”. That uncertainty is fully taken into account in setting the policy with which this proposed Tyrone – Cavan Interconnector is compliant.

51. In the SEAT Statement of Case, Page 17, Paragraph 89 states:

“Further analyses of international epidemiological studies indicate a 30% increase in childhood leukaemia risk associated with average magnetic field exposures above 0.2 μ T (Zhao et al2013)”.

Response

52. In the scientific literature on EMFs, different commentators choose slightly different ways of characterising the evidence. The statement by SEAT based on the paper by Zhao et al is one such. Other authors characterise the evidence in other ways. In each case, the source data on which the author is basing their opinion is the same, and that source data was taken into account by the relevant independent authoritative review bodies. Regardless of how the evidence is described by specific authors, therefore, the source evidence has been taken into account in formulating the policies that are in place for the protection of the public.

53. In the SEAT Statement of Case, Page 18, Paragraph 94 states:

“The literature includes at least four studies showing increased leukaemia risk up to 600 metres from powerlines which is well beyond the range of the AC fields, although well within range of corona ion emission. The findings could be explained by two possible models: that corona ions attach to particles of air pollution making them more likely to be retained in the lung when inhaled, and that corona ion disturbance of the natural electric field of the Earth results in melatonin and circadian rhythm disruption”.

Response

54. Since 2005, it has been helpful to characterise the literature on childhood leukaemia and EMFs as having comprised two strands: one continuing the original focus on magnetic fields, the other, new, strand focussing specifically on proximity to power lines . SONI drew attention to these latter studies in the Consolidated ES (7.4.3.7) and its own Statement of Case (TR05 paragraph 68). There is ongoing debate as to the interpretation of this second strand, proximity to power lines. For instance, the most recent study from the University of Oxford group, one of those referred to in the Statement of Case (TR05 paragraph 68), suggested that the association, while present in earlier years, had diminished and is no longer present in the UK, and studies in France and California have broadly failed to replicate this association. Regardless of the weight that any individual party, be that SEAT or SONI, choose to place on this strand of evidence, the key fact is that it was taken into account by the authoritative independent review bodies in reaching their conclusions.
55. An Bord Pleanála Inspector's Report³ for the North-South 400kV Interconnection Development was published on 21st December 2016. That report, supported by the Board's Direction, confirmed the planning approval of the proposed Interconnector in Ireland. The Inspector's Report states (Page 204):
- "As noted above, the paper by Draper et al (2005) is one of the reports most commented on by the observers, to support their arguments of negative health outcomes. It was peer reviewed and published by the British Medical Journal. The study was considered to be scientifically rigorous, but subject to limitations, in that it was confined to a desktop study and did not take into account EMF within the house and from other sources. I note that Brunch et al., 2014 updated and extended the previous report by Draper and it reported no overall association with residential proximity to 132 kV, 275 kV and 400 KV power lines for leukaemia or any other cancer among children. The statistical association with distance that was reported in the earlier study was not apparent in the extended analyses. "*
56. In the SEAT Statement of Case, Page 18, Paragraph 96 states:

³ <http://www.pleanala.ie/news/VA0017.htm>

“The discussion on the effects of power frequency EMF centre on two aspects: spatial and causal. The evidence on spatial association is no longer debated and it is assumed that prolonged (residential) exposure to EMF causes a range of diseases in humans and animals”.

Response

57. As discussed in the previous paragraphs, and at greater length in the Consolidated ES (7.4), this statement by SEAT is at odds with the conclusions of the authoritative review bodies. Broadly speaking, those authoritative bodies accept that there is in some circumstances a statistical association with childhood leukaemia, but they clearly do not agree that EMF has been shown to cause childhood leukaemia, let alone that *“exposure to EMF causes a range of diseases in humans and animals”*.

4.3.7 The nature of the scientific evidence relating to other health outcomes

58. In the SEAT Statement of Case, Page 17, Paragraph 90 states:

“Other diseases linked to EMF by published scientific research include:

- Childhood Leukaemia*
- Adult Leukaemia*
- Adult Brain Tumours*
- ALS (motor neurone disease)*
- Miscarriage and adverse birth outcomes*
- Depression and depressive symptoms*
- Alzheimer’s Disease; and,*
- Breast Cancer”*

59. In the SEAT Statement of Case, Page 19, Paragraph 104 states:

“.... there is no doubt whatsoever that living close to powerlines increases the incidence of reported cases of numerous debilitating health issues such as severe lowering of melatonin and circadian rhythm disruption which are believed to lead to various aggressive cancers, miscarriage, leukaemia, birth defects (in both humans and animals), motor-neurone disease, Alzheimer’s Disease and many other issues”.

