THE DROVES
SOLAR FARM

The Droves Solar Farm

Appendix 16.3: High-Level Electromagnetic Field Assessment

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High-Level Electromagnetic Field Assessment

Island Green Power

The Droves Solar Farm

November 2025





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EXECUTIVE SUMMARY

Report Purpose

Pager Power has been retained to assess the potential electromagnetic fields generated by electrical equipment within a ground-mounted solar photovoltaic development with respect to safe levels for human exposure. The proposed development is located near Swaffham, Norfolk, UK, and will include underground power cables, overhead powerlines, conversion units, National Grid and Consumer Substations and Battery Energy Storage System (BESS)[1].

Emissions

All electrical equipment emits electric and magnetic radiation. Power cables produce both electric and magnetic fields which can potentially affect human health. Electric and magnetic radiation from underground cables is generally less than radiation from overhead powerlines because emissions from adjacent conductors within a cable tend to cancel each other out. When assessing the impacts of overhead power lines, it is important to consider the impact of both electric and magnetic fields. Underground cables generally cause a negligible electric field above ground but can cause a significant magnetic field, which is dependent on the current in the conductors.

Standards in the UK

The UK Policy on public exposure limits to EMF radiation is designed to comply with the 1998 ICNIRP (International Commission on the Non-Ionizing Radiation Protection) guidelines in terms of the 1999 EU Recommendation. The National Policy Statement for Electricity Networks Infrastructure (EN-5) references the ICNIRP guidelines and states that applications should show evidence of compliance with these guidelines.

In 2010 ICNIRP produced new guidelines but these have not been incorporated into UK Policy. The public exposure limits in UK policy define reference levels for electric and magnetic fields. Where field levels exceed these reference levels in significantly occupied spaces, further investigation is warranted. Further information can be found in section 3 of the report.

Overall Conclusion

Levels of electromagnetic radiation from the underground cables and overhead powerlines are predicted to be below ICNIRP reference levels for magnetic fields, even when assuming maximum radiation is being emitted from the proposed underground cables and the existing overhead powerlines. However, electric field levels from the existing overhead powerlines are predicted to be above ICNIRP reference levels, and an approximately 15m minimum horizontal clearance distance is recommended.

[1] The maximum voltages and potential locations for all underground cables, conversion units and BESS have been considered to account for a worst-case scenario in the absence of a finalised electrical design of the site.

Radiation from the conversion units will be less significant because the equipment is predicted to be housed in protective enclosures and the substation and conversion units will be CE/UKCA marked, meaning they should not generate or be affected by electromagnetic disturbance.

Additionally, radiation from the proposed National Grid and Consumer Substations and BESS will not be significant as they will be located at least 260m from any surrounding dwellings and workplaces. For users of Public Rights of Way (PRoWs), any radiation effects would likely be minimal and not significant in EIA terms as these are not continually occupied, rather they are moving receptors, as opposed to residential dwellings and workplaces.

Assessment Results – 400kV Underground Cables

The maximum magnetic field produced by 400kV underground cables is predicted to be 96.17 micro-Teslas. The magnetic field levels are therefore below the reference level from the public exposure limits in UK policy.

This value correlates to a human being 1m above ground level (agl), directly above the cable, and therefore the magnetic fields will be further diminished due to any separation distances horizontally from the cables to any dwelling.

When considering the cumulative magnetic fields of the proposed underground cables and existing overhead powerlines (worst-case for maximum EMFs and design parameters), the exposure limits directly above the cable are still maintained.

Assessment Results - 400kV Overhead Powerlines

The maximum magnetic field produced by the existing overhead powerlines is predicted to be 81.942 micro-Teslas. The magnetic field value is therefore below the reference level from the public exposure limits in UK policy.

The maximum electric field produced by the existing overhead powerlines is predicted to be 10.642kV/m. The electric field levels are therefore above the reference level from the public exposure limits in UK policy and an approximately 15m minimum clearance distance is recommended. When repositioning the overhead powerlines, it is recommended to maintain a 15m horizontal buffer from receptors that would experience impacts for a significant length of time, such as workplaces and dwellings. This standoff distance limits risks associated with prolonged exposure to electromagnetic fields generated by the overhead powerlines.

When considering the cumulative magnetic fields at 0m from the proposed underground cables and existing overhead powerlines (worst-case for maximum EMFs and design parameters), the exposure limits are still maintained. When considering the cumulative electric fields at 0m from the proposed underground cables and existing overhead powerlines (worst-case for maximum EMFs and design parameters), the exposure limits are exceeded, but can still be met with the recommended clearance distance of 15m.

Assessment Results – Conversion Units

Notable sources of radiation other than the cables will be the conversion units positioned across the proposed development.

The equipment within conversion units will be 'CE' marked (Conformité Européene, or European Conformity marking), and/or 'UKCA' marked (UK Conformity Assessed). CE and UKCA markings indicate that a product has been assessed by the manufacturer and determined to meet the safety, health, and environmental protection requirements of the European Union and the United Kingdom, respectively. CE marking requirements were adopted and extended indefinitely in Great Britain until the UK left the EU in 2020. From 1 January 2021, the UKCA mark started to replace the CE mark for goods sold within Great Britain, and the CE mark has continued to be required for goods sold in Northern Ireland. The marking should ensure that electrical and electronic equipment does not generate, or is not unintentionally affected by, electromagnetic disturbance.

