Section 1 – Health Questions

Rush Community Council (RCC) Question 1:

"Eirgrid is committed to your safety, health and to safeguarding the environment at all times. It is Eirgrid's policy to design and operate the East West Interconnector to the highest safety standards and to comply with the most up to date European and international guidelines and recommendations. We follow the results of scientific investigation in relation to health and Electric and Magnetic Fields (EMFs) sic. No evidence has been found that these that these fields are harmful at the proximity and levels associated with this project. This view is shared by respected national and international authoritative organisations, including the World Health Organisation (WHO), International Commission on Non-Ionising Radiation Protection, International Agency for Research on Cancer (IARC) and the Department of Communications, Energy and Natural Resources (DCENR)"
Eirgrid Communication signed by Messrs John Fitzgerald and Sean Meagher.

However, what the WHO actually state is "There is inadequate evidence in humans for the carcinogenicity of static electric or magnetic fields and extremely low-frequency electric fields." and "5.5 Evaluation There is limited evidence in humans for the carcinogenicity of extremely low-frequency magnetic fields in relation to childhood leukaemia. There is inadequate evidence in humans for the carcinogenicity of extremely low-frequency magnetic fields in relation to all other cancers. There is inadequate evidence in humans for the carcinogenicity of static electric or magnetic fields and extremely low-frequency electric fields. There is inadequate evidence in experimental animals for the carcinogenicity of extremely low-frequency magnetic fields. No data relevant to the carcinogenicity of static electric or magnetic fields and extremely low-frequency electric fields in experimental animals were available."

Do Eirgrid concede the obvious misrepresentation of the WHO's statements? Why has this misrepresentation occurred? Have Eirgrid used similar misrepresentation in communications to Government, Local Government & Council, Planning and Health & Safety Authorities?

Response:

No, EirGrid recognises that our statements do not exactly match the scientific conclusions of World Health Organization's (WHO) expert panel. This discrepancy was not an attempt to misrepresent the WHO's conclusions, but rather to paraphrase the WHO's statements in "plain English" and provide a clear, bottom-line summary of the WHO conclusions. EirGrid understands concern about any misrepresentations of the WHO's conclusions and apologises for any confusion.

At the An Bord Pleanála Oral Hearing held in March 2009, Dr. Bailey (See appendix 1. for qualifications and experience) provided a response to this question on pages 7-8 of his Statement of Evidence and on pages 289-295 of his testimony which is provided in Appendix 2 and 3 respectively for convenience, but additional explanation is provided below for clarity.

The WHO document is comprehensive and follows standard scientific methods, but little effort was made to make the document understandable to the general public. Standard terminology is used by the WHO, which was originally developed by the International Agency for Research on Cancer (IARC), to describe research after it is reviewed and evaluated. The WHO's use of these words is not the same as their usage in everyday conversation, so their statements can be confusing. As noted in your question, there is "inadequate evidence" in humans for the carcinogenicity of static electric and magnetic fields. According to IARC, inadequate evidence means "the studies are of insufficient quality, consistency or statistical power to permit a conclusion regarding the presence or absence of a causal association

between exposure and cancer, or no data on cancer in humans are available."[1] On the other hand, if the human data had suggested a relationship, the WHO would have described the evidence as "sufficient," which means that "a positive association is observed between the exposure and cancer in studies, in which chance, bias, and confounding were ruled out with reasonable confidence."

Evidence from human and animal studies is evaluated separately and then combined to provide an overall category that describes the likelihood of carcinogenicity: known carcinogen; probable carcinogen; possible carcinogen; non-classifiable; and probably not a carcinogen. Static EMF is currently considered "non-classifiable. "

EirGrid's intent is to convey to the public and agencies (including Government, Local Government & Council, Planning and Health & Safety Authorities) that the WHO concluded that there was not sufficient evidence of carcinogenicity in either human or animal studies in relation to static EMF, at levels in the range of naturally-occurring fields. The WHO report on static fields, makes it clear that only high-field exposures, such as those produced by MRIs, were targeted for further research.[2] Unfortunately, because final conclusions about safety are based on the repeated testing of many different hypotheses, only in very rare situations will the WHO and other agencies conclude that the evidence suggests a lack of carcinogenicity. This category requires a large body of high quality research and, simply put, little research is conducted in the area of static EMF at the levels associated with this project because they are of little concern to scientists. With regard to static electric fields, they do not penetrate the human body so there is little reason to investigate chronic or delayed effects; furthermore, the static magnetic fields levels associated with transmission lines are similar to or less than the levels that we are constantly exposed to from the earth's geomagnetic field.

Comparison of Static Magnetic Field Levels from the Proposed Project to Other Sources

Field Source	Magnetic Flux Density (µT)
MRI scanner	1,500,000 – 4,000,000
Electric railways*	<1,000
Battery-powered appliances	300-1,000
Earth's magnetic field (Ireland)	49
Directly over cable system (1 metre above ground level)	13♦
At edge of route corridor	11.6
10 m from cable	0.6

*For example, in Dublin's DART and LUAS suburban transportation systems

♦43 µT on ground above cable system (ground level)

[1] http://monographs.iarc.fr/ENG/Preamble/currentb6evalrationale0706.php

[2] http://www.who.int/peh-emf/publications/reports/ehcstatic/en/index.html

The comments in the above question contain a number of statements taken out of context, which could exemplify the belief such that “There is however a lot of evidence to suggest that EMF may have a negative effect on human health, may cause increased levels of leukaemia, may affect brain function, but as yet, there is just not enough evidence to prove it. “ This statement is incorrect; the extracted text applies to research on exposures from primary sources of alternating (AC) magnetic fields, including 50-Hz powered transmission, distribution, wiring, and appliances not Direct Current (DC) transmission lines.

RCC Question 2:

Additionally, the WHO has published information in relation to illnesses potentially associated with EMF: "Since the epidemiological literature has consistently found elevated risk of childhood leukaemia at ELF magnetic field exposure levels above 0.3 μT for the arithmetic mean and above 0.4 μT for the geometric mean, attributable-fraction estimates for these (relatively) high-level exposures allow the estimated impact on disease incidence of eliminating or reducing exposure above these levels, assuming the relation between exposure and leukaemia incidence is causal." "Both on theoretical grounds and because the changes produced by ELF and static magnetic fields are similar, 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." It is hardly reassuring that Eirgrid state that the line could produce 60μT. Eirgrid state that there is no statistically sound evidence of significant size to prove without doubt that EMF has an effect on human health; nor is there significant evidence to the contrary. There is however a lot of evidence to suggest that EMF may have a negative effect on human health, may cause increased levels of leukaemia, may affect brain function, but as yet, there is just not enough evidence to prove it. "Conceptually, scientists will normally support a positive association (i.e. the risk is real) if the probability that the risk has arisen by chance is below 5%. Scientists are also often willing to 'miss' a real association (i.e. conclude the risk does not exist, when it actually does) with a probability of 20%."

RCC Question 2A What is the exact emission level from this cable?

The static magnetic field produced by the cables under maximum expected loading was calculated to be 43μT (micro Tesla) at the ground level over the cables; 13μT one metre directly above the ground level; 11μT at the edge of the route corridor; and 0.6μT at 10 metres from the cable (see table below and ref page 6 of Dr. Bailey's Statement of Evidence, see Appendix 2). The net field produced by the cable and the earth's geomagnetic field would reduce the earth's geomagnetic field for several metres on either side of the cable (Bailey, Tr. Day 2, p. 294, see Appendix 3). No electric fields will be produced above ground because of the shielding by the metallic cladding of the cable and by the earth.

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*For example, in Dublin's DART and LUAS suburban transportation systems

♦43 μT on ground above cable system (ground level)

RCC Question 2B: What penalties are to be imposed if the cable emissions exceed this amount?

These levels are much, much lower than the recommended guidelines for human exposure issued by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) and the International Committee on Electromagnetic Safety (ICES) for static EMF to prevent against short-term, acute effects (Table 2 on pg. 13 of Dr. Bailey's Statement of Evidence, see Appendix 2). Any conceivable operation or loading of the cables proposed for this project would not cause these guidelines to be exceeded.

RCC Question 2C: Given the obvious proximity to residential and business premises, including single digit meterage to a large crèche and Rush National School, can Eirgrid absolutely guarantee the safety of cable emissions and will they provide signatories to this guarantee?

EirGrid can absolutely guarantee that all exposures to the public will be far, far below levels recommended in health guidelines.

Scientists and scientific organizations do not provide guarantees of safety, even in areas like this one where there will be virtually no change to present-day exposure conditions and there is no reason to expect that an exposure to which populations have been exposed constantly since the beginning of mankind (i.e., the earth's geomagnetic field) without established evidence of harm would now be harmful simply because it is produced by an electric cable. The assessments by national and international health and scientific agencies of health and biological research on DC magnetic fields do not support any inference that the small change that the cable system would make to the earth's background geomagnetic field would be of any health significance. For further information in relation to this query see Dr. Bailey's testimony at the An Bord Pleanála oral hearing in Appendix 3 pages 306 and 307.

RCC Question 3: Given the supporting material submitted (see appendix 4 for RCC's full original question) with the information request regarding the Precautionary Principle why do Eirgrid feel this does not apply to the People of Rush, with particular reference to 0-12 year old children?

The precautionary principle is invoked in areas where there is some reason to question whether a substance or exposure is harmful, either based on a biological rationale or based on some experimental or epidemiologic research which provides some evidence for concern. There is no reason to believe that a small change in the earth's geomagnetic field would be harmful; therefore, there is no reason to invoke the precautionary principle. As Dr. Bailey testified to on pg. 11 of his Statement of Evidence (see Appendix 2), it is inappropriate to invoke the precautionary principle using the uncertainty related to research on other exposure scenarios, e.g., EMF from AC power lines or higher static EMF levels from MRIs. Furthermore, there is no logic to support the application of the precautionary principle to a condition where there will be no static electric field exposure and the static magnetic field level will be similar to or less than the existing geomagnetic field.

Research related to AC magnetic fields and the application of the precautionary principle to this research is not relevant to the evaluation of DC fields. The assessments by national and international health and scientific agencies of health and biological research on DC magnetic fields do not support the inference that the very small change that the cable system would make to the earth's background geomagnetic field would be of any health significance. All exposures to the public would be far, far below levels recommended in health guidelines.

Section 2 - Safety

RCC Question 1:

1. Eirgrid claims that its suggested burial depth of the HVDC cable represents the standard. Having examined data on the HDVC projects listed in Appendix A, it appears the median and model depth for HVDC on land burial is between 1.5m and 2m. On its own web site www.eirgrideastwestconnector , Eirgrid states that the trench depth will be between 0.9m and 1.2m. This would suggest the conductive material could be between 0.7m and 1m from the surface. From my research of the projects listed in appendix A, this is likely to be the shallowest burial depth of any HVDC cable of this size in any developed nation.
"When a high-voltage line is placed underground, the individual conductors are insulated and can be placed closer together than with an overhead line. This tends to reduce the magnetic field produced. However, the conductors may only be 1 m below ground instead of 10 m above ground, so can be approached more closely. The net result is that to the sides of the underground cable the magnetic field is usually significantly lower than for the equivalent overhead line, but on the line of the route itself the field can be higher." Environmental Health Criteria 238 EXTREMELY LOW FREQUENCY FIELDS © World Health Organization 2007
http://www.who.int/peh-emf/publications/Complet_DEC_2007.pdf
Eirgrid suggest that a 1.5 meter burial depth is required to inhibit the affects of EMF in the undersea section, but 1m depth would seem to be acceptable for the land trench where people will be exposed to EMF. Electromagnetic fields
Production of a magnetic field is considered the only potential impact during the operational lifetime of the cable. Design of the project has minimised the potential for generation of EMF by selection of a DC cable rather than AC, and by using a bipole rather than monopole system. Further mitigation to reduce the potential for magnetic fields is present in the cable shielding, and by burial of the cable to a target depth of at least 1.5m below the seabed where possible.
http://www.eirgrideastwestinterconnector.

RCC Question1A: Why do EirGrid suggest that minimising EMF at sea is more important than in a densely populated area?

Whether on land or in the marine, the EWIC is designed such that in all operating conditions the strongest fields it causes will never exceed the international, EU or Irish government guidelines.

The design of the EWIC is such that even if live cables were exposed on the road to facilitate the installation of new services, the cables would be safe to touch and the fields created by the cables while even touching them would not exceed the international, EU or Irish government guidelines.