Response

60. As explained in 4.3.6 above, even for childhood leukaemia, the evidence goes no further than indicating merely the “possibility” of a causal link. Then, as set out in the Consolidated ES (e.g. 7.4.2.4), the authoritative view is that the evidence that any of the other health effects listed by SEAT (or any other health effects) are caused by EMFs is “*much weaker*” even than that for childhood leukaemia.

4.3.8 The nature of the scientific evidence relating to farming, animals, flora and fauna

61. In the SEAT Statement of Case, Page 20, Paragraph 116 states:

“The EIS is materially deficient in numerous respects including its failure to address specific impacts of the project on certain species, such as whooper swans and beehives. (Appendix SEAT16)”.

62. The issue of the possible impact of EMFs on farming or wildlife is also raised in SEAT Appendix 18 by Anne Mallon, Mr and Mrs Todd, Paul Huges, Benson George, and Tom Canning. The specific issue of bees is raised by Tom Canning and the decisions in certain court cases in France by Benson George.

Response

63. These issues are in fact considered in the Consolidated ES (7.4.4), with the conclusion:

“203. Whilst some studies do report minor changes possibly attributable to EMFs, there appears to be no single effect that can be regarded as established, and the preponderance of the evidence has failed to find any effects. This is reflected in the conclusions of those authoritative bodies that have examined this question”.

64. Whooper swans were addressed in the Consolidated ES (7.4.4.1):

“208. NIE and its advisors are aware of no studies suggesting that bats, Whooper Swans or any protected species are affected by power-frequency EMFs”.

65. Bees were addressed in the Consolidated ES (7.4.4.1):

“209. There can be an effect on bees if the hive is in a strong electric field. The mechanism is either heating of the hive by induced currents or small shocks due to small induced charges. Both these effects are readily eliminated by screening the hive by means of a grounded metal cover. Bees have not been found to be sensitive to magnetic fields or to direct effects of electric fields”.

66. The court cases in France were addressed in the Consolidated ES (7.4.4.3) with the summary:

“216. In summary, a French court awarded damages of around 400,000 Euros against RTE, the French transmission company, to M. Marcouyoux, a farmer, for effects of a power line on this farm. But the decision was overturned on appeal...”

67. The Appeal Court (Cour d’Appel de Limoges) judgement concluded that the scientific evidence did not establish any effects on farming operations, concluding their judgement by stating, in translation:

“... the court analysed the factual circumstances under which the damage had occurred, and has been able to accept, without reversing the burden of proof, that when the explanations and data provided are taken as a whole, the existence of a causal link was not sufficiently characterised and from this deduced precisely that GAEC [the farmer] claims for compensation should not be accepted.”

68. An Bord Pleanála Inspector’s Report⁴ for the North-South 400kV Interconnection Development was published on 21st December 2016. That report, supported by the Board’s Direction, confirmed the planning approval of the proposed Interconnector in Ireland, which has the same design and therefore produces the same EMFs as the proposed Tyrone – Cavan Interconnector. The Inspector’s Report states (Page 221):

“In the case of horses and farm animals therefore, the literature tends to be in agreement with the (WHO) 2007 determination that current evidence does not confirm the existence of any health consequence from exposure to ELF EMF”.

And (Page 228):

“... there is no evidence that proximity to high voltage power lines on crop production or quality”.

And (Page 284):

“... there is no evidence of any adverse effects of OHLs on milk or beef produced by cattle grazed under overhead lines or in vicinity of them”.

4.3.9 Perception of health risks

69. The issue of the possible impact of perceptions of health risks is raised in SEAT Appendix 18 by Tom McNally.

⁴ <http://www.pleanala.ie/news/VA0017.htm>

Response

70. The issue of the perception of health effects was addressed in the Consolidated ES (7.4.3.9):

“194. Fears and perceptions about the health effects of the Proposed Development can, of course, be material planning considerations, but the weight to be given to those considerations must depend on the extent to which they are objectively justified”.

71. As explained in the remainder of that section of the Consolidated ES:
- the degree of concern that is objectively justified is, after taking account of the limited strength of the evidence and the measures in place for the protection of the public, limited;
 - Concern or fear, to the extent that it is unjustified by the scientific evidence, can be reduced by sensitive and appropriate communications; and,
 - SONI considers that restricting the time children spent outdoors, ceasing to visit relatives living near the line, or similar reactions would not be justified on the basis of the scientific evidence.

4.3.10 The nature of the process of weighing evidence – general approach

72. In the SEAT Statement of Case, Page 19, Paragraph 100 states:

“To date there are more than 25,000 research papers related to the biological effects of EMF fields. For any subject to have had such a vast body of research devoted solely to it indicates the seriousness and significance of the issue. ...”.

