



## **Thurrock Flexible Generation Plant**

**Environmental Statement Volume 3  
Chapter 13: Human Health**

**Date:** February 2020



**Environmental Impact Assessment**

**Environmental Statement**

**Volume 3**

**Chapter 13**

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## Table of Contents

1. Introduction.....	1
1.1 Purpose of this chapter .....	1
1.2 Planning policy context .....	1
1.3 Legislation .....	2
1.4 Consultation .....	2
2. Assessment Approach.....	7
2.1 Guidance.....	7
2.2 Assessment Methodology .....	7
2.3 Baseline study.....	9
2.4 Study area.....	9
2.5 Uncertainties and/or data limitations .....	11
2.6 Impact assessment criteria .....	11
2.7 Maximum design envelope parameters for assessment .....	12
2.8 Impacts scoped out of the assessment.....	12
2.9 Measures adopted as part of Thurrock Flexible Generation Plant .....	16
3. Baseline environment .....	17
3.1 Current baseline.....	17
3.2 Future baseline .....	18
4. Assessment of Effects .....	19
4.1 Construction phase .....	19
4.2 Operational and maintenance phase .....	22
4.3 Decommissioning phase .....	23
4.4 Cumulative effects.....	24
4.5 Transboundary effects .....	24
4.6 Inter-related effects .....	24
5. Conclusion and summary .....	25
6. References .....	27

## List of Tables

Table 1.1: Summary of NPS EN-1 provisions relevant to this chapter .....	1
Table 1.2: Summary of NPS EN-1 policy on decision making relevant to this chapter.....	2
Table 1.3: Key points raised during scoping and consultation to date.....	3
Table 2.1: Potential health determinants summary .....	8
Table 2.2: Summary of key desktop dataset sources.....	9
Table 2.3: Criteria for magnitude of impact. ....	11
Table 2.4: Matrix used for the assessment of the significance of an effect. ....	12
Table 2.5: Maximum design envelope parameters assessed. ....	13

Table 2.6: Impacts scoped out of the assessment. ....	14
Table 2.7: Designed-in measures. ....	16
Table 5.1: Summary of potential environment effects, mitigation and monitoring. ....	26

## List of Figures

Figure 2.1: Social and ecological determinants of health. ....	7
Figure 2.2: Study Area. ....	10

## Summary

This chapter constitutes the investigation and assessment of potential health determinants pertinent to the construction, operation and decommissioning of the proposed development within the Environmental Statement (ES).

## Qualifications

This document has been prepared by Tara Barratt, a Senior Health Impact Assessment (HIA) Consultant with an MSc in Environmental Technology (specialising in Environmental Epidemiology) and over three years' experience. Tara is an Associate Member of the Institute of Environmental Management and Assessment (IEMA) and contributor to the IEMA Health in EIA Working Group.

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# 1. Introduction

## 1.1 Purpose of this chapter

- 1.1.1 This chapter of the Environmental Statement (ES) presents the findings of the Environmental Impact Assessment (EIA) concerning potential impacts of the proposed Thurrock Flexible Generation Plant on human health.
- 1.1.2 Human health can be influenced (both adversely and beneficially) by a number of environmental and socio-economic determinants which can vary on a project by project basis, and are further modified by local community circumstance and existing health burden.
- 1.1.3 It is important to emphasise that the founding principle and purpose of EIA is to investigate potential environmental effects that may pose a risk to the environment and health at a development planning stage. Due to the multidisciplinary nature of health, planning separates health determinants (i.e. activities and hazards with the potential to influence health) into individual technical disciplines and ES topic chapters (e.g. air quality, noise, transport).
- 1.1.4 The purpose of the Human Health chapter is to draw from and build upon the key outputs provided within each relevant ES topic chapter to further test potential risk to local communities, and where appropriate, to set such risk into context.
- 1.1.5 In particular, this ES chapter:
- Presents the existing environmental baseline established from desk-based studies, surveys and consultation to date;
  - Presents the potential environmental effects on human health arising from the proposed Thurrock Flexible Generation Plant, based on the information gathered and the analysis and assessments undertaken to date;
  - Identifies any assumptions and limitations encountered in compiling the environmental information; and
  - Highlights any necessary monitoring and/or mitigation measures that could prevent, minimise, reduce or offset the possible health effects identified in the EIA process.

## 1.2 Planning policy context

- 1.2.1 Planning policy for energy generation Nationally Significant Infrastructure Projects (NSIPs), specifically in relation to human health, is contained in the Overarching National Policy Statement (NPS) for Energy (EN-1; DECC, 2011a).
- 1.2.2 NPS EN-1 includes guidance on what matters are to be considered in the assessment. These are summarised in Table 1.1 below.

**Table 1.1: Summary of NPS EN-1 provisions relevant to this chapter**

Summary of NPS EN-1 provision	How and where considered in the ES
<b>Human Health</b>	
As described in the relevant sections of this NPS and in the technology-specific NPSs, where the proposed project has an effect on human beings, the ES should assess these effects for each element of the project, identifying any adverse health impacts, and identifying measures to avoid, reduce or compensate for these impacts as appropriate. The impacts of more than one development may affect people simultaneously, so the applicant and the IPC [now the Planning Inspectorate (PINS)] should consider the cumulative impact on health (paragraph 4.13.2 of NPS EN-1).	The assessment of human health effects (both adverse and beneficial) for each element of the proposed development (construction, operation and decommissioning) is provided in Section 4.  Section 4 also includes mitigation and enhancement measures to help reduce adverse effects and maximise potential benefits for each health determinant within each element of the proposed development.  In addition, Volume 5, Chapter 26 assesses potential cumulative impact on health of proposed developments in proximity to the proposed Thurrock Flexible Generation Plant.
The direct impacts on health may include increased traffic, air or water pollution, dust, odour, hazardous waste and substances, noise, exposure to radiation, and increases in pests (paragraph 4.13.3 of NPS EN-1).	Potential health determinants pertinent to the proposed development are outlined in Table 2.1. Not all direct health determinants outlined within NPS EN-1 are relevant to the human health assessment for this development. Potential health determinants that have been scoped out of the assessment are in Table 2.6, with the supporting rationale.
New energy infrastructure may also affect the composition, size and proximity of the local population, and in doing so have indirect health impacts, for example if it in some way affects access to key public services, transport or the use of open space for recreation and physical activity (paragraph 4.13.4 of NPS EN-1).	Potential health determinants which are relevant to the proposed development are outlined in Table 2.1. Not all indirect health determinants outlined within NPS EN-1 are relevant to the human health assessment. Potential health determinants that have been scoped out of the assessment are outlined in Table 2.6, with an appropriate justification.

- 1.2.3 NPS EN-1 also highlights one factor relating to the determination of an application and in relation to mitigation which is summarised in Table 1.2 below.

Table 1.2: Summary of NPS EN-1 policy on decision making relevant to this chapter

Summary of NPS EN-1 policy on decision making (and mitigation)	How and where considered in the ES
<b>Human Health</b>	
Generally, those aspects of energy infrastructure which are most likely to have a significantly detrimental impact on health are subject to separate regulation (for example for air pollution) which will constitute effective mitigation of them, so that it is unlikely that health concerns will either constitute a reason to refuse consents or require specific mitigation under the Planning Act 2008. However, the IPC will want to take account of health concerns when setting requirements relating to a range of impacts such as noise (paragraph 4.13.5 of NPS EN-1).	The facility will be regulated by the Environment Agency during operation under a Part A Environmental Permit, which will control operational emissions. In addition, the potential human health effects from exposure to noise have been taken into consideration applying the WHO guidelines for Community Noise (WHO, 1999), the WHO guidelines for Europe (WHO, 2009), and the WHO Environmental Noise Guidelines for the European Region (WHO, 2018).

- 1.2.4 Promoting healthy and safe communities is a theme of the National Planning Policy framework (NPPF) (Ministry of Housing, Communities and Local Government (MHCLG), 2019), which states that *“Planning policies and decisions should aim to achieve healthy, inclusive and safe places which: a) promote social interaction [...], b) are safe and accessible [...], and c) enable and support healthy lifestyles [...].”* (paragraph 91).
- 1.2.5 Policy PMD1 in the Thurrock Council Core Strategy and Policies for Management of Development (as amended) Adopted January 2015, refers to Minimising Pollution and Impacts on Amenity, Health, Safety and the Natural Environment, whereby:
- “1. Development will not be permitted where it would cause or is likely to cause unacceptable effects on:*
- i. the amenities of the area;*
  - ii. the amenity, health or safety of others;*
  - iii. the amenity, health or safety of future occupiers of the site; or*
  - iv. the natural environment.*
- 2. Particular consideration will be given to the location of sensitive land uses, especially housing, schools and health facilities”.*

## 1.3 Legislation

- 1.3.1 Paragraph 5(2)(a) and Schedule 4 of the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 require that an EIA assesses the effects (where likely to be significant) on population and human health, among other factors.

## 1.4 Consultation

- 1.4.1 Key issues raised during scoping and consultation to date specific to human health are listed in Table 1.3, together with how details of these issues have been considered in the production of this ES, and cross-references to where and how all of the concerns raised are assessed through the planning process.

