

15. Heat and Radiation

Executive Summary

The operational radiation from the proposed development will only be from the transmit (Tx) Array and is non-ionising, which is non-radioactive.

The proposed development is designed to comply with the relevant provisions of International Commission on Non-Ionizing Radiation Protection (ICNIRP) guidelines. Due to the stringent nature of the guidelines, there is no possibility that the proposed development would result in significant effects from radiation. Additionally, Planning Policy Wales (PPW) outlines that as the proposed development is meeting the ICNIRP guidelines, planning authorities do not need to consider health impacts from non-ionising radiation equipment.

The proposed development will also operate in line with The Control of Electromagnetic Fields at Work Regulations 2016 and JSP 392, which place a duty of care on the employer to protect employees.

Design interventions for the proposed development include that the entire Tx Array footprint will be enclosed by a security fence at a minimum safe distance as defined by testing at Deep Space Advanced Radar Capability (DARC) Site 1 in Western Australia (report provided in Appendix 15.2). Warning signs shall be posted to that effect, and only authorised personnel who will be properly trained will be allowed access to the Tx array security fence line.

Although risks to public health will not occur due to the inherent design of the proposed development, a technical report is included in Appendix 15.1 which considers potential non-ionising radiation hazards of the proposed development to humans and wildlife during operation. The potential impacts of non-ionising radiation on habitats and species were also considered and eliminated in Appendix 15.1.

As there is no pathway that would lead to a significant effect on humans from non-ionising radiation, this chapter detailed that there are no likely impacts on occupationally exposed individuals and members of the public, based on the conclusions from the assessment work reported in Appendix 15.1.

15.1. Introduction

15.1.1. This chapter presents information required by the Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017 (the ‘EIA Regulations’)³⁵⁷. As part of the Environmental Impact Assessment (EIA) process, this Environmental Statement (ES) chapter reports the potential significant effects for Heat and Radiation as a result of the proposed development.

15.1.2. The approach to this assessment follows the EIA Scoping Report (March 2023) submitted to Pembrokeshire County Council (PCC) and consultation outlined in Section 5.3, and has been prepared in accordance with the EIA Scoping Opinion (May 2023) for the proposed development from PCC.

15.1.3. As per Schedule 4 of the EIA Regulations, the ES should provide:

“A description of the likely significant effects of the development on the environment resulting from ... the emission of ... heat and radiation”.

15.1.4. Chapter 3 (Proposed Development) contains a detailed description of the proposed development. This chapter is supported by the following appendices, and includes cross-references to other chapters and figures where appropriate:

- Appendix 15.1 (Defence Scientific Expert Group (DSEC) (2025) Evaluation of Radiation Hazards Associated with the DARC Radar); and
- Appendix 15.2 (RF EME Survey Report DARC S1 Augusta TX Site).

15.1.5. The difference between ionising and non-ionising radiation is defined by the Health and Safety Executive³⁵⁸ as follows:

- Ionising radiation includes:
 - X-rays;
 - gamma rays; and
 - radiation from radioactive sources and sources of naturally occurring radiation, such as radon gas.

Ionising radiation has many uses in industry, such as energy production, manufacturing, medicine and research, and produces many benefits to society. However, it is important that the risks of ionising radiation are managed sensibly to protect workers and the public.

- Non-ionising radiation includes:
 - visible light;
 - ultra-violet light;
 - infra-red radiation; and
 - electromagnetic fields (EMFs).

15.1.6. Sources of EMFs are used extensively in telecommunications and manufacturing with little evidence of related long-term health problems. The operational radiation from the proposed development will only be from the transmit (Tx) Array and is non-ionising, which is non-radioactive.

³⁵⁷ The Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017. [Online] Available at: <https://www.legislation.gov.uk/wsi/2017/567/contents> [Accessed 21 October 2025].

³⁵⁸ Health and Safety Executive (2025). Introduction to radiation in the workplace. [Online] Available at: <https://www.hse.gov.uk/Radiation/introduction.htm> [Accessed 21 October 2025].



- 15.1.7. There are no sources of heat as part of the proposed development likely to give rise to significant effects, therefore heat is not considered further in this assessment.

15.2. Legislation and Policy

- 15.2.1. The national legislation and regulatory frameworks applicable in this assessment for Heat and Radiation are summarised in this section. The Planning Statement accompanying the application provides an assessment of the proposed development against relevant policy and legislation.

