

10 Population and Human Health

10.1 Introduction

- 10.1.1 This chapter of the ES was prepared by Savills (UK) Limited and presents an assessment of the likely significant effects of the Development on Population and Human Health. Mitigation measures are identified, where appropriate, to avoid, reduce or offset any significant adverse effects identified and/or enhance likely beneficial effects. The nature and significance of the likely residual and cumulative effects are then reported.
- 10.1.2 The chapter is informed through the Health Impact Assessment (HIA) contained in Appendix 10.1, including the supporting health evidence, baseline, health assessment protocols and full results. However, the overarching approach has been one of integration with the EIA, drawing from and building upon the overlapping technical disciplines to form this Population and Health chapter.

Competence

- 10.1.3 This report has been written by Dr Andrew Buroni (Director of Health and Social Impact at Savills), who holds a Biological/Biomedical Science degree with honours, a Masters in Environmental Impact Assessment (EIA) and a PhD on International Health Impact Assessment (HIA) Methods and Best Practice. He has received formal training in Environmental Health Impact Assessment (EHIA) at the Caribbean Environmental Health Institute by the Pan American Health Organisation and Health Canada, and at the International Health Impact Assessment Consortium (IMPACT) at the University of Liverpool.
- 10.1.4 Dr Buroni is an internationally recognised expert in health and social impact assessment with over 22 years of experience. He has designed, led and given health and equality evidence at public inquiry and issue-specific hearings, and has a substantial catalogue of project experience ranging in scale from local planning to Developments of National Significance (Wales) (or Nationally Significant Infrastructure Projects in England).
- 10.1.5 Dr Buroni sits on the Institute of Environmental Management and Assessment (IEMA) Health in EIA Working Group, and in the process of developing guidance to further embed the consideration of health within planning and EIA.
- 10.1.6 Tara Barratt (Associate, Health and Social Impact at Savills) and Anushree Bhatt (Senior Health and Social Impact Analyst at Savills) supported the development and completion of this report.
- 10.1.7 Tara Barratt has a Master of Science in Environmental Technology with a focus in environmental epidemiology. Tara has six years' experience coordinating and delivering HIA and Population and Health ES chapters for a range of major infrastructure projects across the UK, Ireland, and Australia.
- 10.1.8 Anushree Bhatt holds a Master of Environmental Science and an Honours Bachelor of Science with a Double Major in Environmental Science and Human Biology from the

University of Toronto. Anushree has five years of Canadian environmental consultancy experience as an HIA specialist and an environmental risk assessor.

10.2 Legislation, Planning Policy and Guidance

10.2.1 Health is an overlapping theme that spans across a range of legislative requirements and policy expectations. The following entries are those most pertinent to the application geared towards the protection and promotion of health.

Relevant Legislation

10.2.2 The following legislation is relevant to the Development:

- Well-being of Future Generations (Wales) Act 2015¹.

10.2.3 The Well-being of Future Generations Act sets seven well-being goals geared towards improving the social, economic, environmental and cultural well-being of Wales. In this context, the Act places a Public Sector Duty that extends to wider policy and planning to support the delivery of the objectives, namely, a prosperous, resilient, healthier, more equal, more cohesive, vibrant and globally responsible Wales.

Planning Policy Context

Wales

10.2.4 The following planning policy is relevant to the Development:

- Planning Policy Wales (2021)².

10.2.5 Planning Policy Wales (PPW) sets out the land use planning policies of the Welsh Government, of which in combination with the Technical Advice Notes (TANs) provide the national planning policy framework for Wales.

10.2.6 The primary function of PPW is to ensure that the planning system contributes towards the delivery of sustainable development and improves the social, economic, environmental and cultural well-being of Wales (as per the Well-being of Future Generations (Wales) Act 2015).

Vale of Glamorgan

10.2.7 The following local planning policy is relevant to the Development:

- Vale of Glamorgan Local Development Plan (LDP) 2011 – 2026³.

10.2.8 The LDP sets a framework for sustainable development within the Vale of Glamorgan up to 2026. Health is embedded throughout the LDP, including policy geared towards health protection, health improvement and health care.

Guidance

10.2.9 The current Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017⁴ reinforce the consideration of health within the planning and assessment process, but does not provide definitive guidance on the approach, process or methodology to follow. In the absence of guidance, the non-regulatory Health Impact Assessment (HIA) process is recognised as an appropriate means to meeting the requirements of the EIA Regulations.

- 10.2.10 A full HIA is provided in Appendix 10.1: Health Impact Assessment. The Population and Health ES chapter draws from the outputs of the HIA, structured through the regulatory EIA requirements to investigate, inform, assess and effectively communicate how and where all health issues and opportunities are addressed.
- 10.2.11 Specifically, the following recognised HIA guidance has been taken into account in undertaking the assessment:
- Health Impact Assessment: A practical guide⁵;
 - National Planning Practice Guidance: Health and wellbeing⁶;
 - Wales Health Impact Assessment Support Unit Guidance and Tools⁷; and
 - Quality Assurance Review Framework for Health Impact Assessment⁸.

10.3 Assessment Methodology

Consultation

- 10.3.1 A review of previous consultation responses relating to the 2015 Permission, Environmental Permit ('Permit'), the 2019 VES and 2021 VES has informed the scope and focus of the health assessment. This was supplemented through further engagement by Savills with Public Health Wales on 16th March 2022. This consultation reinforced all consultation with Public Health Wales associated with the 2015 Permission, Permit, the 2019 VES and 2021 VES remained valid, and that the scope and focus of the assessment were appropriate. However, it was noted by Public Health Wales that given current circumstances, a greater focus on responding to residual health concerns and risk perceptions would be of value..
- 10.3.2 The HIA and Population and Health chapter has taken the additional comments from Public Health Wales into consideration, whereby embedded design and mitigation measures relevant to the protection of health and wellbeing are described at the start of both Section 10.5 (Construction Assessment (Retrospective)) and Section 10.6 (Operational Assessment). A dedicated section to respond to general concerns, perceptions of risk and associated stress and anxiety is provided at the end of Section 10.6 (Operational Assessment).