73. In the SEAT Statement of Case, Page 19, Paragraph 102 states:

“The issue of the impact of ultra-high voltage powerlines and their EMF along with the generation of corona ions is the subject of a major field of research on their effects on both human and animal health”.

Response

74. SONI agrees with the description of EMFs as a “*major field of research*” and agrees that the quantity of research papers published over many years indicates, among other things, “*the seriousness and significance of the issue*”. One conclusion to be drawn from this, as suggested in the Consolidated ES (7.4.3.3), is that if the evidence were to have indicated any

adverse health effects of EMFs, this would already have become established, and would subsequently have been taken into account in the formation of policy.

4.3.11 The nature of the process of weighing evidence – specific methodologies

75. In the SEAT Statement of Case, Page 18, Paragraph 91 states:

“Representative results from 33 independent adult leukaemia studies tabled by IARC yielded 23.5 positives ($p \approx 0.01$) and 9 significant-positives ($p < 10^{-7}$). From 43 representative results from CDHS, there were 32 positive ($p < 0.001$) and 14 significant-positives ($p < 10^{-12}$). There were no significant negative results in either list. Results for adult brain cancer gave a similar, but less clear message”.

76. In the SEAT Statement of Case, Page 18, Paragraph 92 states:

“O’Carroll and Henshaw (2008) demonstrated that a statistical assessment of published studies on adult leukaemia had a p value of 10^{-7} or 99.99999% association which by any definition is clearly not a statistical aberration or fluke and shows a definite association of EMF and leukaemia. (For comparison the prediction of the Higgs boson had a similar likelihood of existence prior to its identification at CERN)”.

77. In the SEAT Statement of Case, Page 19, Paragraph 106 states:

“Professor Denis Henshaw, (Bristol University) one of the world’s foremost experts on epidemiological studies of EMF has estimated that the statistical odds of powerlines not being associated with such health issues exceeds one chance in ten million”.

Response

78. These three statements all refer to a particular method for attempting to assess the strength of the evidence based on a crude counting of the number of apparently positive results. This method has not been adopted by any authoritative review body that SONI or its advisors are aware of and SONI does not consider that it has any credibility in the mainstream scientific community. The correct approach, as adopted by the authoritative review bodies and illustrated by the quotations from those bodies in the Consolidated ES (7.4.2), involves not just considering what the result is but weighing other factors related to it, such as its robustness and any flaws in the study from which it came.

79. One of the sources of data for the suggested approach is given as the 2001 IARC Review, and this provides an illustration of the different approaches. SEAT's suggested approach notes that there are 33 relevant leukaemia studies listed by IARC, and simply extracts for each one whether it was "positive" and whether it was "statistically significant". By contrast, IARC itself considers each of these studies in depth, an analysis extending over something like fifty pages, for each one considering the method of exposure assessment and any possible errors introduced by it, the way in which information on the subjects were gathered and any biases introduced by that, the way in which the original authors chose to analyse the data, internal consistency, etc. This allows IARC to reach an overall conclusion that takes account of the quality of each study, giving greater weight to stronger studies and lesser weight to weaker studies. Almost all individual studies have some weaknesses in one or more of these areas; only by the process of experienced and independent experts examining and bringing their judgement to bear on each study in turn can the correct weight for each study be determined. By contrast, SEAT's approach gives the same weight to the smallest and weakest study as to the largest and best-conducted study.
80. It should also be borne in mind that the evidence from humans, obtained by epidemiological studies, is only one of the strands of evidence that needs to be considered to reach an overall assessment of the scientific evidence on EMFs. The other strands of evidence are, broadly, evidence from animals and evidence as to possible mechanisms, and in the case of EMFs these are largely negative and weigh quite heavily against EMFs being a cause of ill health. The independent authoritative review bodies all correctly consider the evidence from all these strands; the method advanced in the SEAT Statement of Case, even if it were scientifically valid, would still need combining with those other strands of evidence before overall conclusions could be drawn.
81. In conclusion, the studies referred to by SEAT do not in any way undermine or qualify the conclusions reached by the authoritative independent review bodies.

82. In the Statement of Case of the Armstrong family, the first page states that, while working as a community nurse in the Tandragee and Laurevale areas:

"I noticed a higher than average incidence of cancer related deaths, in comparison to other areas. In many cases the individuals lived very close to electricity pylons. Throughout the area pylons are sited in people's gardens, with wires overhanging rooves. This was not just a coincidence as it occurred consistently over the five-year period I worked in the area. The powerline in this area is 275kv, compared to the proposed 400kv line. This would cause greater health risks at this very high level".

