Fosse Green Energy

EN010154

6.3 Environmental Statement Appendices

Appendix 14-F: Electromagnetic Fields Assessment

Planning Act 2008 (as amended)

Regulation 5(2)(a)

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended)

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6

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulation 2009 (as amended)

Fosse Green Energy

Development Consent Order 202[ ]

6.3 Environmental Statement Appendices

Appendix 14-F: Electromagnetic Fields Assessment

Regulation Reference	Regulation 5(2)(a)
Planning Inspectorate Scheme Reference	EN010154
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Table of Contents

Plates

Tables

1. Electromagnetic Field Assessment

Executive Summary

ES1 This Appendix assesses the potential impact of electromagnetic fields (EMF) and electric fields generated by Fosse Green Energy (hereafter referred to as the 'Proposed Development').

ES2 The assessment considers possible EMF sources arising from the Proposed Development including above-ground and underground low-medium voltage cables, the Cable Corridor (400kV cabling), Onsite Substation, and ancillary infrastructure such as inverters and transformers (the terminology for infrastructure associated with the Proposed Development is defined and described in further detail within **Chapter 3: The Proposed Development** of this Environmental Statement (ES) **[EN010154/APP/6.1]**.

ES3 With the exception of relatively short lengths of cables connecting solar PV panels to string inverters, all cables associated with the Proposed Development would be buried underground. The dimension of the trenches will vary depending on the number of cables or ducts they contain as is further described in **Chapter 3: The Proposed Development** of this ES **[EN010154/APP/6.1]**. EMF associated with the Proposed Development is considered a low risk given the distance between places where people will be present and the solar infrastructure, and this assessment has been included on a precautionary basis.

ES4 There are not predicted to be any significant impacts arising from the Proposed Development in relation to EMF.

ES5 The infrastructure (underground cabling, overground cabling and Onsite Substation) of the Proposed Development fall below the maximum safe levels of exposure for electromagnetic and electric fields as outlined in the 1998 ICNIRP (International Commission on the Non-Ionizing Radiation Protection) guidelines (Ref 1).

ES6 The 1998 ICNIRP guidelines (Ref 2) outline safe public exposure limits, although updated by the 2010 ICNIRP guidelines (Ref 1), UK Policy remains to follow the 1998 guidelines (Ref 3). In any case, the 1998 guidelines provide lower thresholds for safe field levels and therefore compliance to 1998 guidelines is inclusive of the 2010 ICNIRP guidelines standards.

ES7 The Onsite Substation transformers will be UKCA (UK Conformity Assessed) and/or CE (European Conformity marking) marked to meet UK health, safety and environmental standards, as outlined in paragraphs E.3.9- E.3.14. As the Onsite Substation will meet the standards codified in the UK Electromagnetic Compatibility Regulations 2016 (Ref 4) and EU Electromagnetic Compatibility Directive 2014/30/EU (Ref 5), it will not generate, or be affected by, electromagnetic disturbance.

1.1 Technical Background

Introduction

1.1.1 All electrical equipment emits electric and magnetic radiation. Power cables produce both electric and magnetic fields which can potentially affect human health. The magnitude of the effects is dependent on both the field strength and the exposure time.

1.1.2 Electric fields are the result of voltages applied to electrical conductors and equipment. Electric radiation generated by underground cables are screened out by the sheath around the cable, eliminating the electric field altogether. Fences, shrubs, and buildings easily block electric fields, however, electric fields should be considered in the assessment of overhead lines.

1.1.3 EMF are produced by the flow of electric current; however, unlike electric fields, most materials do not readily block EMF. The intensity of both electric fields and EMF diminishes with increasing distance from the source.

Guidance, Legislation, Policy and Data

1.1.4 Various sources of information relating to safe exposure levels have been reviewed as part of this study.

1.1.5 Key legislation, planning policy and guidance relating to the assessment of Electric and EMF and pertinent to the Proposed Development comprises the documents listed below. More detail regarding these policies can be found in **Appendix 14-A: Other Environmental Topics Policy and Legislation [EN010154/APP/6.3]**.