Scope of the Assessment

Potential sources of impact

- 10.3.3 Hazards with the potential to impact upon population and human health (physical, social and mental) directly attributable to the Development include:
- changes in local air quality (including deposition to land and water);
 - changes in noise exposure;
 - changes in transport nature and flow rate; and
 - risk perception.

Matters scoped out

- 10.3.4 Having a consistent income and being in long-term employment are two of the most important wider determinants of health. While the construction phase of the Development offered a number of direct construction-related employment opportunities (with additional indirect and induced), such opportunities were temporary in nature, and it is anticipated that there would have been some leakage of effects outside of the study area due to the highly mobile nature of the construction industry.
- 10.3.5 During the operation of the Development, while direct, indirect and induced employment opportunities would be long-term and permanent in nature, the magnitude of jobs provided by the Development is limited, and so to would the associated population and human health benefit (i.e. benefits while important, would only be experienced at the individual level).
- 10.3.6 On the above basis, the potential impact on population and human health associated with changes in socio-economic factors (such as direct, indirect and catalytic employment and income) while valuable at the individual level, have been scoped out for assessment at the population level.
- 10.3.7 While renewable energy generation, security and affordability are highly topical, and have positive socio-economic, physical and mental health pathways, the provision and benefit of the electrical and potentially thermal energy use has been scoped out, as the distribution of effect and benefit is at the societal level.

Spatial Scope

- 10.3.8 Environmental health determinants (such as changes to air quality and noise exposure) typically have a local distribution pattern, where the hazards are limited by their concentration and physical dispersion characteristics. Changes in transport nature and flow rate experience similarly local changes. As a result, the spatial scope for health-specific baseline statistics centres on Barry and the Vale of Glamorgan, contrasted against national data.
- 10.3.9 The study area defining the relevant sensitive receptors identified for assessment purposes have been coordinated and remains consistent with the inter-related technical disciplines assessed within the ES (e.g. Chapter 8: Noise and Vibration, Chapter 9: Air Quality).

Temporal Scope

- 10.3.10 The facility is built, could be operational and export electricity to the local grid in 2022, after which the Development could be decommissioned. The assessment thereby includes a retrospective assessment for the construction stage, before assessing the potential operational and decommissioning stages of the Development.

Establishing Baseline Conditions

- 10.3.11 Different communities have varying susceptibility to population and human health effects (both adverse and beneficial) as a result of social and demographic structure, behaviour and relative economic circumstances.
- 10.3.12 The approach to establishing baseline conditions involved the collation and interpretation of published demographic, socio-economic and existing public health data. The following

open-source websites and datasets have been used in order to develop the population and human health baseline:

- NOMIS⁹;
- StatsWales¹⁰; and
- Health Maps Wales¹¹.

10.3.13 The collated data and supporting narrative defining local health circumstance is contained in full within Annex A: Population and Human Health Baseline of Appendix 10.1: Health Impact Assessment. A summary of this data set is presented in this chapter, and the necessary inputs carried across to the relevant health assessment protocol.

10.3.14 Baseline environmental conditions referenced in the relevant technical disciplines (including Noise and Air Quality) are used within the quantitative health assessments where appropriate. For the sake of brevity, these are not repeated within this section.

Pre-Construction Baseline

10.3.15 Following the approach defined in paragraphs 10.3.11 to 10.3.13, in order to inform the Pre-Construction baseline, publicly accessible data has been collected for the year of 2016 (i.e. prior to construction of the Plant). This offers a representative baseline, attuned to health circumstance at the time.

Current Baseline

10.3.16 Following the approach defined in paragraphs 10.3.11 to 10.3.13, in order to inform the current baseline, publicly accessible data has been collected for the latest year possible.

10.3.17 Where public health data is not available for the year 2022 (due to delays between data collection and publishing), recent data is considered, and an added layer of precaution is built into the assessment protocol (assuming the highest burden of poor health in the population as a constant). This also aids in considering pockets of inequality and associated health deprivation.

Future Baseline

10.3.18 As it is challenging to predict the health and wellbeing baseline a decade or more in the future with high confidence, trends are analysed as part of the current baseline to provide insight into likely population distribution and future health circumstance.

10.3.19 For the purpose of quantitative impact assessment, trend data is considered, and an added layer of precaution is built into the assessment protocol, selecting the highest burden of poor health in the population as a constant, and assuming a hypothetical worst-case receptor exposure. As a consequence a consistently precautionary approach has been applied, to ensure that any material impact on public health is clearly reported.

Identifying Likely Significant Effects

Construction (Retrospective)

10.3.20 The population and human health assessment of construction activities draws from and builds upon the key assessment outputs from inter-related technical disciplines (most notably air quality, noise and traffic).

- 10.3.21 In all cases, a precautionary approach has been applied by applying a uniformly high receptor sensitivity during the individual assessment protocols conducted, and again during the professional judgement on significance.

Operation

Population and health effects from changes in air quality

- 10.3.22 While the air quality thresholds detailed within Chapter 9: Air Quality are set to protect the environment and health, the supporting health evidence base on non-threshold pollutants indicated that effects may be experienced at the population level for concentrations below these limits. As such, the population and health assessment provide further context to the assessment outputs provided in Chapter 9: Air Quality, whereby the health effects associated with changes in air quality from the operational activities of the Development are quantitatively assessed.
- 10.3.23 The population and health assessment relating to air quality draws from the dispersion modelling provided in Chapter 9: Air Quality and applies local burdens of poor health and relative exposure to operational emissions (particulate matter and nitrogen dioxide) to assess the magnitude, distribution and significance of any potential risk to population health.
- 10.3.24 The assessment of changes in exposure to pollutants of concern (e.g. dioxins and furans) is covered through the separate Human Health Risk Assessment (HHRA), included as Appendix 9.7. The HHRA considers the fate of emissions in the environment and the potential lifetime risk to health for a worst-case hypothetical receptor via inhalation, ingestion and absorption. The assessment is a requirement of the Permit to operate, but the findings also aid in responding to community health concerns. Specific details of the assessment method applied are provided in Section 10.6 (Operational Assessment).
- 10.3.25 In all cases, a precautionary approach has been applied by applying a uniformly high receptor sensitivity and the evaluation of impact magnitude and significance of effect has been informed by professional judgement, underpinned by the quantitative exposure response assessment and supporting narrative to explain the conclusions reached.

