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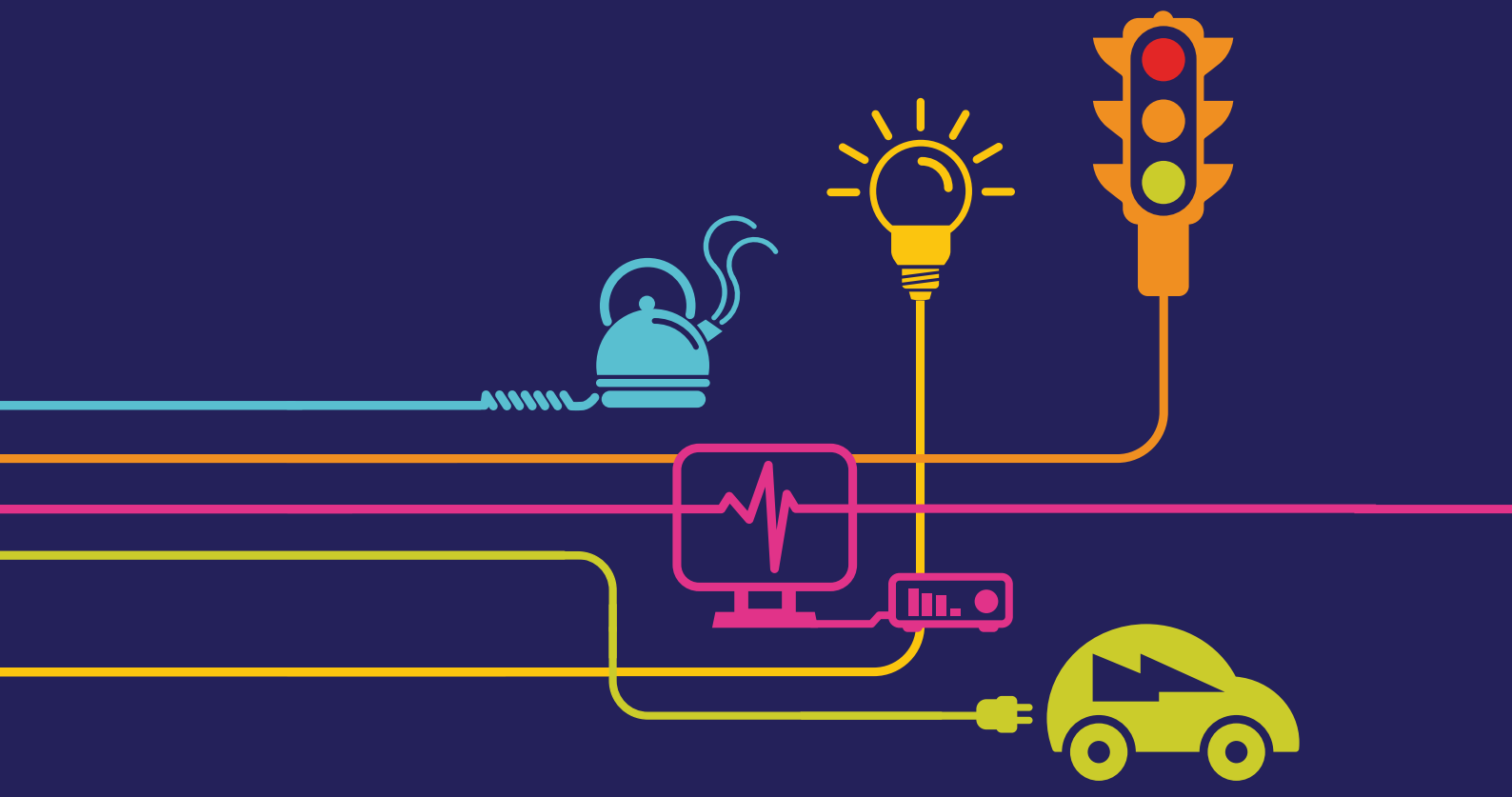
Environmental Statement Electric and Magnetic Fields

Hinkley Point C Connection Project

Regulation 5(2)(a) of the Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009



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ENVIRONMENTAL STATEMENT – MAY 2014

VOLUME 5.16.1, CHAPTER 16 – ELECTRIC AND MAGNETIC FIELDS

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INSETS (VOLUME 5.16.1)

APPENDICES (VOLUME 5.16.2)

16 ELECTRIC AND MAGNETIC FIELDS

16.1 Introduction

16.1.1 This chapter of the Environmental Statement (ES) provides an assessment of the likely significant environmental effects of electric and magnetic fields (EMFs) associated with the construction, operation and decommissioning of the Proposed Development. A description of the Proposed Development is provided in **Volume 5.3.1** and illustrated at **Volume 5.3.3, Figures 3.1 – 3.6**. This chapter is supported by a number of insets provided in this chapter and an appendix provided after the main text of this chapter **Volume 5.16.1**. This chapter should be read with these insets and appendices available for reference as they assist the understanding of the descriptions and assessments presented in the text.

16.1.2 EMFs and the electromagnetic forces they represent are an essential part of the physical world. Their sources are the charged fundamental particles of matter (principally electrons and protons). Electromagnetic forces are partly responsible for the cohesion of material substances and they mediate all the processes of chemistry, including those of life itself. EMFs occur naturally within the body in association with nerve and muscle activity. Humans also experience the natural static magnetic field of the Earth (to which a magnetic compass responds) and natural static electric fields in the atmosphere.

16.1.3 EMFs occur in the natural world, and people have been exposed to them for the whole of human evolution. The advent of modern technology and the wider use of electricity and electrical devices have inevitably introduced changes to the naturally occurring EMF patterns. Energised high-voltage power-transmission equipment, along with all other uses of electricity, is a source of EMFs. These EMFs have the same frequency as the voltages and currents that produce them, which is 50 hertz (Hz) in the UK. The fields are described as power-frequency or extremely-low-frequency (“ELF”) alternating EMFs, and exist in addition to the Earth's steady natural fields.

16.1.4 Electric fields depend on the operating voltage of the equipment producing them and are measured in V/m (volts per metre). The operating voltage of most equipment is a relatively constant value. Electric fields are shielded by most common building materials, trees and fences and diminish rapidly with distance from the source.

16.1.5 Magnetic fields are measured in μT (microtesla) depend on the electrical currents flowing, which vary according to the electrical power requirements at any given time. They are not significantly shielded by most common building materials or trees but do diminish rapidly with distance from the source.

16.1.6 EMFs at 50Hz can cause induced currents to occur in the body, which if high enough can interfere with nerves. There are Government adopted exposure guidelines discussed in paragraph 16.2.17 which are set to protect against these known or direct effects of EMF exposure. There are also ‘indirect’ effects that can occur as a result of exposure to EMFs which are not explicitly covered by the exposure guidelines. Examples of indirect effects are interference with active implantable medical devices (AIMDs) and microshocks (discussed in paragraphs 16.2.47 to 59). The potential impact of both direct and indirect effects has been assessed using the guidance provided in National Policy Statement (NPS) EN-5 (Ref. 16.1) and the codes of practice.

16.1.7 EMFs at much higher frequencies than those generated by the electricity transmission system can be generated by other devices, e.g. radio, television transmissions and microwaves. These higher frequencies interact with objects and people in a rather different way to power frequencies, for example by heating of the body, and it is important to make the distinction. Overhead lines produce fields only at frequencies well below these. The term "non-ionising" radiation is often applied to these frequencies.

Project Engagement

EIA Scoping

16.1.8 As part of the scoping phase of the Environmental Impact Assessment (EIA), National Grid prepared a Scoping Report (April 2013) setting out the proposed approach to EIA in respect of the Proposed Development, including the identification of assessment methods for each of the EIA topics to be assessed

16.1.9 The Scoping Opinion is provided at **Volume 5.5.2, Appendix 5A**. A summary of the Scoping Opinion representations received (relevant to EIA) and National Grid's responses are summarised at **Volume 5.5.2, Appendix 5B**.

Statutory Stage 4 Consultation

16.1.10 Statutory Stage 4 Consultation took place over a period of eight weeks between 3 September and 29 October 2013 in accordance with the Planning Act 2008. Statutory and non-statutory consultees and members of the public were included in the consultation. Various methods of consultation and engagement were used in accordance with the Statement of Community Consultation (SoCC) including letters, website, public exhibitions, publicity and advertising, inspection of documentation at selected locations and parish and town council briefings.

16.1.11 National Grid prepared a Preliminary Environmental Information Report (PEIR) which was publicised at this consultation stage. National Grid sought feedback on the environmental information presented in that report. Feedback received during Statutory Stage 4 Consultation was considered by National Grid and incorporated where relevant in the design of the project and its assessment and presentation in this ES.

16.1.12 A summary of the Statutory Stage 4 Consultation representations received (relevant to EIA) and National Grid's responses are summarised at **Volume 6.1** (Consultation Report).

Draft ES and Supporting Documents

16.1.13 The Draft ES and a large number of the ES supporting documents were provided to a number of statutory and non-statutory bodies over a period of two weeks between 3 and 17 February 2014. This process of engagement (over and above that required by the statutory consultation process) was undertaken to provide an opportunity for these bodies to influence the assessment documents prior to their finalisation to accompany the DCO application.

16.1.14 A summary of the Draft ES representations received (relevant to EIA) and National Grid's responses are summarised at **Volume 5.5.2, Appendix 5C**.

16.1.15 A summary of the main Scoping, Statutory Stage 4 Consultation and Draft ES representations received in relation to EMFs is presented in the table below.

Table 16.1 Summary of the Main EMF Scoping, Statutory Stage 4 Consultation and Draft ES Engagement Representations Received

Representation	**Response**
Recommends that the Applicant should discuss the scope of the EMF assessment with the local authorities. The Applicant is also referred to the comments from the NHS Somerset Clinical Commissioning Group and Nailsea Town Council in Appendix 2.	Relevant stakeholders have been engaged in determining the scope, method and findings of the EMF assessment of the Proposed Development. This is described in **Volume 5.16.1**, in the sub-section 'Engagement' in section 16.1. The assessment has been carried out in accordance with current requirements, as described in the section 'Policy and legislation'.
Representations relate to public concerns around electromagnetic radiation leading to health risks such as childhood leukaemia.	National Grid takes the issue of health very seriously and relies on authoritative and independent scientific organisations such as the World Health Organisation (WHO) and Public Health England (formally the Health Protection Agency [HPA]) to review the worldwide body of scientific evidence on EMFs and health rather than relying on its own assessment of the science. National Grid believe it is right that the decision on what is acceptable or not is made independently of National Grid. NPS EN-5 in section 2.10.6 states *"The balance of scientific evidence over several decades of research has not proven a causal link between EMFs and cancer or any other disease. The HPA CRCE keeps under review emerging scientific research and/or studies that may link EMF exposure with various health problems and provides advice to the department of Heath on the possible need for introducing further precautionary measures."*
Concerns raised regarding the impact of proposed power lines, through EMF creating interference, preventing bat species accessing their foraging areas and their roost sites, though very little is known about the effect of EMF on bats.	This is addressed in section 16.6 of this Volume.

Representation	Response
A Health Impact Assessment should be provided.	There is no specific legislation in the UK which requires a standalone HIA to be undertaken as part of the infrastructure planning process. Although the EU EIA Directive is due to come into force in 2014, this is not expected to be transposed into UK law and thereby come into effect until 2016. Potential impacts which are likely to result in health outcomes are already assessed and mitigated in the appropriate chapters including, but not limited to, impacts associated with noise, air quality, EMF and visual amenity.
National Grid's Technical Construction File satisfies the requirements of the EMC Directive for the grid transmission system. The T-pylon is not included in the TCF but is assumed to be designed within the same acceptable limits due to use of similar equipment. National Grid should confirm whether the T pylon is intended to be included in the TCF.	The technical construction file (TCF) includes on site testing of the existing transmission system assets but also a technical evaluation of the specifications that National Grid design equipment to meet. When designing the T-pylon the specifications for radio frequency (RF) emissions and corona which can potentially cause electromagnetic compatibility (EMC) issues, were identical to those which National Grid apply to its existing transmission system. This ensures that any emissions' from the T-pylon will not exceed those currently produced by National Grid's transmission system. Therefore the TCF satisfies the requirements of the EMC Directive, but National Grid intends to include the T-pylon after construction.