1.1.6 Whilst there are no statutory regulations in the UK that limit the exposure of the general public to power-frequency EMFs, responsibility for implementing appropriate measures for the protection of the public lies with the UK Government, which has a clear policy incorporated in the National Policy Statement (NPS) EN-5, with specific attention to Paragraphs 2.9.54-2.9.55 (Ref 3).

1.1.7 EU Electromagnetic Compatibility Directive 2014/30/EU (Ref 5) and UK Electromagnetic Compatibility Regulations 2016 (Ref 4) provide the UKCA and CE marking standards for ensuring goods will not generate or be affected by electromagnetic disturbance.

1.1.8 The relevant legislation as referred to in Paragraph E.1.6 for the assessment of EMF is the Control of Electromagnetic Fields at Work Regulations 2016 (Ref 6).

1.1.9 The relevant policy as referred to in Paragraph E.1.6 is the NPS for Electricity Networks Infrastructure (EN-5) (Ref 3).

1.1.10 There is no relevant local policy provision in relation to EMFs.

1.1.11 Guidance relevant to electric and EMF includes:

a. National Grid (2015). Undergrounding high voltage electricity transmission lines (Ref 7);

b. Department of Energy and Climate Change (DECC) (2012). Power Lines: Demonstrating Compliance with EMF public exposure guidelines (Ref 8);

c. Energy Networks Association (2012). Electric and Magnetic Fields: The Facts (Ref 9);

d. Energy Networks Association (2017). Electric and Magnetic Fields (Ref 10);

e. International Commission on Non-Ionizing Radiation Protection (ICNIRP) (1998). Guidelines for limiting exposure to time-varying electric, magnetic and EMF (up to 300GHz) (Ref 1);

f. ICNIRP (2020). Guidelines for limiting exposure to EMF (100kHz to 300GHz) (Ref 11); and

g. Department of Transport (2002) The Town and Country Planning (Safeguarded Aerodromes, Technical Sites and Military Explosives Storage Areas) Direction (updated 2016) (Ref 12).

1.1.12 The 1999 EU recommendation and UK Government advice is to follow the 1998 ICNIRP (International Commission on the Non-Ionizing Radiation Protection) guidelines (Ref 1). New guidelines were published by the ICNIRP in 2010 (Ref 2), however these have not yet been applied to public policy. The 2010 guidelines by the ICNIRP allow for greater public exposure, and therefore compliance with the 1998 guidelines ensures the lowest level of public exposure. UK policy defines the safe levels of public exposure for electric and EMF.

1.1.13 Data on safe limits of electric and electromagnetic field exposure has been collated by the UK electricity industry at the website EMFs.info (Ref 13).

Safe Exposure Levels

Radiation from Home Electrical Equipment

1.1.14 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 microteslas (μT) to 0.2μT with an average of approximately 0.05μT, normally arising from currents in the low voltage distribution circuits that supply electricity to homes.

1.1.15 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 appliance, magnetic fields can be 2,000μT for electric razors and hair dryers, 800μT for vacuum cleaners, and 50μT for washing machines.

Radiation Reduction with Distance

1.1.16 Radiation levels reduce with distance; for example, the typical magnetic field from a vacuum cleaner reduces from 800μT to 2μT when the separation distance increases from 3 centimetres to 1 metre.

1.1.17 The electric field in most homes is in the range 1-20 volts per metre (V/m), rising to a few hundred V/m close to appliances.

1.1.18 This means radiation levels from the infrastructure, including the cabling and Onsite Substation will tend to reduce with distance to a receptor.

Reference Limits for EMF

Exposure Limits in the UK

1.1.19 Exposure Limits in the UK are based open the 1998 ICNIRP guidelines (Ref 1), on the advice of the Health Protection Agency (HPA). The values stated in the ICNIRP 1998 paper are shown **Table 1** below.