Population and health effects from changes in noise exposure

- 10.3.26 Consensus on the level and duration of noise required to instigate potential health impacts is not clearly defined. Therefore, the main emphasis of noise standards, regulations and guidance is placed on annoyance and sleep disturbance, as they are the most immediate consequences of noise effects; are applicable to everyone; and allow intervention before any manifest adverse health outcome. Additional health assessment protocols can include quantitative exposure response assessments for changes in hypertension and associated cardiovascular risk, through to impacts on cognitive function and episodic memory at schools (i.e. academic performance) depending on the nature, magnitude, duration and timing of noise.
- 10.3.27 The population and health assessment relating to noise impacts draws from noise modelling outputs provided in Chapter 8: Noise and Vibration, to consider potential changes in noise exposure with the potential to result in annoyance, impact upon cognitive function in schools or result in sleep interference impacting upon cardiovascular health.

- 10.3.28 The significance of the effect has been determined by taking into account the sensitivity of the receptor and the nature, timing, duration and magnitude of any noise impact.
- 10.3.29 A precautionary approach has been applied by applying a uniformly high receptor sensitivity and the evaluation of impact magnitude and significance of effect has been informed by professional judgement, underpinned by narrative to explain the conclusions reached.

Population and health effects from changes in transport nature and flow rate

- 10.3.30 Potential health determinants associated with changes in transport nature and flow rate include increased risk of road traffic accident and injury, community severance and pedestrian amenity. Associated changes in local air quality and noise exposure relating to transport movements are addressed through the previous health assessment protocols described above.
- 10.3.31 The population and health assessment relating to transport impacts draws from the traffic modelling outputs provided in the Transport Technical Note (Appendix 3.10) to communicate the potential health effects associated with the range of aspects explored in relation to changes in transport nature and flow rate (i.e. risk of road traffic accident and injury, community severance and pedestrian amenity).
- 10.3.32 A precautionary approach has been applied by applying a uniformly high receptor sensitivity and the evaluation of impact magnitude and significance of effect has been informed by professional judgement, underpinned by narrative to explain the conclusions reached.

Decommissioning

- 10.3.33 Any decommissioning activities are likely to be similar in type, scale and duration to those that took place during construction. On this basis, the methodology for assessing potential population and human health effects during any potential decommissioning phase are as per the construction (retrospective) phase defined above. As such, this chapter does not include a separate section on decommissioning, where the nature, magnitude and significance will be comparable.

Cumulative Effects

- 10.3.34 The cumulative population and human health assessment follow a similar approach to the assessment of the Development in isolation, drawing from and building upon key assessment outputs from inter-related technical disciplines (i.e. air quality, noise and traffic).
- 10.3.35 Each cumulative development would be considered individually as each would differ in how they impact the relevant health determinants assessed. The assessment is qualitative in nature and receptor-based.

Determining Effect Significance

Sensitivity of Receptor

- 10.3.36 Within a defined population, individuals will range in level of sensitivity due to a series of factors such as age, socio-economic deprivation and the prevalence of any pre-existing health conditions which could become exacerbated. These individuals can be considered particularly vulnerable to changes in environmental and socio-economic factors (both

adversely and beneficially), whereby they could experience disproportionate effects when compared to the general population.

- 10.3.37 As an example, the elderly, young children and individuals with chronic pre-existing respiratory conditions would be more sensitive to adverse changes to air quality, with the potential for higher rates of emergency hospital admission than for someone of working age who has good respiratory health. On the other hand, an individual who has been unemployed for a long period of time would benefit more from employment opportunities generated by the Development in comparison to an individual who is already employed.
- 10.3.38 The baseline data has been collected in order to interpret local health circumstance and underpins the individual assessment protocols applied. This information is detailed in Annex A: Population and Human Health Baseline of Appendix 10.1: Health Impact Assessment and summarised in Section 10.4 (Baseline Conditions).
- 10.3.39 This does not however, fully exclude that there will be individuals within a defined population who are particularly sensitive and could experience disproportionate effects. On this basis, a consistently precautionary approach has been applied to the professional judgment on significance, by assuming that the whole population living within the study area is of uniformly high sensitivity.

Magnitude of Impact

- 10.3.40 The criteria for defining magnitude of impact for population and human health are outlined in Table 10.1.

Table 10.1: Magnitude of Impact Descriptors

Impact Magnitude	Descriptor
High	Change in environmental or socio-economic factor sufficient to result in a major change in baseline population health or socio-economic circumstance (adverse or beneficial).
Medium	Change in environmental or socio-economic factor sufficient to result in a moderate change in baseline population health or socio-economic circumstance (adverse or beneficial).
Low	Change in environmental or socio-economic factor sufficient to result in a minor change in baseline population health or socio-economic circumstance (adverse or beneficial).
Negligible	Change in environmental and socio-economic factor below which it is possible to result in any manifest health outcome at the population level but may impact at an individual level (adverse or beneficial).
No change	No change in environmental or socio-economic factors, which would result in no change of health outcomes.

Assessing Significance

- 10.3.41 The significance of the effect has been determined by taking into account the sensitivity of the receptor and the magnitude of the impact. The method employed for this assessment

is presented in Table 10.2. Where a range of significance levels are presented, the overall assessment for each effect is based upon evidence based expert judgement.

10.3.42 For the purpose of this assessment, any effects with a significance level of slight or less are not considered to be significant in terms of the EIA Regulations.

Table 10.2: Significance of Effect Assessment Matrix

		Magnitude of impact (degree of change)				
		<i>No Change</i>	<i>Negligible</i>	<i>Low</i>	<i>Medium</i>	<i>High</i>
Sensitivity of receptor	<i>Very High</i>	Neutral	Slight	Moderate or Large	Large or Very Large	Very Large
	<i>High *</i>	Neutral	Slight	Slight or Moderate	Moderate or Large	Large or Very Large
	<i>Medium</i>	Neutral	Neutral or Slight	Slight	Moderate	Moderate or Large
	<i>Low</i>	Neutral	Neutral or Slight	Neutral or Slight	Slight	Slight or Moderate
	<i>Negligible</i>	Neutral	Neutral	Neutral or Slight	Neutral or Slight	Slight

*As detailed above, a highly precautionary approach has been applied by assuming that the whole population living within the study area is of uniformly high sensitive for the purpose of defining significance.