Guidelines

- 15.2.2. The International Commission on Non-Ionizing Radiation Protection (ICNIRP) sets guideline for radiofrequency (RF) electromagnetic fields. ICNIRP is the peak international body developing and disseminating science-based advice on health protection in relation to exposure to non-ionising radiation and is recognised by the World Health Organization for its independence and expertise in this area. The ICNIRP guidelines reflect international best practice on what constitutes a high level of protection for all people against substantiated adverse health effects from exposures to both short- and long-term, continuous and discontinuous RF fields. Further, the principles for protection against adverse health effects of exposure to RF fields are based on the ICNIRP Principles for Non-Ionising Radiation Protection, published in 2020. The UK adheres to the RF EMF exposure limits recommended by ICNIRP, which set guideline values for limiting exposure from 0 Hz to 300 GHz.
- 15.2.3. The proposed development has been designed from the outset to comply with the ICNIRP guidelines. As the proposed development will comply with the relevant provisions of ICNIRP guidelines, appropriate health protection standards will be met. Actual risks to public health are therefore not anticipated.

Legislation

- 15.2.4. Legislation relevant to the assessment of Heat and Radiation includes the following:
- The Control of Electromagnetic Fields at Work Regulations 2016³⁵⁹, which places a duty of care on the employer to protect employees.

National Policy

- 15.2.5. Planning Policy Wales (PPW) 2024³⁶⁰ sets out the Welsh Government's planning policy framework for Wales, including the Welsh Government's expectations for the content and quality of planning applications and local plan policy. PPW sets out the policy which the proposed development should comply with. It is also the basis for informing a judgement on the impacts of a development, for example whether the proposed development is consistent with the requirements of PPW. Compliance of the proposed development with PPW is detailed within the Planning Statement.
- 15.2.6. PPW specifies that for telecommunications projects, as long as they adhere to the International Commission on Non-Ionizing Radiation Protection (ICNIRP) guidelines³⁶¹, planning authorities should not take health concerns into account regarding mobile telecommunication equipment. Paragraph 5.2.18 states:

³⁵⁹ The Control of Electromagnetic Fields at Work Regulations 2016. [Online] Available at: <https://www.legislation.gov.uk/uksi/2016/588/contents> [Accessed 21 October 2025].

³⁶⁰ Welsh Government (2024). Planning Policy Wales, Edition 12, February 2024.

³⁶¹ ICNIRP. Guidelines for Limiting Exposure to Electromagnetic Fields (100 kHz to 300 GHz), *Health Phys* 118(5): 483–524, 2020, <https://www.icnirp.org/en/activities/news/news-article/ef-guidelines-2020-published.html>



“Provided that the development meets the International Commission on Non-Ionising Radiation Protection (ICNIRP) guidelines, planning authorities should not consider the health aspects of mobile telecommunication equipment.”

- 15.2.7. Although this PPW guidance is referring to telecommunication equipment, it is deemed relevant for the proposed development as it is referring to non-ionising radiation.

Local Policy

- 15.2.8. Local policy is provided by the PCC – Local Development Plan adopted 2013³⁶², specifically Policy GN.1 General Development Policy which states “*Development will be permitted where the following criteria are met... 4. It respects and protects the natural environment including protected habitats and species; ... 7 It would not cause or result in unacceptable harm to health and safety.*”

- 15.2.9. This chapter makes reference to the current LDP and the planning statement for the proposed development considers emerging policies and therefore considers the LDP Review which is currently being developed.

MOD Policy

- 15.2.10. MOD projects follow existing mandatory guidance to protect staff and members of the public in terms of Heat and Radiation. In addition, the MOD has a duty of care to protect the health and safety of members of the public who have potential to interact with MOD facilities. This is outlined in the JSP 392 as follows:

“Duties Commanding Officer / Head of Establishment (CO / HoE)

18. The CO for an activity and any HoE with EMF transmission sources within their establishment each hold a duty to the Secretary of State, and a personal responsibility, to protect the environment and secure the health, safety and welfare of their staff at work. The CO / HOE each hold general duties to protect persons not in MOD employment (e.g. members of the public) against risks to their health and safety arising from the MOD work activities. This includes radiation safety. The CO / HoE authority (but not responsibility) for EMF radiation safety management arrangements may be delegated to an appropriate, Suitably Qualified and Experienced Person (SQEP) such as an EMF Safety Officer (ESO).”

15.3. Methodology

Assessment Approach

- 15.3.1. As described above, the proposed development is designed to comply with the relevant provisions of ICNIRP guidelines. Due to the stringent nature of the guidelines, there is no possibility that the proposed development would result in significant effects from non-ionising radiation. Additionally, as stated Section 15.2, PPW outlines that as the proposed development is meeting the ICNIRP guidelines, planning authorities do not need to consider health impacts from non-ionising radiation equipment.

- 15.3.2. As described further in Section 15.5, a physical security perimeter fence will be installed around the Tx Array and would have appropriate design and signage commensurate with its function in restricting public access to a distance at which ICNIRP public exposure limits are met. Occupational health and safety is not within the scope of this assessment as it is covered by separate legislation. However, the expectation is that relevant provisions in relation to EMF

³⁶² Pembrokeshire County Council (2013). Local Development Plan: Planning Pembrokeshire's Future. [Online] Available at: <https://www.pembrokeshire.gov.uk/adopted-local-development-plan> [Accessed 21 October 2025].



exposures would also be met for staff and contractors. This is addressed through the requirement of meeting the Control of Electromagnetic Fields at Work Regulations 2016.