1.1.20 The ICNIRP 'reference levels' for the public are 100μT for magnetic fields and 5,000 volts per metre (or 5kV/m) for electric fields (**Table 1**). These are the levels above which more investigation is needed if this level of exposure is likely to occur; the permitted levels of exposure are somewhat higher, 360μT and 9kV/m. They apply where the time of exposure is significant, for instance in a residence. As a worst-case the lower 'reference level' of 100μT and 5kV/m is used in this assessment as the threshold at which potentially significant effects could occur.

Table 1: ICNIRP Exposure Limits 1998

Basic Restriction (mA m^{-2})	Magnetic Fields Reference Level (μT)	Electric Fields Reference Level (kV m^{-1})	Magnetic Field Actually Required (μT)	Electric Field Actually Required (kV m^{-1})
2	100	5	360	9

Height Above Ground Used for Testing Compliance

1.1.21 The UK Code of Practice (Ref 8) derived from the ICNIRP guidelines states that the standard height for measuring electric and magnetic field strength should be:

'1m above ground level on a plain, level surface'.

1.2 Proposed Development

Study Area

1.2.1 The EMFs produced by the electrical assets of the Proposed Development would have a given magnitude at a given distance from the asset. Therefore, the Study Area of the assessment includes all areas around the assets where the EMFs could potentially be. The Study Area for the assessment is therefore the DCO Site, as shown in **Figure 1-2** of the ES **[EN010154/APP/6.2]**. EMF rapidly reduces with distance from the source, to a negligible level within a few metres of the emitting infrastructure, and therefore given the offset of solar infrastructure from the Site boundary, there will not be a noticeable impact offsite.

A summary of the description of the Proposed Development can be found in the **Chapter 3: The Proposed Development** of the ES **[EN010154/APP/6.1].**

Baseline Conditions

1.2.2 The DCO Site is located within a mixture of primarily rural and semi-rural areas, which accommodate existing electrical assets. Electric and magnetic fields 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 microteslas in the UK. This field may be distorted locally by ferrous minerals or by steelwork such as in buildings. The Earth's natural fields are static, and the power system produces alternating fields.

1.2.3 The indicative layout of the Proposed Development, including the location of the Cable Corridor and Onsite Substation are presented in **Figure 3-2A [EN010154/APP/6.2]** and **Figure 3-2B [EN010154/APP/6.2]** of the ES.

1.2.4 This assessment has been based on the worst-case extent of the infrastructure as outlined in **Works Plans [EN010154/APP/2.2]** submitted with the DCO application.

1.2.5 From a review of Natural England's online data mapping sources, it indicates that there are no Sites of Special Scientific Interest (SSSIs), Special Areas of Conservation (SACs), Special Protection Areas (SPAs) or Local Wildlife Sites (LWSs) within the DCO Site, adjacent to or at closer distance than the residential locations assessed within this report which may have required further consideration. For further details refer to **Chapter 8: Ecology and Nature Conservation** of this ES **[EN010154/APP/6.1].**

Proposed Electrical Infrastructure

1.2.6 The Proposed Development will comprise of a 400kV Grid Connection Cable approximately 10km in length buried underground connecting to the national electricity transmission network at a proposed new National Grid Substation near Navenby (subject to a separate planning application and therefore not included within this assessment of EMF). The siting zone for the Cable Corridor is illustrated in **Figure 1-2** of the ES **[EN010154/APP/6.2]**. A typical cable trench would be approximately 3m wide and with a minimum cover of 0.9m for the cable.

1.2.7 With the exception of relatively short lengths of low voltage cables connecting solar PV panels to any string inverters, all cables associated with the Proposed Development would be buried underground. The dimension of the trenches will vary depending on the number of cables or ducts they contain as is further described in **Chapter 3: The Proposed Development** of the ES **[EN010154/APP/6.1].**

1.3 Technical Assessment

Overview

1.3.1 This assessment follows data sourced from the website EMFS.info (Ref 13). Maximum field data values have been used where possible to illustrate a worst-case scenario.