Assumptions and Limitations

10.3.43 The population and health assessment draws from and builds upon the technical outputs from inter-related disciplines (Noise and Vibration, Air Quality Transport, HHRA etc). As a consequence, the assumptions and limitations of those assessments also apply to any information used in this chapter. It is, however, considered that the information available provides a suitable basis for the assessment of health.

10.3.44 Wider limitations include some of the challenges with retrospective assessment of construction effects, but these have been addressed through a consistently precautionary approach and the uniform application of a high receptor sensitivity when defining the significance of effect.

10.3.45 Equally, challenges associated with assessing the potential impact to future populations and their unknow distribution and health circumstance is again addressed through a precautionary approach, and hypothetical assessment assuming worst case process contribution and exposure scenarios.

10.4 Baseline Conditions

Site Setting

10.4.1 The Site is located to the west and north of No. 2 Dock and is located within the industrial setting of the active port of Barry. Currently, the nearest existing residential receptors are

located along Dock View Road approximately 250 m to the northwest of the Site boundary, with additional residential development underway along Ffordd Y Mileniwm and Cory Way bordering the industrial estate, and further development approximately 120m to the southwest of the Site (Barry Waterfront Development).

Health Baseline

- 10.4.2 Different communities have varying susceptibility to health and wellbeing effects (both adverse and beneficial) as a result of social and demographic structure, behaviour and relative economic circumstance. Annex A: Population and Human Health Baseline of Appendix 10.1: Health Impact Assessment provides a detailed profile of local demography, health and socio-economic circumstance, a summary of which for the pre-construction baseline (2016) and current baseline (latest data available) is provided in Table 10.3.

Table 10.3: Baseline conditions summary (pre-construction and current baseline)

Indicator		Pre-Construction (2016 or range)	Current Baseline	Trend
Life Expectancy	Male	79.6 (2010 – 2014)	79.6 (2010 – 2014)	-
	Female	83.4 (2010 – 2014)	83.4 (2010 – 2014)	-
Healthy Life Expectancy	Male	66.6 (2010 – 2014)	66.6 (2010 – 2014)	-
	Female	68.7 (2010 – 2014)	68.7 (2010 – 2014)	-
Population in Barry (total)		56,124	58,486	Increasing
Deprivation – Welsh Index of Multiple Deprivation (WIMD) of LSOA's making up Barry				
20% most deprived LSOAs nationally		34% (2014)	29% (2019)	Decreasing
Mortality rates – age-standardised per 100,000 population, three-year average, persons, all ages				
Mortality from all causes		1003.9 (2014 - 2016)	1034.6 (2017 - 19)	Increasing
Mortality from cardiovascular diseases		230.7 (2014 - 2016)	245.7 (2017 - 19)	Increasing
Mortality from respiratory diseases		162.8 (2014 - 2016)	146.7 (2017 - 19)	Decreasing
Mortality from cancer		279.7 (2014 - 2016)	291.0 (2017 - 19)	Increasing

ⁱ Lower Layer Super Output Areas (LSOA) are a geographic hierarchy used to report small area statistics in England and Wales.

Indicator	Pre-Construction (2016 or range)	Current Baseline	Trend
Hospital admission rates – age-standardised per 100,000 population, three-year average, persons, all ages			
Cardiovascular disease related hospital admissions	1960.4 (2014/15 - 2016/17)	2034.1 (2017/18 - 2019/20)	Increasing
Respiratory disease related hospital admissions	2012.1 (2014/15 - 2016/17)	2324.7 (2017/18 - 2019/20)	Increasing
Cancer related disease related hospital admissions	1369.0 (2014/15 - 2016/17)	1641.3 (2017/18 - 2019/20)	Increasing
Mental health – age-standardised per 100,000 population, three-year average, persons, all ages			
Self-harm (emergency hospital admission rates)	255.1 (2014/15 - 2016/17)	198.8 (2017/18 - 2019/20)	Decreasing
Suicide mortality rate	11.1 (2014 - 16)	9.6 (2017 - 19)	Decreasing
Dementia/Alzheimer's mortality rate	107.5 (2014 - 16)	121.2 (2017 - 19)	Increasing
Lifestyle – age-standardised per 100,000 population, three-year average, persons, all ages			
Alcohol-specific hospital admissions	588.0 (2014/15 - 2016/17)	989.4 (2017/18 - 2019/20)	Increasing
Drug use related hospital admissions	181.2 (2014/16)	156 (2019/20)	Decreasing

10.4.3 Overall, levels of deprivation are improving, and while hospital admission rates are increasing, they are doing so at a higher rate than coinciding mortality rates, indicating greater intervention, treatment and recovery. Equally, mental health indicators are generally improving, with lower levels of self-harm and suicide in the current baseline compared to the pre-construction baseline. Substance abuse remains an issue, particularly alcohol abuse.

Future Baseline

10.4.4 Trends are analysed as part of the current baseline to provide insight into likely future local community circumstances. Overall, the existing health burden is higher than the national average, albeit with some improvement in deprivation and mental health outcomes.

10.4.5 As it is challenging to predict health-specific data with high confidence, it is considered appropriate that the present-day statistics are used for the purpose of this assessment, implementing a precautionary approach that assumes the highest burden of poor health is a constant for the entire study area.

- 10.4.6 Regarding the potential influence on the population and health baseline associated with climate change, while it is probable that the effects of climate change will be realised to some extent during the operational Development, these changes are not expected to materially alter the population and health baseline conditions.

Summary of Receptors and Sensitivity

- 10.4.7 Following the baseline, all human receptors (including residential areas, schools, nursing homes etc.) are considered as sensitive to changes in environmental and socio-economic health determinants; and have been addressed accordingly during both the individual assessment protocols, and during the evidence based professional judgment on significance.
- 10.4.8 This builds in a consistently and overlapping layer of precaution to the Population and Health assessment.