Furthermore, the conversion units are predicted to produce fields at a lower level than that of underground cables because the equipment is typically housed in protective enclosures.

Assessment Results – Substations and BESS

The proposed National Grid and Consumer Substations and BESS are located over 260m from the nearest dwelling, ensuring compliance with public exposure limits. The existing 400kV overhead powerlines, which produce higher fields, are situated with a recommended 15m clearance, further ensuring the 260m separation is sufficient. The substations and BESS are expected to comply with EMF exposure guidelines, with equipment housed in protective enclosures to minimize radiation. For users of PRoWs, any radiation effects would be minimal due to their transient nature. Overall, no significant electromagnetic impacts are predicted from the proposed infrastructure.

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ABOUT PAGER POWER

Pager Power is a dedicated consultancy company based in Suffolk, UK. The company has undertaken projects in 63 countries internationally.

The company comprises a team of experts to provide technical expertise and guidance on a range of planning issues for large and small developments.

Pager Power was established in 1997. Initially the company focus was on modelling the impact of wind turbines on radar systems. Over the years, the company has expanded into numerous fields including:

- Renewable energy projects.
- Building developments.
- Aviation and telecommunication systems.

Pager Power prides itself on providing comprehensive, understandable, and accurate assessments of complex issues in line with national and international standards. This is underpinned by its custom software, longstanding relationships with stakeholders and active role in conferences and research efforts around the world.

Pager Power's assessments withstand legal scrutiny and the company can provide support for a project at any stage.

1 INTRODUCTION

1.1 Purpose of the Study

Pager Power has been retained to assess the potential electromagnetic fields generated by electrical equipment within a ground-mounted solar photovoltaic development with respect to safe levels for human exposure. The proposed development is located near Swaffham, Norfolk, UK, and will include underground power cables, overhead powerlines, conversion units, National Grid and Consumer Substations and Battery Energy Storage System (BESS)[2].

1.2 Proposed Development Boundary

Figure 1 below shows the proposed development boundary overlaid onto aerial imagery.

Figure 1 *Proposed development boundary overlaid onto aerial imagery*

[2] The maximum voltages and potential locations for all underground cables, conversion units and BESS have been considered to account for a worst-case scenario in the absence of a finalised electrical design of the site.

1.3 Assessed Infrastructure

The known locations of assessed infrastructure are shown in Figures 2 and 3 below:

- Proposed development footprint (red polygon);
- Grid Connection Infrastructure area (orange polygon);
- Indicative siting zone for National Grid Substation (blue polygon);
- Indicative siting zone for Customer Substation (green polygon);
- Indicative siting zone for BESS (purple polygon);
- Existing pylons (pink triangular icons) and overhead powerline (white path).

Figures 2 and 3 are intended to provide an overview of the environment and infrastructure.

Figure 2 *Assessed infrastructure locations*

Figure 3 *Assessed infrastructure locations close up*

The technical information considered within this assessment is presented in Table 1 below

Assessed Infrastructure Technical Information			
Underground cables	Voltages	Up to 400kV cables	
	Locations	Positioned within the red line boundary	
Overhead powerlines	Voltages	Existing and repositioned cables up to 400kV	
	Locations	Up to five existing pylons indicated in Figures 2 and 3 and will be replaced and repositioned Exact locations of the diversion are still under discussion and will be determined through ongoing engagement with National Grid Electricity Transmission (NGET)	
Substations	Voltages	Up to 400kV Customer substation	Up to 400kV National Grid substation
	Proposed locations	The option includes a section of field 27 (detailed in green in Figures 2 and 3)	The option includes a section of field 27 (detailed in blue in Figures 2 and 3)
BESS	Proposed locations	The option includes a section of fields 24 and 27 (detailed in purple in Figures 2 and 3)	
Conversion Units (Transformers and PV inverters)	Proposed locations	Positioned across the proposed development	

Table 1 *Assessed infrastructure technical information*

2 TECHNICAL BACKGROUND

2.1 Emissions

All electrical equipment emits electric and magnetic radiation. Power cables produce both electric and magnetic fields which can potentially affect human health. Radiation from underground cables is generally less than radiation from overhead lines because emissions from adjacent conductors within a cable tend to cancel each other out. When assessing the impacts of overhead powerlines, it is important to consider the impact of both electric and magnetic fields.

Underground cables generally cause a negligible electric field above ground but can cause a significant magnetic field which is dependent on the current in the conductors.

2.2 Electromagnetism

The movement of electric charge causes electric and magnetic fields to be produced in the space surrounding the charge. Human exposure to such fields can cause health problems if persistent and/or they are of high strength. The magnitude of the effects is dependent on both the field strength and the exposure time.

2.3 Health Concerns – Potential Effects

The potential effects on human health caused by time-varying magnetic fields, such as those generated by AC[3] cables, are due to induced current on functions of the central nervous system. There are various international bodies which provide maximum safe exposure levels to time varying electromagnetic fields.