Table 1.3: Key points raised during scoping and consultation to date

Date	Consultee and type of response	Points raised	How and where addressed
September 2018	PINS	The Inspectorate notes that impacts to human health from air quality are to be considered and advises that this includes consideration of impacts from construction dust.	The air quality section considers local baseline and assesses to objective thresholds set to be protective of health. The Code of Construction Practice (CoCP) addresses any residual environmental and health hazard, including construction dust. The Human Health chapter draws from and builds upon the air quality assessment, to further investigate any potential impact to local community health during construction, operation and decommissioning.
September 2018	PINS	The Inspectorate notes that the underground cable will exceed 132kV (as referenced in the Department for Energy and Climate Change (DECC) voluntary Code of Practice (DECC, 2012). The Applicant must provide sufficient evidence to demonstrate compliance with the International Commission on Non-Ionising Radiation Protection (ICNIRP) restrictions, in accordance with the DECC voluntary Code of Practice. If significant effects associated with increased electro-magnetic field (EMF) are likely, this should be assessed in the ES.	The underground cable will be designed to comply with the relevant guideline exposure limits set out in the DECC Code of Practice (DECC, 2012) and compliance evidence would be provided in due course following detailed design of the electrical infrastructure. On this basis, potential changes in EMF will be compliant with guidance set to be protective of both occupational and public health and no significant effects are likely.
September 2018	PINS	The assessment of impacts to human health should consider all phases of the proposed development, alone and cumulatively with other developments.	Each of the ES topics, including the Human Health chapter considers construction, operation and decommissioning phases of the proposed development, and further considers potential cumulative impacts.
September 2018	PINS	Specific sensitive receptors for the purposes of the human health assessment have not been proposed in the Scoping Report. The ES should identify the locations of the sensitive receptors (and their distances from the proposed development) and explain how these have been selected, with reference to the extent of the likely impacts. Consideration should be given to people living in residential premises, people at work/ school/ in healthcare facilities, people using recreational areas/ transport infrastructure routes/ publicly accessible land, waterbodies and any drinking water supplies.	From a human health perspective, receptor sensitivity is partly defined by the individual hazard characteristics and exposure pathways (where the physical hazard characteristics, exposure pathways, and aetiology varies between health determinants). Effective scoping is therefore the means to firstly identify the potential hazards, define the hazard characteristics, informing both the evidence base selected, and the health and health care baseline data required. Human Health sensitive receptors remain consistent with the respective topic chapters which overlap with the human health assessment. As such, it is not necessary to carry out a discrete sensitive receptor identification exercise for the purpose of the human health assessment.
6 September 2018	Essex County Council	It is strongly recommended that a health impact assessment is prepared as part of this proposal. The wider determinants of health, with reference to any potential socio-economic benefits, should be explored i.e. employment opportunities including during the construction phase of this project.	All matters that would have been covered within a standalone health impact assessment (HIA) have been integrated within the regulatory assessment process and addressed within the Human Health chapter. As such, a standalone health impact assessment is not deemed necessary. The wider determinants of health (such as income and employment generation) have been duly considered and are included as a sub-section within the human health assessment, including employment opportunities during construction.
No Date	Tilbury2	The potential prolonged construction period (even though significant construction at Tilbury2 will be completed prior to commencement at Thurrock Flexible Generation Plant, Lower Thames Crossing or Tilbury Energy Centre) could have both physical and psychological health impacts on local communities. The cumulative impact of all four projects once operational on health would need to be considered further once more detail on aspects such as air quality and noise are known.	Cumulative impacts on human health have been considered within Volume 5, Chapter 26 based on information that is in the public domain at the time of writing.



Date	Consultee and type of response	Points raised	How and where addressed
6 September 2018	Public Health England (PHE)	<p>PHE state that a specific human health section should be provided which summarises key information, risk assessments, proposed mitigation measures, conclusions and residual impacts, relating to human health. In addition, PHE state that compliance with the requirements of National Policy Statements and relevant guidance and standards should also be highlighted.</p> <p>PHE include an appendix which outlines the generic areas that should be addressed by all promoters when preparing ES for inclusion with an NSIP submission.</p>	<p>This chapter constitutes a specific human health section, which follows a defined structure which meets EIA requirements and references relevant requirements of National Policy Statements and relevant guidance.</p> <p>The appendix of the scoping opinion provided by PHE outlining the generic areas that are relevant have been addressed are taken into account.</p>
3 September 2018	Thurrock Borough Council	<p><i>"It is important that consideration is paid to the potential human health impacts in respect of this proposed development. This relates to the health and wellbeing of any person(s) employed both during construction and operational stages, local residents living in communities within close proximity to the proposed development and the wider community as a whole where impacts may be felt."</i></p>	<p>The human health chapter assesses the potential human health impacts of local residents and the wider community.</p> <p>The health and wellbeing of any person employed during the construction and operation phase is addressed by the Health and Safety at Work etc. Act 1974. On this basis, assessing this would go beyond the scope and focus of the EIA. Therefore, it is not considered appropriate to include any additional detail on this matter within the Human Health chapter.</p>
3 September 2018	Thurrock Borough Council	<p>The following health determinants are acknowledged by Thurrock Borough Council as requiring further investigation within the human health chapter:</p> <ul style="list-style-type: none"> <li>• Air quality</li> <li>• Traffic</li> <li>• Noise</li> <li>• Water safety</li> </ul>	<p>The human health chapter investigates the potential impact on human health from a number of health determinants that include air quality, traffic and noise. The accidental spillage of polluting materials are assessed within Volume 3, Chapter 15: Hydrology and Flood Risk and Chapter 16: Geology, Hydrology and Ground Conditions. The proposed development's operation would be governed by an Environmental Permit enforcing compliance with environmental standards set to be protective of health.</p>
3 September 2018	Thurrock Borough Council	<p><i>"We would request that due to the 'likely significant impacts' and the cumulative effects of this and other significant infrastructure to be developed in close proximity to this site that a standalone HIA chapter will provide a comprehensive and detailed account of all potential impacts, their likelihood and significance in terms of impact on human health and welcome your confirmation on this. As part of the HIA consideration of the cumulative impacts as this and other developments will be needed to ensure that health impacts are accurately measured and mitigation is sufficient and appropriate."</i></p>	<p>Matters that would have been covered within a standalone HIA are assessed and addressed within the human health chapter (cumulative impacts dealt with in Volume 5, Chapter 26). As such, a HIA is not deemed necessary, as the process is fully integrated within the EIA affording the same weight via planning and decision making as the other technical disciplines.</p>
3 September 2018	Thurrock Borough Council	<p><i>"A HIA chapter would include ward(s) level health profiles of the local area/communities whose health may be impacted by the development. This ward level information is available from PHE's 'Local Health' website which is available at: <a href="http://www.localhealth.org.uk/#l=en;v=map13">http://www.localhealth.org.uk/#l=en;v=map13</a>.</i></p> <p><i>Further borough level information is available at Public Health England's Health Profile tool, 'Fingertips' which is available at: <a href="https://fingertips.phe.org.uk/">https://fingertips.phe.org.uk/</a>. A health profile would enable consideration to be paid to the possible health impacts of the specific population living within Tilbury, and mitigation could be embedded that would help reduce the health inequalities faced by this population. Tilbury is one of the most deprived wards within Thurrock, with the most health needs. This should be fully accounted for in any conclusions drawn in this health assessment."</i></p>	<p>The majority of human health baseline data has been collected at the local authority level on the basis that this data is more readily available, recent and has a larger variety of statistics to draw upon pertinent to the health pathways directly attributable to what is proposed. As a result, it is considered that local authority level data is more representative when compared to ward level data, and allows the assessment to better consider public health trends, priorities and needs. Despite this, additional ward-level data has been collected and interpreted in Appendix 13.1.</p> <p>The human health baseline acknowledges the deprivation levels within Thurrock and health needs of the communities living in the vicinity of the proposed development, applying these district level statistics to the local context.</p>
3 September 2018	Thurrock Borough Council	<p><i>"We would like to understand more fully how engagement and consultation with the community will feed into the health assessment and the health outcome conclusions made within this report."</i></p>	<p>All points raised relating to human health during consultation will be reviewed and taken into consideration when refining and finalising the scope and focus of the human health assessment. Where a suggestion regarding the scope of the human health assessment is made but is not considered appropriate to include, a justification will be provided as to why.</p> <p>Justification for the scoping out of particular health determinants is also included in Table 2.6.</p>

Date	Consultee and type of response	Points raised	How and where addressed
3 September 2018	Thurrock Borough Council	<i>"We would also like, as part of the socio-economic and amenity element, to touch on the Landscape and visual effects LVIA that is to be undertaken and suggest that consideration be paid to the potentially negative effects to emotional wellbeing and potential decrease in civic pride that could be felt by Thurrock residents through bad visual planning, as well as potential economic effects on the locality by the negativity of visitors from outside the borough to the historical sites and SSSI areas."</i>	Volume 3, Chapter 6: Landscape and Visual Resources considers potential changes in vistas and the impact significance therein, following an accepted methodology which has been agreed by Thurrock District Council and incorporates good visual planning.
8 August 2018	Thurrock Borough Council	Thurrock Borough Council note the relatively high deprivation levels and vulnerability of some local communities to health impacts and high respiratory disease baseline rates (including Chronic Obtrusive Pulmonary Disorder (COPD)).	The human health baseline includes statistics on respiratory disease emergency hospital admissions and mortality rates and acknowledges that this is higher than the national average. COPD is specifically considered within baseline emergency hospital rate statistics for chronic lower respiratory diseases (which is calculated using raw admissions statistics for England and the local Thurrock COPD Standardised Admissions Ratio).
28 November 2018	Public Health England	PHE note that the Human Health chapter scopes out "access to key public services, transport or use of open space" on the basis that the majority of the proposed development is located on agricultural land. PHE highlight that this is a contradiction (referring specifically to "access to and use of open space") as there is an assessment relating to an area of common land impacted by the proposed development and as a result suggests that details of access to, and potential disruption of, public footpaths, bridleways, common land or other green space be further clarified in subsequent submissions (including details of mitigation measures).	The scope of the assessment has been refined to include consideration of open space (see Table 2.1). Effects on transport remain scoped out of the assessment as outlined in Table 2.6, but a separate Transport Assessment covering this is at Volume 6, Appendix 10.1. An assessment of the effects of Thurrock Flexible Generation Plant on public rights of way (including footpaths and bridleways) and common land is set out Volume 3, Chapter 8: Land Use, Agriculture and Socio-Economics, along with measures to mitigate effects where appropriate. The outputs of this assessment are summarised in this chapter, with the potential associated human health effects assessed.
28 November 2018	Public Health England	PHE state that the scoping report does not identify that engagement with local communities during construction is important in mitigating distress and the impacts on mental health and wellbeing. PHE welcome the provision of local community liaison in the CoCP and recommends that the ES should ensure adequate consultation with local communities and the local public health / health care system for the assessment of baselines and potential impacts at local level on mental health.	The provision of a local community liaison officer is considered within Table 2.7 which details designed-in mitigation measures that are relevant to human health, including mental health.
10 December 2018	Thurrock Borough Council Public Health Team	The public health team requests that further information is to be included regarding the method, frequency and reporting of findings of the assessment.	Text has been added within the main body of Section 2.2: Assessment Methodology to provide further clarification on the method and reporting findings of the assessment.
10 December 2018	Thurrock Borough Council Public Health Team	The public health team states that the assessment relating to the decommissioning phase will need to account for any new communities and infrastructure that has emerged during the operational timeframe.	The human health future baseline, detailed in Section 3.2 addresses this.
10 December 2018	Thurrock Borough Council Public Health Team	The public health team would like to see that ward level baseline data is drawn upon for the assessment as this would enable a better understanding of the overall impact to ensure mitigation is proportionate and sufficient for the population.	The majority of human health baseline data has been collected at the local authority level on the basis that this data is more readily available, recent and has a larger variety of statistics to draw upon pertinent to the health pathways directly attributable to what is proposed. As a result, it is considered that local authority level data is more representative when compared to ward level data, and allows the assessment to consider public health trends, priorities and needs. Nevertheless, additional ward-level data has been collected and interpreted in Volume 6, Appendix 13.1: Health Baseline. The human health baseline acknowledges the deprivation levels within Thurrock and health needs of the communities living in the vicinity of the proposed development, applying these district level statistics to the local context.