The burial depths of the marine cables will vary between 0.5 and 3 metres. The burial depth will be determined by the sea bed conditions and the need to bury the cable in a way that minimises the risk of damage by fishing equipment and anchors. This is the only reason that the cable is buried deeper at sea compared to land.

RCC Question 1B:

In order to set an appropriate depth of trench, Eirgrid need to provide detailed statistical evidence of what is the best practice with regard to tunnel depth of at least 10 first world HVDC transmission lines that pass trough residential areas of a similar size, density and distance between line and residence as Rush. This may prove an impossible task as from my research almost all installations of HVDC cables of this size make great efforts to avoid residential areas.

Eirgrid states that no electrical field will be produced by the cable, yet the WHO states that this is mainly due to the fact that underground cables are typically shielded by a metal sheath. This does not seem to be specified in the Eirgrid design and urgent clarification is needed from Eirgrid to clarify this matter.

Can this be provided?

EirGrid stated that there are no external electric fields associated with the EWIC Direct Current cables as both the marine and land cables have metal sheaths which provide shielding.

A typical cross section of the cable was included in the planning application to An Bord Pleanála. See figure 4.4. of the Ireland Land Environmental report located on the planning application website: http://www.eirgrideastwestinterconnector.ie/

RCC Question 2:

Clarification on cable specification. At our meeting on Friday last, 18th June, John Fitzgerald, Eirgrid Project Director, commented in reference to the +/-200Kv stated voltage actually numerically being 400Kv "Sorry, in terms of the voltage it's 200 KV is the maximum voltage. On each cable there will be 200 KV. It is not a 400 KV cable. There is no 400 KV cable involved".

RCC Question 2A: What is the significance of the +/- symbols before the 200Kv on cable samples and documentation provided?

The Interconnector consists of two 200kV cables and not a 400 kV cable. The +/- symbols are the same as the symbols found on a battery. The maximum voltage on either cable is 200kV DC. One cable is positive (+) 200kV DC, the second cable to negative (-) 200kV DC. Due to the polarity difference between the cables the differential is 400kV DC, but the cable voltage is 200 kV DC.

RCC Question 2B: Why is Woodland listed on Eirgrid documentation as being 400kV if the cable only has a maximum capacity of 200kV?

The Interconnector will connect to the transmission systems in Ireland and Wales. To do so the DC electricity must be converted to a form used on the Irish transmission system which is AC electricity (like what is used in homes, offices etc). This conversion will take place at the convertor station to be located in Woodland which will connect to the existing substation also located in Woodland which is a 400kV AC substation. The same occurs in the opposite direction when exporting power to Wales.

RCC Question 3:

Eirgrid have chosen Rush to be their landfall site for the 500MW, +/-200kV HVDC Light Interconnector. However, other HVDC Interconnector projects, relevant and pertinent to this project, have purposely avoided centres of population and also run much shorter distances of underground HVDC cabling. Why?

The cable distance itself is determined by the location of the connection points into the existing transmission system. For the East West Interconnector the strongest grid connection point in Ireland is the Woodland 400kV Station and this is located approximately 40 km in-land. The Basslink HVDC project is similar in that its grid connection point was located 70km inland in the Gippsland region of Victoria Australia. In the case of Basslink the connection from the landfall site to the grid connection point was completed using overhead lines.

The route selected by EirGrid for the East-West Interconnector is the most environmentally sustainable, economically sensible and practical for linking to the UK electricity transmission network in North Wales.

Other HVDC cables are located in residential areas. For example:

- There are 31kms of underground cables on the Estlink HVDC project between Estonia (close to Tallin) and Finland (south of Helsinki).
- There are 75kms of underground cables on the BorWin1 link HVDC project between the North Sea Coast to the small town of Diele, Germany.

RCC Question 4:

The two HVDC interconnector projects which are relevant to this project are, The Moyle Interconnector, 250MW, two mono polar 250Kv HVDC cables linking Northern Ireland to Scotland (2001) are 63.5Km long, with 55Km undersea.
The two Static Inverter plants (AC to DC & DC to AC), at Auchencrosh, Scotland and Ballycronan, N. Ireland are both close to the landfall sites, minimizing underground cable laying, but more importantly are in no way near centres of population, Larne being the closest in N. Ireland, separated by a ferry channel, with no population centre in Scotland. The SwePol 600MW, 450Kv mono polar HVDC Interconnector between Sweden and Poland (2000), constructed by ABB the chosen contractor for the East-West Interconnector, has a Static Inverter plant at Starno, outside the town of Karlshamn, Sweden and with 2.5Km of underground cable from landfall at the coast. The Static Inverter plant at Bruskowo Wielke in Poland is 12Km from the coastal landfall which is near the town of Ustka. Both locations are located away from any population centre.
Of the three HVDC transmission cable Interconnector projects, with relevance to each other, Rush is the only centre of population that is proposed to carry such a cable through the town.

RCC Question 4A: Why do the other projects purposely avoid centres of population?

This statement is not true. Dublin (see Appendix 5 for a map of the existing high voltage underground cables in Dublin) and other cities in Ireland and internationally have high voltage underground cable installed to serve the factories, shops and homes in that town or city. Urban areas by their very nature are areas with high electrical demand. Underground cables are predominantly used in urban areas because of the unavailability of space to allow the construction of overhead lines.

Other HVDC cables are located in residential areas. For example:

- There are 31kms of underground cables on the Estlink HVDC project between Estonia (close to Tallin) and Finland (south of Helsinki).
- There are 75kms of underground cables on the BorWin1 link HVDC project between the North Sea Coast to the town of Diele.

RCC Question 4B: What are the risks, accidental or otherwise, associated with operating such a power transmission cable through a population centre?

EirGrid operates the existing high voltage electricity transmission system in full compliance with the International guidelines on EMF exposure (ICNIRP), reviewed by the World Heath Organisation and endorsed by the EU and the Irish Government. In all operating conditions, the EWIC will never exceed these guidelines.

There are high voltage underground cables in all urban residential areas in Dublin and are predominantly installed in the roads.

RCC Question 5:

Because they do avoid centres of population and have shorter HVDC cable runs, this implies the need to minimize the safety hazards to large population areas and also to maximize the integrity of the power transmission system from accidental disruption of power by possible damage from earth moving or drilling machinery.

Therefore, what are the consequences of earth moving or drilling machinery accidently damaging the 500MW, +/- 200kV HVDC cables.

If there was an accidental dig in to the interconnector cables the interconnector would be immediately disconnected (in a fraction of a second) until the cable is repaired.

Damage caused by earth moving or drilling machinery is a possibility with all buried assets like gas, water, electricity or foul sewer etc. EirGrid use both direct and indirect controls to minimise the risk of accidental damage to their assets.

Examples of *direct controls* include using ducts surrounded in lean mix concrete, marker tapes, protection marker boards and appropriate back-fill materials. Examples of *indirect controls* include accurate route marking at time of installation, dial-before-U-dig services, and close liaison with local councils and other underground asset owners.

If all controls were to fail and heavy machinery was to breach or cut the cable insulation there would be an electrical path created between the cable conductor (at +/- 200 kV) and the cable screen (at 0 V). Fault current would flow from the cable conductor to the screen and would trigger high speed protection located at each end of the cable. The high speed electrical protection would isolate the cables and prevent the further flow of current. All electrical protection devices are duplicated and are also provided with back-up protection to ensure the risk of mal-operation of the electrical protection system is eliminated.

RCC Question 6:

These HVDC cables have the capability to carry 1400 - 2000 Amps of DC current. Describe the effect on an earth moving or drilling machine accidentally breaching the barriers to this current (HV warning sheet, lean mix concrete in-fill, duct work and cable shield / insulation)? What would be the effect of such a breach in the immediate radius of the earth moving or drilling machinery, particularly in a high population area?

There would be no safety risks to anyone living or in the vicinity of the Interconnector cables if there was a fault associated with an accidental dig-in.

The high voltage underground cables have a metallic screen (low resistance conductive screen) which will carry the fault current away from the point of damage with little stray current entering the surrounding area.

Risks to earth moving or drilling machinery are much less that that associated with contact with any overhead line or underground low voltage cable and are the same as that for other high voltage underground electrical services with screened cables.

By comparison, when an overhead line is struck by a machine all of the electrical fault current must flow to earth through the machine itself as there is no alternate low resistance path. In the case of overhead lines the flow of fault current through the machine and into the earth is a significant risk but this risk is not present in underground cables due to the local earth return path provided by the cable screen.

The disconnection time of high voltage cables is very quick, typically a fraction of a second. Low voltage underground cables do not always have screens and are protected by electrical fuses which have a longer disconnection time and hence the damage associated with the dig-in of low voltage cable is higher.

RCC Question 7: If an Arc Flash were to occur due to accidental breach of the HVDC cable insulation – what size of Arc Flash would result with a 500MW, +/-200Kv @ 1400 – 2000 Amp system?

Firstly, if there was an insulation failure on the EWIC cables which caused arcing, there would be no safety risks to anyone standing directly above the cable or anyone living near the EWIC cables.

This is because the high voltage DC cables are individually shielded; any arc flash will be limited to the immediate vicinity of the insulation between the cable conductor and the conductive screen (a radial distance of about 2 cm).

In addition to this the HVDC cables are protected by very high speed electrical protection system. This protection system detects a fault and disconnects the cables and therefore the fault energy will be limited and this also serves to minimise the arc flash. The above factors mean that the local damage caused to the cable by the arcing fault is often so minor that in fact, it can be very difficult for the fault position to be located.

Further to this the cables are installed in ducts which are then filled with inert material and the ducts themselves are surrounded with lean mix concrete. The combination all of these safety features mean the possibility of any external arcing is extremely low and again, if there was an insulation failure on the EWIC cables which caused arcing, there would be no safety risks to anyone standing directly above the cable or anyone living near the EWIC cables

RCC Question 8:

The proposed trench work to lay the cable through Rush will be approximately 1 metre deep, installing ducts, covered with a fast setting lean mix concrete and a HV warning sheet. However, all underground duct installations will have some water content, either through road damage seepage, water mains leakage or high water table level. This, in tandem with freeze / thaw action (particularly evident this winter) and road movement / flex due to compression from passage of HGV's, buses, trucks, farm and construction machinery, etc, will lead to degradation of the of the insulation material of the HVDC cable. The proposed cable joins or bends to take place at intervals throughout the passage through Rush, particularly on the 90deg turns on the Kilbush lane – Skerries junction and the Skerries – Main St junction, will be more subseptible to weakening. Age degradation will also add to the effect of insulation breakdown, resulting in external HV arcing and possible HV Arc Flash.

Can this HV cable insulation be effected by such degradation, leading to HV containment failure?

The cable and joints are manufactured to take account of all temperature ranges and ground conditions and are not considered a risk to degradation of the cable insulation.

During the design phase, the cable joints and bends are located and developed with full consideration to the manufacturer's specifications and route conditions. The bending forces generated when the cable is being installed have been calculated and where necessary the cable will be assisted when it is being pulled into the ducts by means of mechanical rollers to ensure that the recommended pulling tension is not exceeded. The EWIC cables are designed to last a minimum of 40 years and bending forces created by road movement and compression have been considered and are not considered a risk.

RCC Question 9:

HV cable insulation breakdown can lead to HVDC current transients and external arcing.

RCC Question 9A: What effect would HVDC current transients and external arcing have on electrical and electronic systems in a high population area?

As noted previously, if there was an insulation failure on the EWIC cables which caused arcing, there would be no safety risks to anyone standing directly above the cable or anyone living near the EWIC cables. The possibility of external arcing is considered extremely low and because the cables are buried they are not affected by external electrical transient events such as lightning (as is the case for overhead lines).

In normal operation there are no transient currents and all changes in power transfer are ramp rate limited (slow) and are upper-bounded by the cable current rating. Under these circumstances the current in the cables will generate static magnetic fields which will not induce any voltage in conductive utilities installed in the vicinity of the cables.

If a cable fault occurs there will be a very short duration current transient which is limited in time by the high speed protection system. Because the cable has outer screening the fault current will return in the cable screen and the resulting magnetic field will be eliminated.

Any effect to electrical or electronic systems due to a fault on the DC cables would be negligible.

RCC Question 9B: What effect would HVDC current transients and external arcing have on Rush area gas distribution systems?