Response

83. From a scientific perspective, there is nothing wrong with making an initial observation of an apparently unexpected number of cases of disease associated with an environmental feature. That is how many environmental causes of disease are first identified, and that is how the issue of EMFs was first raised in the 1970s. Having made that observation, however, it is then necessary to place it on a rigorous footing by performing properly conducted systematic epidemiological studies, covering a large enough area or a long enough time period to have adequate statistical power. Many such studies have now been conducted for EMFs and for proximity to power lines and it is these studies, specifically their findings on childhood leukaemia, that form the basis of the conclusion of the authoritative review bodies that magnetic fields are "*possibly carcinogenic*" to humans. That conclusion then informs the setting of exposure limits and additional precautionary approaches that form the relevant policy, and with which this proposed Tyrone – Cavan Interconnector complies.
84. As stated, the initial observation of an apparent excess number of cases of disease associated with a particular environmental feature – in this case, electricity pylons – can be sufficient to prompt further, systematic, studies. Such initial observations, however, rarely constitute adequate evidence in themselves, because they are rarely conducted sufficiently systematically. Among other factors, the ascertainment of cases is often adventitious or anecdotal and therefore not necessarily complete; there will often not be a systematically chosen comparison group; choice of either the cases or the comparison group may be influenced by the pattern that is perceived to be

emerging; what constitutes exposure may be poorly defined at the start of the observations; other conscious or subconscious biases may be in play; and the size of the population examined may not be large enough for statistical confidence.

85. In the SEAT Statement of Case, Page 19, Paragraph 101 states:

“Around the world many local communities only need anecdotal evidence to be convinced of adverse health effects. In some areas cancers are more prevalent than others and are blamed (rightly or wrongly) on powerlines and mobile mast radio masts....”.

Response

86. This statement refers to anecdotal evidence. For the same reasons as given in paragraph 84 above, anecdotal observations do not constitute a sound basis for drawing scientific conclusions. Sound scientific conclusions can be drawn only from high-quality systematic studies, as is done by the authoritative review bodies.

4.3.12 The difference between association and causation

87. In the SEAT Statement of Case, Page 18, Paragraph 93 states:

“Thus in advance of further discussion the statistical certainty exists that EMF is associated with causing some forms of leukaemia (and by implication other diseases as listed above)”.

Response

88. As has already been discussed, and as was set out at length in the Consolidated ES (7.4), the authoritative review bodies do not consider that *“the statistical certainty exists that EMF is associated with causing some forms of leukaemia”*. The authoritative classification, cited by SEAT themselves, is that EMFs are only *“possibly”* carcinogenic to humans.
89. In terms of establishing the current state of the science, it is sufficient simply to note the view reached by these authoritative bodies. By way of extra clarification, however, it is worth noting that there is a difference between statistical association and causation. Statistical associations can, clearly, arise when there is a causal relationship, but they can also arise for other

reasons, for example, a bias in the study, or causation by some other factor altogether.

90. It is worth repeating the extract from the Consolidated ES provided in paragraph 33 above:

“7.4.3.4 Why The Evidence on Causation of Childhood Leukaemia Is Not Regarded As Conclusive

170. The epidemiological evidence suggesting a risk for childhood leukaemia is stronger than that for any other health effect. But the relevant authoritative review bodies do not regard the evidence even on childhood leukaemia as establishing causation. For the purposes of this ES, it is sufficient to note that fact; the reasons why are secondary.

171. However, NIE’s understanding of what lies behind this judgement is:

172. Firstly, however strong the epidemiology is or is not, it is unsupported by the laboratory evidence, which is largely negative, and no plausible mechanism has been identified; and

173. Secondly, in the expert judgement of epidemiologists who are very familiar with the workings of epidemiology, “bias” and “confounding” have not been excluded and remain credible possible explanations. Bias is when some aspect of the design of a study makes it systematically prone to producing a distorted result. Confounding is when the health effect detected by a study is real, but is not caused by the agent under investigation but by some other agent that happens to vary in the same way, so that people are exposed to both agents at once. There is in fact evidence that bias operates in at least some of the studies”.

91. In the SEAT Statement of Case, Page 20, Paragraph 114 states:

“...It is indisputable that there is a risk to health from EMF emitted from EHV powerlines:

“The link between (EMF) and childhood leukaemia is statistically significant and is robust”. (US National Radiological Committee.)”.

Response

92. This quotation is a specific instance where the “link” that is being referred to is clearly a statistical association (hence the description of it as **statistically** significant) and does not imply that the body in question is accepting that a causal relationship has been established, because, as explained in paragraph 89 above, statistical associations can (and often do) arise for reasons other than a causal relationship.

4.3.13 The significance of identifying, or not, a mechanism

93. In the SEAT Statement of Case, Page 18, Paragraph 97 states:

“TSO’s such as the Applicant obfuscate the debate by referring to research on the causal mechanisms of cell degradation being largely unproven. However recent research at the Dublin Institute of Science by Prof. Carmel Mothersill has clearly and unequivocally demonstrated that cell metastasis occurs under MF by a range of mechanisms generally known as the “Bystander Effect and Genomic Instability”.