10.5 Construction Assessment (Retrospective)

Embedded Design and Mitigation

- 10.5.1 Embedded design and mitigation measures adopted as part of the construction of the Development focus on managing potential hazards and focus on precursors to health outcomes, thereby facilitating intervention and manage a hazard before it presents any opportunity for health impact.
- 10.5.2 Construction was undertaken in accordance with a Project Environmental Plan (Appendix 6.2) and Construction Phase Plan (Appendix 6.1) which were approved by VoGC prior to works taking place. Both documents set out the key management measures that the contractors were to adopt and implement in order to control construction activities and emissions with the potential to cause adverse population and health outcomes.
- 10.5.3 Specifically, the plans referenced above managed dust, noise, air pollutants and transport movements (i.e. the core health determinants associated with any construction activity).

Assessment of Effects

Population and health effects from changes in air quality

- 10.5.4 As stated in Chapter 9: Air Quality, during construction of the Development, there would have been the potential for impacts on local air quality to occur as a result of dust and PM₁₀ emissions.
- 10.5.5 As with any development, the risk of dust emissions is determined by the scale and nature of the works and the proximity of sensitive receptors. It is noted that the application of effective mitigation and the distance between the Site and any sensitive receptors was already sufficient to have prevented any significant health risk.
- 10.5.6 As detailed in Chapter 9: Air Quality, a site-specific dust risk assessment based on the latest guidance from the Institute of Air Quality Management (IAQM), concluded that the change in local air quality is considered to have been negligible. Construction emissions therefore represented a negligible change in local air quality, remained within air quality standards

protective of health, and both concentration and community exposure remained orders of magnitude lower than is required to quantify any change in local health outcome.

- 10.5.7 The potential construction air quality hazards are well known, understood and would have been adequately addressed through the PEP and CPP to manage any risk to the environment and health. In this context, the magnitude of impact on population and health would be negligible, which, in an area of high sensitivity would result in a slight adverse effect, which is not considered to be significant in EIA terms.

Population and health effects from changes in noise exposure

- 10.5.8 Under the PEP (Appendix 6.2), construction hours were limited to daytime hours only (07:30 – 18:00 hours during Monday to Friday, and 07:30 – 15:00 hours during Saturday and Sunday). Within these hours, noise arising from activities that could potentially be heard at the Site perimeter boundary were restricted to daytime periods only, removing any potential for sleep disturbance, or the associated risk for hypertension and cardiovascular health outcomes. This limits potential health impacts to potential daytime annoyance, and cognitive function and episodic memory in schools.
- 10.5.9 Given the location of the Site, and when further considering the intermittent and temporary nature of noise generating activities during construction, construction activities were not of a scale, magnitude, duration or timing to result in any tangible impact.
- 10.5.10 Based on the Noise and Vibration chapter results, there would have been negligible noise level impacts during construction activities at residential receptors and the Vale of Glamorgan Council offices with predicted noise level impacts not expected to have exceeded 65dB $L_{Aeq,T}$. Furthermore, the results indicate a negligible increase in road traffic noise level as a result of the retrospective Construction Phase of the Development, with the highest increase in road traffic noise level to be 0.7dB (i.e. below what is considered a perceptible, and not of a magnitude or exposure sufficient to quantify any adverse health outcome).

Population and health effects from changes in transport nature and flow rate

- 10.5.11 Relevant health determinants associated with changes in transport nature and flow rate include increased risk of road traffic accident and injury, community severance and pedestrian amenity.
- 10.5.12 As stated in the Transport Technical Note (Appendix 3.10), the substantial amount of the Development construction took place over a period of approximately two years, between February 2016 and January 2018, and comprised the groundworks and the build stages.
- 10.5.13 The maximum change in transport movements occurred during the groundworks stage, whereby there were up to 50 HGV trips (100 two-way movements) per day. The peak demand of up to 130 staff on-site also generated up to 50 LGVs trips (100 two-way movements) per day. Therefore, the total vehicle trips for the groundworks stage were 100 trips (i.e. 200 two-way movements) per day to an active port.
- 10.5.14 While the magnitude of traffic movements during the build stage was lower than the groundworks stage, the traffic movements from the groundworks stage were used to ensure a worst-case assessment. Changes in traffic flows of less than 30% from the baseline are

considered negligible and therefore would not materially impact risk of road traffic accident and injury, community severance or pedestrian amenity.

- 10.5.15 Results show that of the six road links analysed, the maximum change in total vehicles experienced on any road link during the construction phase was +7% (occurring on Cory Way). All other road links experienced an increase in traffic movements of less than +2%.
- 10.5.16 When analysing HGV movements in isolation, the maximum change experienced on any road link during the construction phase was +3.3%. All other road links experienced an increase in traffic movements of less than 1%.
- 10.5.17 On the basis that changes in transport movements do not meet the 30% impact threshold, they would not have been of a level to materially impact on road capacity, safety or impact on community severance and amenity.
- 10.5.18 The magnitude of impact on population and health would therefore be negligible, which, in an area of high sensitivity would result in a slight adverse effect, which is not considered to be significant in EIA terms.

Mitigation Measures, Monitoring & Residual Effects

- 10.5.19 The mitigation and monitoring measures that were adopted as part of the construction of the Development focused on precursors to any adverse health outcome, thereby inherently embedding health protection.
- 10.5.20 Overall, the residual construction impacts of the Development are not considered to be significant for any of the health determinants assessed, with no measurable impact to health.

10.6 Operational Assessment

Embedded Design and Mitigation

- 10.6.1 The embedded design and mitigation measures adopted as part of the operation of the Development focus on known hazards that are precursors to adverse health outcomes, thereby providing an opportunity to manage a hazard before it presents the opportunity for any adverse health impacts.
- 10.6.2 Such embedded design and mitigation measures include the application of specific abatement technology that is evaluated and controlled by the Environmental Permitting regime. The purpose of abatement technology is to control the nature and concentration of emissions to comply with some of the most stringent permitting requirements of any sector, inherently set to protect the environment and public health. A facility will not obtain a permit to operate, and the permit can be retracted by the regulator at any stage of operation if compliance is not met. In this instance, the Facility has satisfied all of the regulatory authority's requirements, and a Permit to operate has been provided by NRW (Appendix 1.2).
- 10.6.3 On the above basis, embedded design is central to removing and managing known hazards, such that the risk to health is removed and managed.