There will be no effect to gas infrastructure due to any faults in the DC cables of the Interconnector as explained in the answer to question 7 above.

Section 3 - Route

RCC Question 10:

Eirgrid has provided a number of reasons why alternative sites were less suitable for the line, and that the current route is the only feasible location for the interconnector. We contend that other possible routes and locations would be feasible, but would result in a more complex installation and higher cost for Eirgrid. Eirgrid has made no reference to the fact that this route exposes the greatest number of residents to daily contact with the magnetic fields generated by the line. This approach shows a clear disregard for the principles of European Commission guidelines and rulings of the EU courts. 6.3.4. "The Commission affirms, in accordance with the case law of the Court that requirements linked to the protection of public health should undoubtedly be given greater weight that economic considerations." (p.19) 6.4. "...Action taken under the head of the precautionary principle must in certain cases include a clause reversing the burden of proof and placing it on the producer, manufacturer or importer....." (p.20/21) • Jurisdiction of EU Court: "Where there is uncertainty as to the existence or extent of risk to human health, the institutions may take protective measures without having to wait until the reality and seriousness of those risks become fully apparent." (Cases C-157/96 and C-180/96 of 5.May 1998, Grounds 63). "Requirements linked to the protection of public health should undoubtedly be given greater weight than economic considerations"
(Order of 30 June 1999, Case T-70/99) COMMUNICATION FROM THE COMMISSION on the precautionary principle COMMISSION OF THE EUROPEAN COMMUNITIES Brussels, 02.02.2000 COM(2000) 1
http://ec.europa.eu/dgs/health_consumer/library/pub/pub07_en.pdf

RCC Question 10A: Why does the route chosen by EirGrid ignore these considerations given they would not be a factor on alternative routes?

The EWIC is designed such that in all operating conditions the strongest fields it causes will never exceed the international, EU or Irish government guidelines. EirGrid did not ignore public health and precautionary principles in the preparation of its Application. The absence of any magnetic-field exposure of potential health significance, whatever the route selected, meant that special consideration in that regard could not be given to one route over another to the exclusion of other important factors.

EirGrid is required to put in place a safe, secure, reliable, economical and efficient transmission system while respecting a number of criteria such as community, ecology, cultural heritage, geology, and marine life.

The route selected by EirGrid for the East-West Interconnector is the most environmentally sustainable, economically sensible and practical for linking to the UK electricity transmission network in North Wales.

EirGrid has endeavoured to avoid urban areas where possible to minimise temporary traffic disruption during the installation phase and *not* for any health reasons as has been suggested. High voltage underground cables are common place in residential areas of Dublin, urban towns and cities in Ireland and internationally.

EirGrid is satisfied that we researched every feasible route and through our extensive studies we arrived at Rush North Beach.

RCC Question 10B: In response to the statement from RCC regarding the Precautionary Principle:

EirGrid did not ignore public health and precautionary principles. The absence of any magnetic-field exposure of potential health significance, whatever the route selected, meant that special consideration in that regard could not be given to one route over another to the exclusion of other important factors.

There is no evidence that the power cables to be used in the EWIC have any adverse health effects. The International Commission on Non-Ionizing Radiation Protection (ICNIRP) has established protection guidelines for general, continuous, public exposure to static (DC) fields. Constant exposure of up to 40,000µT is considered safe by these guidelines. The static magnetic field produced by the Interconnector cables under maximum expected loading was calculated to be 43µT at the ground over the cables.

RCC Question 11:

Eirgrid drawing number PE424-D000-036-001-001, page 12 of document: http://www.eirgrideastwestinterconnector.ie/Ireland%20Land%20ER%20Appendix%201%20Scoping%20Report.pdf, shows the proposed route travelling directly through Ratoath.

RCC Question 11A: What considerations applied to the substantial re-routing around Ratoath?

EirGrid original proposed route in Co. Meath was a route that included the use of a wider road network to assist in traffic management and also the use of an existing ring road through Ratoath. This route was selected by EirGrid because it allowed construction to take place without road closures. During the consultation period, Meath County Council requested a route change in favour of the less trafficked local roads which now form part of the approved route. This alternative route was preferred by the Council as they viewed road closures of the smaller/ narrow roads less of an impact than restricted traffic movements on the R155 which has very high volumes of commuter traffic. EirGrid agreed to this route alteration during the consultation phase because the alternative route proposed by the Council had previously been assessed by ESBI and was only discounted on our criteria that road closures were to be avoided where possible.

RCC Question 11B: Why did EirGrid not consider Rush applicable for the same considerations?

While EirGrid has endeavoured to avoid urban areas where possible to minimise temporary traffic disruption during the installation phase, the marine landing point of Rush North Beach meant that it was not possible to avoid Rush. While in Meath it was possible to avoid the urban areas of Ashbourne and Ratoath.

EirGrid considered the feasibility of routing through Rogerstown Estuary. However, the Natura 2000 Habitat, Special Protection Area, Special Area of Conservation, and Natural Heritage Area designations status afford it the highest protection under EU law.

The Natura 2000 network includes Sites of Community Importance designated under the Habitats Directive and also Special Protection Areas designated under the 1979 Birds Directive. Natura 2000 plays the key role in protecting the EU's biodiversity in response to the large scale destruction and fragmentation of wildlife habitats which continues to put European biodiversity at risk.

- Rogerstown Estuary is a Natura 2000 site of high conservation importance, with multiple ecological designations as follows:
- Rogerstown Estuary candidate Special Area of Conservation. Designated under EU Directive 92/43/EEC on the conservation of natural habitats and of wild flora and fauna (commonly known as the Habitats Directive). The Estuary is specifically selected for Estuaries and Tidal mudflats, three types of salt marsh (Atlantic, Mediterranean, Salicornia mud), as well as various dune types.

- Rogerstown Estuary Special Protection Area. Designated under EU Directive 79/409/EEC on the conservation of wild birds (commonly known as the Birds Directive). Selected for wintering waterfowl species and especially Brent Geese which occur in numbers of international importance.
- Rogerstown Estuary Statutory Nature Reserve. Includes the outer estuary only. Established in April 1988 under the Wildlife Act 1976.
- Rogerstown Estuary is a proposed Natural Heritage Area.

EU Regulations governing Natura 2000 sites set down that any project having a significantly negative effect on a site may only be authorised in the absence of alternative solutions and then only if it is justified for imperative reasons of overriding public interest, including those of a social or economic nature.

Under the regulations, development in a Natura 2000 site must be avoided unless three tests can be satisfied. These are (i) no alternative available; (ii) imperative reasons of overriding public interest; and (iii) compensatory measures must be provided. The Natura 2000 protective measures are interpreted strictly by the EU.

An alternative solution was identified which is the option of Rush North Beach. While we do understand that there will be a disruption to the people of Rush during the installation phase, we will do out utmost to work with the community and minimise the disruption as much as possible.

RCC Question 12:

The routing of the 45Km HVDC cables, clearly in evidence away from the population centres of Ashbourne and Ratoath, is not just because of traffic management issues (Rush should have been equally considered for this), but due to the risks and objections associated with 500MW, +/-200Kv, 1400 – 2000 Amp HV cables running through high population areas.

Please explain?

The EWIC is designed such that in all operating conditions the strongest fields it causes will never exceed the international, EU or Irish government guidelines. The absence of any magnetic-field exposure of potential health significance, whatever the route selected, meant that special consideration in that regard could not be given to one route over another to the exclusion of other important factors.

While EirGrid has endeavoured to avoid urban areas where possible to minimise temporary traffic disruption during the installation phase, the marine landing point of Rush North Beach meant that it was not possible to avoid Rush. While in Meath it was possible to avoid the urban areas of Ashbourne and Ratoath.

Section 4 – Telecommunications & other Services

RCC Question 13

Optical Fibre communications links, such as the fibre optic link routed with this HVDC Power transmission cable, are generally immune to HV arcing noise, ensuring integrity of power transmission telemetry data and communications.

RCC Question 13A: Is This True?

Yes, this is true. Fibre optic communications are commonly used in close proximity to power transmission circuits including overhead lines where direct lightning strikes and arcing faults are much more common.

RCC Question 13B: What effect can be expected on non optic fibre communications?

As noted in response to Question 7, the size of the arc will be limited by the cable screen and the duration will be limited by the fast protection systems so therefore the possibility of any effect will be negligible.

RCC Question 13C: What effect will this have on any other services?

The effects on non-conductive services are nil, the effects on conductive services are either nil or of a magnitude and frequency which is very much reduced from those associated with equivalent events on overhead power transmission lines and distribution systems and for which these services are designed to be protected from lightning strikes etc.

Section 5 – Economic

RCC Question 14:

The results from the Scottish transaction data indicate that price is reduced by up to -18% for a house within 150m of a HVOTL compared to similar homes sited 400m away. Asking price showed a similar degree of diminution at -20% for property within 50metres of the HVOTL.
Relative to the visual impact, transaction data indicates a reduction of up to –16% for houses with a view of part of a pylon. Asking price could be reduced by -18% for a unit with a partial view of a pylon and by –11% for a view of 1 pylon.
http://www.borg.hi.is/enhr2005iceland/ppr/Sims.pdf

What consideration has been given to reduction in property prices caused by the proximity of this HVDC cable?

All urban towns and cities have underground electricity cables and other utility services installed in residential areas and there is no evidence to suggest that there is any impact on property prices.

Clearly, there will be a significant economic impact for all taxpayers if this project is not delivered on time and on budget. The project is essential if Ireland is to ensure that it has sufficient electricity to meet demand in the future and to meet its renewable energy targets and if we are to continue to attract foreign investment and jobs into Ireland.

RCC Question 15:

An EirGrid Project Manager has already conceded that Fingal County Council were "not happy about the route of the cable" insofar as it would disrupt their plans for upgrading foul water systems and other services within the town.

Given this admission, what restrictions is a HVDC cable, so close to the surface and private property, likely to impose on future development and regeneration of a town for both residential and business services?

EirGrid's project team is working closely with Fingal County Council (FCC) and has been in consultation with FCC since 2007 regarding the route of the EWIC. All issues raised by Fingal County Council were discussed at the public oral hearing in Balbriggan in March 2009 and subsequently addressed. Under EirGrid's conditions of planning, all works will be carried out with the agreement of the Meath and Fingal County Council, the Department of the Environment and the Eastern Regional Fisheries Board.

The proposed trench width is only 550mm wide and the cables will avoid all existing and planned services. On the basis that existing services will be accommodated, future unknown services should not have any difficulty avoiding the EWIC cables.

Responses to Additional Requests from Ian Clarke (18 June 2010)

Question from Ian Clarke: Eirgrid to commit to limit the level of exposure to electromagnetic field on the urban areas of the cable route to below 50 microTesla (μT).

Eirgrid agree to measure the EMF levels along the route through the town, twice a year, and make this information freely available to the people of Rush…. commit to ameliorate the issue within 12 months.

The above requests are based on a number of misunderstandings:

1. The claim that "the WHO state that 50μT is theoretical safe limit" is incorrect and misleading. The only existing limits for static magnetic fields are those recommended by the ICNIRP and ICES at 40,000μT and 118,000μT, respectively. Local variations in the earth's geomagnetic field could potentially exceed 50μT, so EirGrid could not commit to this request.

2. The claimed "lack of any research in the area of long term exposure to static EMF means that there is no certainty that this technology is safe" applies to static EMF at intensities thousands of times greater than that associated with the operation of the proposed project.

3. The quotation from SCEHIHR "Adequate data for proper risk assessment of static magnetic fields are almost totally lacking. The advent of new technology, and in particular MRI equipment, makes it a priority for research," again applies to very strong sources of static magnetic fields, in particular, MRI equipment.

Therefore, there is no scientific basis to support the request that exposure levels be kept below 50μT or for the monitoring of static EMF levels to occur.

APPENDICES

APPENDIX 1: Bill Bailey Qualifications & Experience.

APPENDIX 2: Bill Bailey: Statement of Evidence.

APPENDIX 3: Extract from the An Bord Pleanála Oral Hearing (Day 2).

APPENDIX 4: Full text for Rush Community Council Question 3.

APPENDIX 5: Map of the underground high voltage electricity cables in Dublin.

APPENDIX 1

Bill Bailey Qualifications & Experience.