16.2 Policy and Legislation

16.2.1 Whilst there are no statutory regulations in the UK that limit the exposure of people to power-frequency EMF, responsibility for implementing appropriate measures for the protection of the public lies with the UK Government, who have a clear policy, restated in October 2009 and incorporated in NPS EN-5 (Ref. 16.1), on the exposure limits and other policies they expect to see applied. Practical details of how the policy is to be implemented are contained in Codes of Practice (Ref. 16.2) agreed between industry and Government.

16.2.2 Government in turn acts on the scientific advice from Public Health England, which has responsibility for advising on non-ionising radiation protection, including power-frequency fields. The National Radiological Protection Board (NRPB) had this responsibility until it became part of the HPA on 1 April 2005, and the HPA had the responsibility until 1 April 2013. This chapter refers to either NRPB or HPA according to the name at the time each statement was issued.

16.2.3 In 2004, following a recommendation by NRPB, the UK Government adopted exposure guidelines published in 1998 by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) (Ref. 16.3) in line with the terms of the 1999 EU recommendation (Ref. 16.4) on public exposure to EMFs. In a Written Ministerial Statement in October 2009 (DH 2009; references to the Written Ministerial Statement encompass both the Statement itself and the detailed

Response that the Statement introduced) the Government restated this policy of compliance with exposure limits and, acting on the recommendations of a stakeholder process, added a single precautionary measure relating to high-voltage infrastructure, a policy of optimum phasing of some overhead lines. The Government also made clear that no other precautionary measures are appropriate for high-voltage infrastructure.

16.2.4 These two policies, compliance with exposure limits plus optimum phasing, are the only ones applying to high-voltage infrastructure. NPS EN-5 (Ref. 16.1) documents these policies and they are explained fully below.

National Policy Statement EN-5

16.2.5 As summarised above, Government has set out clear policies on control of EMF exposures in general. NPS EN-5 (Ref. 16.1) gives clear guidance on the EMF requirements of all electricity infrastructure projects. The relevant sections and how they have been addressed are summarised in **Table 16.2** below; further detail is provided at paragraphs 16.2.6 – 16.2.17.

Table 16.2 Summary of NPS EN-5 Requirements Relevant to EMF

Para	Requirement	ES Section	Compliance Assessment
2.10.9	Before granting consent to an overhead line application, the IPC should satisfy itself that the proposal is in accordance with the "Power Lines: Demonstrating compliance with EMF public exposure guidelines – a voluntary Code of Practice" published in February 2011, considering the evidence provided by the applicant and any other relevant evidence. It may also need to take expert advice from the Department of Health.	**Volume 5.16.1**	The Proposed Development has been designed and assessed in line with this code of practice. All of the EMFs produced comply with the Government adopted ICNIRP 1998 guidelines and relevant policies.
2.10.10	Before granting consent to an overhead line application, the IPC should satisfy itself that the proposal is in accordance with the ICNIRP (1998) guidelines	Section 16.5 and 16.10 of this Volume	The overhead line and all other assets associated with the Proposed Development have been demonstrated to comply with the Government adopted ICNIRP 1998 guidelines.

Para	Requirement	ES Section	Compliance Assessment
2.10.11	The Government has developed with industry a voluntary Code of Practice, "Optimum Phasing of high voltage double-circuit Power Lines – A Voluntary Code of Practice"26, published in February 2011 that defines the circumstances where industry can and will optimally phase lines with a voltage of 132kV and above. Applicant should demonstrate compliance with this.	Section 16.5 of this Volume	The overhead line has been designed in compliance with the Policy on Optimum phasing.
2.10.14	The diagram at the end of section 2.10 shows a basic decision tree for dealing with EMFs from overhead power lines to which the IPC can refer.	**Volume 5.16.1,** at **Inset 16.1**	This decision tree has been replicated at Inset 16.1 and forms the basis for the assessment of EMFs from the Proposed Development.
2.10.15	The applicant should have considered the following factors:	See below.	See below.
	- Height, position, insulation and protection (electrical or mechanical as appropriate) measures subject to ensuring compliance with the Electricity Safety, Quality and Continuity Regulations 2002	Section 16.5 of this Volume	The proposed overhead line has been designed to comply with the statutory requirements of the Electricity Safety, Quality and Continuity Regulations 2002. EMF requirements can result in conductor clearances to ground (one of the requirements of these regulations) being increased but always in compliances with the Electricity Safety, Quality and Continuity Regulations 2002. The minimum conductor clearance information provided in section 16.5 demonstrates this compliance.

Para	Requirement	ES Section	Compliance Assessment
	- That optimal phasing of high voltage overhead power lines is introduced wherever possible and practicable in accordance with the Code of Practice to minimise effects of EMFs;	Section 16.5.8 of this Volume	The overhead line has been designed in line with the Policy on Optimum phasing.
	- Any new advice emerging from the Department of Health relating to Government policy for EMF exposure guidelines.	Section 16.2 of this Volume	This has been considered in the policy and legislation sub-section of section 16.2 and all current advice has been used for the assessment. The assessment has been carried out against the current Government recommended EMF exposure guidelines and policies.
	- Where it can be shown that the line will comply with the current public exposure guidelines and the policy on phasing, no further mitigation should be necessary.	**S**ections 16.5 and 16.7 of this Volume	The Proposed Development has been shown to be compliant with current public exposure guidelines of ICNIRP 1998 and the policy on phasing using the principles in the DECC Codes of Practice.

16.2.6 The first consideration for the Examining Authority is set out below:-

"This NPS does not repeat the detail of the ICNIRP 1998 guidelines on restrictions or reference levels nor the 1999 EU Recommendation. Government has developed with the electricity industry a Code of Practice, "Power Lines: Demonstrating compliance with EMF public exposure guidelines – a voluntary Code of Practice", published in February 2011 that specifies the evidence acceptable to show compliance with ICNIRP (1998) in terms of the EU Recommendation. Before granting consent to an overhead line application, the IPC should satisfy itself that the proposal is in accordance with the guidelines, considering the evidence provided by the applicant and any other relevant evidence. It may also need to take expert advice from the Department of Health."

EN-5 Paragraph 2.10.9

16.2.7 Paragraph 2.10.9 of EN-5 mentions the February 2011 publication "Power Lines: Demonstrating compliance with EMF public exposure guidelines – a voluntary Code of Practice". This has now been replaced by a March 2012 edition with the same name. It states:-

"….

When is specific evidence of compliance required?

….

For …overhead power lines and underground cables at voltages of …400 kV.., when evidence of compliance with exposure guidelines is needed, the following will be provided:

A calculation or measurement of the maximum fields (i.e. directly under the line, or directly above the cable)

If this maximum value is less than the ICNIRP guideline levels, it may be assumed that all fields and exposures from that source will be compliant. If this maximum value exceeds the ICNIRP guideline levels, then it is also necessary to provide:
• A calculation or measurement of the field at the location of the closest property at which the public exposure guidelines apply
For overhead lines only, in addition:
• A statement as to compliance with the Code of Practice on phasing, including a justification in the terms of that Code of Practice if the line does not have optimum phasing".

Page 5, "Power Lines: Demonstrating compliance with EMF public exposure guidelines – a voluntary Code of Practice"

16.2.8 Compliance with the guidelines is electricity industry policy. The maximum electric field under the 400kV overhead line will be 3.9% below the ICNIRP guideline and the magnetic field will be 76.9% below the ICNIRP guideline. Further details of the assessment are set out in paragraphs 16.5.2 to 16.5.7. The maximum field above the 400 kV cable will be 73.5% below the ICNIRP guideline. Further details of the assessment are set out in paragraphs 16.5.15 to 16.5.22.

16.2.9 EN-5 also states:-

"There is no direct statutory provision in the planning system relating to protection from EMFs and the construction of new overhead power lines near residential or other occupied buildings. However, the Electricity Safety, Quality and Continuity Regulations 2002 set out the minimum height, position, insulation and protection specifications at which conductors can be strung between towers to ensure safe clearance of objects. The effect of these requirements should be that power lines at or below 132kV will comply with the ICNIRP 1998 basic restrictions, although the IPC should be satisfied that this is the case on the basis of the evidence produced as specified in the Code of Practice".

EN-5 Paragraph 2.10.10

16.2.10 The regulations quoted by paragraph 2.10.10 contain specific details in both the body of the Regulations and in one of Schedules. Regulation 17(2) and Schedule 2 of The Electricity Safety, Quality and Continuity Regulations 2002 require:-

Table 16.3 The Electricity Safety, Quality and Continuity Regulations 2002 – Minimum Height above Ground of Overhead Lines

Nominal Voltages	**Over Roads**	**Other Locations**
Exceeding 66,000 volts but not exceeding 132,000 volts	6.7 metres	6.7 metres
Exceeding 132,000 volts but not exceeding 275,000 volts	7 metres	7 metres
Exceeding 275,000 volts but not exceeding 400,000 volts	7.3 metres	7.3 metres

16.2.11 The Project complies with these requirements, and the minimum conductor clearance information is provided in section 16.5.5 which demonstrates this compliance.

16.2.12 In addition EN-5 states:-

"Industry currently applies optimal phasing to 275kV and 400kV overhead lines voluntarily wherever operationally possible, which helps to minimise the effects of EMF. The Government has developed with industry a voluntary Code of Practice, "Optimum Phasing of high voltage double-circuit Power Lines – A Voluntary Code of Practice", published in February 2011 that defines the circumstances where industry can and will optimally phase lines with a voltage of 132kV and above. Where the applicant cannot demonstrate that the line will be compliant with the Electricity Safety, Quality and Continuity Regulations 2002, with the exposure guidelines as specified in the Code of Practice on compliance, and with the policy on phasing as specified in the Code of Practice on optimal phasing then the IPC should not grant consent".

EN-5 Paragraph 2.10.11

16.2.13 Paragraph 2.10.11 of EN-5 mentions the February 2011 publication "*Optimum Phasing of high voltage double-circuit Power Lines – A Voluntary Code of Practice*". This has now been replaced by a March 2012 edition with the same name. It states that a member of the Energy Networks Association such as National Grid will:

- *Design and construct new high voltage electric lines to include optimum phasing, unless this is unreasonable;*

- *Convert existing electric lines to optimum phasing when they are undergoing maintenance that involves replacing the conductors, unless this is unreasonable; and*
- *Where necessary, "unreasonable" will be interpreted in terms of the cost-benefit analysis presented in the SAGE First Interim Assessment (2007)".*

Page 5 "Optimum Phasing of high voltage double-circuit Power Lines – A Voluntary Code of Practice"

16.2.14 National Grid has designed the project with optimum phasing in accordance with the first bullet of the Code of Practice. The other two bullet points do not apply. Further details of the phasing are set out in paragraph 16.5.8.