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

The UK Policy on public exposure limits to EMF radiation is designed to comply with the 1998 ICNIRP (International Commission on the Non-Ionizing Radiation Protection) guidelines in terms of the 1999 EU Recommendation. In 2010 ICNIRP produced new guidelines but these have not yet been incorporated into UK Policy. The public exposure limits in UK policy define reference levels for electric and magnetic fields. Where field levels exceed these reference levels in significantly occupied spaces, further investigation is warranted.

Another relevant resource consulted is the EMFs.info webpage[4], where the UK electricity industry has collected the relevant studies pertaining to safe limits on exposure in the UK and elsewhere in the world. The relevant sections are analysed in the next chapter.

[3] Alternating Current
[4] Accessed 25th February 2025

2.4 Radiation from Home Electrical Equipment

The World Health Organization (WHO) publishes data regarding electromagnetic fields including the following typical levels for home electrical equipment, shown in Table 2 below.

Appliance	Electric field strength (Volts per metre)	Magnetic field strength (micro-Tesla) (at 1 metre)
Hair Dryer	80	0.01 – 7
Iron	120	0.12 – 0.3
Vacuum Cleaner	50	2 – 20
Refrigerator	120	0.01 – 0.25
Television	60	0.04 - 2

Table 2 *Typical emissions from home electrical equipment*

2.5 Radiation Reduction with Distance

Radiation levels reduce with distance which means, for example, the typical magnetic field from a vacuum cleaner reduces from 800 micro-Tesla to 2 micro-Tesla when the separation distance increases from 3 centimetres to 100 centimetres.

This means radiation levels from the cables, conversion units, substations and BESS will tend to reduce with distance in any direction – including towards a receptor.

3 OVERVIEW OF ELECTROMAGNETIC FIELDS

3.1 Overview

The Electricity Networks Association[5] provides a comprehensive overview of electromagnetic fields (EMFs) and the issues associated with these on their webpage[6]. Regarding health issues caused by EMFs they state the following:

However, there are suggestions that magnetic fields may cause other diseases, principally childhood leukaemia, at levels below these limits. The evidence for this comes from epidemiology studies, which have found a statistical association - an apparent two-fold increase in leukaemia incidence, from about 1 in 24,000 per year up to 1 in 12,000 per year, for the children with the top half percent of exposures. The evidence is strong enough for magnetic fields to be classified by the World Health Organization as "possibly carcinogenic". But because these studies only show statistical associations and do not demonstrate causation, and because the evidence from the laboratory is against, the risk is not established, it remains only a possibility.

3.2 Exposure limits in the UK

As set out in the previous section, the limits in the UK come from the 1998 ICNIRP guidelines. The original guidance in 1999 specified:

i) Basic Restrictions;

   These are the levels at which radiation is potentially harmful to humans. This is a current density[7] given in mA m^{-2} (milliamps per metre squared).

ii) Reference Level (Investigation Level);

   Provided for practical exposure assessment purposes to determine whether the basic restrictions are likely to be exceeded. Compliance with the reference level will ensure compliance with the relevant basic restriction.

iii) Field Actually Required;

   This is the field strength at which the basic restriction is likely to be exceeded.

The values for the above stated in the ICNIRP 1998 paper are shown in Table 3 on the following page. These are the public exposure values, not the occupational exposure values – the former is more conservative than the latter by a factor of five.

[5] This is an industry body for the companies which run the UK and Ireland's energy networks. The group comprises 14 members including National Grid.

[6] www.emfs.info [Accessed 28th March 2024]

[7] Current density is the amount of electric current flowing through a unit area.

ICNIRP 1998 – Public Exposure Limits				
Basic Restriction (mA m^{-2})	Magnetic Fields Reference Level (µT)	Electric Fields Reference Level (kV m^{-1})	Magnetic Field Actually Required to Exceed Basic Restriction (µT)	Electric Field Actually Required to Exceed Basic Restriction (kV m^{-1})
2	100	5	360	9

Table 3 *ICNIRP Exposure Limits 1998*

The levels in Table 3 are considered within this analysis.

3.3 Height Above Ground Used for Testing Compliance

EMFs.info[8] specifically stated the following with regard to the height to be used to test compliance:

The standard height for measuring fields, especially from power lines, is 1 m above ground level ... This isn't just because it's a convenient round number, it's because roughly half way up the height of a standing person is actually the height that gives the best approximation to the induced current in the body.

3.4 Safe Levels – Summary

The values of interest are those shown in Table 3 above. Effectively, this means that in locations of significant exposure time, such as residences, levels should be below:

- 100µT (magnetic fields).
- 5kV m^{-1} (electric fields).

Values exceeding the limits above, at one metre above ground level, would suggest that further investigation is required.

[8] Accessed March 2024.

4 TECHNICAL ASSESSMENT

4.1 Field Levels – Underground Cables

Field level data from various cable configurations have been sourced from EMFS.info. The data below and on the following page shows the magnetic fields for 400kV cables, which represent the maximum assumed voltage for underground cables in the proposed development, considering a worst-case scenario. Typical values for magnetic fields are approximately a quarter of these maximum values[9]. The assessment accounts for varying cable voltages in the proposed development, with the analysis based on the maximum voltage and shallowest depths to adopt a conservative approach. Maximum field data has been used where possible to provide a more conservative assessment. It's important to note that there are no electric fields above ground associated with underground cables. The relevant chart is shown in Figure 4 below. Table 4 on the following page provides the associated indicative numerical values at set distances[10].