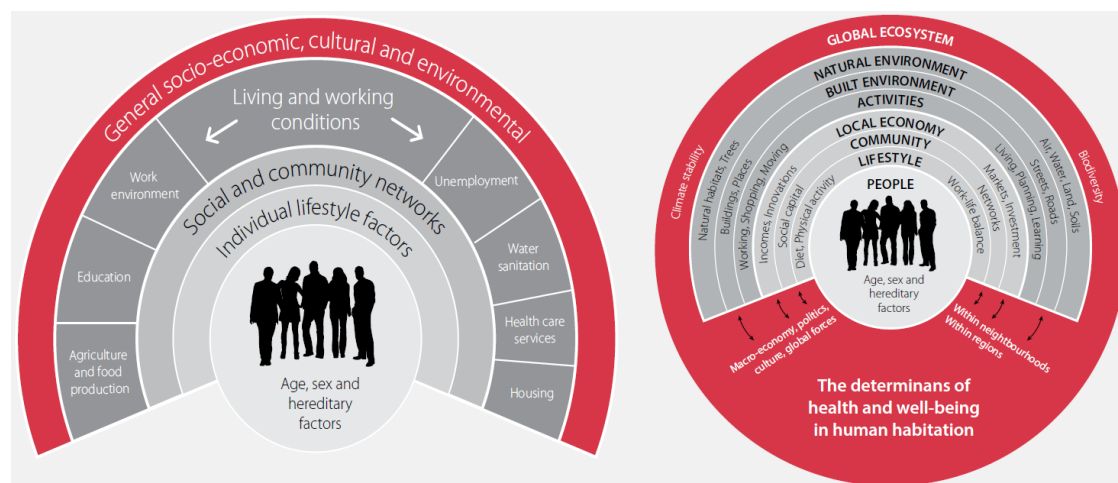


Date	Consultee and type of response	Points raised	How and where addressed
10 December 2018	Thurrock Borough Council Public Health Team	The public health team would like clarification that the local community in Tilbury have been consulted with and insight as to any particular concerns relating to their health and wellbeing.	The local community have been consulted with details of responses included within the Consultation Report (application document A5.1). All general themes raised by public consultees relating to health and wellbeing concerns have been addressed throughout the human health chapter.
10 December 2018	Thurrock Borough Council Public Health Team	The public health team would like further detail on the impact of urban greening and landscaping associated with the proposed development on mental health and wellbeing.	As detailed in Table 2.6, landscape and visual impacts have been scoped out of the human health assessment as this is considered to be addressed within Volume 3, Chapter 6: Landscape and Visual Resources.
10 December 2018	Thurrock Borough Council Public Health Team	The public health team would like to see a human health assessment which addresses any potential effect associated with cumulative noise impacts, including strategies to alleviate this, as ongoing noise at a significant level can have a detrimental impact on both physical and mental health.  In addition, the public health team would like clarification on the time and days where construction activities would take place where this is referenced within the human health chapter.	Cumulative noise impacts are assessed within Volume 4, Chapter 24: Noise and Vibration. The human health chapter draws from and builds upon these key outputs to assess the potential impact on both physical and mental health.  Additional clarification on the time and days where construction activities would take place has been provided in paragraph 4.1.10.
11 January 2019	Essex County Council	Suggest that “ <i>consideration be paid to the potentially negative effects to emotional wellbeing and potential decrease in civic pride that could be felt by Thurrock residents through bad visual planning</i> ”.	As detailed in Table 2.6, visual impacts have been scoped out of the human health assessment as this is addressed within Volume 3, Chapter 6: Landscape and Visual Resources, incorporating good visual planning.
5 November 2019	Public Health England	Note that there have been a number of changes to the proposed development and state that while these changes do not alter their previous consultation responses, PHE expect the assessment to take these changes into consideration.	The development as proposed has been assessed in this chapter.
15 December 2019	Thurrock Borough Council Public Health Team	Note that there are positive changes to the application regarding consideration of alternative routes for rights of way paths, active travel opportunities for staff, natural habitat, consultation and inclusion of a riverside access route for large loads. However, it is stated that further consideration should be given to noise, dust and air quality in a health context on the basis that the new access road for construction traffic would move traffic closer to local housing.	The response regarding positive changes is noted.  As detailed in the Transport, Noise and Air Quality chapters (Volume 3, Chapters 10, 11 and 12) the construction traffic on the revised proposed access routes and associated noise and air pollutant emissions have been modelled. The information from those assessments has been used in assessment of health impacts in Section 4.1 of this chapter.

## 2. Assessment Approach

### 2.1 Guidance

- 2.1.1 'Health' is commonly defined as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" (the definition used by the World Health Organisation (WHO) since 1948) (WHO, 1948).
- 2.1.2 There is a large body of guidance on health assessment generally and in the context of development planning, drawing from expert evidence and national government policy regarding the importance of integrating public health into the planning system.
- 2.1.3 The basis of this assessment is to apply a broad socio-economic model of health that encompasses conventional health impacts such as disease, accidents and risk, along with wider health determinants vital to achieving good health and wellbeing such as employment and local amenity. It considers both physical and mental health, and also addresses equality and social impacts where possible. The assessment is therefore based on both 'social' and 'ecological' (environmental) determinants of health, illustrated in Figure 2.1, which are affected through relevant health pathways.



Reproduced from Chadderton *et al.* (2012), citing Dahlgren and Whitehead (1991), and Barton and Grant (2006).

**Figure 2.1: Social and ecological determinants of health.**

- 2.1.4 When defining potential health determinants for a development project, it is also useful to consider three broad domains of public health practice:

- Health protection (i.e. environmental pollution and standards set to protect health);
- Health promotion (i.e. healthy lifestyles, socio-economic status and inequalities);
- and

- Health care (i.e. provision, effectiveness and equity of access to healthcare services).

### 2.2 Assessment Methodology

- 2.2.1 The assessment follows a source-pathway-receptor approach to identify and assess health impacts that are plausible, and directly attributable to the proposed development. A hazard source itself is not necessarily a health risk: it is only when there is a hazard source, a sensitive receptor and a pathway of exposure where there is any potential for risk to health. Where a source-pathway-receptor linkage exists, then the nature of the specific hazard source, the magnitude of impact via the pathway and the sensitivity of the receptor determine what level of health risk is predicted.
- 2.2.2 The human health assessment draws from and builds upon the key outputs provided within each relevant ES topic chapter. The potentially relevant health and wellbeing pathways that have been assessed are identified in Table 2.1. These pathways have been identified through analysis of the proposed development's construction and operational activities as defined in Volume 2, Chapter 2: Project Description, and have been reinforced through scoping feedback with statutory consultees (Table 1.3).
- 2.2.3 Identification of a potentially relevant health pathway at this stage does not necessarily indicate that there would be a significant impact through that pathway. A significant impact would depend on the magnitude of change, the sensitivity of receptors and the degree to which they are affected.



**Table 2.1: Potential health determinants summary**

Potential health determinant	Potential for impact	Impact type
<b>Construction</b>		
Exposure to air pollution (including nuisance dust, PM <sub>10</sub> , PM <sub>2.5</sub> and NO <sub>2</sub> )	Adverse	Temporary, direct, local
Changes in noise exposure	Adverse	Temporary, direct, local
Construction traffic (safety, amenity, severance)	Adverse	Temporary, direct, local and regional
Construction income and employment opportunities	Beneficial	Temporary, direct, indirect and induced, local and regional
Access to and use of open space for recreation and physical activity	Adverse	Temporary, direct, local
<b>Operation</b>		
Exposure to air pollution (including PM <sub>10</sub> , PM <sub>2.5</sub> and NO <sub>2</sub> )	Adverse	Permanent, direct, local
Changes in noise exposure	Adverse	Permanent, direct, local
Operational traffic (safety, amenity, severance)	Adverse	Permanent, direct, local and regional
Operation income and employment opportunities	Beneficial	Permanent, direct, indirect and induced, local
Access to and use of open space for recreation and physical activity	Adverse	Permanent, direct, local
<b>Decommissioning</b>		
Exposure to air pollution (including nuisance dust PM <sub>10</sub> , PM <sub>2.5</sub> and NO <sub>2</sub> )	Adverse	Temporary, direct, local
Changes in noise exposure	Adverse	Temporary, direct, local
Decommissioning traffic (safety, amenity, severance)	Adverse	Temporary, direct, local and regional
Decommissioning income and employment opportunities	Beneficial	Temporary, direct, indirect and induced, local and regional
Access to and use of open space for recreation and physical activity	Adverse	Temporary, direct, local

2.2.4 All relevant information, including quantitative impact assessment from associated ES chapters that has been used within the human health assessment will be cross-referred to. In this instance, it is not considered appropriate or proportionate to apply additional quantitative methodologies within the human health assessment. As a result, the extent of the human health assessment is complementary and remains qualitative, the results of which are presented in Section 4.

