Air Emissions Risk Assessment

Permit Variation

Lianhetech Seal Sands

Seal Sands
Middlesbrough
TS2 1UB

Prepared by:

SLR Consulting Limited

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1.0 Introduction

SLR Consulting Ltd has been commissioned by Lianhetech Europe Limited (Lianhetech) to provide an Air Emissions Risk Assessment (AERA) in relation to a new manufacturing process at their site at Seal Sands Road, Middlesbrough, TS2 1UB (the 'Site').

This report is supporting documentation in Lianhetech's application to the Environment Agency (EA) to support a variation to Environmental Permit EPR/PP3439GG.

1.1 Background

Lianhetech have a new laboratory building for which a Permit Variation is required. The new laboratory involves the production of rodenticide, the process of which is described in the permit application.

The emissions to air associated with the above will be discharged via a new stack and will comprise:

- Ethylene dichloride (EDC); and
- Methanol (MeOH)

The existing (and currently permitted) process' of WS-2 and WS-3 also emits methanol via stack(s) A1/2 and A1/3, and have therefore been considered within the AERA to provide a cumulative assessment of impacts.

1.2 Scope and Objective

The scope of the assessment is limited to emissions of EDC and MeOH.

The objective of the study is to assess, using atmospheric dispersion modelling, the impact of these emissions against Air Quality Assessment Levels (AQAL) for the protection of human health.

This report presents the approach, detailed methodology and findings of the AERA.

2.0 Legislation and Relevant Guidance

2.1 Environmental Permitting Guidance

The facility is regulated under the Environmental Permitting (England and Wales) Regulations 2016 (as amended) (EPR).

Various Guidance Notes provide a framework for the regulation of installations and additional technical guidance are used to provide the basis for permit conditions. Of relevance to the assessment is the Environment Agency's (EAs) guidance 'Air emissions risk assessment for your environmental permit' (the 'AERA guidance'). The purpose of this guidance is to assist operators to assess risks to the environment and human health when applying for, or varying, a permit under the EPR.

2.2 Environmental Assessment Limits (EAL)

The EA has produced EALs to judge the acceptability of proposed emissions to air from industrial sites, and their relative contribution to the environment. EALs represent a pollutant concentration in ambient air at which no appreciable risks or minimal risks to human health are expected.

The EALs for the purpose of assessment, for the protection of human health are provided in Table 2-1.

Table 2-1 Relevant EAL

Pollutant	Annual Limit (µg/m^3)	Short Term (Hourly) Limit (µg/m^3)
Ethylene dichloride (EDC)	3	No EAL
Methanol (MeOH)	2,660	33,300

2.2.1 Protection of Ecological Receptors

As per the EA's AERA guidance, the substances detailed in Table 2-1 are not listed as a primary or secondary pollutant that requires consideration of ecological impacts, therefore impacts on ecological sites have been scoped out of the assessment.

3.0 ASSESSMENT METHODOLOGY

Detailed atmospheric dispersion modelling has been undertaken with due consideration to relevant guidance[1] and the modelling approach is based upon the following stages:

- review of emission sources, pollutant emission rates and characteristics;
- identification of sensitive receptors; and
- prediction of process contribution through dispersion modelling and evaluation against relevant EALs.

3.1 Quantification of Emissions

The client design team have provided emissions rates of both EDC and MeOH, which are:

- EDC - Maximum emission rate 3.3 grams per hour (g/hr) or 6.5 g per batch process.
- MeOH - Maximum emission rate 2 g/hr or 4.64 grams per batch process.

Batch processes are predicted to be under an hour in duration. To maintain a precautionary approach, it has been assumed that the maximum emission rate will be continuous and emit 24/7 for 365 days per year. This approach also allows consideration of concurrent cumulative emissions from A1/3 and A1/2.

The source parameters provided by Lianhetech and applied in the modelling are provided in Table 3-1 with the emission rates presented in Table 3-2.

Table 3-1 Source Parameters

Parameter / Source	New Stack	Existing: A1/3 (WS3)	Existing: A1/2 (WS2)
Building Location	Proposed building GA-DR-A-3007	MPB – 3	MPB - 2
Stack Location (NGR)	453287, 524197	453379, 524440	453426, 524289
Stack Height (m AGL)	11	28	19
Emission temperature (C)	Ambient	Ambient	Ambient
Stack internal diameter (m)	0.80	0.90	0.12
Velocity (m/s)	12.2	3.6	5.1
Flow (m^3/s)	6.15	2.29	0.06
Concentration EDC (mg/m^3)	0.15	Not Applicable	Not Applicable
Concentration MeOH (mg/m^3)	0.09	432.66	15,892.67

[1] Air Dispersion modelling report requirements (for detailed air dispersion modelling). AQMAU, Environment Agency (not dated).