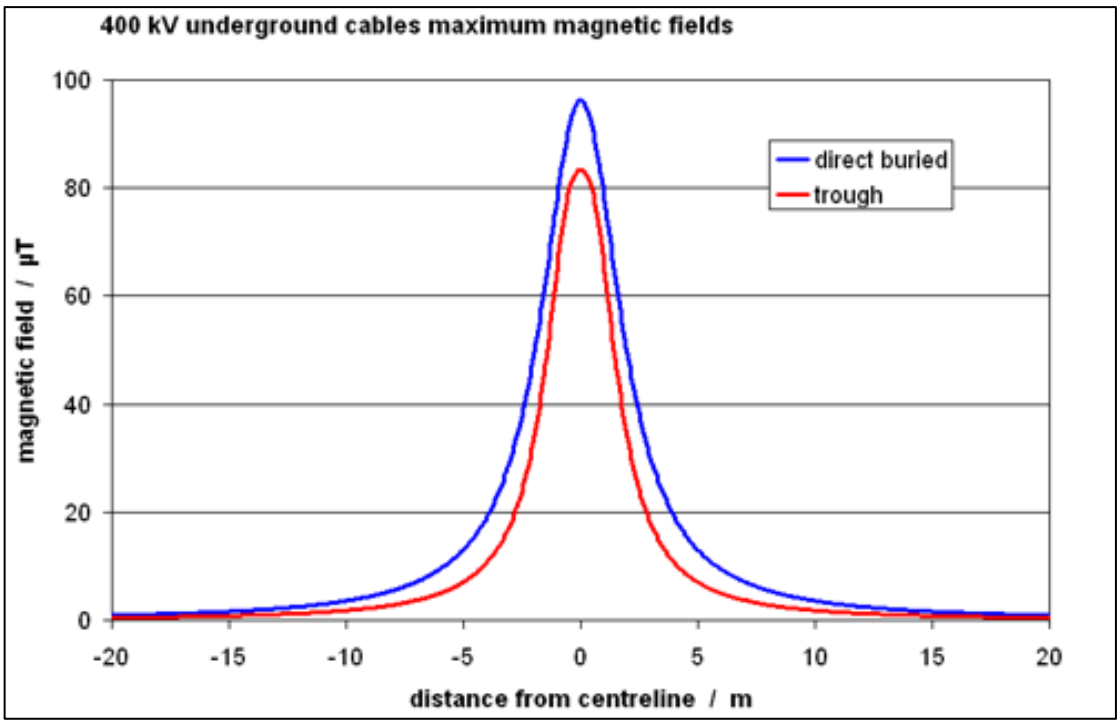

Figure 4 *Maximum magnetic fields associated with 400kV underground cables*

[9] Source: https://www.emfs.info/sources/overhead/specific/400-kv/ [Accessed 28th March 2024]
[10] www.emfs.info [Accessed 28th March 2024]

Distance from Centreline (m)	Magnetic Field (trough double circuit cable with 0.13m spacing and 0.3m depth)	Magnetic Field (direct buried single cable with 0.5m spacing and 0.9m depth)[11]
0	83.30 micro Teslas	96.17 micro Teslas
5	7.01 micro Teslas	13.05 micro Teslas
10	1.82 micro Teslas	3.58 micro Teslas
20	0.46 micro Teslas	0.92 micro Teslas

Table 4 *Maximum magnetic field levels for an underground 400kV cable*

4.2 Field Levels – Overhead Powerlines

Field-level data has been sourced from EMFS.info[12]. The data below and on the following pages show magnetic and electric fields for a typical 400kV overhead powerline operating at the highest allowed loads and minimum ground clearance. This provides a worst-case assessment by illustrating the maximum expected magnetic and electric fields. As the final design of the overhead line infrastructure is yet to be determined, this assessment is based on general assumptions for 400kV systems. The existing 400kV overhead lines are also being rerouted, which may influence the final design. The relevant chart for the maximum magnetic field is shown in Figure 5 on the following page, and the relevant chart for the maximum electric field is shown in Figure 6 on page 20. Tables 5 and 6 provide the associated indicative numerical values at set distances.

[11] This cable was used for the assessment in the following sections.