- 15.3.3. As there is no pathway that would lead to a significant effect on a receptor from the proposed development, this chapter does not follow the traditional EIA methodology of determining significance through assessing the sensitivity of a receptor and the magnitude of potential change. Instead, this chapter details why there are no likely impacts on occupationally exposed individuals and members of the public, based on the conclusions from assessment work reported in Appendix 15.1 (Evaluation of Radiation Hazards Associated with the DARC Radar).
- 15.3.4. The potential implications of the proposed development's micrositing allowance is further discussed in Chapter 3 (Proposed Development).

Studies Undertaken for the Proposed Development

- 15.3.5. Although risks to public health will not occur due to the inherent design of the proposed development, a technical report is included in Appendix 15.1 (Evaluation of Radiation Hazards Associated with the DARC Radar). The report was undertaken by the Ministry of Defence (MOD) Defence Electro Magnetic Authority (DEMA) in accordance with the MOD JSP 392 Management of Radiation Protection in Defence: Part 2 Guidance, Chapter 35: Radio Frequency Radiations, January 2023³⁶³.
- 15.3.6. The technical report considers potential non-ionising radiation hazards of the proposed development to humans and wildlife during operation. It uses finite-element modelling to evaluate the power density of the Deep Space Advanced Radar Capability (DARC) transmit antennas. This is a robust method and takes the far field effect into account. It shows that at a range of 40 m, the transmitted power density is 16 dB (a factor of 40) less than the maximum level specified by ICNIRP.
- 15.3.7. The report reviews three key considerations:
- Power incident as a function of distance and of the radar parameters, and confirms the minimum safe distance for a human from a transmitter.
 - Non-ionising radiation hazards to birds, bats and insects. The method by which these are assessed and results for the DARC radar and various types of bird, bat and insect targets are considered in a quantitative manner. Also considered are the effects of magnetic fields on the ability of birds to navigate.
 - A number of broadly equivalent high-power radars worldwide were considered, to see if there is any evidence of adverse effects on humans or on wildlife.
- 15.3.8. This technical report has been used to assess the proposed development against the ICNIRP guidelines. The conclusions further indicate that there are no likely impacts from the non-ionising radiation on humans and wildlife. The potential impacts of non-ionising radiation on habitats and species were considered and eliminated in Appendix 15.1. These are further discussed in Chapter 8 (Biodiversity) therefore are not considered further in this chapter.
- 15.3.9. This assessment also considers the safeguarding and redundancies embedded in the design and operation of the proposed development before concluding likely significant effects.

³⁶³ MOD (2023). Management of radiation protection in defence: part 2 guidance (JSP 392). Chapter 35: radio frequency radiations. [Online] Available at: https://assets.publishing.service.gov.uk/media/63d7a5d3d3bf7f25213352e8/JSP_392_Chapter_35_web_version.pdf [Accessed 21 October 2025].

- 15.3.10. The assessment in this chapter is also supported by survey results from the Tx Arrays installed at DARC Site 1 in Western Australia presented in Appendix 15.2.

Potential Receptors

- 15.3.11. As defined in Appendix 15.1, occupationally-exposed individuals are adults who are exposed under controlled conditions associated with their occupational duties. These individuals will have undergone appropriate training and be aware of the appropriate risk assessments and precautions. The levels for exposure of members of the public are more stringent than occupationally-exposed individuals and are appropriate for exposure of children or pregnant women. The standards are periodically reviewed, and updated if necessary. For the purposes of this assessment, all human receptors are considered to be of high sensitivity, as a reasonable worst case.
- 15.3.12. The key potential receptors as part of this assessment are defined as follows.
- Occupational exposure: Staff required on site to operate the radar arrays and associated equipment; and
 - Public exposure: Non-occupational staff.

Consultation

- 15.3.13. An EIA Scoping Report was submitted to PCC in March 2023. An EIA Scoping Opinion was received in response to the EIA Scoping Report (May 2023). The applicant's responses to the EIA Scoping Opinion are contained in Appendix 2.1 (DARC EIA Scoping Opinion Response Table). The Scoping Report identified that operational heat and radiation may have potential impacts on occupational, public and wildlife exposure. This chapter follows on from this to show that significant effects are not anticipated from the proposed development.

Assumptions & Limitations

- 15.3.14. The construction phase and operational phase assessments have been based on the proposed development description presented in Chapter 3 (Proposed Development) to establish a realistic worst-case assessment scenario.