16.2.15 As summarised above, Government has set out clear policies on control of EMF exposures in general. NPS EN-5 (Ref. 16.1) gives clear guidance on the EMF requirements of all electricity infrastructure projects stating:

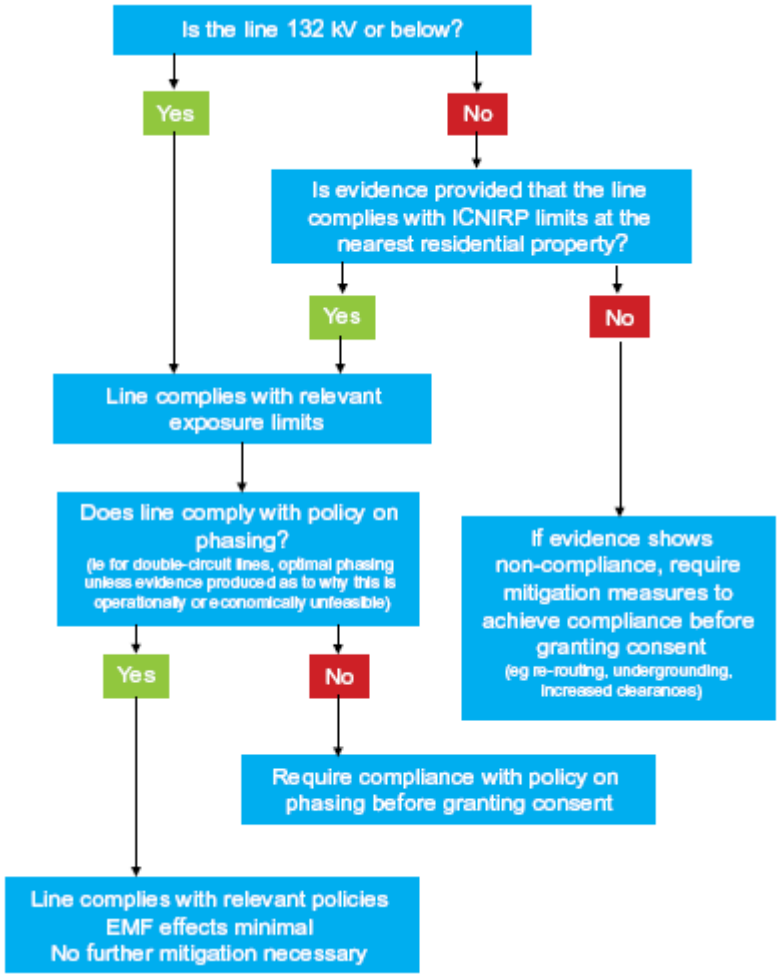
"2.10.9…Before granting consent to an overhead line application, the IPC should satisfy itself that the proposal is in accordance with the guidelines, considering the evidence provided by the applicant and any other relevant evidence."

And

"2.10.11…Where the applicant cannot demonstrate that the line will be compliant …… with the exposure guidelines as specified in the Code of Practice on compliance, and with the policy on phasing as specified in the Code of Practice on optimal phasing then the IPC should not grant consent."

16.2.16 A simplified route map for dealing with EMFs is provided in NPS EN-5 and is reproduced in **Inset 16.1**.

Inset 16.1: Simplified Route Map for Dealing with EMFs Reproduced from NPS EN-5 (Pg. 23)



16.2.17 All relevant policies and guidance, such as those contained within NPS EN-1 (Ref. 16.5) and EN-5 (Ref. 16.1) have been reviewed and applied to this assessment of the proposed development. These policies, guidance and legislation are explained and documented below including, for openness and transparency, a commentary of the science on which these have been based.

Exposure Limits

16.2.18 In March 2004 the NRPB provided new advice to Government, replacing previous advice from 1993, and recommending the adoption in the UK of guidelines published in 1998 by the ICNIRP (Ref. 16.3). The Government subsequently adopted this recommendation, saying that limits for public exposures should be applied in the terms of the 1999 EU Recommendation (Ref. 16.4). **Table 16.4** summarises the recommended values for power frequencies.

Table 16.4 Recommended Values for Power Frequencies

Public Exposure Levels	Electric Fields	Magnetic Fields
Basic restriction (induced current density in central nervous system)	$2mA/m^2$	
Reference level (external unperturbed field)	5,000V/m	100µT
Field corresponding to the basic restriction	9,000V/m	360µT

16.2.19 In recommending these levels, the NRPB considered the evidence for all suggested effects of EMFs. They concluded that the evidence for effects on the nervous system of currents induced by the fields was sufficient to justify setting exposure limits, and this is the basis of their quantitative recommendations (Ref. 16.6). They concluded that the evidence for effects at lower fields, for example the evidence relating to childhood leukaemia, was not sufficient to justify setting exposure limits, but was sufficient to justify recommending that Government consider possible precautionary actions. Precautionary measures are considered in more detail below.

16.2.20 The EMF guidelines are documented in NPS EN-5 (Ref. 16.1) and practical details of their application are explained in the Code of Practice, 'Power Lines: Demonstrating compliance with EMF public exposure guidelines – a voluntary Code of Practice' (Ref. 16.2) published by the Department of Energy and Climate Change (DECC). It is the electricity industry's policy to comply with Government guidelines on EMF, and this Code of Practice forms an integral part of this policy.

16.2.21 The ICNIRP guidelines (Ref. 16.3) recommend that the general public are not exposed to levels of EMFs able to cause a current density of more than $2mA/m^2$ within the human central nervous system, as shown in the table. This recommendation is described as the "basic restriction". The external fields that have to be applied to the body to cause this current density have to be calculated by numerical dosimetry, since *in-vivo* measurements of current density are not practical.

16.2.22 The ICNIRP guidelines also contain values of the external fields called "reference levels". For the public, the reference level for electric fields is 5kV/m, and the reference level for magnetic fields is 100µT. The 1999 EU Recommendation (Ref. 16.4) uses the same values as ICNIRP (Ref. 16.3).

16.2.23 In the ICNIRP guidelines and the EU Recommendation, the actual limit is the basic restriction. The reference levels are not limits, but are guides to when detailed investigation of compliance with the actual limit, the basic restriction, is required. If the reference level is not exceeded, the basic restriction cannot be exceeded and

no further investigation is needed. If the reference level is exceeded, the basic restriction may or may not be exceeded.

16.2.24 The Code of Practice (Ref. 16.2) endorses this approach and gives the values of field corresponding to the basic restriction, stating:

"The 1998 ICNIRP exposure guidelines specify a basic restriction for the public which is that the induced current density in the central nervous system should not exceed 2mA m^{-2}. The Health Protection Agency specify that this induced current density equates to uniform unperturbed fields of 360μT for magnetic fields and 9.0kV m^{-1} for electric fields. Where the field is not uniform, more detailed investigation is needed. Accordingly, these are the field levels with which overhead power lines (which produce essentially uniform fields near ground level) shall comply where necessary. For other equipment, such as underground cables, which produce non-uniform fields, the equivalent figures will never be lower but may be higher and will need establishing on a case-by-case basis in accordance with the procedures specified by HPA. Further explanation of basic restrictions, reference levels etc is given by the Health Protection Agency."

16.2.25 The Code of Practice (Ref. 16.2) also specifies the land uses where exposure is deemed to be for potentially a significant period of time and therefore where the public guidelines apply. These land uses are, broadly, residential uses and schools.

16.2.26 Therefore, if the fields produced by an item of equipment are lower than 9kV/m and 360μT, the fields corresponding to the ICNIRP basic restriction, it is compliant with the ICNIRP guidelines and hence with Public Health England (PHE) recommendations and Government policy. If the fields are greater than these values, it is still compliant with Government policy if the land use falls outside the residential and other uses specified in the Code of Practice (Ref. 16.2) and it may still be compliant if the fields are non-uniform.

Occupational Exposure

16.2.27 The ICNIRP occupational guidelines are higher than the public guidelines, by, broadly, a factor of five. Therefore, where the fields are compliant with the public guidelines, any occupational activities will also be compliant with the relevant guidelines.

16.2.28 The occupational guidelines do not yet have a clear paper trail of implementation in the UK in the way that the public exposure guidelines do. It is anticipated that occupational limits (based on ICNIRP 2010 (Ref. 16.7) rather than ICNIRP 1998 (Ref. 16.3, see below) will acquire legal force through an EU Directive (Ref. 16.8) adopted in Europe in 2013, which will be brought into force in the UK in due course by Regulation. The present situation is that they have force through the Health and Safety Executive's endorsement of them.

16.2.29 Employers have a duty of care to their employees. Employers discharge that duty of care in relation to EMFs by complying with the relevant exposure limits. Occupational exposure guidelines are higher than the public exposure guidelines which the Proposed Development will be compliant with. Therefore all exposures from the proposed development will be compliant with the occupational exposure limits and an employer need take no additional action in order to comply.

Future Changes

16.2.30 As discussed, current Government policy is based on the limits from the 1998 ICNIRP Guidelines (Ref. 16.3), in the terms of the 1999 EU Recommendation (Ref. 16.4). In 2010, ICNIRP published new exposure guidelines (Ref. 16.7) for the range of frequencies including power frequencies. These new guidelines do not apply in the UK unless and until Government decide to adopt them. This is clear in the Code of Practice on Compliance (Ref. 16.2):

"Current Government policy on electric and magnetic fields (EMFs) is that power lines should comply with the 1998 ICNIRP Guidelines on exposure to EMFs in the terms of the 1999 EU Recommendation, and this Code of Practice implements this policy. As and when either ICNIRP issue new Guidelines or the EU revise the Recommendation, it will be for Government to consider those changes and to decide whether to adopt them or not. If Government policy changes, this Code of Practice will also be changed accordingly, but until that happens, the present policy as reflected in this Code of Practice remains in force."

16.2.31 In fact, ICNIRP's intention in its new guidelines does not appear to be to make the guidelines either more or less onerous. It takes account of the most recent scientific developments. But having done so, the key scientific effects used as the basis for the guideline levels are essentially unchanged, and the safety margins applied are broadly unchanged. The detailed values derived as basic restrictions and reference levels have changed, but this is principally a consequence of a different method of derivation, without representing any change in scientific thinking about the appropriate level of protection. National Grid's assessment is that the Proposed Development would in fact be compliant with those Guidelines were they ever to be introduced.

Precautionary Measures

16.2.32 As well as these established effects, over the past 30 years it has been suggested that exposure to power-frequency magnetic or electric fields of the magnitude encountered in the environment could be linked with various health problems, ranging from headaches to Alzheimer's disease and cancer. The most persistent of these suggestions relates to childhood leukaemia. A number of epidemiological studies have suggested a statistical association between the incidence of childhood leukaemia and the proximity of homes to power transmission and distribution equipment or power-frequency magnetic-field strengths in the homes. However, no causal link has been established between cancer (or any other disease) and magnetic or electric fields and indeed there is no established mechanism by which these fields could cause or promote the disease.

16.2.33 The question of possible health effects of environmental power-frequency fields has been thoroughly reviewed in recent years by a number of national and international bodies. The principal such bodies that have authoritative relevance in the UK are the Public Health England (formerly the HPA), the International Agency for Research on Cancer (IARC), WHO, the official scientific advisory committee for the EU the Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR), and the standards-setting body the ICNIRP.

16.2.34 When assessing the scientific evidence on EMFs, it is essential to consider all the evidence and to perform an overall assessment of the evidence, weighting each strand of evidence and each individual study as appropriate to its strengths and weaknesses. No single study can ever be conclusive (in either direction).

16.2.35 Such reviews have been performed by the authoritative expert bodies, and it is those bodies that provide the most reliable conclusions, and on whose conclusions Government policy is based. The following are summaries of the conclusions of these relevant authoritative review bodies.

The National Radiological Protection Board/The Health Protection Agency/Public Health England

16.2.36 In 2004 the then NRPB published new "Advice on Limiting Exposure to Electromagnetic Fields (0-300GHz)" (Ref. 16.9) and accompanied it with a "Review of the Scientific Evidence for Limiting Exposure to Electromagnetic Fields (0-300GHz)" (Ref. 16.6). The former summarises epidemiological evidence as follows (p15):

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

55 "Studies of occupational exposure to ELF EMFs do not provide strong evidence of associations with neurodegenerative diseases…..