Bill Bailey Qualifications & Experience

William H. Bailey, Ph.D., an expert in the field of bioelectromagnetics, is a Principal Scientist in the Center for Exposure and Dose Reconstruction, Exponent Health Sciences, and Director of the New York office. Dr. Bailey is also a visiting scientist at the Weill Medical College of Cornell University in New York. Dr. Bailey is a research scientist and consultant with more than 25 years experience in the evaluation of scientific research for scientific, governmental, and private organizations relating to potential health and safety effects of direct current (DC) "static" electric and magnetic fields (EMF) as well as alternating current (AC) EMF in the extremely-low-frequency (ELF) range.

Dr. Bailey specializes in applying state-of-the-art assessment methods to environmental and occupational health issues. His 30 years of training and experience include laboratory and epidemiologic research, health risk assessment, and comprehensive exposure analysis. Dr. Bailey has investigated exposures to DC, AC, and radiofrequency electromagnetic fields, 'stray voltage', and electrical shock, as well as exposures to a variety of chemical agents and air pollutants. He is particularly well known for his research on the potential health effects of electromagnetic fields and has served as an advisor to international agencies including the International Agency for Research on Cancer (IARC), the International Commission on Non-ionizing Radiation Protection (ICNIRP), and the World Health Organization (WHO) as well as numerous federal and state agencies in the United States (US). In addition, Dr. Bailey was a consultant to the Connecticut Academy of Science and Engineering for the assessment of the potential environmental effects of electromagnetic fields from undersea cables on benthic habitats in the Long Island Sound in New York.

Dr. Bailey has lectured at Rutgers University, the University of Texas (San Antonio), and the Harvard School of Public Health. He was formerly Head of the Laboratory of Neuropharmacology and Environmental Toxicology at the New York State Institute for Basic Research, Staten Island, New York, and an Assistant Professor and National Institutes of Health postdoctoral fellow in Neurochemistry at The Rockefeller University in New York. Further details of his background and experience are provided in his curriculum vitae (Attachment 1).

Dr. Bailey has directed assessments of potential human health and environmental effects of DC magnetic fields associated with numerous underground, undersea, and overhead high-voltage DC transmission lines in Canada and the US.

Dr. Bailey's firm was responsible for the calculation of DC magnetic fields from the underground cables, oversight in the preparation of Section 4.6.3 "Electric and Magnetic Fields – Underground Cable Route," and the technical review of portions of Chapters 4 and 6 of the Ireland Marine Environmental Report relating to DC magnetic fields.

Dr. Bailey was subsequently asked to comment on and reply to the submissions of landowners concerning health issues relating to EMF and in so doing communicate the status of research on static (DC) magnetic fields and international exposure guidelines that may apply to this Interconnector.

APPENDIX 2

Bill Bailey: Statement of Evidence.

IN THE MATTER OF AN ELECTRICTY DEVELOPMENT APPLICATION TO

AN BORD PLEANÁLA
(REG. NO. VA0003)

AND IN THE MATTER OF AN ORAL HEARING

Static (DC) Magnetic Field Assessment for the East West Interconnector Project

STATEMENT OF EVIDENCE OF WILLIAM H. BAILEY, PH.D.

Center for Exposure and Dose Reconstruction

March 2009

1. Qualifications and Experience

1.1 I am William H. Bailey, Ph.D., a scientist in the field of bioelectromagnetics, and a Principal Scientist in the Center for Exposure and Dose Reconstruction, Exponent Health Sciences, and Director of the New York office. I am also a visiting scientist at the Weill Medical College of Cornell University in New York. I have more than 25 years experience in the evaluation of scientific research for scientific, governmental, and private organizations relating to potential health and safety effects of direct current (DC) "static" electric and magnetic fields (EMF) as well as alternating current (AC) EMF in the extremely-low-frequency (ELF) range.

1.2 I specialize in applying state-of-the-art assessment methods to environmental and occupational health issues. My 30 years of training and experience include laboratory and epidemiologic research, health risk assessment, and comprehensive exposure analysis. I have investigated exposures to DC, AC, and radiofrequency electromagnetic fields, 'stray voltage', and electrical shock, as well as exposures to a variety of chemical agents and air pollutants. Much of my research has focused on the potential health effects of electric and magnetic fields and have served as an advisor to international agencies including the International Agency for Research on Cancer (IARC), the International Commission on Non-ionizing Radiation Protection (ICNIRP), and the World Health Organization (WHO) as well as numerous federal and state agencies in the United States (US). In addition, I have been a consultant to the Connecticut Academy of Science and Engineering for the assessment of the

potential environmental effects of electromagnetic fields from undersea cables on benthic habitats in the Long Island Sound in New York.

1.3 I have lectured at Rutgers University, the University of Texas (San Antonio), and the Harvard School of Public Health. I was formerly the Head of the Laboratory of Neuropharmacology and Environmental Toxicology at the New York State Institute for Basic Research, Staten Island, New York, and an Assistant Professor and National Institutes of Health postdoctoral fellow in Neurochemistry at The Rockefeller University in New York. Further details of my background and experience are provided in my curriculum vitae (Attachment 1).

1.4 I have directed assessments of potential human health and environmental effects of DC magnetic fields associated with numerous underground, undersea, and overhead high-voltage DC transmission lines in Canada and the US.

2. Role in the Project

2.1 My firm was responsible for the calculation of DC magnetic fields from the underground cables, oversight in the preparation of Section 4.6.3 “Electric and Magnetic Fields – Underground Cable Route,” and the technical review of portions of Chapters 4 and 6 of the Ireland Marine Environmental Report relating to DC magnetic fields.

2.2 I was subsequently asked to comment on and reply to the submissions of third parties concerning health issues relating to EMF and in so doing communicate the status of research on

static (DC) magnetic fields and international exposure guidelines that may apply to this project.

3. Submissions

3.1 Approximately half of the third party submissions to the An Bord Pleanála regarding this project mentioned health and safety concerns that appeared to relate to EMF associated with the operation of the underground cables. Only one of these submissions expressed any detailed arguments supporting such concerns; the remainder just expressed a general concern about "radiation," "health risks," "health implications of a cable with such a high voltage," etc. I will respond to the specific issues raised in that submission, and, in doing so, to the general concerns expressed in the other submissions.

4. Responses to Submissions

4.1 The general public has some common misperceptions about the type and nature of the fields associated with operation of the proposed underground cable system. The underground cables will only produce a magnetic field above ground; no electric field will be produced above ground because of the metallic cladding of the cable and shielding by the earth. Electric fields are blocked by common objects, while magnetic fields are not.

4.2 Despite the distinction made in Section 4.6.3 of the Environmental Report between AC and DC electric and magnetic fields, and the clear statement that "[t]he proposed EWI cables will not be a source of [AC] EMF at this frequency [50 Hz]," some of the submissions express the belief that the EMF associated with the proposed project are the same, or very

similar, to those produced by transmission lines, distribution lines, appliances and other electrical equipment that are transmitting alternating current. Others of the general public may share such a belief as well. This belief is incorrect—the cable system will be a source of static DC fields, not AC fields. Static DC fields are quite constant in their direction—that is why a compass always points to the magnetic North Pole—whereas AC fields from the power system change direction 50 times each second.

4.3 There are three considerations that distinguish DC electric and DC magnetic fields from the type of fields produced by AC power sources. First, all life on earth has evolved in the presence of naturally occurring DC fields. Second, DC fields do not have the same capability to directly induce voltages and currents in nearby conducting objects, including people, as do AC EMF. Third, biological and health research has not associated exposure to DC fields at levels found in the environment with adverse health effects. The implications of the latter two considerations are discussed further below in the context of the potential exposures associated with the operation of the proposed cable system and responses to the submissions.

DC Magnetic Field Exposure

4.4 The flow of current deep in the earth is the major source of the ambient background DC magnetic field. The intensity of this geomagnetic field in this part of Ireland, expressed in units of magnetic flux density, is approximately 49 microTesla (μT). **The proposed dc cable system will be a DC magnetic field source with an intensity similar to or lower than the**

earth's geomagnetic field. From one residence to another, the value of the background DC magnetic field may vary by as much as 20%, reflecting the effect of steel in buildings, etc. (Swanson, 1994). Other DC magnetic field sources produced by a variety of technologies generally produce much stronger fields, e.g., magnets in telephones or earphones (300-1000 µT) (EC, 1996). Other sources include permanent magnets, battery-powered appliances, magnetic resonance imaging (MRI) machines, some electrified railway systems, and certain industrial processes. Table 2 shows the levels of static magnetic fields measured near these common sources, and the representative levels of the magnetic field we calculated above the cable system, at the edge of the route corridor (± 2 m), and at 10 m from the cable system. As is standard practice, the calculated field values are presented at a height of 1 m above ground.

Table 1. Comparison of Static Magnetic Field Levels from the Proposed Project to Other Sources

Field Source	Magnetic Flux Density (µT)
MRI scanner	1,500,000 – 4,000,000
Electric railways*	<1,000
Battery-powered appliances	300-1,000
Earth's magnetic field (Ireland)	49
Directly over cable system	13♦
At edge of route corridor	11.6
10 m from cable	0.6

*For example, in Dublin's DART and LUAS suburban transportation systems

♦43 µT on ground above cable system

4.5 The submission contends that there is compelling evidence, which I have identified as largely relating to AC EMF, for the belief that An Bord Pleanála should refuse the East West Interconnector application. The submission alleges that scientific knowledge shows that there is a health risk associated with EMF

exposure and that risk management/risk mitigation methodologies in the area of public health and safety have not been employed. These allegations are discussed below.

Health Research on Static Magnetic Fields

4.6 On pages 2-4 of the submission, statements from a letter from EirGrid are compared to excerpts of documents from the IARC (IARC, 2002), the WHO (WHO, 2007), and a presentation at a scientific meeting by Kheifets, Repacholi, Van Deventer and Goldstein (2003).

International Agency for Research on Cancer

4.7 The submission correctly quoted the IARC report; "There is inadequate evidence in humans for the carcinogenicity of static electric or magnetic fields…" (p. 24). While the submission expresses concern about this statement, it is clear that the submitter does not understand how to interpret this standard IARC statement. The IARC Working Group classified static magnetic fields in "Group 3-Not Classifiable" because of inadequate evidence from either human or animal studies that such exposures cause or contribute to cancer. IARC defines "Inadequate evidence of carcinogenicity" as "The studies cannot be interpreted as showing either the presence or absence of a carcinogenic effect because of major qualitative or quantitative limitations, or no data on cancer in experimental animals are available." The IARC Working Group described limitations in four cohort studies of workers highly exposed to static magnetic fields (~1000 – 140,000 µT), and they did not find that any of these studies reported an excess of any cancer for exposed

workers (IARC, 2002, pp. 170-182); in addition, no adverse effects of static magnetic fields were reported at exposure levels in the range of the earth's geomagnetic field. As the WHO later noted, the uncertainty about long-term exposure pertains to static magnetic fields in the millitesla range (WHO, 2006a), not in the range of the earth's geomagnetic field or the range of fields produced by transmission lines similar to the proposed DC line.

World Health Organization

4.8 The submission asserts that a 2007 WHO report provides "information in relation to illnesses potentially associated with EMF" (p. 2) and references a description of epidemiology studies that have reported statistical associations with ELF, i.e., magnetic fields (50-60 Hz) above 0.3-0.4 µT. The submission also quotes from a presentation Kheifets made at a WHO meeting in 2003 to support the claim that "as yet, there is just not enough evidence to prove it [that "EMF may have a negative effect on health"]" (Kheifets, 2003). Yet, this presentation on the "Application of Precautionary Principle to EMF" clearly states that the focus of the presentation was on "[p]ossible health effects arising from exposure to extremely low frequency (ELF) electromagnetic fields (EMF)…" (p. 19), as does the 2007 WHO report. Thus, the two WHO-related documents cited in the submission are relevant to exposures to AC magnetic fields, not the DC magnetic fields that are the exposure of interest in the evaluation of this project. Furthermore, while there is some suggestive evidence of an association between AC magnetic fields and some health effects, no scientific organization

(including the WHO) has concluded that there is any long-term adverse health effects associated with magnetic fields.

4.9 A recent WHO report relevant to the evaluation of the possible biological and health effects of DC magnetic fields that was not cited in the submission is the Environmental Health Criteria report on static fields (WHO, 2006b). In summary, the conclusions were:

> Short-term exposure to static magnetic fields in the tesla range [i.e. above 1,000,000 µT] and associated field gradients revealed a number of acute effects (p. 216).
>
> With regard to static magnetic fields, the available evidence from epidemiological and laboratory studies is not sufficient to draw any conclusions about chronic and delayed effects. IARC (2002) concluded that there was inadequate evidence in humans for the carcinogenicity of static magnetic fields, and no relevant data available from experimental animals. They are therefore not at present classifiable as to their carcinogenicity to humans (p. 216).