94. In the SEAT Statement of Case, Page 18, Paragraph 94 states:

“The literature includes at least four studies showing increased leukaemia risk up to 600 metres from powerlines which is well beyond the range of the AC fields, although well within range of corona ion emission. The findings could be explained by two possible models: that corona ions attach to particles of air pollution making them more likely to be retained in the lung when inhaled, and that corona ion disturbance of the natural electric field of the Earth results in melatonin and circadian rhythm disruption”.

95. In the SEAT Statement of Case, Page 18, Paragraph 95 states:

“The adverse health effects associated with EMF exposure could all potentially be explained by circadian rhythm disruption Melatonin is a broad-spectrum, ubiquitously-acting antioxidant and anticancer agent which also reduces growth of human myeloid leukaemia cells and whose disruption by light-at-night is associated with increased cancer risk. Melatonin disruption in humans is really seen in populations exposed to “real” fields – down to 0.2 μT ”.

96. In the SEAT Statement of Case, Page 19, Paragraph 105 states:

“In the latter aspect - (b) the physical mechanism as to how the magnetic and/or electrical fields cause cellular metastasis is still in doubt but recent advances have almost certainly now defined this process by “the Bystander Effect and Genomic Instability” “.

Response

97. These statements by SEAT all refer to the issue of whether a physical, biophysical, or biological mechanism has been identified to explain how EMFs could have effects on living systems. Specific suggestions put forward for such a mechanism include the “bystander effect”; “genomic instability”; “melatonin disruption”; “circadian rhythm disruption”; and, “corona ions”. The following points arise:

- The presence or absence of a known mechanism, or more generally the plausibility of such a mechanism existing, is indeed one of the strands of

evidence that has to be weighed in reaching an overall assessment of the evidence on EMFs.

- The evidence on mechanisms has duly been assessed and weighed by the authoritative review bodies. For example, evidence about mechanisms is explicitly built into the IARC classification scheme, alongside evidence from humans and animals, with defined rules for how the conclusions reached on mechanisms influences the overall assessment.
- Therefore, whatever the specific evidence on specific suggested mechanisms may be, that is already taken account of by the relevant authorities in reaching the assessment of the science on which the policy regime applicable to this proposed Tyrone – Cavan Interconnector is based.
- Given this, it is not necessary to debate the specific evidence on each mechanism separately. Broadly speaking, however, for each suggestion, the conclusion of the authoritative review bodies is that they are not in fact established by the evidence.
- In particular, the evidence on corona ions was addressed in the Consolidated ES (7.4.3.8).

4.3.14 The role of caution in the policy response to the science

98. In the SEAT Statement of Case, Page 18, Paragraph 99 states:

“The physicist or engineer seeking information on the possible biological effects of non-ionizing electric and magnetic (EMF) fields is faced with a difficult task. EMF fields emerged as a new public health issue in 1979 with publication of Wertheimer & Leeper's study⁶ of childhood cancer in relation to power distribution line proximity. However, concerns about possible health effects of microwave and radiofrequency energy go back to the Second World War and before, and reports of health effects appear in Soviet and Eastern European literature in the 1950s and 1960s”.

Response

99. SONI does not agree that seeking information on EMFs is a difficult task. SONI itself, and more broadly the UK electricity industry acting collaboratively, has sought to make information available to the public as referred to in the specific context of this proposed Tyrone – Cavan

Interconnector in the Consolidated ES (7.4.3.9), and other bodies do likewise. It is clearly desirable that information is readily available. However, in the particular context of deciding on an appropriate policy response, it does not matter whether the task of gathering information by any individual is easy or difficult, because that task has been performed by the relevant authoritative review bodies, and their conclusions form the basis of the policy regime set by the Government, with which this proposed Tyrone – Cavan Interconnector complies.

100. The question of whether the authoritative review bodies take account of all the relevant evidence was addressed in the Consolidated ES (7.4.2.1):

“152 The authoritative review bodies are tasked with reaching a conclusion as to whether there are health effects or not. To do this they select the literature they consider relevant to examine. If there is relevant scientific evidence about a specific health effect, it will have been weighed by the review bodies. If the review bodies have not weighed a specific piece of scientific evidence, that can be taken as evidence that it is not sufficiently relevant”.

101. In the SEAT Statement of Case, Page 19, Paragraph 101 states:

“Around the world many local communities only need anecdotal evidence to be convinced of adverse health effects. In some areas cancers are more prevalent than others and are blamed (rightly or wrongly) on powerlines and mobile mast radio masts. If one examines the technical literature over the last five years one could tend to err on the side of anecdotal evidence as being good enough. There is however, a compelling and substantial body of peer-reviewed scientific publications available to err on the side of caution”.