1.3.2 The Nationally Significant Infrastructure Projects: Technical Advice Page for Scoping Solar Development (Ref 14) states:

'Where proposed cables are over 132kV, an EMF assessment should be provided in an appendix to the Environmental Statement. This should include the location, routing and voltages of any cables over 132kV and a risk assessment to any human and ecological sensitive receptors within the ZoI.'

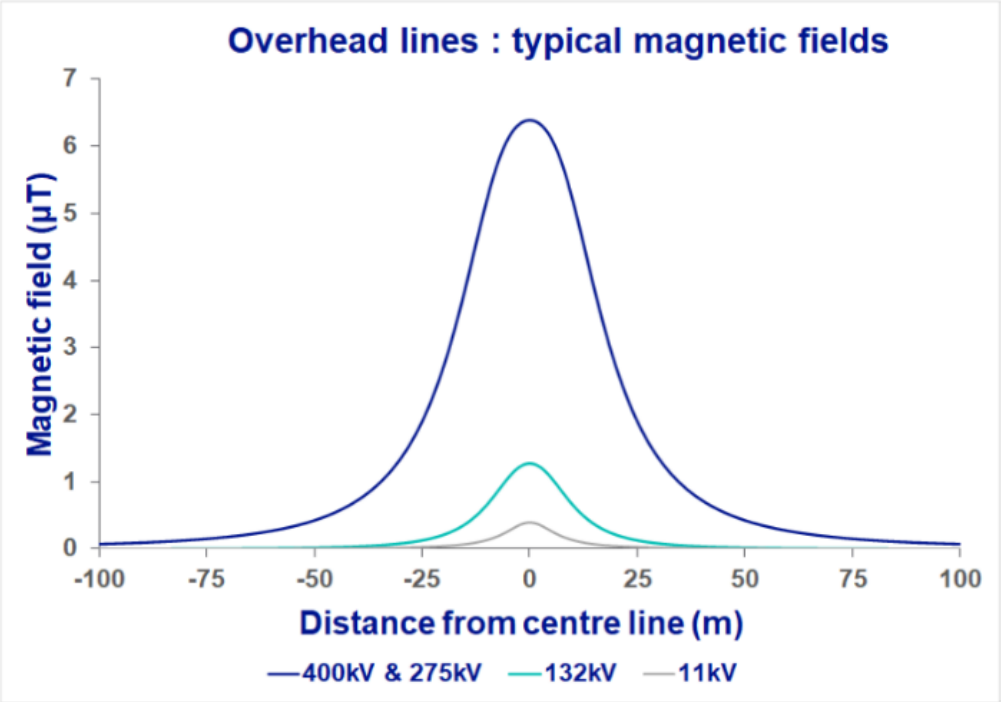
1.3.3 DECC guidance Power Lines: Demonstrating Compliance with EMF public exposure guidelines, (Page 4) (Ref 8) states "*that underground cables at voltages up to and including 132kV"* are considered not capable of exceeding the ICNIRP exposure guidelines for EMF (Ref 1) and that compliance with exposure guidelines for such equipment can be assumed unless evidence is brought to the contrary in specific cases. However, there is potential for exceedances of 132kV where infrastructure overlaps.

1.3.4 With the exception of cables between solar PV panels and inverters, typically required to be above ground level and then underground if required (between racks and in the inverter's input), all other on-site cabling would be underground.