56 "Studies of suicide and depressive illness have given inconsistent results in relation to ELF EMF exposure, and evidence for a link with cardiovascular disease is weak.

57 "The overall evidence from studies of maternal exposure to ELF EMFs in the workplace does not indicate an association with adverse pregnancy outcomes, while studies of maternal exposure in the home are difficult to interpret.

58 "Results from studies of male fertility and of birth outcome and childhood cancer in relation to parental occupational exposure to ELF EMFs have been inconsistent and unconvincing.

59 "All these conclusions are consistent with those of AGNIR (2001).

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

International Agency for Research on Cancer

16.2.37 The IARC is an agency of the WHO. Its Unit of Carcinogen Identification and Evaluation has, since 1972, periodically published Monographs, which assess the evidence that various agents are carcinogenic and classify the agents accordingly. In June 2001, a Working Group met to consider static and ELF EMFs (Ref. 16.10). Power-frequency magnetic fields were classified as “possibly carcinogenic”, on the basis of “limited” evidence from humans concerning childhood leukaemia, “inadequate” evidence from humans concerning all other cancer types, and “inadequate” evidence from animals. Power-frequency electric fields were judged “not classifiable” on the basis of “inadequate” evidence from both humans and animals. These classifications are consistent with the conclusions reached by the NRPB.

World Health Organisation

16.2.38 WHO published an Environmental Health Criteria Monograph in 2007 on ELF EMFs (Ref. 16.11), produced by a Task Group that met in 2005. This concluded, in part:

“Chronic effects

Scientific evidence suggesting that everyday, chronic low-intensity (above 0.3-0.4μT) power-frequency magnetic field exposure poses a health risk is based on epidemiological studies demonstrating a consistent pattern of increased risk for childhood leukaemia. Uncertainties in the hazard assessment include the role that control selection bias and exposure misclassification might have on the observed relationship between magnetic fields and childhood leukaemia. In addition, virtually all of the laboratory evidence and the mechanistic evidence fail to support a relationship between low-level ELF magnetic fields and changes in biological function or disease status. Thus, on balance, the evidence is not strong enough to be considered causal, but sufficiently strong to remain a concern.

A number of other diseases have been investigated for possible association with ELF magnetic field exposure. These include cancers in both children and adults, depression, suicide, reproductive dysfunction, developmental disorders, immunological modifications and neurological disease.

The scientific evidence supporting a linkage between ELF magnetic fields and any of these diseases is much weaker than for childhood leukaemia and in some cases (for example, for cardiovascular disease or breast cancer) the evidence is sufficient to give confidence that magnetic fields do not cause the disease.”

Scientific Committee on Emerging and Newly Identified Health Risks

16.2.39 SCENIHR is the European Union's Scientific Committee on Emerging and Newly Identified Health Risks. On January 19 2009 SCENIHR published its most recent report on EMFs, "Health Effects of Exposure to EMF" (Ref. 16.12). National Grid understands that SCENIHR’s next report is expected to be published during 2014. The section of the abstract concerned with power-frequency fields states:

"The few new epidemiological and animal studies that have addressed ELF exposure and cancer do not change the previous assessment that ELF magnetic fields are a possible carcinogen and might contribute to an increase in childhood leukaemia. At present, in vitro studies did not provide a mechanistic explanation of this epidemiological finding.

No new studies support a causal relationship between ELF fields and self-reported symptoms.

New epidemiological studies indicate a possible increase in Alzheimer's disease arising from exposure to ELF. Further epidemiological and laboratory investigations of this observation are needed.

Recent animal studies provided an indication for effects on the nervous system at flux densities from 0.10-1.0 mT. However, there are still inconsistencies in the data, and no definite conclusions can be drawn concerning human health effects.

Very few recent in vitro studies have investigated effects from ELF fields on diseases other than cancer and those available have very little relevance. There is a need for hypothesis-based in vitro studies to examine specific diseases.

It is notable that in vivo and in vitro studies show effects at exposure levels (from 0.10mT and above) to ELF fields that are considerably higher than the levels encountered in the epidemiological studies (µT-levels) which showed an association between exposure and diseases such as childhood leukaemia and Alzheimer's disease. This warrants further investigation."

Conclusions from Reviews of Science

16.2.40 Thus, there is some scientific evidence suggesting that electric or, particularly, magnetic fields may have health effects at levels below the current UK exposure guidelines. The authoritative classification is the WHO's, in 2001 (Ref. 16.10) and reiterated in 2007 (Ref. 16.11), that power-frequency magnetic fields are "possibly" a cause of cancer, specifically just of childhood leukaemia, with the evidence relating to any other health effect "much weaker". The Government has addressed this uncertainty by adopting precautionary measures relating to various sources of EMFs.

16.2.41 The only specific precautionary measure that relates to high-voltage power lines or any other high-voltage transmission equipment is a policy of "optimum phasing". "Phasing" is the order in which the conductors of the two circuits are connected relative to each other, and certain phasing arrangements produce lower magnetic fields than others. This policy was introduced in the Written Ministerial Statement of 2009 in response to a recommendation from the Stakeholder Advisory Group on ELF EMFs (SAGE) in its First Interim Assessment (Ref. 16.13). The details are given in a second Code of Practice, 'Optimum Phasing of high voltage double-circuit Power Lines' (Ref. 16.14).

16.2.42 "Optimum phasing" is the phasing that produces the lowest magnetic fields to the sides of the line, taking account of the likely current flows in the line. The Code of Practice (Ref. 16.14) states that new power lines should have optimum phasing where reasonable. It explains that it will normally be possible to achieve optimum phasing simply by choosing how to order the connections at the end of the line, but that if achieving optimum phasing would either require an extra structure or would

conflict with the requirements for power system stability, this would normally be "unreasonable" and is not required.

16.2.43 All the relevant scientific evidence on EMFs was considered fully in the process of establishing the exposure guidelines that apply in the UK. Those exposure guidelines together with the policy on optimum phasing (and other precautionary policies that relate only to low-voltage equipment) are considered by the PHE and Government to be the appropriate response to that evidence.

16.2.44 Government have specifically rejected the introduction of "corridors" around power lines on EMF grounds, stating of this option (Ref. 16.15):

"The Government therefore considers this additional option to be disproportionate in the light of the evidence base on the potential health risks arising from exposure to ELF/EMF and has no plans to take forward this action."

16.2.45 Having thus established that it is not Government policy to have restrictions on homes and schools near power lines, the Statement goes on to say (paragraph 38):

"It is central Government's responsibility (rather than individual local authorities) to determine what national measures are necessary to protect public health."

16.2.46 This makes it clear that Government has not introduced any restrictions on constructing new power lines close to existing properties on grounds of safety or health risks, and neither is it appropriate for individual local authorities to do so.

16.2.47 Therefore, no additional measures or precautions are necessary or appropriate beyond the exposure guidelines and the policy on optimal phasing.

Microshocks

16.2.48 Under high-voltage overhead lines conducting objects may become electrically charged if they are isolated from earth. If this charged object is then touched by a person at a different electrical potential, charge is transferred between the person and the object. When the person is very close to the object but before touching it, the voltage difference between the person and the object can be sufficient to cause the air in the gap to break down and a small spark discharge occurs. This can be perceived by the person and is known as a microshock.

16.2.49 The size of a microshock depends on the size of the electric field, the sizes of the objects concerned, how well grounded or insulated they are, meteorological conditions, and the sensitivity of the skin. All of these factors determine the severity of the perception which can range from barely perceptible through to annoyance and in some rare circumstances even pain. Microshocks are similar to the static shocks that can occur by, for example, walking across a nylon carpet in dry weather. Microshocks have no known long-term health effects and any sensation is normally confined to the momentary spark discharge as contact is made or broken.

16.2.50 In a 2005 Information Sheet (Ref. 16.16), HPA (now PHE) state:

"…on the basis of the available evidence, the direct effects of microshocks on the body are not considered capable of producing lasting harm. The response to some

extent will depend on the sensitivity of the individual. Although the possibility of microshocks cannot be ruled out, in field strengths up to about 5kV m^{-1} they are unlikely to be painful to the majority of people."

16.2.51 Microshocks are indirect effects and as such are not directly covered by quantitative limits that protect against direct effects of electric fields. The ICNIRP guidelines (Ref. 16.3) do have a cautionary reference level of 5kV/m, but limiting exposure to 5kV/m is not considered the most appropriate way of dealing with microshocks. Reducing electric fields by changes to the design are possible, but will usually result in taller pylons, increasing the visual impact of the overhead line. As there is no threshold of electric field for preventing microshocks, the benefit of reducing the field to 5kV/m may be marginal. Rather than introducing an arbitrary limit the Code of Practice on compliance (Ref. 16.2) states:

"…..there is a suite of measures that may be called upon in particular situations, including provision of information, earthing, and screening, alongside limiting the field which should be used to reduce the risk to the public of indirect effects. In some situations, there may be no reasonable way of eliminating indirect effects, for instance where erecting screening would obstruct the intended use of the land."

16.2.52 A separate code of practice on microshocks, developed jointly by Industry and DECC, has been adopted (Ref. 16.17). This follows the principles for managing microshocks quoted above, but contains more details on the practical measures which can be taken.

16.2.53 The proposed overhead line has been designed to comply with the government exposure limits for electric fields, ensuring 9kV/m is not exceeded, and in accordance with the Code of Practice demonstrated in 16.5.10. Some areas under the proposed overhead line will have electric fields which could potentially cause microshocks to occur if the correct set of circumstances exists. National Grid will ensure that if microshocks are reported these will be investigated and mitigated where appropriate, following the provisions of the Code of Practice (Ref. 16.17).

Active Implantable Medical Devices

16.2.54 EMFs can affect AIMDs, such as pacemakers, insulin pumps and Implanted Cardiac Defibrillators (ICDs) if the external field strength exceeds the immunity of the device. EMFs can induce voltages in the body which, if high enough, can exceed the immunity of the device and temporarily affect its operation.

16.2.55 All modern AIMDs are required to be immune from interference from magnetic EMFs up to the ICNIRP General Public Reference Levels of 1999/519/EC (Ref. 16.4) where the AIMD has been implanted and programmed in a standard manner. The ICNIRP General Public Reference levels at 50Hz are 100µT for magnetic fields and 5kV/m for electric fields. However, many AIMDs will have considerably higher immunity to external EMFs than the minimum requirements.

16.2.56 Specifically, the Active Implantable Medical Devices Directive (90/385/EEC) (Ref. 16.18) includes the following provision:

"Devices must be designed and manufactured in such a way as to remove or minimize as far as possible: …risks connected with reasonably foreseeable environmental conditions such as magnetic fields, external electrical influences…"

16.2.57 Neither National Grid nor the Medicines and Healthcare products Regulatory Agency (MHRA) are aware of any instance of a patient with a modern, correctly fitted AIMD experiencing any interference from the electricity transmission system.

16.2.58 The proposed underground cables and overhead lines are capable of producing electric and magnetic fields in excess of the ICNIRP General Public Reference Levels (Ref. 16.3), but which remain lower than the public exposure guideline limit. In theory, therefore, some interference of EMFs with AIMDs could possibly occur. However, some existing National Grid overhead lines and underground cables are likewise theoretically capable of producing fields that exceed the public reference levels, and neither the MHRA or National Grid are aware of any instance of electricity transmission infrastructure interfering with a correctly fitted modern AMID such as a pacemaker or ICD. The risk of any interference occurring is not significant in practice for the following reasons:

- manufacturers have to ensure that AIMDs are immune up to the General Public Reference Level, however many modern AIMDs will be immune to EMFs considerably in excess of these levels; and

- the maximum EMFs from an overhead line or underground cable as calculated for assessing compliance with the exposure limits represent a worst case scenario, chosen to demonstrate that exceeding the exposure guidelines is not possible. Typically, however, the overhead line will produce EMFs lower than these levels for two reasons: the circuits are unlikely to operate at the maximum rating routinely, and a typical current on a day to day basis would be around 50% or less; and typically the conductors of an overhead line will be higher than the minimum design clearance used for assessing compliance, therefore reducing the EMFs, with the minimum clearance found only in a limited area towards the middle of certain spans.