Response

102. SONI does not agree that terms such as “*compelling*” correctly reflect the state of the science as assessed by the relevant authoritative review bodies. However, as detailed in the Consolidated ES (7.3.2.4), the UK has implemented a precautionary approach by putting in place specific precautionary policies following a stakeholder exercise. The proposed Tyrone – Cavan Interconnector complies with all applicable precautionary policies as set out the Consolidated ES (7.3.6) and therefore already incorporates the degree of caution that is considered appropriate by Government for the protection of the public.

4.3.15 Putative future changes to the scientific evidence and policy position

103. In the SEAT Statement of Case, Page 18, Paragraph 98 states:

“Considering the lifetime of the proposed project and the rapidity with which research is linking EMF’s with a wide range of both human and animal health issues SEAT contends that to erect a major source of EMF and to irradiate communities should be considered reckless endangerment and a precautionary approach would mean that the interconnector should not proceed”.

Response

104. As explained in the Consolidated ES (7.3.5.6):

“108. More generally, the acceptability of the Proposed Development can be decided only on the basis of the present policy position as set out in the exposure limits and other policies, not on the basis of any speculation as to what future policy may be”.

105. If, at some future date, the scientific evidence shifted, the relevant authoritative review bodies would consider that, and Government would in turn consider whether any change in policy was warranted. Any hypothetical new policy would apply to the proposed Tyrone – Cavan Interconnector, if in operation by then, just as for every other power line already existing. In the meantime, the acceptability of the proposed Tyrone – Cavan Interconnector can be judged only against the policy currently existing.

4.3.16 The status of the exposure limits

106. In the SEAT Statement of Case, Page 19, Paragraph 100 states:

“.... Many current standards do not protect people from many consistent and well established biological and health effects. The international guideline (International Commission for Non-Ionizing Radiation Protection, ICNIRP (1998)) for public exposure to 50 Hz fields is 1000 mG (100µT).and for 60 Hz is 833.3mG (83.3µT). These are set to avoid electric shock”.

Response

107. In terms of the proposed Tyrone – Cavan Interconnector, the fact is that the 1998 ICNIRP exposure limits, applied in the terms of the 1999 EU Recommendation, are the exposure limits that Government has adopted as the appropriate level of protection for the public, and therefore the relevant

limits for the proposed Tyrone – Cavan Interconnector to comply with. The scientific basis of the limits does not alter that fact. However:

- The ICNIRP limits were set after extensive consideration of all relevant scientific evidence. If there are effects that SEAT consider to be “*consistent and well established*”, but which are not protected against by the limits, that is because the authoritative experts as represented by ICNIRP did not consider that evidence in fact justified setting exposure limits.
- The ICNIRP limits were not “*set to avoid electric shock*”. The limits are in fact set primarily to prevent effects caused by the voltages induced in the central nervous system by EMFs, and therefore provide much greater protection than if they were merely set to avoid electric shock.

4.3.17 Compliance with the exposure limits

108. In the SEAT Statement of Case, Page 20, Paragraph 109 states:

“In the case of electric field exposure, the International Commission of Non-Ionizing Radiation Protection (1998) specifies that the levels should not exceed the Basic Restriction on current density in the body, a value calculated to arise for an exposure of about 9 kilovolts per meter (kV/m). This guideline is applied in the EU to areas where the public spends significant time”.

Response

109. SONI agrees with this statement of the relevant exposure limits, which SONI itself set out in the Consolidated ES (7.3.2.3). It is particularly important to note that SEAT agrees that the exposure limit corresponds to 9 kV/m given their statement in their Paragraph 115 considered below.

110. In the SEAT Statement of Case, Page 20, Paragraph 110 states:

“The maximum electric field calculated for the majority of the proposed development is approximately 7.9kV/m, with a minor increase to 8.0kV/m at the short transposition section. This means that the exposure to the OHL is running at c. 90% the restriction level in the body”.

Response

111. In this paragraph, importantly, SEAT accept that the proposed overhead line is compliant with the relevant electric-field exposure limits, and by extension, also with the magnetic-field exposure limits.
112. In the SEAT Statement of Case, Page 20, Paragraph 111 states:

“These facts highlight very clearly why affected communities, especially farmers, should be concerned about this development”.