[12] Accessed March 2024

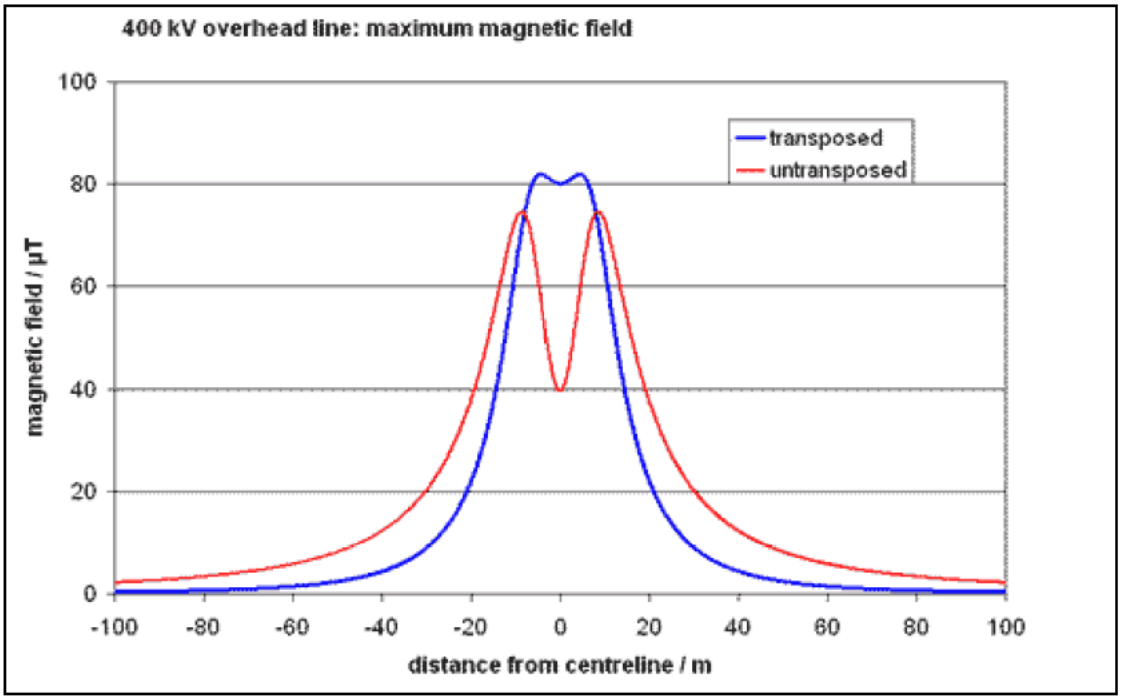

Figure 5 *Maximum magnetic fields associated with 400kV overhead powerline*

Distance from Centreline (m)	Magnetic Field (L12 lattice pylon design with 7.6m ground clearance and the highest allowed loads)
0	81.942 micro-Tesla
10	72.818 micro-Tesla
25	22.103 micro-Tesla
50	8.148 micro-Tesla
100	2.145 micro-Tesla

Table 5 *Maximum magnetic field levels for an overhead 400kV powerline (source: EMFS.info)*

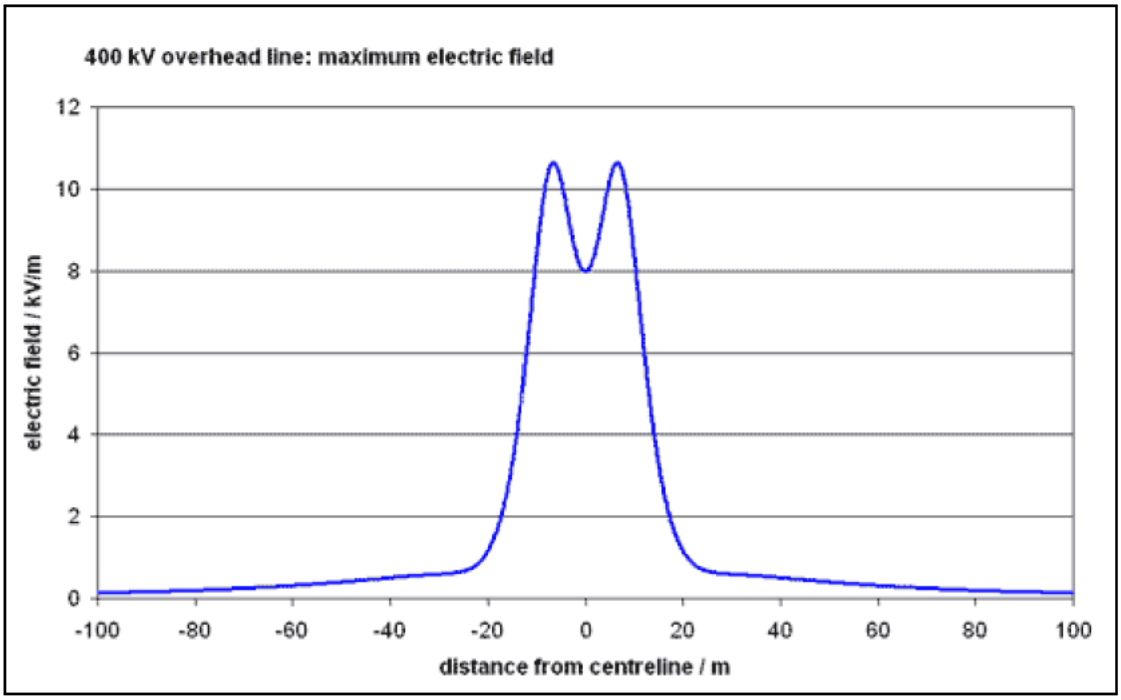

Figure 6 *Maximum electric fields associated with 400kV overhead cable*

Distance from Centreline (m)	Electric Field (L12 lattice pylon design with 7.6m ground clearance and the highest allowed loads)
0	10.642 kV/m
10	8.410 kV/m
25	0.669 kV/m
50	0.404 kV/m
100	0.136 kV/m

Table 6 *Maximum electric field levels for an overhead 400kV cable (source: EMFS.info)*

4.3 Recommended Minimum Clearance Distances

The recommended minimum clearance distances for different categories of cable based on the public exposure limits previously referenced in this report for magnetic and electric fields are presented in Table 7 on the following page.