2.4.2 The study area for socio-economic health determinants is also confined to Thurrock Borough. While it is likely that socio-economic determinants (i.e. income and employment) associated with the proposed development have a wider sphere of influence (as employment could potentially be sourced from further afield), it is considered that Thurrock Borough is an appropriate study area.

## 2.3 Baseline study

### Desktop study

2.3.1 Information on human health within Thurrock Borough, Essex county, East of England region and England were collected through a detailed desktop review of existing datasets. These are summarised at Table 2.2 below.

**Table 2.2: Summary of key desktop dataset sources**

Title	Source	Year
Life expectancy	PHE Health Profiles	2010-2017
Healthy life expectancy	Office for National Statistics (ONS)	2009-2014
Mortality statistics	PHE Health Profiles, NHS Digital	2009-2017
Mental health statistics	PHE Mental Health and Wellbeing Joint Strategic Needs Assessment (JSNA)	2010-2018
Lifestyle statistics	PHE Health Profiles	2012-2018
Hospital admitted patient care activity	NHS Digital	2018-2019
The English Indices of Deprivation	Ministry of Housing, Communities and Local Government	2019
Socio-economic statistics	NOMIS (Office of National Statistics)	2014-2019

## 2.4 Study area

**The geographical study area for environmental health determinants within the human health assessment is confined to Thurrock Borough (**

2.4.1 Figure 2.2) as it is anticipated that impacts from environmental health determinants would remain local. In addition, the majority of baseline data has been collected at the district level (Thurrock Borough) on the basis that data is most readily available at this geographic level, and considered representative of local community circumstance. Within Thurrock Borough, complementary ward level statistics have been collected for: Tilbury East; Tilbury St. Chads; and Tilbury Riverside and Thurrock Park wards.



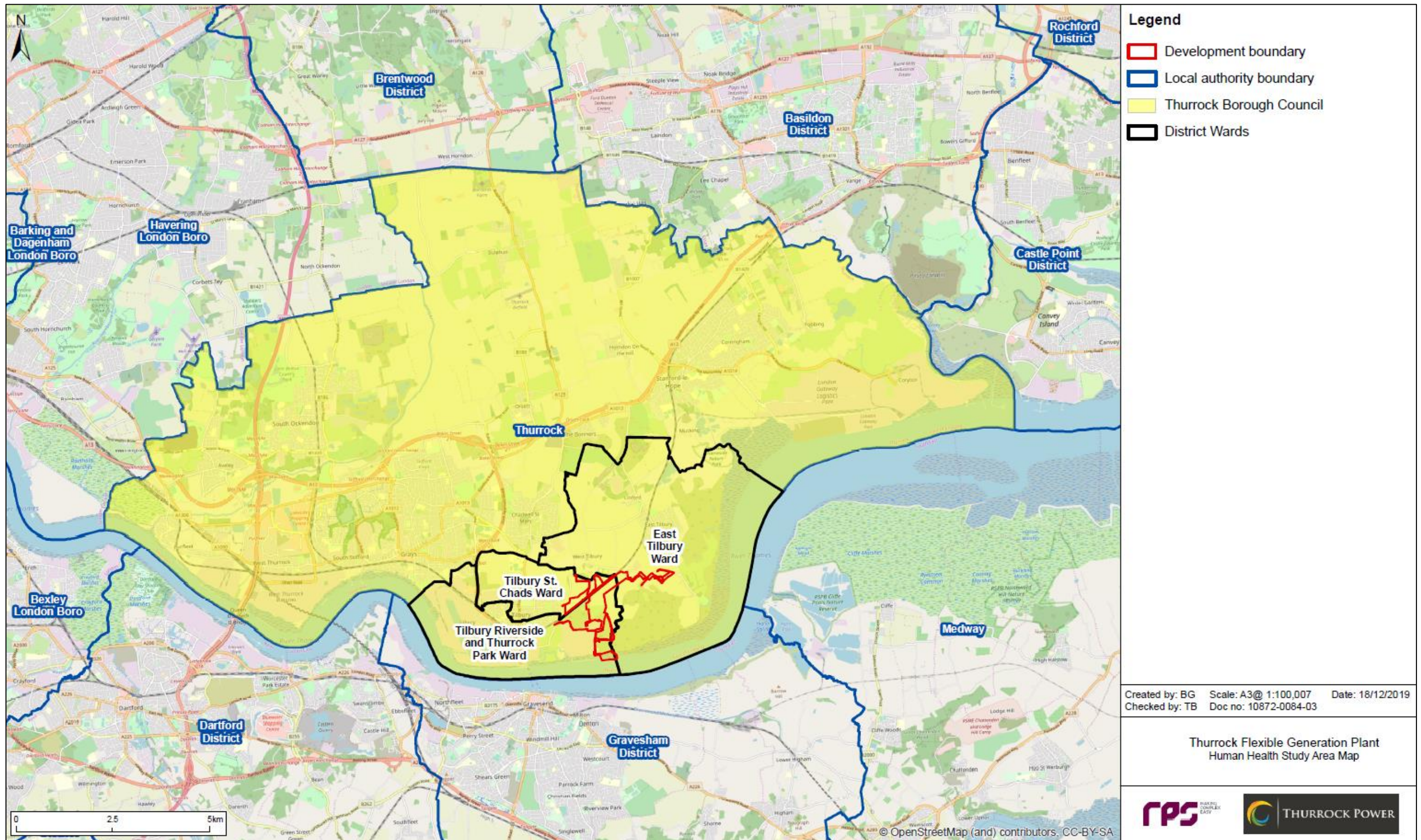


Figure 2.2: Study Area.



## 2.5 Uncertainties and/or data limitations

- 2.5.1 The human health assessment draws from and builds upon the technical outputs from the ES (most notably the air quality, noise and vibration, transport and socio-economic assessment chapters), to investigate changes in environmental and socio-economic conditions directly attributable to the proposed development. As a consequence, the limitations of the supporting assessments, and the conservative assumptions applied to address them, are inherent to the assessment of health.
- 2.5.2 Baseline data limitations are managed through the triangulation of national statistics to establish local health circumstance and relative sensitivity to the individual health pathways assessed.
- 2.5.3 It is considered that the information available provides a suitable basis for a robust assessment of human health for EIA purposes.

## 2.6 Impact assessment criteria

- 2.6.1 The significance of an effect is determined based on the magnitude of an impact and the sensitivity of the receptor, affected by the impact of that magnitude. This section describes the criteria applied in this chapter to characterise the magnitude of potential impacts and sensitivity of receptors. The terms used to define magnitude and sensitivity are based on those used in the Design Manual for Roads and Bridges (DMRB) methodology, which is described in further detail in Volume 2, Chapter 4: Environmental Impact Assessment Methodology.
- 2.6.2 The criteria for defining magnitude in this chapter is informed through the assessment process, tailored to the individual health pathways, hazard characteristics and end health points to inform a professional judgement on magnitude, as outlined in Table 2.3.

Table 2.3: Criteria for magnitude of impact.

Magnitude of impact	Definition used in this chapter
Major	Change in environmental and socio-economic circumstance sufficient to result in a major change in baseline population health (adverse or beneficial)
Moderate	Change in environmental and socio-economic circumstance sufficient to result in a moderate change in baseline population health (adverse or beneficial)
Minor	Change in environmental and socio-economic circumstance sufficient to result in a minor change in baseline population health (adverse or beneficial)
Negligible	Change in environmental and socio-economic circumstance below that for which it is possible to result in any manifest health outcome at a population level (adverse or beneficial)
No change	No opportunity for change in health outcome

- 2.6.3 Within a defined population, existing burdens of health and sensitivity to changes in environmental and socio-economic conditions can vary significantly due to individual socio-economic circumstance, genetic predisposition and stage of life.
- 2.6.4 A precautionary approach has been applied by assuming that the entire population of Thurrock are of a uniformly **high** sensitivity to changes in environmental (air quality, noise, etc.) and socio-economic conditions.
- 2.6.5 The significance of the effect upon human health is determined by correlating the magnitude of the impact and the sensitivity of the receptor. The particular method employed for this assessment is presented in Table 2.4. Where a range of significance of effect is presented in Table 2.4, the final assessment for each effect is based upon expert judgement.
- 2.6.6 For the purpose of this assessment, any effects with a significance level of minor or less are considered to be **not significant** in EIA terms.



Table 2.4: Matrix used for the assessment of the significance of an effect.

	Magnitude of impact					
		<i>No change</i>	<i>Negligible</i>	<i>Minor</i>	<i>Moderate</i>	<i>Major</i>
Sensitivity of receptor	<i>Negligible</i>	No change	Negligible	Negligible or minor	Negligible or minor	Minor
	<i>Low</i>	No change	Negligible or minor	Negligible or minor	Minor	Minor or moderate
	<i>Medium</i>	No change	Negligible or minor	Minor	Moderate	Moderate or major
	<i>High</i>	No change	Minor	Minor or moderate	Moderate or major	Major or substantial
	<i>Very high</i>	No change	Minor	Moderate or major	Major or substantial	Substantial
		No change	Minor	Moderate or major	Major or substantial	Substantial

## 2.7 Maximum design envelope parameters for assessment

- 2.7.1 The maximum design envelope parameters identified in Table 2.5 have been selected as those having the potential to result in the greatest effect on an identified receptor or receptor group. These parameters have been identified based on the overview description of the development provided in Volume 2, Chapter 2: Project Description, including all potential development options where these are under consideration by the applicant.
- 2.7.2 Effects of greater adverse significance are not predicted to arise should any other development scenario within the project design envelope be taken forward in the final design scheme.