Response

113. The opposite is the case. The fact that the exposures to electric fields (and also, though not considered in this paragraph, to magnetic fields) from the proposed overhead line do not exceed – indeed, are significantly below - the relevant exposure limits, as set out in the Consolidated ES (7.3.3.1), should give substantial comfort to affected communities, including farmers. There is no basis for requiring or for advocating compliance with an additional margin beyond the exposure limits; the exposure limits themselves already include the safety margin that the authoritative experts who set the limits consider appropriate and adequate.
114. The reference to “a minor increase to 8.0kV/m at the short transposition section” relates to a section of the proposed Development in the Republic of Ireland.
115. In the SEAT Statement of Case, Page 20, Paragraph 115 states:

“SONI/Eirgrid clearly set out the ICNIRP guidelines as the relevant benchmark for EMF risk levels and thresholds for both magnetic and electric fields. These EMF reference levels for electric fields are breached in relation to electric fields. No defence of this was provided in the application. ...”.

Response

116. It is a matter of fact that the proposed overhead line is compliant with the relevant exposure limits for both magnetic and electric fields, as set out in the Consolidated ES (7.3.3.1), and as agreed by SEAT itself in Paragraph 110 of its Statement of Case. The apparently contradictory statement in this paragraph relates to the reference level, 5 kV/m, rather than the actual limit, 9 kV/m. The role of the reference level, and why it does not constitute the limit, is explained in detail in the Consolidated ES (7.3.2.3):

“59. In the ICNIRP guidelines and the EU Recommendation, the actual limit is the basic restriction. The reference levels are not limits, but are guides to when detailed investigation of compliance with the actual limit, the basic restriction, is required. If the reference level is not exceeded, the basic restriction cannot be exceeded and no further investigation is needed. If the reference level is exceeded, the basic restriction may or may not be exceeded”.

117. In the Armagh City Banbridge and Craigavon Borough Council Statement of Case, page 3, Section 1 draws attention to an editing error relating to reference levels in the Consolidated ES Addendum Non-Technical Summary. This was corrected in SONI’s Statement of Case, in TR05 5.17.1.

4.3.18 Compliance with precautionary policies

118. In the Armagh City Banbridge and Craigavon Borough Council Statement of Case, page 3, Section 1 states:

“Further than compliance with the ICNIRP levels, it is recommended hat the DoE ensures that the proposed development takes account of the precautionary principle by the choice of route, development type and design of the line to minimise public exposure to EMF”

Response

119. A precautionary approach has indeed been taken to the issue of EMFs in this project, in accordance with UK policy on precautionary approaches as applied to EMFs, as set out in the Consolidated ES (7.3.2.4):

“65 As explained above, EMF policy in the UK is based on compliance with quantitative exposure guidelines. But EMF policy also takes account of the need to consider possible precautionary measures in addition to the exposure guidelines.

....

70 In summary, Government decided that one precautionary measure would apply to high-voltage overhead lines, a measure relating to a design feature of some lines called “optimum phasing”, but that other precautionary measures, notably “corridors” or minimum separations of overhead lines from properties, were not appropriate and would not apply...”.

120. The Consolidated ES also sets out how the proposed Tyrone – Cavan Interconnector complies with the precautionary policies that are in place in the UK (7.3.6.), concluding *“The proposed line is therefore compliant with that policy”*..:

121. Normal good line routing practice ensures that power lines avoid as far as possible inhabited areas, thereby reducing exposures to EMFs. However, there is no requirement in UK policy to route lines differently in order to reduce EMF exposures, and, specifically, there are no minimum required separations between overhead lines and properties.
122. The specific issue of the precautionary policy on optimum phasing is raised in SEAT Appendix 18 by Jim Lennon.

Response

123. “Phasing” refers to the order in which the two circuits of a double-circuit power line are connected relative to each other. “Optimum phasing” is the relative order of connection that produces the lowest magnetic fields to the sides of the line. The UK’s policy on optimum phasing applies to all overhead power lines of the specified voltages. However, the policy requires action only for double-circuit lines. The policy does not require any changes to single-circuit lines, such as the line proposed for this Interconnector, and does not require them to be constructed as double-circuit lines merely to take advantage of optimum phasing. Therefore the proposed Tyrone – Cavan Interconnector is compliant with the policy on phasing.
124. This was explained in more detail in the Consolidated ES (7.3.6.1), including:

“113. The requirement for this Interconnection circuit could be met either by a single-circuit 400kV line, or by a double-circuit 275kV line. Designs for both were considered at the design stage. The single-circuit 400kV design was chosen because it has a lower visual impact and lower cost. To construct the overhead line as a double-circuit line instead of a single-circuit line, solely in order to be able to construct it with optimum phasing, would require every support structure to be significantly higher in order to accommodate the additional circuits and would therefore entail a markedly increased visual impact and a greater cost. It would clearly not be “reasonable” in the context of the SAGE Recommendation and is therefore not required by the policy on optimum phasing. The proposed line is therefore compliant with that policy.

114. It is correct that the fields from the line will fall off not quite as rapidly with distance as they would do if it were a double-circuit line with optimum phasing. However, the fields in either case are completely compliant with the exposure guidelines”.