The dataset provided maximum values and typical values for the configurations that have been evaluated – in all cases the 'maximum' option has been chosen where possible in order to remain conservative.

Type of Line	Recommended minimum Clearance Distance (m)	Estimated Maximum Magnetic Field (micro-Tesla)	Estimated Maximum Electric Field (kV/m)
400kV underground cable	None	96.17 (below 100 limit)	-
400kV overhead powerline	Approximately 15m	81.942 (below 100 limit)	10.642 (above 5 limit)

Table 7 *Recommended clearance distances for the 400kV underground cables*

This shows that clearance distances are not required for any proposed underground cables. The table highlights that the fields produced by the cables are significantly below the acceptable exposure limit, and significant effects upon health are not predicted.

Additionally, the estimated maximum magnetic field produced by the overhead powerline is significantly below the acceptable exposure limit, and significant health effects are not predicted.

However, the estimated maximum electric field produced by the overhead powerline surpasses the acceptable exposure limits specified in Table 3. A minimum clearance distance of approximately 15 meters is recommended for the 400kV overhead powerline to reduce the maximum electric field to below the reference exposure.

This recommendation specifically addresses public exposure limits for human health, and the minimum clearance distance is with reference to stationary, prolonged receptors such as residential dwellings and workplaces. Therefore, receptors that would experience prolonged or significant exposure should not be within 15m horizontally of the overhead powerlines. This standoff distance limits risks associated with prolonged exposure to electromagnetic fields generated by the overhead powerlines.

4.4 Radiation from Other Sources

4.4.1 Conversion Units

Notable sources of radiation, other than the cables and powerlines, will include the conversion units positioned across the proposed development. As of the time of this report, the specific locations for these have not been finalised.

The equipment within conversion units should be CE marked (Conformité Européene, or European Conformity marking), and/or 'UKCA' marked (UK Conformity Assessed). CE and UKCA marking indicates that a product has been assessed by the manufacturer and deemed to meet the safety, health and environmental protection requirements of the European Union[13] and the United Kingdom[14], respectively. CE marking requirements have been adopted and extended indefinitely in Great Britain until the UK left the EU in 2020. From 1 January 2021, the UKCA mark started to replace the CE mark for goods sold within Great Britain, and the CE mark has continued to be required for goods sold in Northern Ireland. This will be confirmed prior to installation.

The relevant EU Directive for CE marking is[15] Electromagnetic Compatibility Directive 2014/30/EU, and the relevant UK Statutory guidance for UKCA marking is the Electromagnetic Compatibility Regulations 2016[16]. This legislation should ensure that electrical and electronic equipment should not generate, or be affected by, electromagnetic disturbance.

Additionally, the conversion units are also predicted to produce fields at a lower level than that of underground cables as the equipment will be housed in protective enclosures.

4.4.2 Substations and BESS

Other notable sources of radiation associated with the proposed development include the substations (Customer and National Grid) and BESS located within and adjacent to the Grid Connection Infrastructure area. The potential sites for the National Grid and Customer Substations and BESS are detailed in Section 1.3.

The minimum horizontal distance between the Grid Connection Infrastructure area and any dwelling is approximately 330m. The existing 400kV overhead powerline would produce more significant electric and magnetic fields than any type of additional electrical infrastructure proposed as a part of this development. As detailed in Section 4.3, the recommended horizontal clearance distance for such overhead lines is approximately 15m. Based on this recommendation and professional judgement, the 330m separation distance is considered sufficient to ensure that no significant impacts are predicted for the proposed Grid Connection Infrastructure area.

[13] Source: https://europa.eu/youreurope/business/product-requirements/labels-markings/ce-marking/index_en.htm
[14] Source: https://www.gov.uk/guidance/using-the-ukca-marking
[15] Source: https://ec.europa.eu/growth/sectors/electrical-engineering/emc-directive_en
[16] Source: https://www.gov.uk/government/publications/electromagnetic-compatibility-regulations-2016/electromagnetic-compatibility-regulations-2016-great-britain

The final substation positioning and connection method will be determined by the developer through ongoing engagement with NGET, ensuring compliance with relevant EMF exposure guidelines and industry standards.

Similarly to the conversion units, the equipment installed as part of the proposed substations, are expected to be 'CE' and/or 'UKCA' marked. CE and 'UKCA' marking should ensure that electrical and electronic equipment does not generate, or is not unintentionally affected by, electromagnetic disturbance. The substations are also predicted to produce fields at a lower level than that of underground cables because the equipment is expected to be housed in protective enclosures.