Overground cables

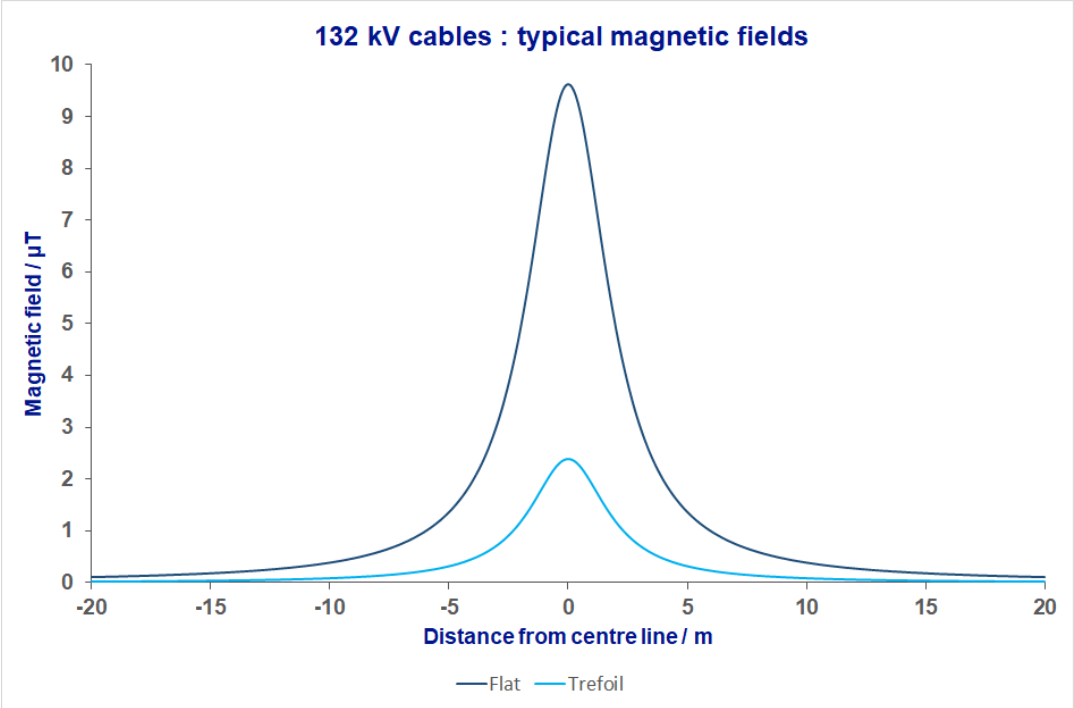
1.3.5 **Plate 1** below shows the magnetic fields for overhead lines relative to distance. While the Proposed Development will not feature overhead lines, some overground cabling is expected (<1kV cables) between solar PV panels and converters, these thresholds have therefore been included to provide a conservative assessment. As shown in **Plate 1**, Cables under 11kV have a maximum magnetic field of less than 1µT, reaching undetectable levels (0µT) after around 20m distance. Onsite cables would have a voltage of less than 1kV and therefore would not significantly contribute to any increase in EMF, even when overlapping with other infrastructure.

Plate 1: Typical Magnetic Fields of Overhead Lines



1.3.6 **Plate 2** below shows the expected maximum magnetic fields for 132kV cables. The maximum magnetic field (10µT) for 132kV underground cables is significantly lower than the reference exposure limit of 100µT. Therefore, because there is a low exposure for 132kV cables, there can be considered to be no significant electromagnetic exposure risk to human health from the low (~1kV) and medium (33kV) voltage cables included within the Proposed Development.