## 2.8 Impacts scoped out of the assessment

- 2.8.1 The impacts listed in Table 2.6 have been scoped out of the assessment for human health as agreed through the EIA scoping process detailed in Volume 2, Chapter 5: Scoping and Consultation.

**Table 2.5: Maximum design envelope parameters assessed.**

Potential impact	Maximum design scenario	Justification
<b>Construction</b>		
Health and wellbeing impact due to direct, indirect and induced employment generation associated with the construction phase	Construction workforce averaging 250 full-time equivalent (FTE) and peaking at 350 FTE for up to 24 months	Reasonable employment generation predicted by the applicant, which would have potential for beneficial effects on health and wellbeing
Health and wellbeing impact due to loss of access to and use of open space for recreation and physical activity	Maximum design scenario for construction traffic generation as specified in Volume 3, Chapter 8: Land Use, Agriculture and Socio-Economics	The maximum design scenario parameters for loss of access to and use of green space have been specified for that assessment
Health and wellbeing impact due to changes in construction traffic (potentially affecting severance, risk of accident and injury and pedestrian or cyclist amenity)	Maximum design scenario for construction traffic generation as specified in Volume 3, Chapter 10: Traffic and Transport	The maximum design scenario parameters for construction traffic generation have been specified for that assessment
Health and wellbeing impact due to changes in noise exposure (potentially affecting annoyance, stress or sleep disturbance)	Maximum design scenario for construction noise generation as specified in Volume 3, Chapter 11: Noise and Vibration	The maximum design scenario parameters for construction noise and vibration have been specified for that assessment
Health and wellbeing impact due to changes in air quality (potentially affecting respiratory health or mortality)	Construction dust risk and construction traffic air pollutant impact maximum design scenario as specified in Volume 3, Chapter 12: Air Quality	The maximum design scenario parameters for air pollutant emissions have been specified for that assessment
<b>Operation and maintenance</b>		
Health and wellbeing impact due to changes in noise exposure (potentially affecting annoyance, stress or sleep disturbance)	Maximum design scenario for operational and maintenance noise generation as specified in Volume 3, Chapter 11: Noise and Vibration	The maximum design scenario parameters for operational and maintenance noise generation have been specified for that assessment
Health and wellbeing impact due to changes in air quality (potentially affecting respiratory health or mortality)	Gas engines' air pollutant impact maximum design scenario as specified in Volume 3, Chapter 12: Air Quality	The maximum design scenario parameters for gas engines' air pollutant emissions have been specified for that assessment
<b>Decommissioning</b>		
Human health impacts from operational sources listed above	Ongoing operation of all or part of flexible generation plant after 35 years	Greatest long-term impact
Human health impacts from decommissioning and deconstruction activity	Decommissioning and deconstruction workforce similar to the construction phase	Reasonable maximum employment generation predicted by the applicant



Table 2.6: Impacts scoped out of the assessment.

Potential impact	Justification
<b>Construction phase</b>	
Water pollution	The potential pollution of surface watercourses/controlled waters within or near the proposed development area during construction due to the accidental spillage of polluting materials are to be assessed within Volume 3, Chapter 15: Hydrology and Flood Risk and Volume 3, Chapter 16: Geology, Hydrology and Ground Conditions to environmental standards set to be protective of health.
Composition, size and proximity of local population	Construction will be temporary, and it is likely that the majority of construction workers would commute from their existing place of residence; on this basis, it is anticipated that there would be no long-term introduction of a workforce to the area. As a result, there would be no change to the composition, size or proximity of the local population.
Access to key public services and transport	The application site primarily comprises agricultural land; as a result, there is no scope for adverse impacts to human health resulting from reduced access to key public services or transport during construction.
<b>Operation and maintenance</b>	
Transport nature and flow rate	Impacts on traffic and transport have been scoped out in Volume 3, Chapter 10, Traffic and Transport on the basis that vehicle movements when the plant is operational will be irregular, low and significantly under thresholds on which assessment is required. As a result, no associated significant human health effects are likely.
Access to and use of open space for recreation and physical activity	Impacts on recreational resources has been scoped out in Volume 3, Chapter 8: Land Use, Agriculture and Socio-Economics as there would be no further impacts on areas of common land and PRoW following the completion of the pre-construction and construction activities.
Income and employment	Socio-economic impacts have been scoped out in Volume 3, Chapter 8: Land Use, Agriculture and Socio-Economics on the basis that the facility is expected to be operated by around six full-time equivalent (FTE) employees with approximately one major maintenance period (duration three weeks) and four minor maintenance visits (duration one week each) per annum, estimated to require up to 20 and six staff daily respectively. Overall, this magnitude of employment is not considered to result in a significant effect on employment generation and therefore, no significant effects on human health are likely.
Water pollution	There is no hazard source as the proposed development will not generate waste water (aside from potentially cooling water) or process effluent during normal operation. Any surface run off entering the existing watercourse would be clean. The facility will also be operated in accordance with an Environmental Permit and will have a managed surface drainage system with oil interceptors, bunding and spill kits in case of accidents.  In addition, the potential pollution of surface watercourses/controlled waters within or near the proposed development area during operation due to the accidental spillage of polluting materials are to be assessed within Volume 3, Chapter 15: Hydrology and Flood Risk and Volume 3, Chapter 16: Geology, Hydrology and Ground Conditions to environmental standards set to be protective of health.
Odour	The main pollutant from the exhaust stacks is nitrogen oxides which are not associated with any odour impacts.
Visual impacts	Visual impacts are addressed within a dedicated chapter (Volume 3, Chapter 6: Landscape and Visual Resources).
Hazardous waste and substances	As set out in Volume 2, Chapter 2 and Volume 6, Appendix 2.2, likely significant effects arising from accidents or disasters have been scoped out of the EIA and the proposed development is not expected to be a COMAH site or require a hazardous substances consent.
Radiation	The operational activities associated with the proposed development would not generate any ionising radiation. While the proposed development would be a source of non-ionising power-frequency electric and magnetic fields, given the location of the development immediately adjacent to the existing Tilbury Substation with minimal distance for the grid connection, there is no potential for public exposure to EMF generated, and all generation and transmission infrastructure will comply with ICNIRP guidelines, set to be protective of both public and occupational health.
Increases in pests	An increase in pests would generally be associated with the uncontrolled storage of waste, which is not relevant for the proposed development.
Composition, size and proximity of local population	The proposed development will have no influence on the size or proximity of local populations.
Access to key public services and transport	The application site primarily comprises agricultural land; as a result, there is no scope for adverse impacts to human health resulting from reduced access to key public services and transport during operation.
<b>Decommissioning phase</b>	

Potential impact	Justification
Transport nature and flow rate	Impacts on traffic and transport have been scoped out in Volume 3, Chapter 10, Traffic and Transport on the basis that vehicle movements during decommissioning would be lower than during construction. As a result, human health effects associated with changes in transport nature and flow rate during decommissioning would be of no greater significance than those assessed for construction.
Water pollution	The potential pollution of surface watercourses/controlled waters within or near the proposed development area during decommissioning due to the accidental spillage of polluting materials are to be assessed within Volume 3, Chapter 15: Hydrology and Flood Risk and Volume 3, Chapter 16: Geology, Hydrology and Ground Conditions to environmental standards set to be protective of health.
Composition, size and proximity of local population	Decommissioning will be comparable to but of a shorter duration than the construction phase and will have no influence on the size or proximity of local populations.
Access to key public services and transport	There is no scope for adverse impacts to human health resulting from reduced access to key public services or transport during decommissioning as the application site will only include the proposed development.



## 2.9 Measures adopted as part of Thurrock Flexible Generation Plant

2.9.1 A number of measures have been designed in to the flexible generation plant to reduce the potential for impacts on human health. These are listed in Table 2.7.

Table 2.7: Designed-in measures.

Measures adopted as part of Thurrock Flexible Generation Plant	Justification
Common land lost as a result of the proposed development will be replaced to ensure that there are no adverse impacts.	Removes potential adverse impact on health and wellbeing by creating barriers to recreation and participation in physical activity.
<p>All designed-in measures relevant to human health are outlined within the wider technical disciplines which comprise:</p> <ul style="list-style-type: none"> <li>• Volume 3, Chapter 8: Land Use, Agriculture and Socio-Economics</li> <li>• Volume 3, Chapter 10: Traffic and Transport</li> <li>• Volume 3, Chapter 11: Noise and Vibration</li> <li>• Volume 3, Chapter 12: Air Quality</li> </ul>	The environmental and socio-economic determinants listed have the potential to directly and indirectly influence health, these wider technical disciplines also offer relevant designed-in mitigation for the protection of human health.
<p>All underground cabling associated with the proposed development would not be in a publicly accessible location.</p> <p>Evidence of compliance with guideline occupational exposure limits for electromagnetic fields is to be provided following detailed design of the electrical infrastructure.</p>	Electric and magnetic fields associated with the generation and transmission are addressed through appropriate design to manage exposure at source to prevent exposure that would result in occupational or public health risk.
Local community liaison officer to be set-up during the construction phase (and decommissioning phase, if applicable) to act as a mode of communication between the public and developer.	Engagement with local communities that are affected can be important in mitigating distress and the impacts on mental health and wellbeing.