Assessment of Effects

Population and health effects from changes in air quality

10.6.4 The air quality health evidence base is significant, with extensive epidemiological research on a wide array of emissions, forming the basis to air quality objectives, protective of health. The following section builds upon the air quality assessment, which focusses on the relevant objective thresholds set to protect the environment and human health, by applying appropriate exposure response risk ratios to further explore and communicate the magnitude and significance of any health effect in the context of existing local health circumstance.

Nitrogen Dioxide and Particulate Matter

10.6.5 Chapter 9: Air Quality includes modelled changes in concentrations of nitrogen dioxide (NO₂) and particulate matter (PM) associated with the stack across a 5km by 5km grid. The grid points intersect a total of 34 Lower Super Output Areas (LSOAs) located in the Vale of Glamorgan. The total population within the 34 LSOAs is 57,380, with 36,608 of the population aged 30+.

10.6.6 To estimate the change in health outcomes associated with changes in exposure to air quality, concentration-response functions (CRFs) recommended in the World Health Organisation's (WHO) Health Risks of Air Pollution in Europe (HRAPIE) guidance¹² are applied with the absolute change in air quality (in µg/m³), population estimates, and various baseline health data for the study area.

10.6.7 To ensure the assessment is as accurate as possible, a sub-assessment was undertaken for each LSOA, whereby the exposure assessment assumes the estimated population living within each LSOA is exposed to the average change in air pollutant concentration across that specific LSOA. The results for each individual LSOA are then added together to calculate the overall result associated with the project as a whole.

10.6.8 Table 10.4 shows the potential health outcomes associated with the predicted change in air pollutant exposure during operation.

Table 10.4: Population health outcomes associated with changes in air pollution

Health outcome	Number of cases attributable to the project
Natural cause mortality (aged 30+)	0.23
Respiratory disease emergency hospital admissions	0.39
Cardiovascular disease hospital admissions	0.01
Total hospital admissions	0.40

10.6.9 The results indicate that even when assuming the highest burden of poor health as a population constant, changes in air quality are negligible, would remain well within air quality objectives protective of health, and are not of a nature, concentration or exposure sufficient to quantify any change in morbidity or mortality during any year of operation.

Dioxins, Furans and Dioxin-like Polychlorinated Biphenyls (PCBs)

- 10.6.10 A Human Health Risk Assessment (HHRA) was undertaken and is included as Appendix 9.7. The HHRA assessed the potential risk to human health arising from emissions of polychlorinated dibenzo-para-dioxins and polychlorinated dibenzofurans (PCDD/Fs, often referred to as dioxins/furans) and dioxin-like PCBs from the Development.
- 10.6.11 The HHRA was completed upon the worst-case and most conservative scenarios, namely that of an individual exposed for a lifetime (70 years) to the effects of the highest airborne concentrations at any point and consuming mostly locally grown food.
- 10.6.12 For the HHRA, the quantification of the exposure was based on the worst-case scenario associated with:
- the location of the exposed hypothetical receptor and duration of exposure;
 - exposure rate; and
 - emission rate from the source.
- 10.6.13 Despite the highly hypothetical and unrealistically precautionary assessment scenario applied, the HHRA demonstrates that facility emissions do not present a significant risk to health from any pollutant of concern.

Conclusion

- 10.6.14 Overall, the magnitude of air quality impact on population and health would be negligible (i.e. no measurable health impact), which, in an area of high sensitivity would result in a slight adverse effect, which is not considered to be significant in EIA terms.

Population and health effects from changes in noise exposure

- 10.6.15 The relationship between noise and health outcomes is complex, with both auditory and non-auditory outcomes that vary by noise source, receptor, and can be further influenced/confounded by other sensory inputs and even individual attitudes to noise.
- 10.6.16 In this instance, the operation of the Development does not present any auditory health outcome (i.e. the change in noise level does not constitute a magnitude or duration sufficient to cause any physical damage to the hearing organelles).
- 10.6.17 Non-auditory health outcomes include the potential to impact health via annoyance and/or sleep disturbance. Chapter 8: Noise and Vibration identifies surrounding residential receptors as sensitive. The nearest identified existing and future residential premises in close proximity to the Development were identified in Chapter 8: Noise and Vibration as follows:
- R1) Existing residential housing on Dock View Road, located c.215 metres distance to the north west of the closest perimeter site boundary of the Development;
 - R2) Future residential housing (currently under construction as of May 2022), as to be located on Cory Way, c.170 metres distance to west of the closest perimeter site boundary;

- R3) Future residential housing (currently under construction as of May 2022), as to be located on East Quay, c.100 metres distance to south west of the closest perimeter site boundary;
- R4) Existing residential housing located on Cei Dafydd, sited c.370 metres distance to the west of the closest perimeter site boundary; and
- R5) Existing residential housing as located on Subway Road, sited c.380 metres distance to the west of the closest perimeter site boundary.

10.6.18 As discussed in Chapter 8: Noise and Vibration, following mitigation, there is potential for “sub adverse” impacts, depending on the context at residential receptors R1, R2, and R3 during the daytime, evening and/or night-time hours.

10.6.19 A “sub adverse” impact means that the predicted overall A-weighted, BS 4142:2014+A1:2019 defined Rating Level at each of the identified noise-sensitive residential receptors was between 0dB and +4dB.

10.6.20 At R1: Dock View Road, the night-time increase was +2dB. At R2, the evening increase was +1dB and +2dB at night-time.

10.6.21 At R3: East Quay, the evening increase was +2dB and at night was +4dB. Overall, the difference between the Rating Level and the existing background sound level is below the threshold for an indication of the significant impact (i.e. a limiting Rating Level that exceeds the Background Sound Level by +5dB or greater, depending on the context).

10.6.22 A change of 3dB is typically considered to be the threshold of a perceptible change in noise. For the majority of the residential receptors the change is less than 3dB, with the exception of one location (i.e. R3) and only at night. Although one of the five residential receptors would border on a perceptible change in noise, the nature and magnitude remain below a quantifiable change to health.