Plate 2 Typical Magnetic Fields of 132kV cables



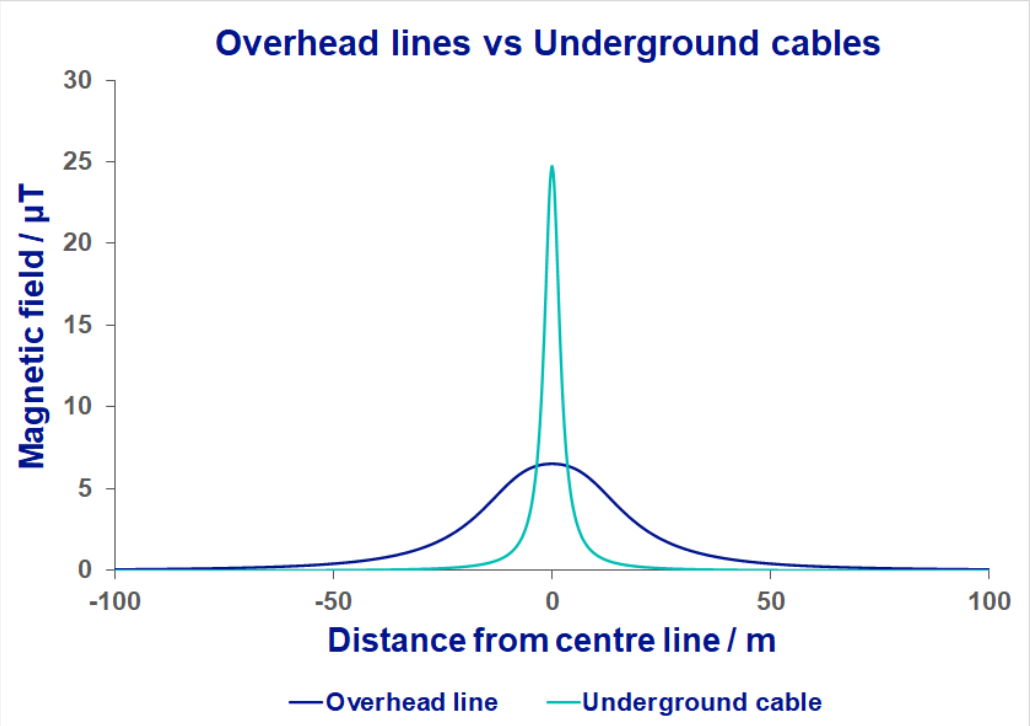
Underground Cables

Magnetic Fields

1.3.7 **Plate 3** below shows the strength of magnetic field for 400kV overhead lines and underground cables relative to distance, which represents the maximum assumed voltage for underground cables (the Proposed Development will not feature overhead lines) for the Proposed Development.

1.3.8 The magnetic field for a 400kV cable in immediate proximity (0m, on top of the buried cable) is 25µT, which is significantly lower than the maximum threshold of 100µT for exposure to be considered of risk to humans.

Plate 3 The Maximum Expected Exposure to Magnetic Fields



Electric Fields

1.3.9 The website EMFS.info (Ref 13) states[1]:

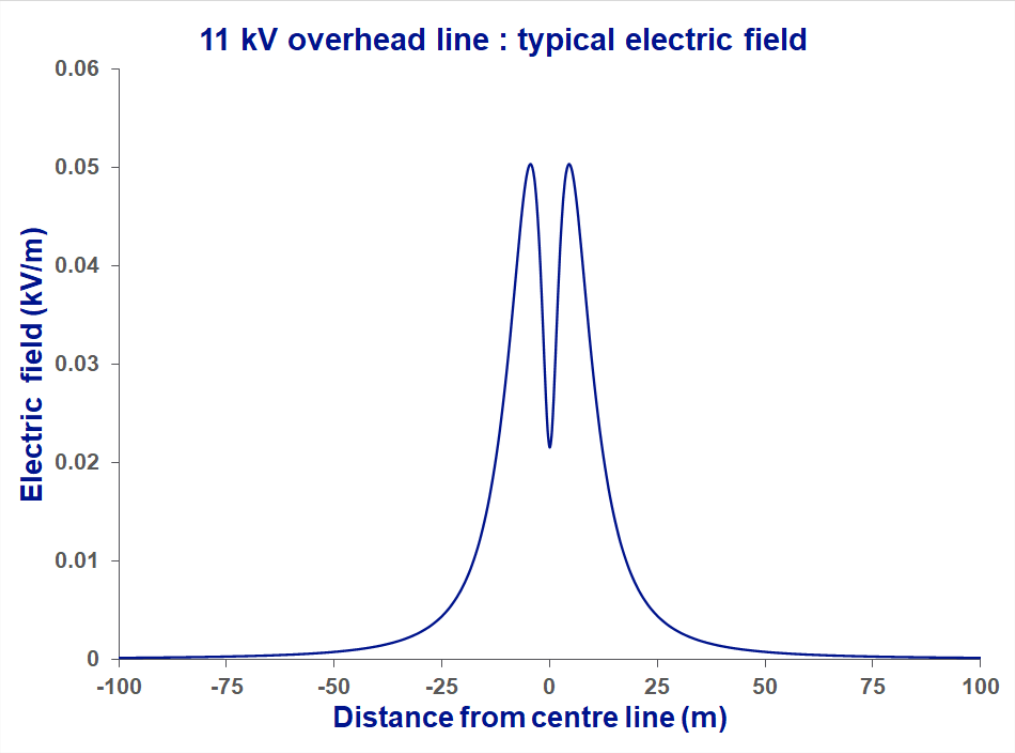
'Electric fields from underground cables are contained within the cable's protective insulation and sheath, so there are no external electric fields.'