## 3. Baseline environment

### 3.1 Current baseline

#### Introduction

- 3.1.1 Evidence suggests that different communities have varying susceptibilities to health impacts and benefits as a result of social and demographic structure, behaviour and relative economic circumstance. The aim of this section is to summarise local health circumstance of communities likely to be affected by the proposed development.
- 3.1.2 Data has been collected for Thurrock Borough, or Thurrock Clinical Commissioning Group (CCG) where applicable, which is considered representative of communities in proximity to the proposed development. In addition, data has been collected at the ward level. While fewer up-to-date statistics are available at the ward level, this data provides an indication of health and socio-economic circumstance at a higher spatial resolution. Relevant wards include: Tilbury Riverside and Thurrock Park; East Tilbury; and Tilbury St. Chads.
- 3.1.3 For a full account of the supporting information and source referencing, refer to Volume 6, Appendix 13.1: Health Baseline.

#### Life expectancy and physical health

- 3.1.4 Both male and female life expectancy within Thurrock are below the regional and national averages and have been decreasing in recent years.
- 3.1.5 Healthy life expectancy (HLE) is the proportion of life spent in "good" health. In general, female HLE is also below the regional and national averages; male HLE on the other hand has been rising over the years, and is now above the regional and national average.
- 3.1.6 Emergency hospital admissions for a variety of respiratory and cardiovascular diseases and conditions are higher in Thurrock compared to the national average. All-age all-cause mortality rate, cardiovascular disease mortality rate and cancer mortality rate for Thurrock are all consistently higher than their comparators. The exception to this is respiratory disease mortality rate which is consistently higher than the national average between the years of 2013 to 2016, but lower than the national average in 2012 and 2017.

#### Mental health

- 3.1.7 Mental health statistics within Thurrock are mixed. Dementia recorded prevalence and hospital stays for self-harm are lower than the regional and national averages. Recent statistics show suicide rate to be lower than the regional and national averages in 2016-18, but was above the regional and national averages between the years of 2013-15 and 2015-17. Depression recorded incidence has been gradually increasing where most recent statistics show that depression recorded incidence in Thurrock is lower than the national average and remains similar to the regional average.

#### Lifestyle

- 3.1.8 The rates of childhood obesity and excess weight in adults in Thurrock are higher than the regional and national averages and have shown a general increase in recent years. Mirroring this, the proportion of adults meeting the recommended weekly duration of physical activity in Thurrock is below the regional and national averages.
- 3.1.9 Risk taking behaviours include smoking and excessive alcohol intake. Smoking prevalence in Thurrock is consistently higher than the regional and national averages, while hospital stays for alcohol related harm in Thurrock are below the regional and national average.

#### Deprivation

- 3.1.10 Overall, there is a slightly lower proportion of Lower Super Output Areas within Thurrock that are categorised in the 20% most deprived nationally compared to the 20% least deprived nationally. When analysing domains against each other, the education and crime domains are the most deprived in Thurrock, while the health domain is the least deprived in Thurrock.

#### Socio-economic

- 3.1.11 Employment and unemployment figures in Thurrock are all relatively similar to the county, regional and national averages. However, the proportion of the population in Thurrock who are claiming jobseeker's allowance is increasing and remains consistently higher than the county, regional and national averages.
- 3.1.12 Median income levels in Thurrock remain consistently below the county average, and in recent years below the regional average but more comparable to the national average. In general, qualification attainment in Thurrock is also lower than the national average.

### Ward level baseline

3.1.13 At the ward level, there is a range in socio-economic status and burden of poor health across the study area. It is clear that East Tilbury ward has the lowest burden of poor health and socio-economic deprivation, while the opposite is true for Tilbury Riverside and Thurrock Park ward which is the ward where the proposed development is located. In particular, unemployment, emergency hospital admission for COPD, and mortality rate for CHD are particularly high in Tilbury Riverside and Thurrock Park ward when compared to the neighbouring wards and the national average.

### Conclusion

3.1.14 On the above basis, and as detailed in Volume 6, Appendix 13.1: Health Baseline, population health throughout Thurrock is mixed depending on which indicators are being analysed.

3.1.15 When analysing physical health indicators, there is generally a higher burden of poor health in Thurrock, albeit higher male HLE and lower mortality from respiratory disease within Thurrock in recent years when compared to the regional or national average. Regarding mental health indicators, most recent statistics show a lower burden of poor mental health compared to the regional and national average; however, particularly for suicide rate there has been some fluctuation against comparators.

3.1.16 The majority of lifestyle indicators show a high proportion of children and adults who are overweight which is generally associated with negative behaviours such lack of exercise and smoking. The exception to this is excessive alcohol intake where it is evident that a lower proportion of people within Thurrock are admitted to hospital for alcohol related harm.

3.1.17 Overall, while health circumstance is improving for some indicators (particularly for mental health), the trend is not uniform, with high burdens of poor physical health and negative lifestyle-related indicators in particular.

## 3.2 Future baseline

3.2.1 As it is challenging to predict the future human health baseline with high confidence, trends are analysed as part of the current baseline to provide insight into likely future local community circumstance. For the purpose of this assessment, the present-day baseline human health data have been used for the future baseline.

### Climate change

3.2.2 The Met Office Hadley Centre (MOHC) UK Carbon Projections ('UKCP18') dataset (MOHC, 2018) provides probabilistic projections of change in climatic parameters over time for 25 km grid squares across the UK. Projected changes for a RCP8.5<sup>1</sup> future global greenhouse gas emissions scenario have been reviewed for the 2050–2069 and 2080–2099 periods, representing changes towards the end of the proposed development's initial 35-year operating lifetime and changes for the period beyond that should operation continue.

3.2.3 The likely ranges of change in climatic parameters including precipitation, temperature, wind speed, humidity and frequency of extreme weather are not considered to materially affect the future baseline described above for human health or increase the sensitivity of receptors to impacts beyond that described in Section 3.2.1.

<sup>1</sup> RCP8.5 refers to a high-emissions scenario assuming 'business as usual' growth globally with little additional mitigation. This is a conservative (worst-case) approach for the assessment



## 4. Assessment of Effects

### 4.1 Construction phase

#### Human health effects from changes to air quality

##### *Magnitude of impact*

- 4.1.1 Construction of the proposed development has the potential to influence human health from nuisance dust and from changes to local air quality associated with construction traffic. Volume 3, Chapter 12: Air Quality assesses the magnitude of impact at human receptors.
- 4.1.2 Prior to mitigation, the impacts from dust resulting from general on-site construction activities and/or through the movement of vehicles are limited to annoyance. However, following implementation of control measures, it is anticipated that construction dust emissions would not be significant.
- 4.1.3 As detailed in Volume 6 Appendix 12.6: Assessment of Traffic-related Emissions, the increase in local particulate matter (PM<sub>10</sub> and PM<sub>2.5</sub>) levels directly attributable to construction traffic associated with the proposed development is predicted to be negligible at all receptors and would remain below air quality objective thresholds set to be protective of the environment and health.
- 4.1.4 The increase in local NO<sub>2</sub> levels is predicted to remain below air quality objective thresholds set to be protective of the environment and health at all but one of the receptors analysed. The exception to this is R21 which is predicted to exceed the objective threshold with or without the proposed development. The predicted concentration at this receptor does not change when rounded to one decimal point, therefore, the contribution to local NO<sub>2</sub> concentrations directly attributable to construction traffic associated with the proposed development is minimal.
- 4.1.5 The human health effects from changes to air quality are predicted to be of local spatial extent, short term duration and intermittent. It is predicted that the impact will affect the receptor directly, but not of a concentration or exposure sufficient to quantify any change in baseline health. The magnitude is therefore considered to be **negligible**.

##### *Sensitivity of the receptor*

- 4.1.6 As described in paragraph 2.6.3, it is not possible to allocate a fair or accurate sensitivity classification to a population. On this basis, a precautionary approach has been taken, where the sensitivity of residential receptors to human health effects from changes to air quality is considered to be uniformly **high**.

##### *Significance of effect*

- 4.1.7 Overall, it is predicted that **negligible** magnitude of impact on the **high** sensitivity receptor would result in a **minor** adverse effect, which is not significant in EIA terms.

##### *Further mitigation or enhancement*

- 4.1.8 No significant adverse effects have been predicted and no further mitigation is considered to be required.

##### *Residual effect*

- 4.1.9 The residual effect following no mitigation or enhancement is predicted to remain **minor** adverse, which is not significant in EIA terms.

#### Human health effects from changes in noise exposure

##### *Magnitude of impact*

- 4.1.10 As detailed within Volume 2, Chapter 2: Project Description, normal construction working hours will be Monday to Friday 08:00–18:00 and Saturday 08:00–13:00. However, non-noisy activities which would not cause disturbance off-site (such as fit-out within buildings), or construction activities that cannot be interrupted (such as a continuous concrete pour) may be required outside these hours.
- 4.1.11 Based on this information, potential human health effects from changes in noise exposure would be limited to increased annoyance from a reduction in local amenity during the daytime. This would be a direct and local impact resulting from on-site construction activities and associated transport movements. Due to the nature of the construction period, the impact would be short term and intermittent.
- 4.1.12 Volume 3, Chapter 11: Noise and Vibration assesses the magnitude of impact at human receptors where it is predicted that noise levels from on-site construction activity associated with the proposed development will be below the lower cut-off value during the day of 65 dB LAeq and therefore not significant in noise terms. While certain construction activities have the potential to overlap, resulting in a cumulative noise impacts upon receptors, it is not anticipated that this would result in an exceedance of the daytime cut-off value for more than one month.
- 4.1.13 Regarding noise impacts associated with construction traffic, a change in noise exposure of +1.6 dB in the daytime period and +2 dB in the night-time period is predicted during peak construction, and is also not considered significant in noise terms.

4.1.14 Overall, the human health effects from changes in noise exposure are predicted to be of local spatial extent, short term duration and intermittent. It is predicted that the impact will affect the receptor directly, but is not of a magnitude, exposure, duration or timing to quantify any change in baseline health. The magnitude is therefore considered to be **negligible**.

*Sensitivity of the receptor*

4.1.15 A precautionary approach has been taken, where the sensitivity of residential receptors to human health effects from changes in noise exposure is considered to be uniformly **high**.