4.10 This conclusion is the same as the earlier IARC (2002) report regarding DC magnetic fields, but the context for these conclusions is clearer in the WHO document. The range of exposure for which the WHO identified uncertainty and an insufficiency of evidence is above 0.01 T (10,000 µT) and, for this reason, the WHO recommended additional research at higher exposure levels. The WHO further recommends cost-effective precautionary measures that would apply to high field exposures resulting from the industrial and scientific use of DC magnetic fields (WHO, 2006a, b). An independent review performed for the European Commission also concluded that risk assessments are only necessary with respect to very high

occupational exposures to DC magnetic fields, e.g., MRI fields (SCENIHR, 2007). The conclusions of this 2007 review were re-affirmed in the updated opinion by this scientific panel (SCENIHR, 2009).

Evaluation by Other National and International Scientific and Health Agencies

4.11 Because exposure to magnetic fields is ubiquitous and questions about potential health risks have been raised by some studies, major scientific organizations throughout the world have appointed panels of health scientists to review the body of available research carefully and offer conclusions on the status of the science. These scientific organizations have assembled panels reflecting the full diversity of research experience required and conducted valid weight-of-evidence reviews.

4.12 In Ireland, the government released a report of the Expert Group on the Health Effects of Electromagnetic Fields on March 22, 2007 (DCMNR, 2007). A panel of eight scientists examined a wide range of issues in relation to potential health effects of EMF, including those produced by the electric system. The report answers many questions commonly raised by the public in relation to EMF and health. The panel's conclusions regarding static magnetic fields were similar to those of the WHO (2006a,b) but like ICNIRP they further "suggested that the wearers of cardiac pacemakers, ferromagnetic implants and other implanted medical and surgical devices should avoid locations where the magnetic field exceeds 0.5 millitesla (mT)" or 500 μT. Nowhere above the proposed cable system or in any publicly accessible location nearby would the DC magnetic field

rise to this level. This conclusion may help to alleviate the concern expressed in another third party submission about persons with pacemakers living close to the proposed route.

Risk Management/Mitigation Strategies

4.13 The submission advocates for the application of the precautionary principle to this project based on his understanding that "scientific uncertainty exists [as to]… the causation between EMF and health" (p. 4). The submission quotes from recommendations of the European Commission and the Committee of Ministers as supportive of the precautionary principle in general. The belief expressed in the submission that precautionary risk management or mitigation strategies be applied, however, is based on policies that have been developed to address exposures to AC magnetic fields, where there has been uncertainty regarding the interpretation of reported statistical associations between lower AC magnetic field levels and long-term health effects. The submission ascribes an inappropriate degree of scientific uncertainty about the potential health risks of exposure to background levels of DC magnetic fields. According to the WHO, IARC and the SCENIHR, the largest uncertainty surrounding DC fields is related to very high exposures from industrial and scientific applications. Thus, the citations and arguments in the submission are not relevant to an underground DC transmission line that produces levels of DC magnetic fields that are less than the geomagnetic field of the earth.

4.14 For example, on pages 6-8 of the submission, there is an extensive quotation on the application of the precautionary

principle to AC EMF that is attributed to the WHO, but which has been copied almost entirely from a draft presentation by Dr. Kheifets in 2003. Neither that presentation nor the quotation cited from a 2002 German Federal Board of Radiation Protection press release have any relevance to the DC magnetic fields associated with the proposed underground cables. In fact, the submission appears to deliberately not quote the paragraph that follows immediately after the cited quotation, which explicitly states that Kheifets (2003) concluded that the precautionary principle was only to apply to AC ELF fields and radiofrequency (RF) fields. The paragraph reads:

> "In the EMF context, there is sufficient evidence, judged against these criteria, to invoke the Precautionary Principle for both extremely low frequencies (ELF) and radio-frequency (RF) electromagnetic fields."

4.15 Page 9 of the submission cites several "European countries that have applied the Precautionary Principles in order [to] set (sic) guidelines this has typically led to *limits of 0.4 microtesla or under* being set," a Swiss ordinance, a submission by a citizen to the Electricity Commission in Australia, and a 1995 draft report from the US that never completed peer review, as evidence for the need for precautionary action. Again, the submission mistakenly relates proposals and documents that relate solely to AC EMF to the DC magnetic field associated with the proposed project.

4.16 Having noted the public health and risk management strategies that are *not* relevant to this project, it is important here to

summarize those strategies that have been recommended by health and scientific agencies to address DC magnetic fields.

4.17 Scientific and engineering standard-setting organizations have set standards for human exposure to DC magnetic fields based on the principles governing the interactions of these fields and their effects. The exposure guidelines for DC magnetic fields recommended for the general public by the WHO were developed by ICNIRP, a related agency (ICNIRP, 1994). These guidelines allow for the continuous average exposure of the general public to static magnetic fields at levels below 40 mT (40,000 μT). The National Radiation Protection Board in the United Kingdom[1] supported these guidelines as a "cautious approach" (NRPB, 2004, p. 137).

4.18 ICNIRP's guidelines, as well as the guidelines of the International Committee for Electromagnetic Safety (ICES), for exposure to DC and AC magnetic fields are presented in Table 2 below (ICNIRP, 1994; ICES, 2002):

Table 2. Comparison of Screening Guidelines for Public Exposure to AC and DC Magnetic Fields

	ICNIRP		ICES	
Frequency	AC	DC	AC	DC
Magnetic Field (μT)	100	40,000	904	118,000

4.19 This table illustrates that the exposure standards that have been recommended for DC magnetic fields are far higher than for AC magnetic fields. As explained in these standards, the differences between the guidelines for AC and DC magnetic fields relates to differences with respect to potential interactions with organisms

[1] The NRPB merged with the Health Protection Agency (HPA) in April 2005 to form the new Radiation Protection Division.

(mechanisms) and, more importantly, the assessment of health research for each type of exposure.

5. Conclusions

5.1 Exposure to the DC magnetic field among persons walking over or living near the proposed underground cable system will be similar to or less than exposure to the earth's background geomagnetic field.

5.2 Research related to AC magnetic fields and the application of the precautionary principle to this research is not at all relevant to the health risk evaluation of DC fields.

5.3 The assessments by national and international health and scientific agencies of health and biological research on DC magnetic fields do not support the inference that the very small change that the cable system would make to the earth's background geomagnetic field would be of any health significance.

5.4 All exposures to the public would be far, far below levels recommended in health guidelines.

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APPENDIX 3

Extract from the An Bord Pleanála Oral Hearing (Day 2).

ORAL HEARING

PROPOSED EAST-WEST INTERCONNECTOR

AN BORD PLEANÁLA REFERENCE VA0002

BRACKEN COURT HOTEL, BALBRIGGAN

HEARD BEFORE THE INSPECTOR

MS. UNA CROSSE

ON WEDNESDAY, 11TH MARCH 2009

DAY TWO

I hereby certify the
following to be a true
and accurate
transcript
of recordings of the
evidence in the
above-named action.

_____

O'Hara? Jenny Lacey? Ian Clarke?

MR. CLARKE: Yes.

INSPECTOR: Mr. Clarke, if you would like to take a seat and if you can avoid asking questions that we have already answered in the session. And if you can just speak into the microphone. 19:21

MR. CLARKE: Since you made reference to my objection, if I can speak to Dr. Bailey? 19:21

INSPECTOR: Can you move the microphone closer?

292 Q. **MR. CLARKE:** Good evening. Thank you for making the long journey over here. I didn't get much of a chance, because of the short period of time, to go over your submission, but I just have a couple of questions. You made reference to a possible misunderstanding of one of the bodies' classifications, the IARC working group? 19:22

A. **DR. BAILEY:** What page are you on? 19:22

293 Q. Page 7.

A. Yes.

294 Q. Just on the group three not classicable, you just suggested that perhaps there was a misunderstanding, I just wanted to clarify that. My understanding was that by the not classicable classification, it essentially says that there was insufficient data to make a classification, you either say that was there any risk at all or basically to make any kind of submission. So 19:23

you are neither saying it was a safe or it was unsafe, you were simply saying there was not enough data to suggest it was unsafe, but nor was there enough data to suggest that it was entirely safe; is that correct or have I misunderstood? 19:23

A. I understand your point, and you have correctly stated as to what group three is. But these are very broad categories and as you continue on with my discussion of this, both with regard to IARC and also with regard to Word Health Organisation, it's clear that the area of 19:24 uncertainty is not with exposures which are the same magnitude as earth's field, it has to do with exposures that are thousands of times higher than that. For instance, looking at workers who are highly exposed by reason of their work place in a chlora alkaloid plant, 19:24 or are there long term effects of exposures to the magnetic fields from magnetic resonance imaging devices that fields of 1.5 tesla. So that's where the area of uncertainty is, and unfortunately they don't break this down in this broad category as to whether the 19:25 uncertainty, when they categorise it in group three, is a one and a half million microteslas, whether it is at a 100,000 microteslas or whether it's 50 microteslas, and the rest of the discussion was to indicate where we felt that uncertainty was that puts this into a group 19:25 three. I don't think there was a firm basis to put static magnetic fields into group three with regard to evidence as to the earth's geomagnetic field.

295 Q. I suppose just the sense that I got from my brief

dipping a toe into these waters, was that there was essentially four sides to the square. There was studies on the effect of acute exposure to high levels of AC, there was studies into the...(INTERJECTION)

A. Excuse me, did you say AC? 19:26

296 Q. Yes.

A. This line is not is source of AC.

297 Q. I know, I am just covering the whole area, one of the sides to my square. On the other side there seems to be a lot of -- a reasonable amount, I think some people 19:26 would say probably insufficient -- but some studies into the chronic effects or the long term effects of chronic exposure of very low levels of AC in a large statistically valid group of people. The other side was that there was some studies, once again 19:26 insufficient, into the short-term effects of acute exposure to extremely high levels of static electricity, and that's where the MRI levels fall into it. The other side, the missing side, of my square, the exposure of relatively low levels of static 19:27 magnetism under the microtesla level, over a lifetime and the chronic effects that it has, seems to be just nonexistent. I just don't understand -- I can see your direction where you say that the World Health Organisation and other bodies have said that there is 19:28 evidence that suggests that further studies are needed in these areas, but I think, by implication, the fact that no valid studies have been done into the long-term exposure of very low levels of magnetic fields, other

than studies relating to the location of people on the planet and the earth's actual magnetic field, but I couldn't find a single report into the long term effects of exposure to HV DC cabling anywhere in the planet. And I even wondered, looking at how that was 19:28
spread, whether you could actually do it, because there generally seems to be related to these submarine cables going as far as some type of conduction station. So even if you did do the study, the fact that you are looking at a similar geographical spread would probably 19:29
mean that they would be largely statistically involved because you are looking at it from so many similar circumstances as in proximity to the sea and power stations and X number of common factors. Is that something you share or is there studies into the 19:29
exposure of lines such as this?

A. Well, first of all, there is two ways that we answer questions like this: We look at our data base of general scientific knowledge, and in that knowledge we have three types of studies: We have human 19:29
epidemiology studies, which may involve short-term exposures, it may involve long-term exposures; we have studies with animals or short-term studies with humans in the laboratory; and then we have iced invitro studies with isolated tissues and cells. And as part 19:29
of health risk assessment we look at all three of those bodies of evidence and we look at the strength and limitations of what each of those studies tell us. Generally, for most exposures in our environment we do

not have much human epidemiology data. We are exposed to, perhaps, 80,000 chemicals that are in general use, and only a very small number of those chemicals have ever been subjected to epidemiologic studies.

19:30

So, most of the determinations we make about health and safety, for instance of drugs and medicines that we take and give to our children, are based upon animal studies, short-term human studies and invitro studies. So, it's not unique that there are no long-term studies of particular exposure levels, in this case levels of 49 microtesla, which is in this field in this area. So, that's one way that we would come up with decisions.