Significant radiation is not predicted from the proposed substations and BESS because:

- The Grid Connecton Infrastructure area is over 400 metres from the nearest dwelling and must comply with relevant public exposure limits. The substations and BESS are over 1.1km from the nearest dwelling. Electromagnetic fields from substation equipment will not extend significantly beyond the perimeter fence, if at all, and all dwellings remain at a safe distance, as radiation levels decrease with increasing separation.
- For users of Public Rights of Way (PRoWs), any radiation effects would likely be minimal as these are not continually occupied, rather they are moving receptors, as opposed to residential dwellings and workplaces.

An overview of the nearest dwellings relative to the Grid Connection Infrastructure area, including indicative siting zones for the National Grid Substation (blue polygon), Customer Substation (green polygon) and BESS (purple polygon) be found in Figure 7 on the following page.

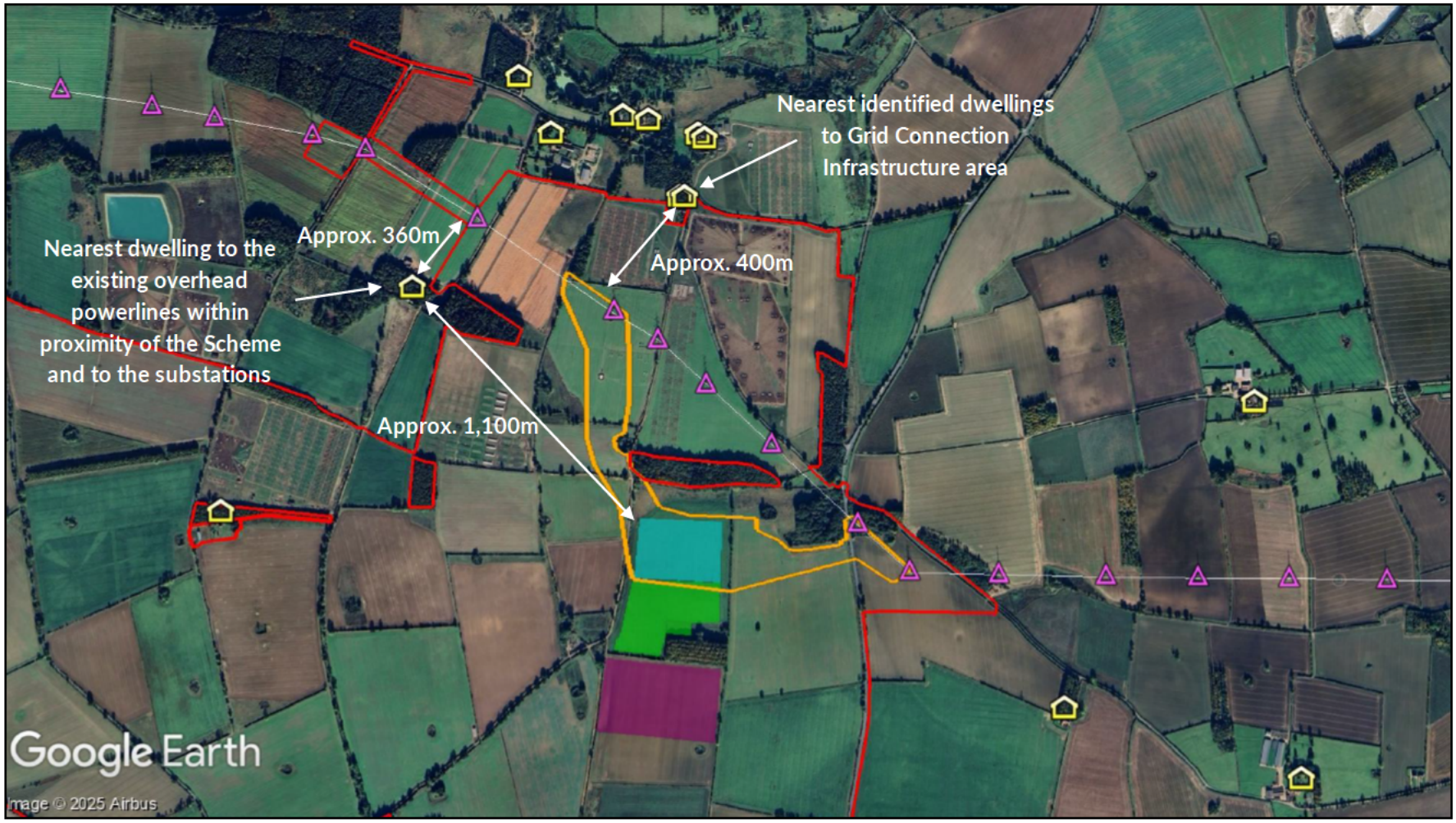

Figure 7 *Nearest dwellings relative to the Grid Connection Infrastructure area*

4.5 Comparative Assessment

The maximum magnetic field produced by appliances such as vacuum cleaners can reach up to 20 micro-Tesla. It would follow that appliances with larger voltages would produce fields at a higher level; however, the 132kV underground cables do not produce significantly larger fields.