*Significance of effect*

4.1.16 Overall, it is predicted that **negligible** magnitude of impact on the **high** sensitivity receptor would result in a **minor** adverse effect, which is not significant in EIA terms.

*Further mitigation or enhancement*

4.1.17 No significant adverse effects have been predicted and no further mitigation is considered to be required.

*Residual effect*

4.1.18 The residual effect following no mitigation or enhancement is predicted to remain **minor** adverse, which is not significant in EIA terms.

**Human health effects from changes to transport nature and flow rate**

*Magnitude of impact*

4.1.19 An increase in HGVs and staff vehicle movements has the potential to change the transport nature (composition and flow rate on local roads). Depending on the magnitude of change, there is the potential for an increased risk of accident and injury; feelings of isolation from increased severance; and loss of amenity from increased severance or transport disruption. Any change to transport nature and flow rate would be a direct and local impact where due to the nature of the construction period, the impact would be short term and intermittent.

4.1.20 Volume 3, Chapter 10: Traffic and Transport assesses the magnitude of impact on human receptors. The human health effects from changes in transport nature and flow rate are predicted to be of local spatial extent, short term duration and intermittent. It is predicted that the impact will affect the receptor directly, but is not of an order of magnitude sufficient to quantify any change in baseline health outcome. The magnitude is therefore considered to be **negligible**.

*Sensitivity of the receptor*

4.1.21 A precautionary approach has been applied, where the sensitivity of residential receptors to human health effects from changes to transport nature and flows is considered to be uniformly **high**.

*Significance of effect*

4.1.22 Overall, it is predicted that **negligible** magnitude of impact on the **high** sensitivity receptor would result in a **minor** adverse effect, which is not significant in EIA terms.

*Further mitigation or enhancement*

4.1.23 No significant adverse effects have been predicted and no further mitigation is considered to be required.

*Residual effect*

4.1.24 The residual effect following no mitigation or enhancement is predicted to remain **minor** adverse, which is not significant in EIA terms.

**Human health effects from income and employment generation**

*Magnitude of impact*

4.1.25 Having a consistent income and being in long-term employment are two of the most important wider determinants of health. The construction phase of the proposed development would offer a number of job opportunities; while job opportunities would vary in type, the majority of jobs available would be for construction workers. This would be an indirect impact which, dependent on procurement, has the potential to benefit some construction workers in and around Thurrock Borough.

4.1.26 However, it should be noted that due to the highly mobile nature of the construction industry and as construction companies tend to bring much of their labour force with them to undertake developments, it is unlikely that all of the construction companies and contractors commissioned on the proposed development would be based in and around Thurrock Borough.

4.1.27 Volume 3, Chapter 8: Land Use, Agriculture and Socio-Economics assesses the magnitude of socio-economic impact on human receptors whereby it is estimated that the construction workforce will average 250 FTE over the 24 month construction period, peaking at 350 FTE. It is also estimated that a further 75 to 153 temporary indirect and induced jobs would be generated over the construction period.

4.1.28 The human health effects from income and employment generation are predicted to be primarily of regional spatial extent and short term duration. It is predicted that the impact will affect the receptor directly through employment and indirectly via indirect and induced income and employment opportunities important to health. However, the magnitude of direct, indirect and induced income and employment opportunities are not sufficient to quantify any change in baseline health. The magnitude is therefore considered to be **negligible**.

*Sensitivity of the receptor*

4.1.29 A precautionary approach has been applied, where the sensitivity of residential receptors to human health effects from income and employment generation is considered to be uniformly **high**.

*Significance of effect*

4.1.30 Overall, it is predicted that **negligible** magnitude of impact on the **high** sensitivity receptor would result in a **minor** beneficial effect, which is not significant in EIA terms.

*Further mitigation or enhancement*

4.1.31 No further mitigation or enhancement measures are recommended.

*Residual effect*

4.1.32 The residual effect following no mitigation or enhancement is predicted to remain **minor** beneficial, which is not significant in EIA terms.

**Health effects from access to and use of open space for recreation and physical activity**

*Magnitude of impact*

4.1.33 As stated in Volume 3, Chapter 8: Land Use, Agriculture and Socio-Economics, there will be a permanent loss of up to 10.10 ha on an area of common land known as Walton Common due to the construction of the proposed development.

4.1.34 There would be a temporary impact during construction on access to a small 0.08 ha parcel of Tilbury Green common land (at Footpath 200) and Parsonage Common. At Tilbury Green common land, a small area of up to 0.08 ha would be temporarily affected for a period of up to one month by construction works associated with the laying of the proposed gas pipeline. Unsurfaced access routes for agricultural type machinery across a small area of common land at Parsonage Common (up to 0.25 ha) would be required for the purposes of establishing the new area of common land and for habitat creation and enhancement; however, public access would not be interrupted.

4.1.35 The provision of 11.6 ha of 'replacement' land similar in type and quality is proposed to mitigate for the permanent loss of 10.03 ha and the short-term temporary disruption to 0.08 ha of Tilbury Green common land. The replacement land will be contiguous with the other parts of land which form part of The Green, Hall Hill, Fort Road, Parsonage and Walton Commons to the north, and access on foot will be improved through the creation of a new permissive path from Fort Road.

4.1.36 Regarding Public Rights of Way (PRoW), there may be a temporary diversion of a short length of FP200 for gas pipeline construction. The Thames Estuary Path (along FP146 and National Cycle Route (NCR) 13) would remain along their current alignment with appropriate measures in place to manage the interface of low volumes of construction traffic and pedestrians/cyclists at the crossing point.

4.1.37 In the context of health and wellbeing, the temporary loss of access is unlikely to have a material effect on the basis that the change does not persist and therefore has limited opportunity to influence human health. As the permanent loss of land is being replaced and as that replacement land will have improved access which is contiguous with the remaining areas of common land, there is no removal of any opportunity for recreation and physical activity. Similarly, the diversion and presence of traffic management along PRoW and cycle routes would not remove the opportunity for recreation and physical activity.

4.1.38 As a result, the overall magnitude of impact on human health is considered to be **negligible**.

*Sensitivity of the receptor*

4.1.39 A precautionary approach has been applied, where the sensitivity of residential receptors to human health effects from changes to access to and use of open space for recreation and physical activity is considered to be uniformly **high**.

*Further mitigation or enhancement*

4.1.40 No significant adverse effects have been predicted and no further mitigation is considered to be required.

*Residual effect*

4.1.41 The residual effect following no mitigation or enhancement is predicted to remain **minor** beneficial, which is not significant in EIA terms.



### Future monitoring

- 4.1.42 Recommended monitoring focuses on environmental precursors to human health effects, thereby providing the opportunity for intervention to prevent any manifest health outcome. Recommended monitoring measures relating to human health are detailed within the relevant topic chapters where necessary.

## 4.2 Operational and maintenance phase

### Human health effects from changes to air quality

#### *Magnitude of impact*

- 4.2.1 During operation, due to the nature of the fuel the predominant facility emission contribution will be NO<sub>2</sub> resulting from the gas engine exhaust stacks. The magnitude of impact on human health is derived using process contribution information detailed in Volume 3, Chapter 12: Air Quality.
- 4.2.2 As detailed in Volume 3, Chapter 12: Air Quality, the increase in local NO<sub>2</sub> levels directly attributable to the proposed development is predicted to remain below air quality objective thresholds set to be protective of the environment and health at all but one of the receptors analysed. The exception to this is located at the receptor on West Street which exceeds the objective threshold by 2.4 µg/m<sup>3</sup> and is primarily due to a high background concentration at this receptor which already exceeds the objective threshold. The absolute change at this receptor directly attributable to the proposed development is minimal (0.6 µg/m<sup>3</sup>).
- 4.2.3 Overall, it can be concluded that the change in concentration and exposure directly attributable to the proposed development are not of a level to quantify any change in baseline health. The magnitude of impact on human health is therefore considered to be **negligible**.

#### *Sensitivity of the receptor*

- 4.2.4 A precautionary approach has been applied, where the sensitivity of residential receptors to human health effects from changes to air quality is considered to be **high**.

#### *Significance of effect*

- 4.2.5 Overall, it is predicted that **negligible** magnitude of impact on the **high** sensitivity receptor would result in a **minor** adverse effect, which is not significant in EIA terms.

### *Further mitigation or enhancement*

- 4.2.6 No significant adverse effects have been predicted and no further mitigation is considered to be required.

### *Residual effect*

- 4.2.7 The residual effect following no mitigation or enhancement is predicted to remain **minor** adverse, which is not significant in EIA terms.

### Human health effects from changes in noise exposure

#### *Magnitude of impact*

- 4.2.8 Due to the nature of the proposed development (providing additional capacity during peak demand), operational activities will generally coincide when populations are active, with limited operation that might impact upon sleep. As such, the proposed development has the potential to directly contribute to human health effects from annoyance (during the daytime period) and limited risk of sleep disturbance.
- 4.2.9 The magnitude of potential human health effects resulting from annoyance and sleep disturbance is derived using information detailed in Volume 3, Chapter 11: Noise and Vibration.
- 4.2.10 As stated in Volume 3, Chapter 11: Noise and Vibration, during the daytime and evening time periods, when Thurrock Flexible Generation Plant is most likely to operate, a maximum noise change of +3 dB is predicted, which is below the threshold of perception and therefore unlikely to seriously affect the health or quality of life at the most-affected residential receptors.
- 4.2.11 During the night-time period, the baseline sound level already exceeds the WHO Guidance level for the onset of sleep disturbance during the night-time period (i.e. lowest observed adverse effect level) of 45 dB L<sub>Aeq</sub> (façade) at the majority of receptors. In the unlikely event of the proposed development operating for significant periods at night, the flexible generation plant in operation will make a negligible contribution, if any, to ambient noise levels. The contribution at the two most affected receptors (Buckland and St James' Church) is not anticipated to be intrusive.
- 4.2.12 Overall, the human health effects from changes in noise exposure are predicted to be of local spatial extent, short term duration and intermittent (i.e. during peak demand). It is predicted that the impact will affect the receptor directly, and will not be of a magnitude, timing, duration or exposure sufficient to quantify any change in health baseline. The magnitude of impact on human health is therefore considered to be **negligible**.