16.2.59 Thus, there is considerable confidence in saying that, based on the absence of reported incidents and the typical EMF exposures that will occur on a daily basis, transmission assets do not appear to interfere with AMIDs in practice. The risk of any interference occurring is assessed as being negligible and does not constitute a significant effect.

16.2.60 This is confirmed in NPS EN-5 (July 2011) (Ref. 16.1), at section 2.10.7, which states that:

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

Farming, Flora and Fauna

16.2.61 The NPS for Electricity Networks Infrastructure (EN-5) (July 2011) (Ref. 16.1) in Part 2, section 2.10.8 states "*There is little evidence that exposure of crops, farm animals or natural ecosystems to transmission line EMFs has any agriculturally significant consequences."*

Summary of Policy

16.2.62 The EMF policies applying to high-voltage electricity equipment comprise compliance with the exposure guidelines; the policy on optimum phasing, the policy on indirect effects expressed in the code of practice; but no other policies.

16.2.63 NPS EN-5 (July 2011) explicitly applies these policies to applications for consent for new overhead lines. If a proposed overhead line complies with the relevant exposure guidelines and the policy on optimum phasing, there are no grounds in relation to EMFs not to grant consent.

Issues Raised in the EIA Scoping Opinion

16.2.64 In the Environmental Impact Assessment (EIA) Scoping Report submitted to PINS, National Grid set out the scope of the Environmental Statement including areas to be scoped out of the full assessment.

16.2.65 It was proposed that EMC be scoped out of the full assessment which was accepted by the Secretary of State with the following commentary in the Scoping Opinion:

"3.18 Electro-magnetic compatibility has been scoped out because the overhead line, sealing end compounds and underground cable proposed for the project are similar in construction and operation to those tested in the Technical Construction File and covered by the Certificate of Conformity in Appendix E of the Scoping Report. The Secretary of State (SoS) agrees that electro-magnetic compatibility can be scoped out of the ES. It would be helpful to demonstrate in the ES that the specification of the overhead line, sealing end compounds and underground cable proposed for the project are similar to those tested in the Technical Construction File"

And

"3.19 If the specification of the overhead line, sealing end compounds and underground cable changes such that they are no longer covered by the Certificate of Conformity then electro-magnetic compatibility should be scoped into the ES."

16.2.66 National Grid has addressed these points below.

Electromagnetic Compatibility

16.2.67 In 2009 the European Council Directive on electromagnetic compatibility, 89/336/EEC (Ref. 16.19) and its amendments, was enacted into UK law. The main objective of the EMC Directive is to guarantee the free movement of electrical and electronic appliances and to create an acceptable electromagnetic environment within the European Union.

16.2.68 Fixed apparatus and large networks of the type owned and operated by National Grid are also included in the EMC Directive. The requirements of the EMC Directive are that the electromagnetic disturbance that the apparatus generates should not exceed a level allowing radio and telecommunication equipment and other apparatus to operate as intended; and the apparatus has an adequate level of intrinsic immunity to electromagnetic disturbance to enable it to operate as intended.

16.2.69 The main source of interference from transmission systems arises from RF emissions caused by corona discharge. RF emissions and corona levels are

limited by designing to National Grid's technical specifications which include BS5049-3 (Ref. 16.20), along with other equipment specific standards such as BS EN60437 (Ref. 16.21) for the insulators on the pylons. These same specifications have been applied to the T-pylon design to ensure its RF emissions and corona levels (the main sources resulting in EMC issues) will be of similar or better performance to the existing lattice towers.

16.2.70 National Grid's Transmission System has met the essential requirements detailed in Article 4 of the EMC Directive. This was achieved by creating a TCF as per article 10.2 of the EMC Directive (Ref. 16.19). The TCF is based on a combination of extensive on-site testing (overhead lines and substations) and examination of National Grid's technical specifications, policies and standards to ensure that radio noise and corona are adequately addressed. The on-site surveys showed that there were no significant emission problems to address; and equipment technical specifications and policies ensured equipment was designed in accordance with British Standards to limit RF noise and corona. Using the rationale of the TCF it was determined that the National Grid system meets the essential requirements of the EMC Directive. A Certificate of Conformity was issued and is provided at **Volume 5.16.2, Appendix 16A**.

16.2.71 Underground cables were acknowledged in this assessment but it was not considered necessary to perform measurements on these. The electric fields from these cables are screened; however power frequency magnetic fields are always present. Power frequency magnetic fields reduce very quickly with distance (see section 16.5.5) and are not a source of RF emissions themselves.

16.2.72 A significant portion of the TCF is establishment of good engineering practices to ensure that RF, corona and therefore EMC issues are adequately considered in the design and installation specifications. National Grid's technical specifications ensure that all equipment prone to RF emissions is designed and tested so these remain within acceptable levels as set out in BS5049-3 (Ref. 16.20). The proposed overhead line will contain electrical equipment that is similar to those tested by on-site measurements documented in the TCF, and will also be designed to the same technical specifications.

16.2.73 The T-pylon is a new pylon type and was therefore not explicitly included in the TCF. However, it is made up from basically the same subsystems (conductors system, insulators, and fittings) as existing pylon designs, and each of these subsystems is governed by the same National Grid technical specifications as were applied to the existing designs. Therefore, as the technical specifications are the same for the T-pylon as those applied to existing National Grid overhead lines already tested in the TCF the overall EMC performance of the T-pylon will be designed within the same acceptable limits as that of existing lattice pylons with similar conductors.

16.2.74 Given the technical specifications and standards covering RF emissions and corona for the T-pylon are the same as those covering our existing transmission systems; and that the EMC performance of this system has been certificated as compliant with Directive 89/336/EEC (Ref. 16.19) by a Competent Body following appropriate onsite testing, the proposed development will therefore present no issues with TV or radio interference under normal operating conditions.

16.2.75 This addresses the points raised by the Secretary of State in the Scoping Opinion and EMC is therefore scoped out of this ES.

16.3 Method

Study Area

16.3.1 The study area of the assessment includes all areas where the EMFs could potentially extend from the electrical assets of the Proposed Development. This is asset rather than location-specific and also includes consideration of any changes in alignment that could occur within the Limits of Deviation proposed for the development. This ensures that the equipment will be compliant with exposure guidelines irrespective of the Proposed Development's exact location within the Limits of Deviation.

16.3.2 The assessment considers the EMFs produced from the electricity assets associated with the Proposed Development. Each asset is assessed including the cumulative impacts on existing assets.

Predicted Field Levels

16.3.3 The magnetic field produced by the currents in an electrical circuit falls with distance from the circuit. The magnetic field is highest at the point of closest approach to the conductors and falls quite rapidly with distance. Similarly, there is partial cancellation between the electric fields produced by the voltages on individual conductors, and the electric field is usually highest at the point of closest approach to the conductors and falls quite rapidly with distance.

16.3.4 For sources of field with a simple, defined geometry, such as overhead lines and underground cables, calculations are the best way of assessing fields and are acceptably accurate. The calculations of fields presented here follow the provisions specified in the Code of Practice on Compliance (Ref. 16.2) and were performed using specialised computer software that has been validated against direct measurement (Ref. 16.22) including industry standard modelling package EFC-400 v2012 and in-house modelling package EM2D.

16.3.5 Since field strengths are constantly varying, they are usually described by reference to an averaging calculation known as the "root mean square" or RMS. Future mention of power-frequency field strengths in this chapter will mean the RMS amplitude of the power-frequency modulation of the total field, which is the conventional scientific way of expressing these quantities.

16.3.6 To assess compliance with exposure limits, the Code of Practice (Ref. 16.2) specifies that the maximum fields the line is capable of producing should be calculated using the following conditions:

- electric fields: for nominal voltage and design minimum clearance;
- magnetic fields: for the highest rating that can be applied continuously in an intact system (i.e. including ratings which apply only in cold weather, but not including short-term ratings or ratings which apply only for the duration of a fault elsewhere in the electricity system) and design minimum clearance; and
- electric and magnetic fields: for 1m above ground level, of the unperturbed field, taking account of the correct wire type and bundle size, taking account of the basic pylon geometry for the design of overhead line in question, but ignore

variations in wire spacing at angle pylons etc, of the 50 Hz component ignoring harmonics, ignoring zero-sequence currents and voltages and currents induced in the ground or earth wire, and using the infinite-straight-line approximation.

16.3.7 The calculations for the proposed development were thus performed using worst case conditions including minimum conductor clearances for overhead lines, minimum burial depth for cables, and maximum rating. The circuits are unlikely to operate at this maximum rating routinely, therefore resulting in lower typical magnetic fields on a day to day basis.

16.3.8 Electric fields (but not magnetic fields) are readily perturbed by conducting objects, including, for example, buildings, fences and trees. The fields calculated here are unperturbed fields, as specified by the Code of Practice (Ref. 16.2). These give a valid indication of the size of any electric-field related phenomena over the area concerned, but the local value, close to a source of perturbation, would vary. In practice, perturbations within or to the sides of buildings and other fixed objects usually act so as to reduce, not increase, the electric field. Fields inside any buildings are generally much reduced. However, the Code of Practice (Ref. 16.2) specifies that it is acceptable to demonstrate compliance by reference to the unperturbed fields.

Assessment of Effects

16.3.9 The Proposed Development would be assessed as having a significant effect if non-compliance with the EMF exposure limits was demonstrated, using the principles set out in Codes of Practice 'Power Lines: Demonstrating compliance with EMF public exposure guidelines – a voluntary Code of Practice' (Ref. 16.2). Conversely, as specified in NPS EN-5 (Ref. 16.1), if the Proposed Development complies with the exposure limits and with the policy on phasing (Ref. 16.14), EMF effects are assessed as not significant and no mitigation is necessary.

16.4 Baseline Environment

16.4.1 The Proposed Development is located within a mixture of rural, urban and industrial areas, all of which accommodate existing electrical assets. All equipment that generates, distributes or uses electricity produces EMFs. The UK power frequency is 50 Hz which is the principal frequency of the EMFs produced.

16.4.2 EMFs both occur naturally. The Earth's magnetic field, which is caused mainly by currents circulating in the outer layer of the Earth's core is roughly 50 µT in the UK. This field may be distorted locally by ferrous minerals or by steelwork such as in buildings. At the Earth's surface there is also a natural electric field, created by electric charges high up in the ionosphere, of about 100 V/m in fine weather.

16.4.3 As detailed earlier in the chapter, the earth's natural fields are static, and the power system produces alternating fields. In homes in the UK that are not close to high-voltage overhead lines or underground cables, the average "background" power-frequency magnetic field (the field existing over the whole volume of the house) ranges typically from 0.01 – 0.2 µT with an average of approximately 0.05 µT, normally arising from currents in the low-voltage distribution circuits that supply

electricity to homes (Ref. 16.23). The highest magnetic fields to which most people are exposed arise close to domestic appliances that incorporate motors and transformers. For example, close to the surface, fields can be 2000 µT for electric razors and hair dryers, 800 µT for vacuum cleaners, and 50 µT for TVs and washing machines. The electric field in most homes is in the range 1-20 V/m, rising to a few hundred V/m close to appliances (Ref. 16.23).

16.4.4 Currently there are existing 132kV overhead lines which produce EMF; these are assessed in section 16.5.

16.5 Prediction and Assessment of the Significance of the Potential Effects

Construction Effects

16.5.1 During construction and prior to energisation, transmission equipment will not produce any significant EMFs; therefore this is not considered further.