The maximum magnetic field produced by the proposed underground cables is 5.01 micro-Tesla. In comparison to the household appliances previously mentioned, these values are significantly lower and are within the acceptable exposure limits. The substation and conversion units will produce magnetic fields at levels lower than the underground cables, thus, lower than the household appliances previously mentioned.

The maximum electric field produced by larger household appliances such as refrigerators is 0.12kV/m and, as mentioned above, the maximum magnetic field produced by appliances such as vacuum cleaners can reach up to 20 micro-Tesla. While the overhead powerlines generate stronger magnetic and electric fields compared to household appliances, it is crucial to consider the recommended clearance buffer of 15 meters for human activity. This safety measure mitigates exposure to these fields, ensuring acceptable exposure limits.

4.6 Cumulative Effects

When assessing the cumulative effects of electromagnetic fields, the worst case is based upon the addition of source a and source b; however, it is important to note that this is only true for magnetic fields that are exactly in line. When the electromagnetic fields are not in line, the sum of these is less than 'a+b'.

For the purpose of this assessment the worst case has been calculated i.e. based upon 'a+b'. The closest dwellings to the Grid Connection Infrastructure Area are over 300m away and significantly beyond the 15m buffer which may be required for overhead power lines. No significant cumulative impacts are predicted for overhead power lines and underground cables.

As discussed in Section 4.3, the conversion units, National Grid and Customer Substations and BESS produce smaller magnetic fields than that of the 400kV underground cables, thus, considering all sources of radiation and their relative locations, it is predicted that the cumulative magnetic and electric fields are likely to be below the acceptable exposure limits.

The cumulative effects are not significantly impacted by the use of household items. While electrical appliances do contribute to overall exposure of electromagnetic fields, the levels remain well below the recommended exposure limits due to the lower voltages of these appliances and their intermittent use, resulting in only a temporary and minor addition to the overall electromagnetic field levels.

It is not expected that there will be any significant cumulative effects with other known solar schemes, including High Grove Solar. Whilst the High Grove Solar cable route will cross the south of the site, all receptors are significantly beyond the recommended clearance buffer and no impacts are predicted.

5 CONCLUSIONS

5.1 400kV Underground Cables

The maximum magnetic field produced by 400kV underground cables is predicted to be 96.17 micro-Teslas. The magnetic field levels are therefore below the reference level from the public exposure limits in UK policy.

This value correlates to a human being 1m above ground level (agl), directly above the cable, and therefore the magnetic fields will be further diminished due to any separation distances horizontally from the cables to any dwelling.

When considering the cumulative magnetic fields of the proposed underground cables and existing overhead powerlines (worst-case for maximum EMFs and design parameters), the exposure limits directly above the cable are still maintained.

5.2 400kV Overhead Powerlines

The maximum magnetic field produced by the existing overhead powerlines is predicted to be 81.942 micro-Teslas. The magnetic field value is therefore below the reference level from the public exposure limits in UK policy.

The maximum electric field produced by the existing overhead powerlines is predicted to be 10.642kV/m. The electric field levels are therefore above the reference level from the public exposure limits in UK policy and an approximately 15m minimum clearance distance is recommended. When repositioning the overhead powerlines, it is recommended to maintain a 15m horizontal buffer from receptors that would experience impacts for a significant length of time, such as workplaces and dwellings. This standoff distance limits risks associated with prolonged exposure to electromagnetic fields generated by the overhead powerlines.

When considering the cumulative magnetic fields at 0m from the proposed underground cables and existing overhead powerlines (worst-case for maximum EMFs and design parameters), the exposure limits are still maintained. When considering the cumulative electric fields at 0m from the proposed underground cables and existing overhead powerlines (worst-case for maximum EMFs and design parameters), the exposure limits are exceeded, but can still be met with the recommended clearance distance of 15m.

5.3 Conversion Units

Notable sources of radiation other than the cables will be the conversion units positioned across the proposed development.

The conversion units will be 'CE' marked (Conformité Européene, or European Conformity marking), and/or 'UKCA' marked (UK Conformity Assessed). CE and UKCA markings indicate that a product has been assessed by the manufacturer and determined to meet the safety, health, and environmental protection requirements of the European Union and the United Kingdom, respectively. CE marking requirements were adopted and extended indefinitely in Great Britain until the UK left the EU in 2020. From 1 January 2021, the UKCA mark started to replace the

CE mark for goods sold within Great Britain, and the CE mark has continued to be required for goods sold in Northern Ireland. The marking should ensure that electrical and electronic equipment does not generate, or is not unintentionally affected by, electromagnetic disturbance.

Furthermore, the conversion units are predicted to produce fields at a lower level than that of underground cables because the equipment is typically housed in protective enclosures.

5.4 Substations and BESS

The proposed National Grid and Consumer Substations and BESS are located over 1km from the nearest dwelling, ensuring compliance with public exposure limits. The existing 400kV overhead powerlines, which produce higher fields, are situated with a recommended 15m clearance, further ensuring the 1km separation is sufficient. The substations and BESS are expected to comply with EMF exposure guidelines, with equipment housed in protective enclosures to minimize radiation. For users of PRoWs, any radiation effects would be minimal due to their transient nature. Overall, no significant electromagnetic impacts are predicted from the proposed infrastructure.

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THE DROVES

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