#### *Sensitivity of the receptor*

- 4.2.13 A precautionary approach has been applied, where the sensitivity of residential receptors to human health effects from changes in noise exposure is considered to be uniformly **high**.

#### *Significance of effect*

- 4.2.14 Overall, it is predicted that **negligible** magnitude of impact on the **high** sensitivity receptor would result in a **minor** adverse effect, which is not significant in EIA terms.

#### *Further mitigation or enhancement*

- 4.2.15 No significant adverse effects have been predicted and no further mitigation is considered to be required.

#### *Residual effect*

- 4.2.16 The residual effect following no mitigation or enhancement is predicted to remain **minor** adverse, which is not significant in EIA terms.

### 4.3 Decommissioning phase

#### Human health effects from changes to air quality

##### *Magnitude of impact*

- 4.3.1 If after 35 years of operation it is decided that decommissioning of the proposed development is considered appropriate, it is anticipated that the human health effects from changes to air quality would remain similar to the construction phase.

- 4.3.2 Volume 3, Chapter 12: Air Quality assesses the magnitude of impact at human receptors. As such, the human health effects from changes to air quality are predicted to be of local spatial extent, short term duration and intermittent. It is predicted that the impact will affect the receptor directly, but will not be of a concentration sufficient to quantify any change in health baseline. The magnitude is therefore considered to be **negligible**.

##### *Sensitivity of the receptor*

- 4.3.3 A precautionary approach has been applied, where the sensitivity of residential receptors to human health effects from changes to air quality is considered to be **high**.

##### *Significance of effect*

- 4.3.4 Overall, it is predicted that a **negligible** magnitude of impact on the **high** sensitivity receptor would result in a **minor** adverse effect, which is not significant in EIA terms.

#### *Further mitigation or enhancement*

- 4.3.5 No significant adverse effects have been predicted and no further mitigation is considered to be required.

#### *Residual effect*

- 4.3.6 The residual effect following no mitigation or enhancement is predicted to remain **minor** adverse, which is not significant in EIA terms.

#### Human health effects from changes in noise exposure

##### *Magnitude of impact*

- 4.3.7 It is anticipated that the human health effects from changes in noise exposure during decommissioning would remain similar to the construction phase.

- 4.3.8 Volume 3, Chapter 11: Noise and Vibration assesses the magnitude of impact at human receptors. As such, the human health effects from changes in noise exposure are predicted to be of local spatial extent, short term duration and intermittent. It is predicted that the impact will affect the receptor directly, albeit with minimal exposure, and not of a magnitude sufficient to quantify any change in health baseline. The magnitude is therefore considered to be **negligible**.

##### *Sensitivity of the receptor*

- 4.3.9 As described in paragraph 2.6.3, it is not possible to allocate a fair or accurate sensitivity classification to a population. On this basis, a precautionary approach has been applied, where the sensitivity of residential receptors to human health effects from changes in noise exposure is considered to be **high**.

##### *Significance of effect*

- 4.3.10 Overall, it is predicted that a **negligible** magnitude of impact on the **high** sensitivity receptor would result in a **minor** adverse effect, which is not significant in EIA terms.

##### *Further mitigation or enhancement*

- 4.3.11 No significant adverse effects have been predicted and no further mitigation is considered to be required.

##### *Residual effect*

- 4.3.12 The residual effect following no mitigation or enhancement is predicted to remain **minor** adverse, which is not significant in EIA terms.

## Human health effects from income and employment generation

### *Magnitude of impact*

4.3.13 It is anticipated that the human health effects from income and employment generation during decommissioning would remain similar to the construction phase.

4.3.14 As such, the human health effects from income and employment generation are predicted to be primarily of local spatial extent and short term duration. It is predicted that the impact will affect the receptor indirectly, but will not be of level sufficient to quantify any change in health baseline. The magnitude is therefore considered to be **negligible**.

### *Sensitivity of the receptor*

4.3.15 A precautionary approach has been applied, where the sensitivity of residential receptors to human health effects from income and employment generation is considered to be **high**.

### *Significance of effect*

4.3.16 Overall, it is predicted that a **negligible** magnitude of impact on the **high** sensitivity receptor would result in a **minor** beneficial effect, which is not significant in EIA terms.

### *Further mitigation or enhancement*

4.3.17 No further mitigation or enhancement measures are recommended.

### *Residual effect*

4.3.18 The residual effect following no mitigation or enhancement is predicted to remain **minor** beneficial, which is not significant in EIA terms.

## Future monitoring

4.3.19 Recommended monitoring focuses on environmental precursors to human health effects as set out within the relevant topic chapters, thereby providing the opportunity for intervention to prevent any manifest health outcome.

## 4.4 Cumulative effects

4.4.1 Cumulative effects are those arising from impacts of the proposed development in combination with impacts of other proposed or consented development projects that are not yet built or operational. An assessment of cumulative effects for human health has been made and is reported in Volume 4, Chapter 26.

## 4.5 Transboundary effects

4.5.1 A screening of transboundary impacts has been carried out and is presented in Volume 6, Appendix 4.1: Transboundary Impacts Screening Note. This screening exercise identified that there was no potential for significant transboundary effects with regard to human health from Thurrock Flexible Generation Plant upon the interests of other EEA States.

## 4.6 Inter-related effects

4.6.1 Inter-relationships are considered to be the impacts and associated effects of different aspects of the construction, operation and decommissioning of Thurrock Flexible Generation Plant on the same receptor. The following assessments have been made and a description of the likely inter-related effects on human health is provided in Volume 5, Chapter 31: Summary of Inter-Related Effects.

### *Project lifetime effects*

4.6.2 Assessment of the potential for effects that occur during more than one stage of the development's lifetime (construction, operation and decommissioning) to interact such that they may create a more significant effect on a receptor than when assessed in isolation for each stage.

### *Receptor-led effects*

4.6.3 Assessment of the potential for effects via multiple environmental or social pathways to interact, spatially and temporally, to create a greater inter-related effect on a receptor than is predicted for each pathway (in its respective topic chapter) individually.



## 5. Conclusion and summary

- 5.1.1 As shown in Table 5.1, it is not anticipated that there would be any significant human health effects resulting from the construction, operation or decommissioning of the proposed development. This has been concluded on the basis that any change in health determinant would not be sufficient to quantify any change in baseline health outcomes within the surrounding community.

Table 5.1: Summary of potential environment effects, mitigation and monitoring.

Description of impact	Measures adopted as part of the project	Magnitude of impact	Sensitivity of receptor	Significance of effect	Additional measures	Residual effect	Proposed monitoring
<b>Construction</b>							
Human health effects from changes to air quality	As per Chapter 12: Air Quality	Negligible	High	Minor adverse (not significant in EIA terms)	As per Chapter 12: Air Quality	Minor adverse (not significant in EIA terms)	As per Chapter 12: Air Quality
Human health effects from changes in noise exposure	As per Chapter 11: Noise and Vibration	Negligible	High	Minor adverse (not significant in EIA terms)	As per Chapter 11: Noise and Vibration	Minor adverse (not significant in EIA terms)	As per Chapter 11: Noise and Vibration
Human health effects from changes to transport nature and flow rate	As per Chapter 10: Traffic and Transport	Negligible	High	Minor adverse (not significant in EIA terms)	As per Chapter 10: Traffic and Transport	Minor adverse (not significant in EIA terms)	As per Chapter 10: Traffic and Transport
Human health effects from changes from income and employment generation	As per Chapter 8: Land Use, Agriculture and Socio-Economics	Negligible	High	Minor beneficial (not significant in EIA terms)	As per Chapter 8: Land Use, Agriculture and Socio-Economics	Minor beneficial (not significant in EIA terms)	As per Chapter 8: Land Use, Agriculture and Socio-Economics
Human health effects from changes in access to and use of open space for recreation and physical activity	As per Chapter 8: Land Use, Agriculture and Socio-Economics	Negligible	High	Minor adverse (not significant in EIA terms)	As per Chapter 8: Land Use, Agriculture and Socio-Economics	Minor adverse (not significant in EIA terms)	As per Chapter 8: Land Use, Agriculture and Socio-Economics
<b>Operation and maintenance</b>							
Human health effects from changes to air quality	As per Chapter 12: Air Quality	Negligible	High	Minor adverse (not significant in EIA terms)	As per Chapter 12: Air Quality	Minor adverse (not significant in EIA terms)	As per Chapter 12: Air Quality
Human health effects from changes in noise exposure	As per Chapter 11: Noise and Vibration	Negligible	High	Minor adverse (not significant in EIA terms)	As per Chapter 11: Noise and Vibration	Minor adverse (not significant in EIA terms)	As per Chapter 11: Noise and Vibration
<b>Decommissioning (after 35 years decommissioning takes place)</b>							
Human health effects from changes to air quality	As per Chapter 12: Air Quality	Negligible	High	Minor adverse (not significant in EIA terms)	As per Chapter 12: Air Quality	Minor adverse (not significant in EIA terms)	As per Chapter 12: Air Quality
Human health effects from changes in noise exposure	As per Chapter 11: Noise and Vibration	Negligible	High	Minor adverse (not significant in EIA terms)	As per Chapter 11: Noise and Vibration	Minor adverse (not significant in EIA terms)	As per Chapter 11: Noise and Vibration
Human health effects from changes from income and employment generation	As per Chapter 8: Land Use, Agriculture and Socio-Economics	Negligible	High	Minor beneficial (not significant in EIA terms)	As per Chapter 8: Land Use, Agriculture and Socio-Economics	Minor beneficial (not significant in EIA terms)	As per Chapter 8: Land Use, Agriculture and Socio-Economics

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