19:30

19:31

Now, with regard to studies of high voltage DC transmissions lines, the size of under sea cables, which are obviously not routed near where people are living in long periods of time, there are overhead DC transmission lines that are built in a number of parts of the world, and there have been studies done at populations living around these high voltage DC transmission lines. But that's a different, more complicated phenomena than we have here because for those overhead lines you have...(INTERJECTION)

19:31

19:31

298 Q. You have interaction with AC, isn't that the problem there?

A. Not interaction with AC, but you have an external DC electric field. You also have air ions and a DC

magnetic field, so it's a more complicated exposure, not really comparable to what you have in an under sea cable. One thing that I would point out, if you have concerns about the DC magnetic field from the cable, is that in fact that though I presented in this report was a description of the fields produced by the cable itself in isolation, but in fact the field from the cable is identical to that of the earth's geomagnetic field. And depending on how the cable is oriented with respect to the earth's geomagnetic field, that magnetic field can be increased or decreased. 19:32 19:32

Now, what we did is, we did some calculations to see when we look at the combination of the earth's geomagnetic field and that of the cable for typical east west orientation of the cable, it turns out that the ambient geomagnetic field on either side of the cable is like this, and then when you get over the cable the intensity of the combined field is actually less, maybe some 20 per cent or more less than the geomagnetic field. So, when you look at the combined fields together for a typical orientation of the cable, the cable is not increasing the magnetic field above the ground or changing it, it's decreasing it. So, to the extent that you have concerns about increased exposure to magnetic fields, in fact for that typical cable orientation, the field would be lower than the geomagnetic field in that position for about two metres on either side of the cable. Once you are beyond two 19:32 19:33 19:33

metres from the cable, the field is virtually the same as the geomagnetic field.

299 Q. I suppose I should mention with the absence of absence of actual data on the long-term effects, I suppose the concern would be, if you look back to one of the reasons there is so much concern or focus in this area goes back to the Drouper (as heard) report, one of the studies into the effects of overhead AC lines in the north of England and the number of...(INTERJECTION) 19:34

A. Those are overhead AC transmission lines. 19:34

300 Q. Exactly. And then there was a couple of subsequent -- and I know that's been proven to be a similar problem to what we might have with AC/DC, that it's a reasonably localised study. And then there was subsequent studies in Scandinavia, Finland, Norway and Denmark, and they had inadequate numbers of people in the studies. I suppose my concern was, prior to that research, you mentioned the other three strands, that they indicate that there was no hint from the other elements that there was going to be an increased incident of childhood leukaemia as is the WHO are now suggesting that there may well be with overhead DC. And I suppose part of that as well is there is an acknowledged link or possible link, if not probable, and I know there has been some focus that that may be related to the ionic crone (as heard) of discharged ions, which in turn have great propensity to...(INTERJECTION) 19:35 19:35 19:35

A. That's what one person has proposed.

301 Q. That's what one person's proposal is, but the problem there is that that's all we have at the moment, is that people are supposing what is causing that link to childhood leukaemia. As yet no one really knows. Someone else has proposed that the link is exclusively with AC, but no one really has done the studies to say that the link with childhood leukaemia and high voltage power lines is exclusively related to AC, they have simply done it with AC, they are supposing that the link...(INTERJECTION) 19:36

A. If I can just respond to that. In fact, studies have looked at DC magnetic fields in relationship to childhood cancers. Theres are studies that have been done in the U.S., in which associations were found between surrogate measures, or ways of estimating exposures to magnetic fields, or measurements of the AC magnetic field, and in those studies they also measured the DC magnetic field and there was no relationship between variations in the DC magnetic field from home to home and childhood cancers. So, there have been a limited number of studies which have looked at DC magnetic fields. 19:36 19:37

302 Q. But it didn't relate to HV DC cabling?

A. No. But a DC magnetic field is a DC magnetic field, whether it comes from the earth, whether it comes from materials of steel in the building, or whether it comes from the DC cable. 19:37

303 Q. But the link with -- if I go back to AC, and once again I know it's not directly linked, but just as an

aside -- the exposure levels where the increased incidents of childhood leukaemia extended to about 300, 400 metres more, but the levels of exposure at that distance are far less than those children would have been exposed to in their households, as the levels of DC would be exposed to are a lot less in the phone I have in my pocket that is probably producing higher levels of magnetic fields. So, I just wonder why this is exclusively linked to the high voltage cabling when the actual exposure to variations in the magnetic field are greater from their household appliances? 19:38 19:38

A. Well, first of all, it's not exclusively linked to overhead high voltage transmission lines. In fact, most of the early studies that were done involved exposures to AC distribution lines at low voltages that run past most peoples' residences where they have overhead distribution. The very early study by Wardheimer and Leiker in 1979 involved distribution lines in Denver, Colorado, and there were very few high voltage transmission lines in that study. There are also studies that have been done of exposure to appliances, televisions, radios, hair dryers and so on, which in some of those studies have also reported statistical associations. So, by no means are the associations exclusively related to overhead transmission lines. You are indeed correct that there are multiple sources of these fields in the UK, approximately studies that have been done by the NRPB and other investigators indicate that about one-third 19:39 19:39

of the exposure to AC magnetic fields comes from appliances, about one-third from low voltage distribution sources, and where high voltage lines are nearby, about one-third might come from those sources. But everyone has exposures to the earth's geomagnetic field at a much higher level than the levels that are of concern for AC magnetic fields? 19:40

304 Q. I suppose, but once again there is that increased link even though we have...(INTERJECTION)

A. The other thing that I would add is that the thorough and serious investigation of AC electrical magnetic fields from a health perspective, really began in the late 60s and really got going after 1979, I would contrast that to the research that's been done on DC magnetic fields. If you go back, the earliest studies on DC magnetic fields were Greek physicians, who had ascertained that there was this natural material called lode stone, and they realised that these stones could attract each other and so they assumed they had some power and so they began applying these lode stone magnets, as it were, to various parts of the body in an attempt to cure various illnesses. So, from the very time of the very early Greeks, there has been interest in potential therapeutic applications of magnets in DC magnetic fields, and this continues today and people are selling magnets to put in your shoes, in your bed and pillows, on your bracelet, that are claimed therapeutic benefits, but there is really no firm scientific evidence that, in fact, these applications 19:40 19:41 19:41 19:41

have these benefits. But what this indicates is that for a very long time, hundreds of years, scientists have been looking at these fields, studying the interactions, and we know a great deal about how magnetic fields interact with all kinds of materials, including the human body, and so that our body of knowledge is far greater on DC magnetic fields, in terms of biological studies, invitro studies and so on, than what we have for AC magnetic fields up until 1979.

19:42

305 Q. You referenced one of the -- I won't even attempt to pronounce it -- one of the European Commission reports. It's just that their conclusion was -- and I know once again that the studies that they did once again related to high levels of exposure for very short periods of time, but the overall statements was adequate data for proper risk assessment of static magnetic fields are almost totally lacking.

19:43

19:43

A. That's correct, that is their statement. But they go on to indicate...(INTERJECTION)

306 Q. And MRI makes it a priority for research. Now, they haven't said -- and that's the complete conclusion -- but they haven't said but the studies in -- they have addressed there was a particular need but nor have they said that paucity of information doesn't exist for chronic exposure. I think you probably have to recognise it's not an area of science that's effectively closed, there is a lot of research to be done in that area, wouldn't you agree?

19:44

19:44

A. I don't think any area of science is closed, science is

a continuous, accumulative process. People pose hypotheses, people test them to see if there is data to support them, and that's a continual process. Science cannot prove the absence of something, what we do is we continually test hypotheses and the more and more we test those hypotheses, the more firm we are in the conclusions that we have reach based upon previous data.

So, we have a long history of study on DC magnetic fields, tests that have been made for all different kinds of reasons, some to assess hazards, some to assess benefit. And all together the scientific agencies that have evaluated that data have not indicated that exposures at the level of the earth's pure magnetic field are a cause for human health concern. 19:45

307 Q. But what is the level of the earth's geomagnetic field?

A. In this area it's about 49 microtesla.

308 Q. Is that is modal level? Because it seems to vary substantially. 19:45

A. Not substantially, there are small fluctuations in the geomagnetic field but those are very small. The geomagnetic field varies across the planet, being the lowest at around 30 microtesla at the equator and going up to 70 microtesla at the Poles. 19:46

309 Q. I suppose just bearing that that is at 50 microtesla, but there seems to be some variation in what levels we will be exposed to here. You quoted a figure, was it

19? It just seemed when the microtesla have been just such a small amount...(INTERJECTION)

A. It's in table 1, on page 6.

310 Q. So, that's directly over the cable system, 13 microtesla. It just puzzled me the fact that the actual specifics of the cable haven't as yet been ironed out as such yet, that you are able to give such an exact figure. 19:47

A. Well, we did modeling of the magnetic fields from the two cable systems that are under evaluation by EirGrid, and I have reported the highest value of either of those systems. 19:47

311 Q. One of the other things you mentioned was that a lot of the detection comes from metal shielding.

A. The metal cladding of the cable and the earth itself effectively block the electric field. 19:47

312 Q. And the other thing was just one thing I am confused about, someone mentioned that because the two cables in question were going to be put so close together, it was an either/or approach, either they would be metallically shielded, or else the two cables would be put together and effectively cancel each other out. 19:48

A. The magnetic fields are vectors, which means that they have not only a magnitude but they have a direction. A simple illustration of that is a bio-magnet or a compass, it's not like measuring the concentration of oxygen in the room and you can vary that concentration, there is no direction associated with it. But for magnetic and electric fields, these are vectors and so 19:48

they have a direction. If you have a magnetic field going in this direction and it is opposed by a magnetic field going in the opposite direction, those fields will tend to cancel. So, if you have the two cables next to each other, then the magnet field from the cables combined will be less than as if you have the cables separated by 10 metres.

313 Q. It's less but does warrant having no metallic shielding?

A. That has nothing to do with metallic shielding at all. 19:49

314 Q. But I think someone mentioned previously that the two approaches being looked at were either having the two cables in reverse polarity, one of them directional and the other that there was not, that cancelled it out. If they didn't go with that approach they were going to utilise metallic shielding. 19:49

A. It was called a metallic return, I think that may be what you are thinking of, a single cable within a metallic return. We calculated the fields from both of the designs that are under consideration and the values that I reported here in table 1 are the highest values. 19:49

315 Q. And that figure, 13 microtesla, that's as if you dug that cable up and stood on it, is it?

A. No, that is measured 1 metre above the ground. By convention around the world, the measurements of electric and magnetic fields are made 1 metre above the ground, and if you look at the table...(INTERJECTION) 19:50

316 Q. 60 centimetres at some point, is that the actual current bearing...(INTERJECTION)

A. I said 1 metre above the ground.

317 Q. Above the ground?

A. Yes. Now, if you look at the footnote...(INTERJECTION)

318 Q. So that's assuming the cable is at what depth?

A. We assume the cable is buried a metre below the ground. 19:50

319 Q. Which it's not, 60 centimetres; is that correct?

A. Approximately a metre below the ground.

320 Q. And that's the minimum depth of the current bearing cable.

A. **MR. MAHER:** The minimum depth of the cable is actually from the top of the ...(INTERJECTION) 19:51

INSPECTOR: Sorry, Mr. Maher, if you would just come up to the microphone so the stenographer can pick up what you are saying. 19:51

A. **MR. MAHER:** The minimum depth of the cable will be 900 millimetres or 90 centimetres to the top of the duct. So, the cable actually will be approximately a metre under the ground, but it will be deeper at locations to avoid other services in a built-up area, but predominantly the cable will be approximately a metre but the minimum depth will be 90 centimetres under ground. 19:51

321 Q. And is there a variation of that 90 centimetre depth?

A. No, the minimum -- it will be deeper but that's the top of the duct, not to the centre of cable, which Bill is referring to. So, a metre is as near as -- the duct is

to 200 ml, the cable is approximately the full width of the duct, so the top of the duct is 900.

MR. BAILEY: Now, if you look at that table there is a footnote to that number, it indicates that at the ground the magnetic field will be higher, 43 microtesla. The strength of the field is highest at the surface of the cable, and then its intensity diminishes rapidly with distance, so 1 metre above the cable, that's 43 microtesla and that's at the ground, when you go 1 metre above the ground you are at 13 microtesla. 19:52 19:52

322 Q. I just wonder from that figure, would 50 microtesla be a figure that EirGrid would be happy to set as a maximum exposure level?