1.3.10 In accordance with National Grid guidance (Ref 7), EMF effects from underground cables would not exceed the ICNIRP reference levels, therefore, electric fields pertaining to the underground cables have been scoped out of this assessment.

1.3.11 **Plate 4** below shows the electrics fields of an 11kV overhead line, with the maximum electric field reaching 0.05kV/m. This is far less than the ICNIRP 'reference levels' of 5,000 volts per metre (or 5kV/m) for electric fields. Any above ground lines will be less than 1kV and therefore will not exceed this threshold. Therefore, no further assessment of the 132kV cabling or lines is required.

[1] Last Accessed 28/02/2025

Plate 4: Typical Electrical Field of an 11kV Overhead Line



Onsite Substation Transformers

1.3.12 The remaining potential source of significant magnetic and electrical field radiation will be the Onsite Substation, containing up to three transformers. It is not considered that the inverters will emit notable magnetic and electrical field radiation.

1.3.13 The Onsite Substation transformers will be UKCA (UK Conformity Assessed) (Ref 414) and/or CE (European Conformity marking) (Ref 5) marked, illustrating that the product has been assessed and meets UK/EU health, safety and environmental protection requirements. As a result of the UK leaving the EU, from 2021 onwards the UKCA mark began to replace the CE mark previously required, however the CE mark continues to be used to make some goods including those sold in Northern Ireland.. The mark/s used will be fully compliant with UK legislation and confirmed prior to installation.

1.3.14 EU Electromagnetic Compatibility Directive 2014/30/EU (Ref 5), states that electrical and electronic equipment should not generate, or be affected by, electromagnetic disturbance to receive CE marking.

1.3.15 The UK Electromagnetic Compatibility Regulations 2016 (Ref 4) state that electrical and electronic equipment should not generate, or be affected by, electromagnetic disturbance to receive UKCA marking.

1.3.16 The Onsite Substation within the Proposed Development will be of industry standard and fully compliant with Electromagnetic Compatibility (EMC)

standards (Paragraph 1.3.13) and therefore no significant electric fields from the Onsite Substation are predicted.

1.3.17 The Onsite Substation will produce a lower magnetic field than the 400kV underground Grid Connection Cable and therefore will fall within acceptable exposure limits.

Recommended Minimum Clearance Distances

1.3.18 The electricity export cable will be located at least 10m from permanent receptors due to the need for construction vehicles to manoeuvre both sides of the trench within the working width. Therefore, no significant effects to receptors are predicted to occur.

1.3.19 The estimated maximum magnetic field at this distance will be 2-3μT (see **Plate 3**) and within the acceptable exposure limits.

1.3.20 The Proposed Development is not expected to require a buffer due to electric fields, as with the exception of overground low voltage cables between Solar PV panels and transformers (<1kV), cables will be underground and therefore there will be no electric field.

1.3.21 Some Public Rights of Way (PRoW) and permissive paths do cross over the Cable Corridor and may also pass over the Interconnecting Cables and Cable Corridor where they are routed within the Principal Site. PRoWs are shown on **Figure 2-2** of the ES **[EN010154/APP/6.2]**. The presence of the public either directly above or adjacent to underground cables associated with the Proposed Development would be transient, with the individuals using the PRoW exposed to electro-magnetic fields from the cables for only very short periods of time. It is considered that the level of exposure to users of PRoW would be lower than that associated with general household appliances. Therefore, no significant effects to users of PRoW are predicted to occur.

1.3.22 No ecological sensitive receptors have been identified in sufficient proximity to the Proposed Development to be affected by EMF. No significant impacts are therefore predicted upon ecological sensitive receptors.