4.3.19 Planning permission decision in the London Borough of Merton

125. The issue of a planning permission decided in the London Borough of Merton is raised by Jim Lennon.

Response

126. The planning appeal decisions in question (APP/T5720/A/09/2099306 & APP/T5720/A/09/2098386) relate to a single case in England that was refused due to fears of exposure to EMFs. That case was determined prior to the Written Ministerial Statement of 2009 and the introduction of the Codes of Practice as detailed in the Consolidated ES (7.3.2), so does not reflect the current planning policy position. Perception of harm is a material consideration, but the weight to be given to such perception depends on the extent to which it is objectively justified on the evidence. Notably in that case there was no quantified evidence on increased levels of exposure to EMFs, and no consideration of the exposure limits. It is unclear if the Inspector was even aware of the exposure limits. The circumstances are therefore not comparable, in that the Consolidated ES clearly documents that the proposed Interconnector will be compliant with the relevant exposure limits. In this case, therefore, perceived concerns should not be given significant relative weight.

4.3.20 EMFs in relation to alternatives

127. In the SEAT Statement of Case, Page 20, Paragraph 115 states:

“SONI/Eirgrid clearly set out the ICNIRP guidelines as the relevant benchmark for EMF risk levels and thresholds for both magnetic and electric fields. These EMF reference levels for electric fields are breached in relation to electric fields. No defence of this was provided in the application. The Applicant has given no weighting to the elimination of all health risks in its Consideration of Alternatives. Undergrounding eliminates electric field exposure”.

Response

128. The question of EMFs in relation to alternatives, and specifically to undergrounding, was considered in the Consolidated ES (7.3.7). It is correct that undergrounding eliminates the external electric field, and, except, sometimes, close to the route, reduces but does not eliminate the magnetic

field. However, because all exposures, whether from an overhead line or an underground cable, are compliant with the relevant exposure limits, this does not provide a basis for preferring one solution or the other, and there is no basis in UK or Northern Ireland policy for preferring undergrounding (or any other alternative) on grounds of EMFs.

4.3.21 EMFs and Implanted Medical Devices

129. The issue of Implanted Medical Devices is raised in SEAT Appendix 18 by James Woods, Fergal Woods, Anne Mallon, Mr and Mrs Todd, and Paul Huges.
130. The issue of EMFs and active implanted medical devices, of which an ICD is one example, was thoroughly considered in the Consolidated ES (7.4.5). The conclusion (7.4.5.8) was:

“242. There could in theory be hazards associated with the operation of pacemakers and ICDs as a consequence of interference with fields from overhead lines. However, the probability of that occurring is extremely small; in fact the relevant authorities are unaware of any cases in the UK where this has happened. Therefore, overhead lines are not regarded as a significant risk to implanted heart devices, a position endorsed in NPS EN-5 (DECC 2011), which states:

“2.10.7 The Department of Health’s Medicines and Healthcare Products Regulatory Agency (MHRA) does not consider that transmission line EMFs constitute a significant hazard to the operation of pacemakers“.”

131. An Bord Pleanála Inspector’s Report⁵ for the North-South 400kV Interconnection Development was published on 21st December 2016. That report, supported by the Board’s Direction, confirmed the planning approval of the proposed Interconnector in Ireland, which has the same design and therefore produces the same EMFs as the proposed Tyrone – Cavan Interconnector. The Inspector’s Report states (Page 228):

“Various studies have been carried out in different scenarios on the impacts on pacemakers and other medical devices and none suggest significant evidence of interference from high voltage lines”.

⁵ <http://www.pleanala.ie/news/VA0017.htm>

4.4 Conclusions

132. There is clear policy in place in the UK for the protection of the public from EMFs, based on consideration of all relevant evidence by the relevant independent authoritative review bodies.
133. The proposed Tyrone – Cavan Interconnector complies fully with those policies. In particular, it complies with the relevant quantitative exposure limits, a fact agreed by SEAT.
134. An Bord Pleanála Inspector’s Report⁶ for the North-South 400kV Interconnection Development was published on 21st December 2016. That report, supported by the Board’s Direction, confirmed the planning approval of the proposed Interconnector in Ireland. The Inspector’s Report concludes (Page 617):
- “The proposed development*
- ...
- would not be prejudicial to public health...”.*
135. The summary on public health here refers back to and incorporates the detailed consideration of EMFS in pages 196-228.
136. In conclusion, nothing in the objectors’ Statements of Case and representations serves to undermine the conclusions set out in the SONI Statement of Case and supporting Technical Reports. As stated in SONI’s Main Rebuttal Document, the proposed Tyrone - Cavan Interconnector remains clearly acceptable in planning terms.

⁶ <http://www.pleanala.ie/news/VA0017.htm>