A. For what reason? 19:53

323 Q. Just because, I suppose, that's the figure we are being given now, but the figures of 100 microtesla are also being mentioned as to WHO's standards based on AC current, but if that's going to be the level -- it's probably not a question for yourself, but I wonder would EirGrid be happy to set that as the level as opposed to guaranteeing residents that it will not exceed 50 microtesla? 19:53

A. From a scientific point of view I don't see a basis for that. Ireland is subject to the European Union recommendations and the European Union has recommended the INCIRP standard, and the INCIRP standards, which I described in my report, are thousands of times higher and the...(INTERJECTION) 19:53

324 Q. But they don't relate to lifetime exposure levels.
A. They do not specify a time duration, continuous exposure...(INTERJECTION)
325 Q. My understanding is occupational exposure.
A. They have a public exposure standard, and it's quoted if you go to table 2. 19:54
326 Q. But I suppose the question is if the only exposure we are going to have is going to be less than 50, is there any reason for not making that guarantee?
A. Their variations, as I illustrated how rapidly the strength of the field from the cable varies with distance, it varies if you move the cable further apart, bring it closer together, then the fields can go up or down somewhat. So, I think that the values that are put on the table are the best estimate on average of what they are, but you can move the cables an inch further apart and an inch closer together and you'd have variation on that. So, in table 2 we are looking at the INCIRP recommendation for public exposure of 40,000 microtesla, so a variation between 13 microtesla and 43 microtesla in that range is not significant. From a scientific perspective I don't see a rationale for putting any restriction on a magnetic field exposure in that range. 19:54 19:55 19:55
327 Q. I suppose the concern would be that those figures, as we established previously, are set for long-term exposure and chronic effects, but there have actually been no studies into long-term exposure, and maybe the overwhelming weight of scientific knowledge at the 19:56

moment suggests that it's correct, there is a legitimate concern in residents here, and if it just simply comes down to the building methodology, it doesn't seem like an awful lot to ask for to be precise. These are concerns somewhat, it's something we have to live with for the rest of our lives, and if we can say that what we are looking at isn't going to exceed the earth's magnetic field, as opposed to potentially double it. The concern would be that in ten years' time there is a long-term study done in this area and they say, 'oops, we made a mistake', you are not going to come and dig that cable up? 19:56 19:57

INSPECTOR: Mr. Clarke, if you wouldn't mind, for the purposes of the hearing your points are noted. It's now 8:05, so I am...(INTERJECTION) 19:57

MR. CLARKE: Could I just make some very quick points?

INSPECTOR: Yes.

328 Q. **MR. CLARKE:** First of all, do you think it would be safe, just for the record, to say that this line is 100 per cent safe, without any doubt? 19:57

A. Scientists are not in a position of making guarantees or absolutes, and safety is something that is arrived at by governments. I can tell you, as a scientist, that of all the things I have evaluated in this world for risk, that the DC magnetic field is one of the lowest things in terms of a risk scale that I have ever 19:57

looked at, and I wouldn't have myself any personal concerns about sleeping on top of the ground above the cable. But safety is something that is established by government agencies as to whether a certain degree of risk is acceptable or not.

329 Q. Essentially there may be, it isn't possible to say without a shadow of a doubt?

A. I think the government agencies have given their answer in the form of the reviews that I pointed you to, and also to the guidelines, as to what they consider a safe exposure to magnetic fields based upon a consideration of the entire body of knowledge at this time.

330 Q. Which is lacking. That's the concern and I appreciate your points. Just some other quick points, you made reference earlier to the good neighbour policy with regards to road closures and weekend work. My concern with that would be that all the residents of Kilbush Lane, who are directly involved in this, had no direct contact with EirGrid prior to the submission. I know there was something at a general level in the town of Rush, but I think the fact that it just affected us directly, the neighbourly thing would be to contact us. I suppose our concern would be, is this typical of your good neighbour policy or is it only some neighbours that you contact? When you do suggest to work weekends, you said occasionally this was going to have to happen, if it has to happen are you going to say 'we are working this weekend and tough'?

A. **MR. FITZGERALD:** The work organising will be

APPENDIX 4

Full text for Question 3 from Rush Community Council.

Full question submitted by Rush Community Council to Question 3.

As a signatory of the Maastrict Treaty, Ireland is bound to adhere to the Precautionary Principle (PP), and while the treaty specified an obligation only to apply PP to protect the environment, the Commission, Committee of Ministers and the Parliament have endorsed an extended scope for PP into the area of human health. The Commission assigns a duty of care to decision-makers such as an Bord Pleanála to provide answers where scientific uncertainty exists, such as is the case with the causation between EMF and health. It also states that even if only the minority of evidence indicates risk or if the evidence is not yet complete, decision-makers may still set precautionary guidelines based on the principals of PP. It also provides case law to support the precedence of public health over economic matters in decision making and the application of the burden of proof to the importer. Summary 5. "…Decision-makers faced with an unacceptable risk, scientific uncertainty and public concerns have a duty to find answers." (p.3) 1. "…the precautionary principle has been politically accepted as a risk management strategy in several fields." (page 8) "Although the precautionary principle is not explicitly mentioned in the Treaty except in the environmental field, its scope is far wider and covers those specific circumstances where scientific evidence is insufficient, inconclusive or uncertain and there are indications through preliminary objective scientific evaluation that there are reasonable grounds for concern that the potentially dangerous effects on the environment, human, animal or plant health may be inconsistent with the chosen level of protection." (p.9) 6.2. "The absence of scientific proof of the existence of a cause-effect relationship, a quantifiable dose/response relationship or a quantitative evaluation of the probability of the emergence of adverse effects following exposure should not be used to justify inaction. Even if the scientific advice is supported only by a minority

7 9 fraction of the scientific community, due account should be taken of their views, provided the credibility and reputation of this fraction are recognised." (p.16) …to involve all interested parties at the earliest possible stage." (p.16) 6.3.4. "The Commission affirms, in accordance with the case law of the Court that requirements linked to the protection of public health should undoubtedly be given greater weight that economic considerations." (p.19) 6.4. "…Action taken under the head of the precautionary principle must in certain cases include a clause reversing the burden of proof and placing it on the producer, manufacturer or importer……" (p.20/21) Jurisdiction of EU Court:

"Where there is uncertainty as to the existence or extent of risk to human health, the institutions may take protective measures without having to wait until the reality and seriousness of those risks become fully apparent." (Cases C-157/96 and C-180/96 of 5.May 1998, Grounds 63).

"Requirements linked to the protection of public health should undoubtedly be given greater weight than economic considerations" (Order of 30 June 1999, Case T-70/99). "

COMMUNICATION FROM THE COMMISSION on the precautionary principle COMMISSION OF THE EUROPEAN COMMUNITIES Brussels, 02.02.2000 COM(2000) 1 http://ec.europa.eu/dgs/health_consumer/library/pub/pub07_en.pdf

The precautionary principle is also endorsed by the Committee of Ministers.

"1. The Committee of Ministers welcomes the attention given by the Parliamentary Assembly in its Recommendation 1787 (2007) "The precautionary principle and responsible risk management" to a principle that is of crucial importance for the modern world.

2. The Committee of Ministers recalls here the undertakings given by the Heads of State and Government of member states in the Final Declaration of the Third Summit of the Council of Europe "to ensure security for our citizens in the full respect of human rights and fundamental freedoms" and to meet, in this context, "the challenges attendant on scientific and technical progress".

3. The precautionary principle has multiple aspects: scientific, economic, media-related and legal, to which balanced consideration must be given if it is to be implemented in an appropriate manner. In this regard, the Committee of Ministers has noted with interest the measures proposed by the Assembly and has brought this recommendation to the attention of member state governments. It has also sent it to the Steering Committee for Education (CDED) and to the Steering Committee for Higher Education and Research (CDESR)." "The precautionary principle and responsible risk management"

Parliamentary Assembly Recommendation 1787 (2007) (Reply adopted by the Committee of Ministers on 16 January 2008 at the 1015th meeting of the Ministers' Deputies)

https://wcd.coe.int/ViewDoc.jsp?Ref=CM/AS(2008)Rec1787&Language=lanEnglish&Ver=final

The European Commission has also spoken of the application of PP to Health at a WHO EMF conference:

"Dr Belvèze of the Commission outlined how the Precautionary Principle (PP) became formally adopted into EU policy three years ago. It is now an important element of all the EU's scientific, legal and political measures. Its application to EMF is one of the first major actions of the EU in extending the application of the PP to public health. The PP is nothing else than a policy decision to ensure that insufficient scientific evidence does not prevent the decision-maker from taking action when there is a strong perception of risk. The PP is seen as a Risk Management tool for the decision-maker. It is not a tool that can be applied separately out of this framework. Dr Belvèze saw the main guidelines in applying the PP to be proportionality, non-discrimination, and consistency. The guidelines also include an evaluation of the health benefits and the costs of action and lack of action. Finally there should always be scope for further review in the light of new scientific information. Dr Belvèze concluded his presentation with an impressive list of initiatives taken internationally to win support for the EU's precautionary policy and encouraged the Working Groups to work on clarifying the PP guidelines to enable them be employed internationally."

Application of the Precautionary Principle to Electromagnetic Fields (EMF) http://www.who.int/peh-emf/meetings/en/Lux_final_rapp_report.pdf . The WHO has also indicated that it sees PP as the prudent approach when developing guidelines: "WHO wants to broaden its public health policy to include agents for which it is not yet possible to quantify the risk. The definition of the PP is less important than finding a way of moving forward. Dr Repacholi was up-front and personal. The WHO needs our help. The world is a risky and uncertain place. So why should we be surprised that science too has its uncertainties that makes it hard for us to assess risks. What do you do meanwhile? There are reports of biological effects of EMF at levels below the well recognised standards and guidelines. WHO would now like to develop a framework and guidelines that would allow the application of the PP not only for EMF but also for WHO policy generally." Application of the Precautionary Principle to Electromagnetic Fields (EMF) http://www.who.int/peh-emf/meetings/en/Lux_final_rapp_report.pdf .The WHO has also recommended guidelines for the application of PP to EMF: When to apply the Precautionary Principle
Risks are present in all aspects of our lives, and there will always be some uncertainty associated with those risks. As individuals and as a society we regularly make decisions under uncertainty, without a full knowledge of the extent of the risk. While the possibility of risk does not in itself require action, uncertainty in itself does not justify inaction. The question then is: "When to act?" What strength of evidence is required to trigger action or invoke the Precautionary Principle? (e.g. a possible cause, no conclusive scientific proof, or sufficient evidence).
Risk Analysis: The analysis of risk encompasses three main elements, namely risk assessment, risk management and risk perception. Within this framework, the Precautionary Principle is relevant when considering the range of risk management options available. To be effective it must take into account both measured and perceived risk. The following factors, important to the application of the PP, developed in a German report [4], are expanded and adapted here to the EMF issue: Extent of damage: Adverse effects can be quantified in different ways, depending on the end-point considered (e.g. in terms of number of lives lost to cancer, or production losses from electrically hypersensitive (EHS) people who cannot work due to their condition). Probability of occurrence: The existence of a potential adverse effect from an environmental exposure could trigger the Precautionary Principle. Knowledge of the probability of the adverse effect as a function of the level of exposure greatly enhances decisions; these probabilities are one of the most uncertain aspects of risk assessment, especially for EMF. Uncertainty: Uncertainties exist at every level of evaluation, from uncertainty about the presence of a hazard to uncertainty in the levels of exposure a person receives. The relevant metric is the most important uncertainty for the application of the Precautionary Principle to EMF. Ubiquity: Most common EMF exposures come from the use of cell phones and appliances as well as from electrical wiring in and outside of homes and proximity to mobile phone masts in urban areas. Ubiquity of this exposure is an important driver for the Precautionary Principle. Pattern of Exposure: In general, pattern of exposure including length, intensity, and fractionation can play a key role in their influence on disease incidence. This could be due to the existence of a threshold, complex dose-response pattern and adaptive response. Potential differences in effects due to low long term exposures from power lines and base stations vs. more intermittent but much higher exposure from appliances and cell phones have been suggested but not adequately examined. Delayed effect: Latency is the time between the initial exposure and evidence of disease. One of the main diseases of interest is cancer, which has latency from several years to decades. Thus, consideration of latency is important, particularly in the case of cell phones, where ubiquitous exposure is recent and where potential development of brain cancer might be years away, thus calling for an anticipatory consideration of the Precautionary Principle. Inequity and injustice associated with the distribution of risks and benefits over time, space and social status (e.g. routing of power lines or erection of base stations in low-income areas) Psychological stress and discomfort associated with the risk or the sources of risk (e.g. people particularly sensitive to EMF). This has clearly been a driver for the application of the Precautionary Principle to EMF Potential for social conflict and mobilization: Degree of interest and pressure from advocacy groups and associations. Again, this has occurred with the EMF issue, especially when new facilities such as base stations or power lines are proposed or built. Voluntary vs. involuntary exposure: People feel differently about risk when the choice is theirs. For EMF, higher exposures from cell phones and appliances have been of less concern to the public than lower but involuntary exposures from base stations and power lines. Scientific Uncertainty While the Precautionary Principle applies by definition to situations characterized by scientific uncertainty, its application to the EMF issue is especially problematic, because there is uncertainty not only as to whether exposure is associated with increased risk or not, but also: Uncertainty about the magnitude and specificity of the risk. The risk from exposure to EMF, if real, could be small but affect a large number of people. Alternatively, the risk could be large but affect only a small number of susceptible individuals. Other possibilities might include simultaneous exposure to another factor. Different possible relationships between risk and exposure may require different precautionary measures to reduce risk, making application of the Precautionary Principle particularly difficult. Uncertainty as to which aspect of exposure might be harmful. Certain actions, while reducing some aspects of exposure, might inadvertently increase risk by increasing some other, as yet unknown, aspect that might turn out to be the true cause. The concept of precautionary action is often rooted in the assumptions that less exposure is better and that reducing one aspect of exposure will also reduce other aspects that might be harmful. Neither of these assumptions, in the context of electric and magnetic fields, is necessarily valid. In fact, some laboratory research has suggested that biological effects due to EMF can vary within windows of field frequency and intensity. While such a complex and unusual pattern is unlikely and would defy most accepted tenets of toxicology and epidemiology, the possibility that it may be real must be considered when applying the Precautionary Principle to EMF. The absence of a clearly elucidated, robust, and reproducible mechanism of interaction of EMF with biological