Conclusion

10.6.23 Overall, the magnitude of noise impact on population and health would be negligible (i.e. no measurable health impact), which, in an area of high sensitivity would result in a slight adverse effect, which is not considered to be significant in EIA terms.

Population and health effects from changes in transport nature and flow rate

10.6.24 Relevant health determinants associated with changes in transport nature and flow rate include increased risk of road traffic accident and injury, community severance and pedestrian amenity.

10.6.25 As stated in the Transport Technical Note (Appendix 3.10), on a typical operational day, the delivery of biomass to the facility would result in approximately 14 HGV movements. However, there may be occasions when deliveries may be late or delayed; therefore, to ensure the assessment is worst case, up to 15 HGV biomass deliveries per day have been assumed.

10.6.26 Other deliveries to the operational Development comprise hydrated lime and urea pill, which would not be delivered daily. Hydrated lime would require up to one HGV delivery per week, while urea pill would require up to one HGV delivery every two weeks. The Development

would generate both fly ash and air pollution control residues (APCR) which would both need exporting from the Development. The number of HGVs required to export fly ash would be between two and three per week, with no more than one visit on any one day. The number of HGVs required to export APCR would be two per week, with no more than one visit on any one day.

- 10.6.27 Overall, for the purposes of considering the worst-case scenario, whereby all HGV deliveries/removal trips converge on a singular day, the total number of daily HGV movements is assumed to be 19 (38 two-way movements) to an active port.
- 10.6.28 In addition, on the busiest days, there would be up to 12 staff on site per day Monday to Friday and five staff on site per day Saturday to Sunday. Following the application of Census data, it is assumed that there would be eight staff car trips per day (16 two-way movements).
- 10.6.29 Changes in traffic flows of less than 30% from the baseline are considered negligible and therefore would not materially impact risk of road traffic accident and injury, community severance or pedestrian amenity.
- 10.6.30 Results show that of the six road links analysed, the maximum change in total vehicles experienced on any road link during the operational phase was +1.9% (occurring on Cory Way). All other road links experienced an increase in traffic movements of less than +0.5%.
- 10.6.31 When analysing HGV movements in isolation, the maximum change experienced on any road link during the operational phase was +1.3%. All other road links experienced an increase in traffic movements of less than 1%.
- 10.6.32 On the basis that changes in transport movements do not meet the 30% impact threshold, and do not present any material risk to public health. The magnitude of impact on population and health would be negligible (i.e. no measurable risk to health), which, in an area of high sensitivity would result in a slight adverse effect, which is not considered to be significant in EIA terms.

Risk Perception

- 10.6.33 Existing pre-conceptions surrounding energy generation facilities, including biomass can engender a wide range of perceived health risks, which if left unaddressed, can fester and lead to unnecessary stress and anxiety
- 10.6.34 Such subjective and often intangible factors are generally not effectively addressed through the regulatory assessment or permitting process, which concentrate on tangible changes in environmental conditions directly attributable to what is proposed and are structured to comply with regulatory requirement.
- 10.6.35 The provision of factually, scientifically robust information can help to alleviate such community concerns, raising awareness of the Facility and demonstrating how both the environment and public health have been considered throughout the planning process.
- 10.6.36 The HIA and corresponding ES Population and Health Chapter has investigated all credible health pathways directly attributable to what has been constructed on the Site, and raised during the previous stages of consultation, and demonstrated that the operation of the Development will have a negligible impact on environmental circumstance, and no

measurable impact on health, while supporting renewable energy generation, energy security and reducing dependence on fossil fuel.

- 10.6.37 All the credible health hazards have been inherently addressed through design; have been appropriately assessed to tests the position of the UK Health Security Agency (formally PHE)¹³, and that the Facility has satisfied the regulatory authority and gained a Permit to operate.
- 10.6.38 This chapter communicates the distribution and significance of potential risk, and monitoring data will be applied to test compliance during the lifetime of the Facility. On this basis, perceived risks have been appropriately investigated and addressed, and ongoing engagement and publicly accessible monitoring will aid transparency and further manage residual perceptions of risk.
- 10.6.39 The magnitude of impact on population and health from perceived risk is therefore negligible (i.e. no measurable impact to health), which, in an area of high sensitivity would result in a slight adverse effect, which is not considered to be significant in EIA terms.

Mitigation, Monitoring and Residual Effects

- 10.6.40 The above assessment of population and health effects has taken into account any proposed further mitigation measures which are outlined within the relevant environmental technical disciplines. In this instance, the only technical discipline requiring additional mitigation is Chapter 8: Noise and Vibration, whereby additional noise mitigation measures are proposed and will be installed by the Appellant prior to commercial operations commencing. These measures are in addition to the already implemented control measures. Further details are provided in Chapter 8: Noise and Vibration. Following the implementation of this further mitigation, residual noise and vibration effects are at worst, considered slight adverse (not significant) during the operational phase of the Development.
- 10.6.41 On the basis that the embedded and further mitigation measures proposed focus on precursors to health and wellbeing outcomes, this precludes any adverse impact on health, whereby the potential risk is not measurable and no additional health-specific mitigation measures are considered necessary.
- 10.6.42 Furthermore, monitoring adopted as part of the Development also focuses on precursors to health outcomes, enabling intervention at environmental thresholds prior to there being any material risk to public health. Specifically, continuous 24-hour environmental noise monitoring will be undertaken, which would immediately alert the operator of noise issues, and facilitate intervention where appropriate.

Decommissioning

- 10.6.43 Any decommissioning activities are likely to be similar in type, scale and duration to those that took place during construction and as such human health effects during this phase would be as per the retrospective construction phase.