15.4. Baseline

- 15.4.1. There are currently no sources of non-ionising radiation at Cawdor Barracks.

15.5. Design Interventions

Design Interventions

- 15.5.1. The development of the proposed design has been an iterative process. The environment team has worked in close collaboration with the infrastructure design team to avoid or reduce environmental impacts and effects through the proposed development design. These are referred to as design interventions. The principles of the design and mitigation hierarchy outlined in Chapter 2 (Methodology) have been followed, the first principle being to avoid potential adverse effects, if at all feasible, before seeking to minimise or mitigate for any unavoidable impacts.
- 15.5.2. Design interventions for the proposed development include that the entire Tx Array footprint will be enclosed by a security fence at a minimum safe distance as defined by testing at DARC Site 1 in Western Australia (report provided in Appendix 15.2). The distance of the fence from the Tx Array for the proposed development is still to be defined, however it will account for the minimum safe distance for radiological hazard while the array is in operation. Warning signs shall be posted to that effect, and only authorised personnel who will be properly trained will be allowed access to the Tx array security fence line.

15.6. Assessment of Effects

- 15.6.1. This section explains why potential impacts on receptors from Heat and Radiation are not expected with design interventions and controls implemented.
- 15.6.2. During operation, all planned works inside the Tx Array area will be in line with relevant UK legislation, policy and guidance (see designer commitment in Appendix 15.1, Annex A). As detailed in Section 15.2, these include the ICNIRP guidelines, The Control of Electromagnetic Fields at Work Regulations 2016 and JSP 392, which place a duty of care on the employer to protect employees.

Occupational Exposure

- 15.6.3. Staff may be required to enter the Tx Array area to conduct planned works and maintenance activities during operation. These individuals will have undergone appropriate training and be aware of the appropriate risk assessments and precautions.
- 15.6.4. In compliance with the UK legislation, policy and guidance, no occupational exposure will be to a level that would cause significant effects to staff.

Public Exposure

- 15.6.5. The public will not be authorised to enter the Tx Array at any point. The entire Tx Array footprint will be enclosed by a security fence at a minimum safe distance for radiological hazard while the array is in operation. Warning signs shall be posted to that effect, and only authorised personnel will be allowed access to the Tx array security fence line. The potential impacts to these staff are described in the section above.
- 15.6.6. In compliance with the UK legislation, policy and guidance, no public exposure will be to a level that would cause significant effects to the public.

15.7. Mitigation and Enhancement

- 15.7.1. No significant effects have been identified, and no mitigation or enhancement measures are proposed beyond the design intervention and control measures already embedded in the proposed development.

15.8. Cumulative effects

- 15.8.1. As part of the EIA process, the environment team has undertaken a coordinated, multidisciplinary approach to ensure cumulative effects are considered across disciplines and influenced design where appropriate.
- 15.8.2. The assessment on cumulative effects is presented in Chapter 17 (Cumulative Effects Assessment).
- 15.8.3. No significant intra-cumulative or inter-cumulative effects for this environmental topic are anticipated as a result of the proposed development.

15.9. Residual Significant Effects

- 15.9.1. No residual significant effects have been identified.

15.10. Monitoring

- 15.10.1. The DEMA report cited in Appendix 15.1 recommends that results should be validated by practical measurements, as well as providing assurance that values predicted by the far-field

calculations are adequate. Such measurements are regarded as essential and will be completed in advance of the operational phase of the proposed development.

- 15.10.2. Should the practical measurements change the conclusions of the assessment, in particular if the transmitted power density is greater than the maximum level specified by the ICNIRP, then additional measures would need to be made and agreed with PCC.

15.11. Summary and Conclusions

- 15.11.1. The proposed development is designed to comply with the relevant provisions of ICNIRP guidelines. Due to the stringent nature of the guidelines, there is no possibility that the proposed development would result in significant effects from non-ionising radiation. Additionally, PPW outlines that as the proposed development is meeting the ICNIRP guidelines, planning authorities do not need to consider health impacts from non-ionising radiation equipment.
- 15.11.2. The proposed development will also operate in line with The Control of Electromagnetic Fields at Work Regulations 2016 and JSP 392, which place a duty of care on the employer to protect employees.
- 15.11.3. Design interventions for the proposed development include that the entire Tx Array footprint will be enclosed by a security fence at a minimum safe distance as defined by testing at DARC Site 1 in Western Australia (report provided in Appendix 15.2). Warning signs shall be posted to that effect, and only authorised personnel who will be properly trained will be allowed access to the Tx array security fence line.
- 15.11.4. As there is no pathway that would lead to a significant effect on humans from non-ionising radiation, this chapter detailed that there are no likely impacts on occupationally exposed individuals and members of the public, based on the conclusions from the assessment work reported in Appendix 15.1 (Evaluation of Radiation Hazards Associated with the DARC Radar).