Operational Effects

Overhead Lines – Compliance with Exposure Limits

16.5.2 132kV overhead lines are specified in the Code of Practice (Ref. 16.2) as a type of equipment that is inherently compliant with Government exposure limits due to the design. Evidence for demonstration of compliance with Government exposure guidelines for 132kV cables is maintained at:

http://www.energynetworks.org/electricity/she/emfs.html.

16.5.3 However, calculations of the EMFs from 132kV overhead lines are provided for completeness.

16.5.4 The overhead line design will influence the EMFs produced and therefore each of the proposed pylon designs has been assessed separately.

16.5.5 The new double circuit 400kV overhead line would be constructed using a combination of standard lattice and T-pylons. Standard lattice pylons will be constructed at the Hinkley Point line entries. The remainder of the route (excluding the underground section) will consist of T-pylons, with the exception of Section G and H where standard lattice pylons are proposed. Twin Redwood conductor bundles will be used for the proposed 400kV overhead line, except for the Hinkley Point line entries where a smaller conductor bundle is proposed. This would be a twin high temperature low sag (HTLS) or equivalently rated conductor bundle. All spans would have a minimum conductor design clearance to ground of 8.1m. The new double circuit 132kV overhead lines would be constructed using lattice pylons, which would be strung with single UPAS conductor with a minimum conductor design clearance of 6.7m. A small section of single circuit 132kV wood pole overhead line is also proposed strung with single UPAS conductor. All of the pylon types proposed are shown at **Volume 5.3.3, Figure 3.8**.

16.5.6 Calculations for the 400kV overhead line were performed at the pre-fault continuous rating of the twin Redwood conductor bundle which is 3870 Amps and 3760 Amps for HTLS or equivalent bundle; and nominal voltage (400kV) at 1m above ground. The highest calculated EMFs produced by the overhead line using

the worst case conditions are shown in **Tables 16.5 and 16.6**. All calculations were performed in accordance with the conditions set out in the codes of practice.

Table 16.5 Calculated Maximum EMFs from 400kV Overhead Line Designs

Pylon Type	Conductor Bundle	Maximum Electric Field at Nominal Voltage (kV/m)	Maximum Magnetic Field at Pre-Fault Continuous Loading (μT)
Standard Lattice Pylon	Twin High temperature low sag (HTLS) or equivalently rated conductor	7.87*	80.1**
Standard Lattice Pylon	Twin Redwood	8.65*	83.1**
T-pylon	Twin Redwood	8.38*	73.2**

* the public exposure limit for electric fields is 9.00kV/m

**the public exposure limit for magnetic fields is 360.0μT

Table 16.6 Calculated Maximum EMFs from 132kV Overhead Line Designs

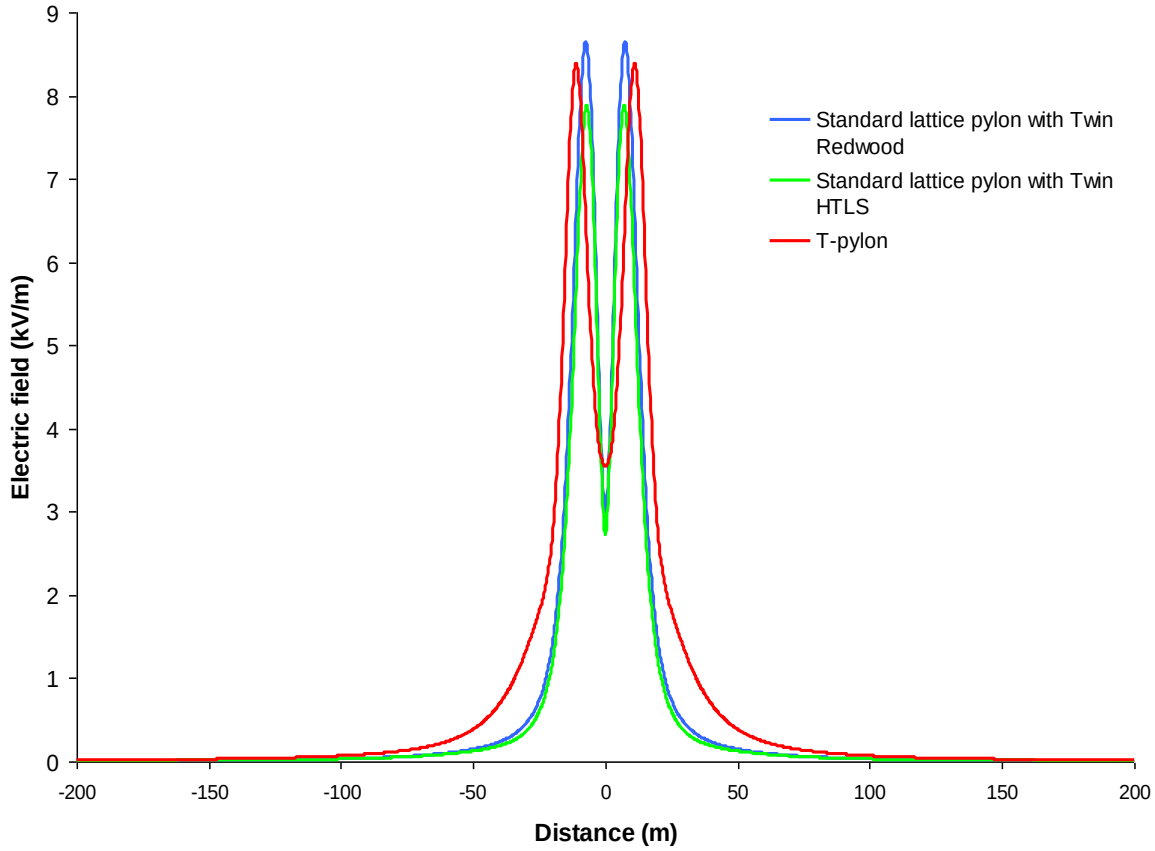
Pylon Type with Twin Redwood Conductor Bundle	Maximum Electric Field at Nominal Voltage (kV/m)	Maximum Magnetic Field at Pre-Fault Continuous Loading (μT)
Steel Lattice Pylon	2.09*	21.6**
Wood Pole	1.69*	20.7**

* the public exposure limit for electric fields is 9.00kV/m

**the public exposure limit for magnetic fields is 360.0μT

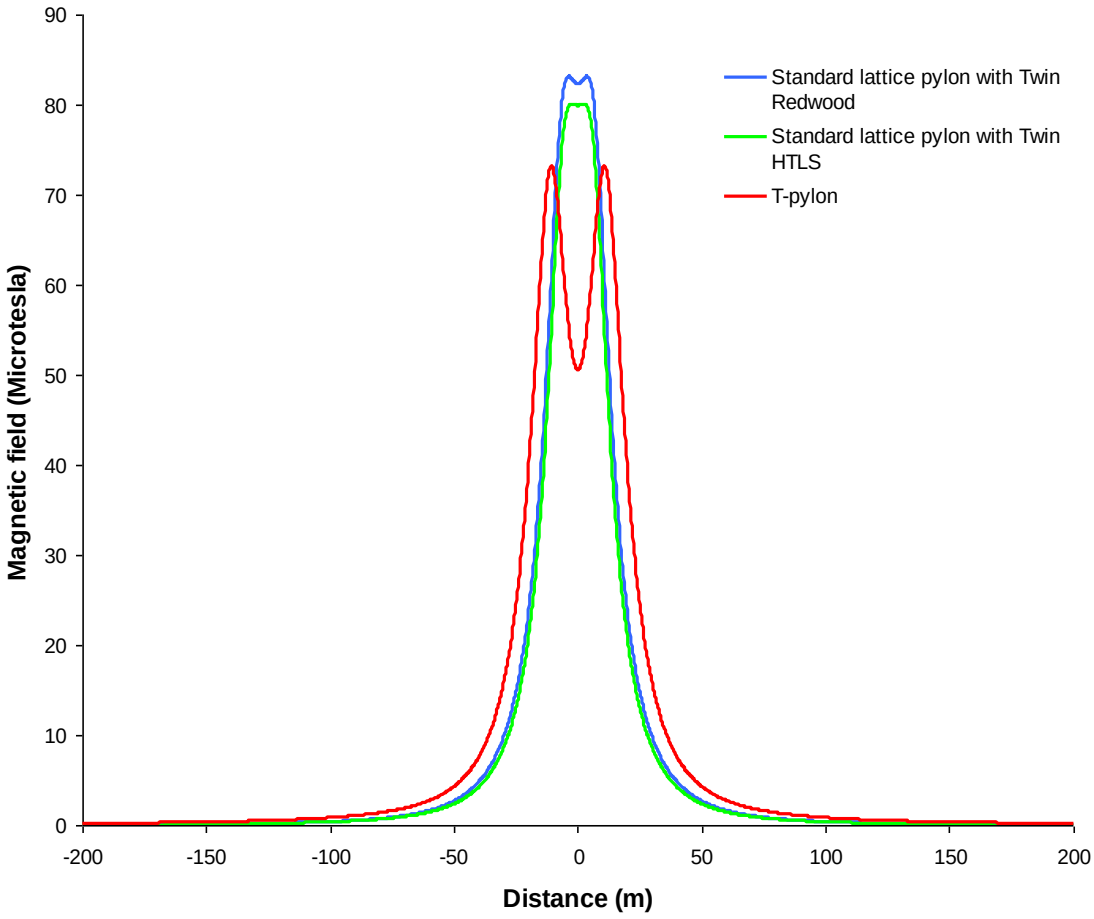
16.5.7 The EMFs produced by the overhead line decrease rapidly with distance from the overhead line (**Insets 16.2 and 16.3**).

Inset 16.2: Calculated Electric Field from Proposed 400kV Overhead Line Designs



All calculations were performed according to the principles in the Code of Practice

Inset 16.3: Calculated Magnetic Field from Proposed 400kV Overhead Line Designs



All calculations were performed according to the principles in the Code of Practice

Overhead Lines – Compliance with Policy on Phasing

16.5.8 The 400kV overhead line has been designed with transposed phasing meaning that it is optimally phased as per the Code of Practice (Ref. 16.14). The two circuits are arranged to produce the greatest degree of cancellation between the magnetic fields produced by the two circuits and hence the lowest resultant magnetic field to the sides of the line. Where an overhead line would comprise both lattice pylons and T-pylons, the phasing can be chosen only once for the whole overhead line (to change the phasing between the lattice and T-pylon sections would require an extra structure, contrary to the Code of Practice). Optimal Phasing has the greatest benefit for designs of overhead line built with standard lattice pylons; these have the conductor bundles arranged in two roughly vertical arrays. It is less effective for designs such as the T-pylon where the bundles would be in a triangular arrangement (but where the field would be lower anyway because of the design). Therefore, the phasing has been chosen to be optimum for the standard lattice pylon section which would give the greatest overall benefit of reducing the fields.

Overhead Lines – Assessment

16.5.9 The maximum EMFs produced by the proposed overhead line would be less than the relevant public exposure limits. Thus, the proposed overhead line would meet the relevant exposure guidelines, the ICNIRP general public guidelines (Ref. 16.3) in the terms of the EU Recommendation (Ref. 16.4). It would also comply with the Government policy on phasing, and there are no other restrictions on grounds of EMFs, health or safety applying to power lines.

16.5.10 The assessment presented above shows that the maximum value of the fields produced by the proposed overhead lines would be compliant with the relevant exposure limits in **Tables 16.5 and 16.6**, even directly under the overhead line. There is no minimum lateral distance from the overhead line required in order to achieve compliance. The assessment of compliance is therefore not dependent on: the exact routing of the overhead line; the exact location of the nearest existing residential property to the overhead line; the nearest proposed property already granted planning permission; or the nearest property that might in future be granted planning permission, because the field from the overhead line is compliant everywhere, not just compliant outside a specified distance.