10.7 Cumulative Effects

- 10.7.1 Cumulative projects have been considered where there is the potential to interact with the health determinants assessed, modify exposure pathways or introduce new receptors.
- 10.7.2 2019/01371/RES is for the landscaping of public open space. On the basis that this development does not introduce any new receptors, it is not considered relevant to the cumulative assessment of population and human health effects and has been scoped out.
- 10.7.3 Similarly, 2021/00379/FUL is for the construction of new primary school, access, car parking, landscaping and associated works, which is currently under construction located >1km from the Development. Due to its distance from the Development and on the basis that receptors would be present at the primary school for only part of the day (the majority of which would be spent inside classrooms), this development is not considered relevant to the cumulative assessment of population and human health effects and has been scoped out.
- 10.7.4 The following four residential developments are located within 1km of the Development, are currently under construction and are considered relevant to the cumulative assessment of population and human health effects:
- 2019/01393/RES – residential development for 58 units, together with single retail unit and all associated engineering works;
 - 2019/01386/RES – approval is sought for the layout, appearance, scale landscaping for a 3-storey apartment block, the Reserved Matters of Planning Permission ref. 2009/00946/OUT (36 units);
 - 2019/01385/RES – reserved matters submission for 56 dwellings at East Quay, Barry Waterfront; and
 - 2019/01384/RES – approval is sought for the appearance, landscaping, layout and scale (the Reserve Matters) as prescribed by Condition 4 of the Outline Planning Permission (2014/00229/EAO) for East Quay, which comprises of a residential development of 62 dwellings with associated works.
- 10.7.5 The occupation of the above developments would introduce additional sensitive receptors to the study area. Applying the UK average household size of 2.4 people per dwelling (and not considering any net additional effects i.e. individuals moving from within the study area), the additional population would equate to approximately 509 people.
- 10.7.6 In the context of the population assessed within the study area (a total population of 57,380 people) whereby no measurable change to population health outcomes is reported, the cumulative developments identified are not anticipated to change the results or conclusions of the main assessment undertaken in the above sections.

Table 10.5: Summary of Residual Effects

Effect	Receptor (Sensitivity)	Geographic Scale	Temporal Scale	Magnitude of Impact	Mitigation and Monitoring	Residual Effect
<i>Construction (Retrospective)</i>						
Changes in local air quality	High	Local	Temporary	Negligible	n/a	Slight adverse (not significant)
Changes in noise exposure	High	Local	Temporary	Negligible	n/a	Slight adverse (not significant)
Changes in transport nature and flow rate	High	Local	Temporary	Negligible	n/a	Slight adverse (not significant)
<i>Operational</i>						
Changes in local air quality	High	Local	Permanent	Negligible	n/a	Slight adverse (not significant)
Changes in noise exposure	High	Local	Permanent	Negligible	Continuous 24-hour environmental noise monitoring to alert the site operator of noise issues	Slight adverse (not significant)
Changes in transport nature and flow rate	High	Local	Permanent	Negligible	n/a	Slight adverse (not significant)
Risk Perception	High	Local	Temporary	Negligible	Publicly accessible monitoring data and engagement	Slight adverse (not significant)
<i>Decommissioning</i>						
Changes in local air quality	High	Local	Temporary	Negligible	n/a	Slight adverse (not significant)

Effect	Receptor (Sensitivity)	Geographic Scale	Temporal Scale	Magnitude of Impact	Mitigation and Monitoring	Residual Effect
Changes in noise exposure	High	Local	Temporary	Negligible	n/a	Slight adverse (not significant)
Changes in transport nature and flow rate	High	Local	Temporary	Negligible	n/a	Slight adverse (not significant)

Cumulative Effects

As above.

References

- ¹ Future Generations Commissioner for Wales (2015). *Well-being of Future Generations (Wales) Act 2015*. Available at: <https://www.futuregenerations.wales/about-us/future-generations-act/> (Last accessed: March 2022).
- ² Welsh Government (2021). *Planning Policy Wales (Edition 11)*. Available at: <https://gov.wales/planning-policy-wales> (Last accessed: March 2022).
- ³ Vale of Glamorgan Council (2017). *Local Development Plan 2011-2026*. Available at: https://www.valeofglamorgan.gov.uk/en/living/planning_and_building_control/Planning/planning_policy/Planning-Policy.aspx (Last accessed: March 2022).
- ⁴ The Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017. Available at: <https://www.legislation.gov.uk/wsi/2017/567/contents> (Last accessed: July 2022).
- ⁵ Chadderton, C. et al. (2012). *Health Impact Assessment: A practical guide*. Public Health Wales, Cardiff University and WHIASU. (Last accessed: March 2022).
- ⁶ Ministry of Housing, Communities & Local Government (2019). *Planning practice guidance: Healthy and safe communities*. Available at: <https://www.gov.uk/guidance/health-and-wellbeing>
- ⁷ Wales Health Impact Assessment Support Unit (n.d.). *Guidance and Tools*. Available at: <https://phwwhocc.co.uk/whiasu/resources/> (Last accessed: April 2022).
- ⁸ Wales Health Impact Assessment Support Unit (2020). *Quality Assurance Review Framework for Health Impact Assessment*. Available at: https://phwwhocc.co.uk/whiasu/wp-content/uploads/sites/3/2021/05/QA_Interactive_PDF_version_eng..pdf (Last accessed: May 2022).
- ⁹ Nomis (n.d.). *Official Labour Market Statistics Data Query*. Available at: <https://www.nomisweb.co.uk/query/select/getdatasetbytheme.asp?opt=3&theme=&subgrp=> (Last accessed: March 2022).
- ¹⁰ StatsWales (n.d.). *Catalogue*. Available at: <https://statswales.gov.wales/Catalogue> (Last accessed: March 2022).
- ¹¹ Public Health Wales (n.d.). *Health Maps Wales*. Available at: <https://www.healthmapswales.wales.nhs.uk/> (Last accessed: March 2022).
- ¹² World Health Organisation (2013). Health risks of air pollution in Europe – HRAPIE project. Available at: https://www.euro.who.int/_data/assets/pdf_file/0006/238956/Health_risks_air_pollution_HRAPIE_project.pdf (Last accessed: May 2022).
- ¹³ Public Health England (2019). PHE statement on modern municipal waste incinerators (MWIs) study. Available at: <https://www.gov.uk/government/publications/municipal-waste-incinerators-emissions-impact-on-health/phe-statement-on-modern-municipal-waste-incinerators-mwi-study#:~:text=PHE%20's%20risk%20assessment%20remains,likely%20to%20be%20very%20small> (Last accessed: July 2022)