1.3.23 Where the cables associated with the Proposed Development are proposed to cross watercourses, the cables will be installed a minimum of 2m below minor/ordinary watercourses (except where minor/ordinary watercourses have minimal or no water flow and water management is easily managed) and 5m beneath main rivers. EMF levels at this distance would be almost imperceptible (around 3μT, or lower if the cables are installed in bedrock), with any fish also being directly above the buried cables for only a very short duration. The effect on river fauna is therefore considered to be negligible.

1.4 Cumulative Effects

1.4.1 EMF associated with the Proposed Development has been assessed to have no significant effect on receptors. It is expected that the EMF associated with other developments included within the cumulative developments shortlist (as discussed in **Chapter 15: Cumulative Effects and Interactions** of the ES

[EN010154/APP/6.2]) would also have no significant effect on receptors and would adhere to the same relevant Government policy and legislation as set out above to ensure all EMF is below the relevant exposure limits. Therefore, no Cumulative Effects are expected due to EMFs.

1.5 References

Ref 1 International Commission on Non-Ionizing Radiation Protection (ICNIRP). (1998). Guidelines for limiting exposure to time-varying electric, magnetic and EMF (up to 300 GHz). Health Phys, 74(4), 494-522.

Ref 2 ICNIRP. (2010). Guidelines for limiting exposure to time-varying electric and magnetic fields (1 Hz-100kHz). Health Phys, 99 (6), 818-836.

Ref 3 Department for Energy, Security and Net-Zero (DESNZ) (2023, Updated January 2024) National Policy Statement for electricity networks infrastructure (EN-5). Available at: https://www.gov.uk/government/publications/national-policy-statement-for-electricity-networks-infrastructure-en-5

Ref 4 His Majesties Stationary Office (HMSO) (2016). The Electromagnetic Compatibility Regulations 2016. Available at: https://www.legislation.gov.uk/uksi/2016/1091/contents

Ref 5 The European parliament and the council of the European Union (2014). Electromagnetic Compatibility Directive 2014/30/EU. Available at: https://www.legislation.gov.uk/eudr/2014/30#:~:text=(5)%20Provisions%20of%20national%20law,protection%20in%20the%20Member%20States

Ref 6 HMSO (2016). The Control of EMF at Work Regulations. Available at: https://www.legislation.gov.uk/uksi/2016/588/contents/made

Ref 7 National Grid (2015). Undergrounding high voltage electricity transmission lines.

Ref 8 DECC (2012). Power Lines: Demonstrating Compliance with EMF public exposure guidelines. A voluntary Code of Practice. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/48308/1256-code-practice-emf-public-expguidelines.pdf

Ref 9 Energy Networks Association (2012). Electric and Magnetic Fields: The Facts.

Ref 10 Energy Networks Association (2017). Electric and Magnetic Fields. Available at: https://www.energynetworks.org/industry-hub/resourcelibrary/electric-and-magnetic-fields-facts.pdf

Ref 11 ICNIRP (2020). Guidelines for limiting exposure to EMF (100 kHz to 300 GHz). Available at: https://www.icnirp.org/cms/upload/publications/ICNIRPrfgdl2020.pdf.

Ref 12 Department of Transport (2002). The Town and Country Planning (Safeguarded Aerodromes, Technical Sites and Military Explosives Storage Areas). Direction (updated 2016). Available at: https://www.gov.uk/government/publications/safeguarding-aerodromestechnical-sites-and-military-explosives-storage-areas/the-town-andcountry-planning-safeguarded-aerodromes-technical-sites-and-militaryexplosives-storage-areas-direction-2002

Ref 13 EMFs.info (2024) Electic and magnetic fields and health. Available at: https://emfs.info/

Ref 14 Planning Inspectorate (2024) https://www.gov.uk/guidance/nationally-significant-infrastructure-projects-technical-advice-page-for-scoping-solar-development. Available at: https://www.gov.uk/guidance/nationally-significant-infrastructure-projects-technical-advice-page-for-scoping-solar-development