16.5.11 However, although not required for assessing compliance, the graphs presented above can be used to estimate the maximum fields at any given distance from the line.

Underground Cable Sections

16.5.12 As a consequence of their design, underground cables do not produce an external electric field. Cables would be enclosed in a metal sheath (a protective metal layer within the cable) which would shield the electric field. Therefore electric fields are not considered further for this type of equipment.

16.5.13 Magnetic fields produced by direct buried cables fall quickly with distance as you move away and the highest magnetic fields are observed directly above the cables.

16.5.14 Calculations of the magnetic field produced by the proposed underground cables have been performed using the industry standard modelling package EFC-400 v2012.

<u>400kV Cables</u>

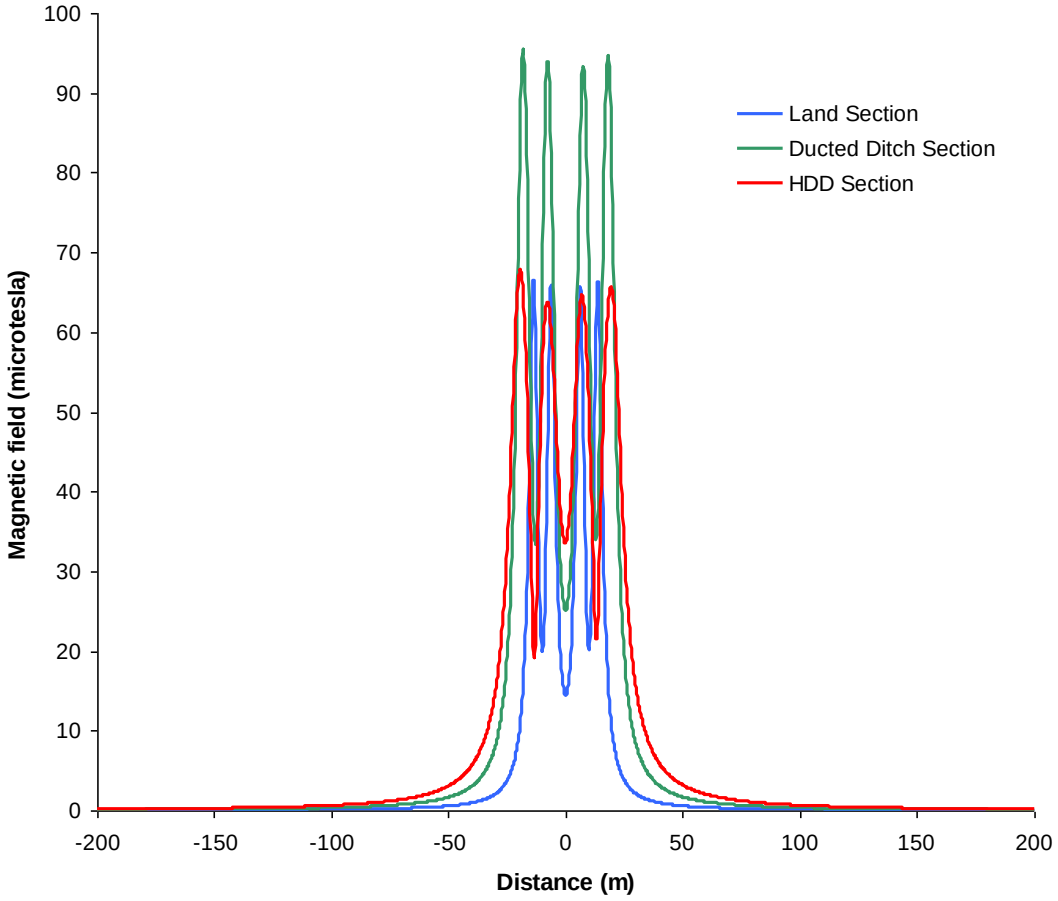
16.5.15 The 400kV cable circuits have been assessed for compliance with the Government exposure limits. Two 400kV cable circuits would be directly buried in troughs, placed in ducts or installed via horizontal directional drilling (HDD); the layout of these cables is shown in **Volume 5.3.3, Figure 3.17**. The installation method would vary depending on ground conditions. Each installation method has been considered including a typical land section, a ducted ditch crossing section and HDD installation.

16.5.16 Each circuit would have 2 cables per phase and cables would be installed at a minimum depth of 1.1m on land sections, 1.6m on ducted ditch crossing sections and 3m on HDD sections. Calculations were performed using maximum continuous rating for the cable circuits of 3248 Amperes per circuit and minimum burial depth.

16.5.17 The maximum calculated magnetic field is 66.8µT for the land section, 95.4µT for the ducted ditch crossing sections and 67.8µT for HDD sections at 1m above ground, located directly above the cables using these worst case conditions. **Inset**

16.4 shows the calculated magnetic field from the cables and demonstrates how quickly the magnetic field would reduce with distance. Calculations were performed in accordance with the conditions set out in the codes of practice (Ref. 16.2).

Inset 16.4: Calculated Magnetic Field from Proposed 400kV Underground Cables (Land Section, Ducted Ditch Crossing Section and HDD Section)



Calculations were conducted using the maximum continuous rating of the cables, minimum burial depth and at 1m above ground

132kV Cables

16.5.18 The DECC Code of Practice (Ref. 16.2) provides guidance as to when specific evidence of compliance with exposure guidelines is required to be demonstrated and when compliance can be taken as a given. Many types of equipment are not capable of exceeding the Government exposure limits. As agreed with Government under the Code of Practice (Ref. 16.2), the Energy Networks Association maintains a list of these types of equipment which are inherently not capable of exceeding the ICNIRP exposure guidelines, and 132kV cables fall into this category. Evidence for demonstration of compliance with Government exposure guidelines for 132kV cables is maintained at http://www.energynetworks.org/electricity/she/emfs.html.

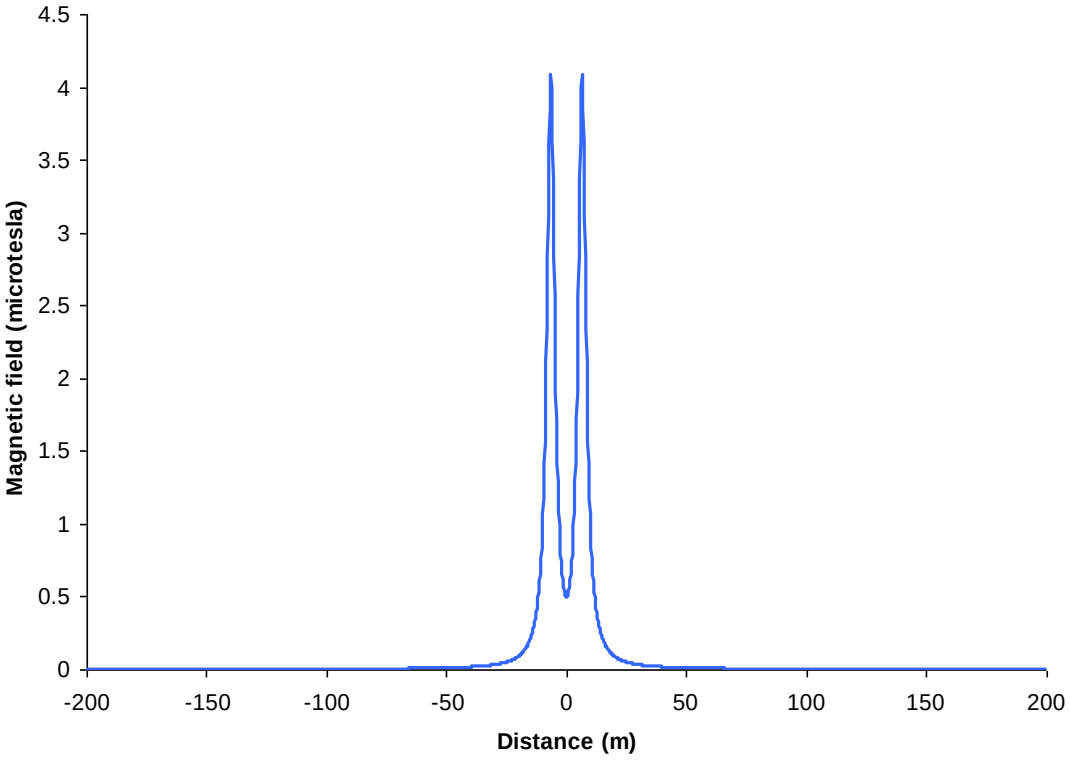
16.5.19 Although not therefore necessary under the Code of Practice, calculations of magnetic fields produced by a typical 132kV cable layout have been performed.

16.5.20 There would be two 132kV cable circuits each with one cable per phase arranged in a touching trefoil or triangular arrangement installed at a minimum depth of 0.9m. Calculations were performed using maximum continuous rating for the cable circuits of 785 Amperes per circuit and minimum burial depth.

16.5.21 The maximum calculated magnetic field at 1m above ground would be 4.1µT located directly above the cables using these worst case conditions. **Inset 16.5** shows the calculated magnetic field from the cables and demonstrates how quickly the magnetic field would reduce with distance. Calculations were performed in accordance with the conditions set out in the codes of practice (Ref. 16.2).

16.5.22 Cable joints would be present at intervals along the route; this allows different cable sections to be joined together in a cable joint bay. At these joint bays the cables have a greater separation which gives rise to higher magnetic fields. For completeness the maximum calculated magnetic field located directly above a joint bay is 58.4µT, however there would be very few joint bays over the length of the cable route and each joint bay would be only 7m in length; therefore this is not representative of the typical exposure.

Inset 16.5: Calculated Magnetic Field from Proposed 132kV Trefoil Underground Cables



Calculations were conducted using the maximum continuous rating of the cables, minimum burial depth and at 1m above ground

Underground Cable Sections – Assessment

16.5.23 All of the underground cable sections would comply with the relevant exposure limits. There are no other EMF policies applying to underground cables.

Cable Sealing End Compounds

16.5.24 The cable sealing end (CSE) compounds are the interfaces between the underground cables and overhead line. There would be no switchgear or transformers present, unlike substations.

16.5.25 There would be no equipment within a CSE compound that would produce high EMFs. The EMFs produced by a CSE compound would be effectively determined solely by the underground cable and overhead line entering and exiting the site; these have been assessed separately.

16.5.26 CSE compounds are deemed to be compliant with exposure guidelines, as per the Code of Practice (Ref. 16.2) (evidence for this is maintained at http://www.energynetworks.org/electricity/she/emfs.html).

Sandford Substation

16.5.27 The proposed substation is a 400kV highly integrated switchgear (HIS) design with an associated 132kV air insulated switchgear (AIS) substation. Neither of these will contain air-cored reactive equipment.

16.5.28 As agreed with Government under the Code of Practice (Ref. 16.2) the Energy Networks Association maintains a list of types of equipment where the design is such that it is inherently not capable of exceeding the ICNIRP exposure guidelines, i.e. a list of equipment that is therefore always compliant with the guidelines, and where a detailed case-by-case demonstration of compliance is not required. Substations of all operating voltages without air-cored reactive equipment are deemed compliant with the exposure limits. Evidence for the demonstration of compliance with exposure guidelines is maintained at:

http://www.energynetworks.org/electricity/she/emfs.html

16.5.29 The proposed Sandford substation design is therefore compliant with the UK Government guidelines set out in NPS EN-5 (Ref. 16.1) and assessed using the principles of the DECC Codes of Practice (Ref. 16.2).