systems and the plethora of field characteristics that could be relevant, make avoidance strategies that fall short of eliminating EMF exposure entirely both difficult to analyze and potentially counterproductive. Complete elimination of exposure could only be accomplished if no one were to use electricity or modern communications technology. Triggers for the application of the Precautionary Principle to EMF The Precautionary Principle should be invoked when: - there is good reason, based on empirical evidence or a plausible causal hypothesis, to believe that harmful effects to people might occur, even if the likelihood of harm is remote; and - a scientific evaluation of the consequences and probabilities reveals such uncertainty that it is not yet possible to assess the risk with sufficient confidence to inform decision-making. Adapted from the UK Interdepartmental Liaison Group on Risk Assessment [5] There are three factors that might, in general, trigger the application of the precautionary principle: Recognition that there is objective scientific evidence that amounted to the possibility of a health risk. This is the situation where (as is the case with ELF magnetic fields) the International Agency for Research on Cancer (IARC) or a body with equivalent status classifies an agent as "possibly carcinogenic" or "possibly" a cause of other forms of ill health. Where there is no such classification, applying this criterion is less objective and less satisfactory. A recognition that there may be a very low cost intervention available, in which case an action may be justified even when the scientific evidence is weak, specifically when it is too weak even to be classified as "possible". This is the case for the use of hands-free devices for mobile phones and limiting the amount of time children spend on these phones. This criterion needs to be applied with care to ensure that an apparently "low cost" option really is low cost. In principle, no matter how low

Uncertainty as to which aspect of exposure might be harmful. Certain actions, while reducing some aspects of exposure, might inadvertently increase risk by increasing some other, as yet unknown, aspect that might turn out to be the true cause. The concept of precautionary action is often rooted in the assumptions that less exposure is better and that reducing one aspect of exposure will also reduce other aspects that might be harmful. Neither of these assumptions, in the context of electric and magnetic fields, is necessarily valid. In fact, some laboratory research has suggested that biological effects due to EMF can vary within windows of field frequency and intensity. While such a complex and unusual pattern is unlikely and would defy most accepted tenets of toxicology and epidemiology, the possibility that it may be real must be considered when applying the Precautionary Principle to EMF. The apparent cost of an intervention, at least a rudimentary cost-benefit analysis should be undertaken. Public pressure. This would often result in consideration of precautionary actions even in circumstances where the evidence is weak and subjective, but nonetheless must be recognized as a practical consideration. Note that these are triggers, not for taking precautionary action, but for applying the Precautionary Principle, that is, for making a detailed assessment of the benefits and consequences of action that may or may not be taken. The Precautionary Principle, when applied properly, should not result in unjustifiable or disproportionate actions. Therefore, in principle, it can be applied no matter how weak the evidence. The reasons for requiring a trigger are pragmatic; applying the Precautionary Principle properly entails much work. There is always the possibility of a superficial application resulting in inappropriate actions. It is therefore sensible not to invoke the Precautionary Principle without adequate justification. Further non-EMF specific guidelines to the application of PP to health related risk management can be found at http://www.who.int/peh-emf/meetings/archive/en/Precaution_Draft_2May.pdf

APPLICATION OF PRECAUTIONARY PRINCIPLE TO EMF L Kheifets, M Repacholi, E van Deventer, L Goldstein

World Health Organization, 20 Avenue Appia, CH-1211 Geneva 27, Switzerland Tel: +41 22 791 4976; Fax: +41 22 791 4123; Email: kheifetsl@who.int 3rd International EMF Seminar in China: Electromagnetic Fields and Biological Effects Guilin, China October 13-17, 2003 http://www.who.int/peh-emf/meetings/archive/en/proceedings_eng.pdf .The German Federal Board for Radiation Protection (BfS) considers the current regulations insufficient, when it recommends in a press-release of Feb 1st 2002 that : "1. Unnecessary exposure should be avoided and 2. Unavoidable exposure should be minimised. The possible risk may be small, but one has to consider that these presumably small risks concern several millions of people. There is a demand for action to meet the precautionary principle requirement. Exposure has to be kept at a minimum, the public has to be informed." Examples of EMF guidelines where the Precautionary Principle has been applied:

As the WHO admits, its own guidelines do not aim to protect against the long term EMF health effects: "No authority concerned with exposure standards produced exposure guidelines with the aim to protect from long-term EMF-health-effects, like a possible cancer risk." "Facts about Electromagnetic Fields" – joint publication of the Austrian Government with WHO, published as information-paper for decision makers - Broschüre des Bundeskanzleramtes, Verkehrsministeriums und der WHO, für Kommunalbehörden, Seite 9) A number of European countries that have applied the Precautionary Principles in order set guidelines this has typically led to limits of 0.4 microtesla or under being set. "1996 Swedish Advisory Bodies suggest power distribution should avoid above 0.2 microtesla Swiss Government 1999 limit for new installations 1 microtesla 2000 Three Italian Regions Veneto, Emilia- Romagna and Tuscana limit for new installations 0.2 microtesla 2002 New Substation in Queensland, Australia Energes Ltd settle out of court 0.4 microtesla. 2003 California Education Department exposure limit for schools (under discussion) 0.01 microtesla I refer to the recent California Health Department Report on EMF's which cites added risk of miscarriage, childhood and adult Leukaemia, brain cancer and greater incidence of suicide as some of the health effects associated with elevated exposure." http://www.merton.gov.uk/democratic_services/ds-agendas/ds-reports/_000-5999/3941.pdf

"Swiss ordinance is a two-tier regulation. On one hand, the international exposure limits apply to all places to which persons have access. Those limits are based on scientifically accepted health effects caused by excessive eddy currents (low-frequency fields) or excessive tissue heating (high-frequency fields). Exposure limits protect people against all known detrimental health

effects. A large «safety factor» (factor 50) is included in the limits. Based on the precautionary principle, Switzerland has defined in addition to these exposure limits precautionary limits for so-called «sensitive places» like apartments, schools, offices, etc.: for low-frequency fields an additional factor of 100 (magnetic field), and for high-frequency fields an additional factor of 10 (electric field) was introduced. Precautionary limits account for people's concerns and for still unsettled scientific questions and, hence, uncertainty in risk-assessment." http://www.emf-info.ch/e/emf4.html "Based on the data to date on EMF and health countries such as Italy, Sweden and Switzerland have already begun adopting precautionary approach guidelines to significantly reduce exposure levels below those which have been shown to cause illness (levels above 0.4microtesla). In June 2005, The Netherlands also announced plans to set a 0.4microtesla exposure limit for new transmission lines, and banning the construction of buildings and developments that would exposure people to prolonged magnetic fields of 0.4microtesla" Submission to the Electricity Commission on the December 2005 round of consultation meetings on alternatives to the proposed Auckland 400kV transmission proposal Prepared on behalf of New Era Energy by Robert J. McQueen December 21, 2005 "8.4.1.3 Option 3: An exposure guideline of 1 μT (10 mG) and 100 V/m: A considerable body of observations has documented bioeffects of fields at these strengths across the gamut from isolated cells to animals, and in man. Although the majority of these reported effects do not fall directly in the category of hazards, many may be regarded as potentially hazardous. Since epidemiological studies point to increased cancer risks at even lower levels, a case can be made for recommending 1 μT (10 mG) and 100 V/m as levels not to be exceeded in prolonged human exposures. Most homes and occupational environments are within these values, but it would be prudent to assume that higher levels may constitute a health risk. In the short term, a safety guideline set at this level would have significant consequences, particularly in occupational settings and close to high voltage transmission and distribution systems, but it is unlikely to disrupt the present pattern of electricity usage. These levels may be exceeded in homes close to transmission lines, distribution lines and transformer substations, in some occupational environments, and for users of devices that operate close to the body, such as hair dryers and electric blankets. From a different perspective, adoption of such a guideline would serve a dual purpose: first, as a vehicle for public instruction on potential health hazards of existing systems that generate fields above these levels, as a basis for "prudent avoidance"; and second, as a point of departure in planning for acceptable field levels in future developments in housing, schooling, and the workplace, and in transportation systems, both public and private, that will be increasingly dependent on electric propulsion." National Council of Radiation Protection and Measurements (NCRP) draft report www.microwavenews.com . Eirgrid claims to be applying the highest safety standards, when the information set out above clearly states that this is not the case. The EMF limits which Eirgrid has chosen to adhere to are 100 to 500 times greater than the highest standards of our European neighbours. Given this supporting material for the Precautionary Principle why do Eirgrid feel this does not apply to the People of Rush, with particular reference to 0 – 12 year old children?

End.

APPENDIX 5

Map of HV Underground Cables in Dublin


LEGEND
CORDUFF
HUNTSTOWN
FINGLAS
POPPINTREE
DARDISTOWN
PORTMARNOCK
CLONSHAUGH
CROMCASTLE
KILMORE
GRANGE (DR)
COLLEGE PARK
BALLYCOOLEN
SUTTON
BAYSIDE
HOWTH JUNCTION
COOLOCK
SANTRY
BALLYMUN
FINGLAS
DUNSINK
PELLETSTOWN
MERVILLE
ARTANE
RAHENY
CABRA
CLONTARF
CASTLEKNOCK
PHOENIX PARK
DUBLIN BAY
LUCAN EAST
PALMERSTOWN
EAST WALL ROAD
NORTH WALL
KINGSBRIDGE
LIFFEY VALLEY
RINGSEND
IRISHTOWN
POOLBEG
SHELLYBANKS
INCHICORE
BALGADDY
GRANGE CASTLE
CLONDALKIN
CRUMLIN
CARVILLE AVENUE
MILLTOWN (DR)
ROCK HILL
BALLYMOUNT
GREENHILLS
KIMMAGE
BELFIELD
DODDER ROAD
CHEEVERSTOWN
TYMON
TEMPLEOGUE
MOUNT MERRION
MONKSTOWN
HARBOUR
DUN LAOGHAIRE
COOKSTOWN
BELGARD
DUNDRUM
BLACKROCK
CITYWEST
TANEY
BALLYBODEN
DEANSGRANGE
SALLYNOGGIN ROAD
DALKEY
WHITESTOWN
SAGGART
OLDBAWN
BREWERY ROAD
POTTERY ROAD
BALLINCLEA
SANDYFORD
CENTRAL PARK
CARRICKMINES
LOUGHLINSTOWN
CITY CENTRE TERMINI and MAIN BUS STOPS
Scale 1:7 500 being 133mm (approx) = 1km or 8.42 inches = 1 Mile
Scale: 50mm = 1 Kilometre