Seabank Substation Extension and Modifications to Churchill, Portishead, Avonmouth and Seabank Substations

16.5.30 A substation extension at Seabank 400kV Substation and modifications at Churchill, Portishead, Avonmouth and Seabank 132kV Substations to facilitate the proposed works are proposed. All of the existing equipment and the new proposed equipment does not and will not contain any reactive equipment with air-cored reactors.

16.5.31 Therefore the design is compliant with the UK Government guidelines set out in NPS EN-5 (Ref. 16.1) and assessed using the principles of the DECC Codes of Practice (Ref. 16.2). Evidence for the demonstration of compliance with exposure guidelines is maintained at http://www.energynetworks.org/electricity/she/emfs.html.

Decommissioning Effects

16.5.32 When the equipment is de-energised and decommissioned no EMFs would be produced. Therefore this is not considered further.

16.6 Inter-relationship of Potential Effects

16.6.1 The potential effect of EMFs on bats has been highlighted as a concern in the Scoping Opinion, specifically:

"…concerned that the proposed power lines could potentially, through Electro Magnetic Field (EMF) interference, prevent bat species accessing their foraging areas and their roost sites, though very little is known about the effect of EMF on bats.

16.6.2 Part 2, section 2.10.8 of The NPS for Electricity Networks Infrastructure (EN-5) (July 2011) (Ref. 16.1) states

"There is little evidence that exposure of crops, farm animals or natural ecosystems to transmission line EMFs has any agriculturally significant consequences."

16.6.3 There is some evidence suggesting that high frequency radar EMF may potentially interfere with bats navigation and foraging, but this is at frequencies higher than those produced by the proposed development.

16.6.4 National Grid is not aware of any evidence that low frequency EMFs which would be produced by the Proposed Development would interfere with bats' navigation or foraging.

16.6.5 Additionally National Grid has several thousand kilometres of existing overhead lines, and issues with bat loss or interference with habitats close to these have not previously been identified.

3.5.1 The potential effects of magnetic fields on European eel and brown/sea trout populations of the Severn Estuary Ramsar have been fully reviewed in **Volume 5.8.1, section 8.5;** however in summary a literature review commissioned by Scottish Natural Heritage in 2010 (Ref. 16.24) revealed that EMFs from subsea cables may interact with eels if migration routes take them over cables in shallow water but no evidence of deviation from migration routes was recorded. They concluded that:

"Current knowledge suggests that EMFs from subsea cables and cabling orientation may interact with migrating eels (and possibly salmonids) if their migration or movement routes take them over the cables, particularly in shallow waters (<20m). The effect, if any, could be a relatively trivial temporary change in swimming. "

16.6.6 Given the relatively small changes in background magnetic fields and the small transitory change to swimming direction predicted as a worst case effect of exposure, no significant effect on European eel and brown/sea trout populations are predicted.

16.7 Mitigation

16.7.1 No mitigation measures are necessary as the Proposed Development has been demonstrated to comply with the current public exposure guidelines as detailed in NPS EN-5 (Ref. 16.1). If these requirements are met NPS EN-5 (Ref. 16.1) states that "*no further mitigation should be necessary."*

16.8 Residual Effects

16.8.1 The Proposed Development has been demonstrated to comply with the current public exposure guidelines as detailed in NPS EN-5 (Ref. 16.1). If these requirements are met NPS EN-5 states that "*EMF effects are minimal."*

16.9 Cumulative Effects

16.9.1 The cumulative assessment is provided at **Volume 5.17** and includes potential cumulative effects of the Proposed Development together with other major development proposals.

16.9.2 It is National Grid's and the electricity industry's policy to ensure that all electrical assets comply with Government exposure limits and policies. As all of the proposed developments will comply with these exposure limits, the cumulative impacts will not be significant.

16.10 Conclusions

16.10.1 Government, acting on the advice of authoritative scientific bodies, has put in place appropriate measures to protect the public from EMFs. These measures comprise compliance with the relevant exposure limits, and one additional precautionary measure, optimum phasing, applying to high-voltage power lines, this policy is incorporated in NPS EN-5 (Ref. 16.1).

16.10.2 The assets associated with the Proposed Development would be fully compliant with the Government policy. Specifically, all the fields produced would be below the relevant exposure limits, and the proposed overhead lines would comply with the policy on optimum phasing. Therefore there would be no significant EMF effects resulting from this Proposed Development.

16.10.3 The NPS for Electricity Networks Infrastructure (EN-5) (July 2011) (Ref. 16.1) in Part 2, Section 2.10.6 states "*The balance of scientific evidence over several decades of research has not proven a causal link between EMFs and cancer or any other disease."*

16.10.4 There is some scientific evidence of possible effects at lower levels at 50Hz. The electricity industry takes this evidence seriously and recognises that it can generate public concern. However, the evidence has been extensively reviewed, and the UK Government policy with which this Proposed Development complies has been set in the light of this evidence and as the appropriate response to it.

16.1 Department of Energy and Climate Change. National Policy Statement for Electricity Network Infrastructure (EN-5). London: The Stationary Office, 2011.

16.2 Department of Energy and Climate Change. Power Lines: Demonstrating compliance with EMF public exposure guidelines. A voluntary Code of Practice. London, 2012.

16.3 International Commission on Non Ionising Radiation Protection. Guidelines for Limiting Exposure to Time-Varying Electric, Magnetic and Electromagnetic Fields. Health Physics, 1998, 74 (4), p.494.

16.4 European Union Council. Recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) (1999/519/EC). Brussels, 1999.

16.5 Department of Energy and Climate Change. Overarching National Policy Statement (NPS) for Energy (EN-1). London: The Stationary Office, 2011

16.6 National Radiological Protection Board. Review of the scientific evidence for limiting exposure to electromagnetic fields (0-300 GHz). Doc NRPB, 2004, 15(3), p.1

16.7 International Commission on Non Ionising Radiation Protection. ICNIRP Guidelines for Limiting Exposure to Time-Varying Electric, Magnetic and Electromagnetic Fields (1 Hz-100 kHz), Health Physics. 2010, 99(6): p.818

16.8 European Parlament. Directive 2013/35/EU of the European Parliament and of the Council of 26 June 2013 on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (electromagnetic fields) (20th individual Directive within the meaning of Article 16(1) of Directive 89/391/EEC) and repealing Directive 2004/40/EC. Brussels, 2013.

16.9 National Radiological Protection Board.. Advice on limiting exposure to electromagnetic fields (0-300 GHz). Doc NRPB, 2004, 15(2), p.1

16.10 Working Group on the Evaluation of Carcinogenic Risks to Humans. Non-ionizing radiation, Part 1: Static and extremely low-frequency (ELF) electric and magnetic fields. (Monographs on the Evaluation of Carcinogenic Risks to Humans, 80). Lyon, IARC, 2002

16.11 World Health Organisation, Environmental Health Criteria Monograph No 238 on Extremely Low Frequency Fields, 2007. (Online) Available from http://www.who.int/peh-emf/publications/elf_ehc/en/index.html.

16.12 Scientific Committee on Emerging and Newly Identified Health Risks SCENIHR (2009), Health Effects of Exposure to EMF

16.13 Stakeholder Advisory Group on ELF EMF. SAGE First Interim Assessment. 2007. (Online) Available from http://www.emfs.info/NR/rdonlyres/39CDF32F-4E2E-AD30 - A2B0006B8ED5/0/SAGEfirstinterimassessment.pdf

16.14 Department of Energy and Climate Change. Optimum Phasing of high voltage double-circuit Power Lines. A voluntary Code of Practice. London, 2012.

16.15 Department of Health. Government response to the stakeholder advisory group on extremely low frequency electric and magnetic fields (ELF EMFs) (SAGE) recommendations. 2009. (Online) Available from http://webarchive.nationalarchives.gov.uk/20130107105354/http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_107124

16.16 Health Protection Agency. Application of ICNIRP Exposure Guidelines for 50 Hz Power Frequency Fields. 2005. (Online) Available from: http://www.hpa.org.uk/web/HPAweb&HPAwebStandard/HPAweb_C/1195733805036

16.17 Department of Energy and Climate Change. Power lines: Control of microshocks and other indirect effects of public exposure to electric fields. A voluntary Code of Practice. London, 2013.

16.18 Council Directive 90/385/EEC of 20 June 1990 on the approximation of the laws of the Member States relating to active implantable medical devices. Brussels, 1990.

16.19 Council Directive 89/336/EEC of 3 May 1989 on the approximation of the laws of the Member States relating to electromagnetic compatibility, Brussels, 1989.

16.20 British Standards Institution. EN BS 5049-3: Radio interference characteristics of overhead power lines and high voltage equipment: Part 3- Code of practice for minimising the generation of radio frequency noise. London: BSI, 1994.

16.21 British Standards Institution. BS EN 60437:1998 Radio interference test on high-voltage insulators. London: BSI, 1998.

16.22 J. Swanson, Magnetic fields from transmission lines: Comparison of calculations and measurements, IEE Proceedings.-Generator Transmission Distribution, 1995, 142 (5), p481.

16.23 J. Swanson & D.C. Renew, Power-frequency fields and people, Engineering Science and Education Journal, 1994, p 71

16.24 A.B. Gill & M. Bartlett, Literature review on the potential effects of electromagnetic fields and subsea noise from marine renewable energy developments on Atlantic salmon, sea trout and European eel. 2010, Scottish Natural Heritage Commissioned Report No.401

Appendix 16A – Certificate of Conformity

Technical Certificate 05R110 issued by
Hursley EMC Services Ltd

Appointed by the Secretary of State for Trade and Industry as a UK EMC Competent Body

TECHNICAL CERTIFICATE

PRODUCT TITLE: NGT Electricity Transmission Network

MANUFACTURED BY: National Grid Transco (NGT) plc
Manufacturers Address: NGT House, Warwick Technology Park, Gallows Hill, Warwick CV34 6DA UK

Applicants Name: Mr Jon Carlton, of NGT plc.

Product Description: The NGT Electricity Transmission Network (consisting of some 14,000 Km of high voltage supply lines) is the high voltage electricity transmission system in England and Wales.

Technical Statement: The Technical Construction File (TCF), "NGT Electricity Transmission Network" (dated 2005), describes the general construction, conformity procedures and EMC test rationale for the Electricity Network. This Technical Construction File, in so far as is technically viable, is based on testing to international standards, specifically EN50121-2:2000 and CISPR 18 for emissions. These standards were used as the most suitable guide for the emissions testing in lieu of any other practical or harmonized product related standards. Given the size of the equipment, testing was performed in-situ at several representative sites and is therefore an approximation to the standards. The results of the tests applied and described in the test reports along with the EMC detail supplied in the TCF indicate that the product complies with the standards.
Taking into consideration the technical rationale provided in the TCF and the results of the site measurement reports, Hursley EMC Services is satisfied the TCF does demonstrate compliance with the essential protection requirement of EC Directive 89/336. NGT operates a certified ISO 9001 quality management system covering both the operation and installation procedures for the Electricity Network. Due to its size and nature along with quality procedures used for installations the NGT Electricity Transmission Network would seem inherently immune to normal EMC phenomena.
This route to compliance with respect to the provisions of EC Directive 89/336 is in accordance with section 42(c) of the UK Statutory Instrument 1992 No 2372 (The Electromagnetic Compatibility Regulations). This application and certificate applies only to the NGT Electricity Transmission Network for the UK as described in the Technical Construction File.

COMPETENT BODY CONFORMITY STATEMENT

Hursley EMC Services Ltd. certifies that the National Grid Transco plc TCF demonstrates that the NGT Electricity Transmission Network conforms to the protection requirements of European Council Directive 89/336 and its amendments. This directive is on the approximation laws of the Member States relating to electromagnetic compatibility.

Signed: [redacted]
EMC Technical Manager

Approved: I [redacted]
EMC Quality Manager

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