Table 3-2 Emission Rates

Species	New Stack (g/s)	Existing: A1/3 (WS3) (g/s)	Existing: A1/2 (WS2) (g/s)
EDC	0.00092	Not emitted	Not emitted
MeOH	0.00056	0.9908	0.9535

3.2 Model Setup

For this assessment the AERMOD model[2] has been applied; this model is widely used and accepted by the EA for undertaking such assessments and is considered a suitable model for this type of assessment.

3.2.1 Model Domain / Receptors

The modelling has been undertaken using a receptor grid across an Ordnance Survey map of the study area. Pollutant exposure isopleths are generated by interpolation between receptor points and superimposed onto the map. This method allows the maximum ground level concentration outside the site boundary to be assessed.

A nested receptor grid was applied as follows:

- 100m x 100m at 10m grid resolution;
- 200m x 200m at 20m grid resolution;
- 500m x 500m at 50m grid resolution;
- 1000m x 1000m at 100m grid resolution;
- 2000m x 2000m at 200m grid resolution; and
- 5000m x 5000m at 500m grid resolution.

In addition, the modelling of discrete sensitive receptor locations as described in Section 4.1 was undertaken to assess the impact at relevant exposure locations for annual mean impact and facilitate the discussion of results.

3.2.2 Building Downwash

Building downwash occurs when turbulence, induced by nearby structures, causes pollutants emitted from an elevated source to be displaced and dispersed rapidly towards the ground, resulting in elevated ground level concentrations. The integrated Building Profile Input Programme (BPIP) module within AERMOD was used to assess the potential impact of building downwash upon predicted dispersion characteristics.

The model buildings and stacks are presented in Figure 3-1 and Figure 3-2.

[2] Software used: Lakes AERMOD View, (Executable Aermod_24142).

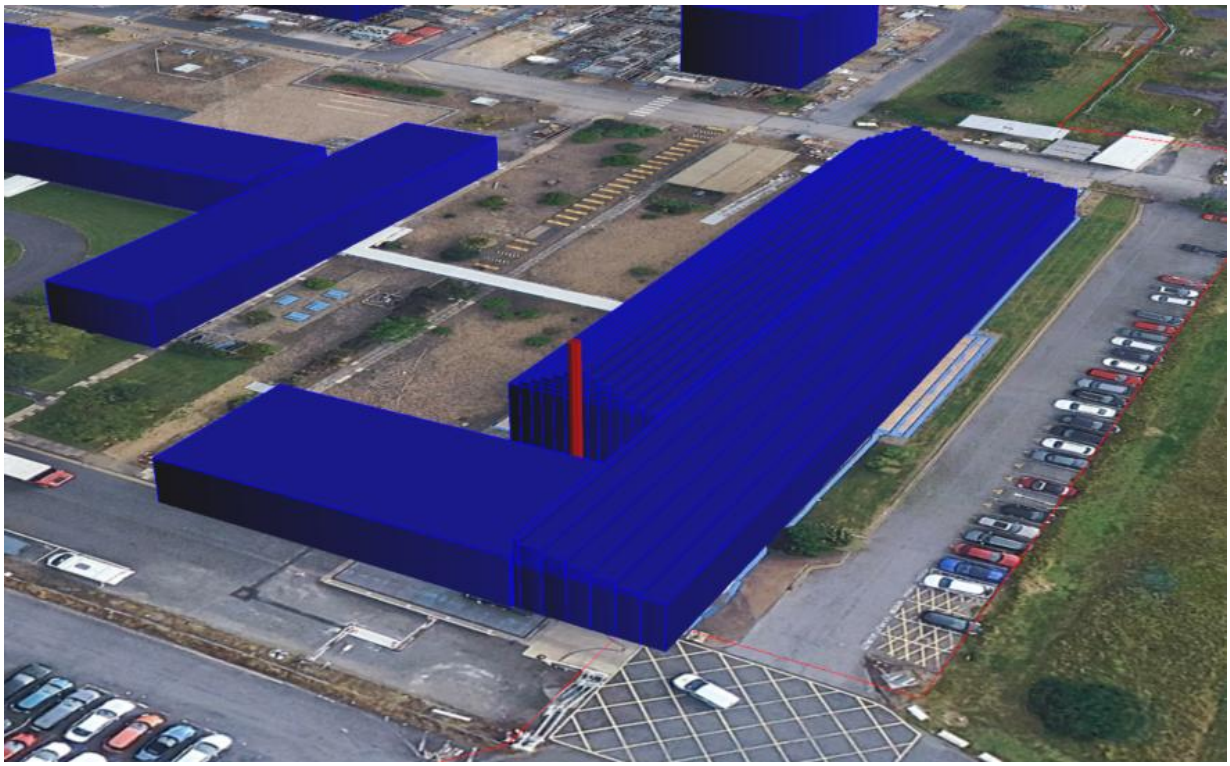


Figure 3-1 Modelled Buildings and New Stack

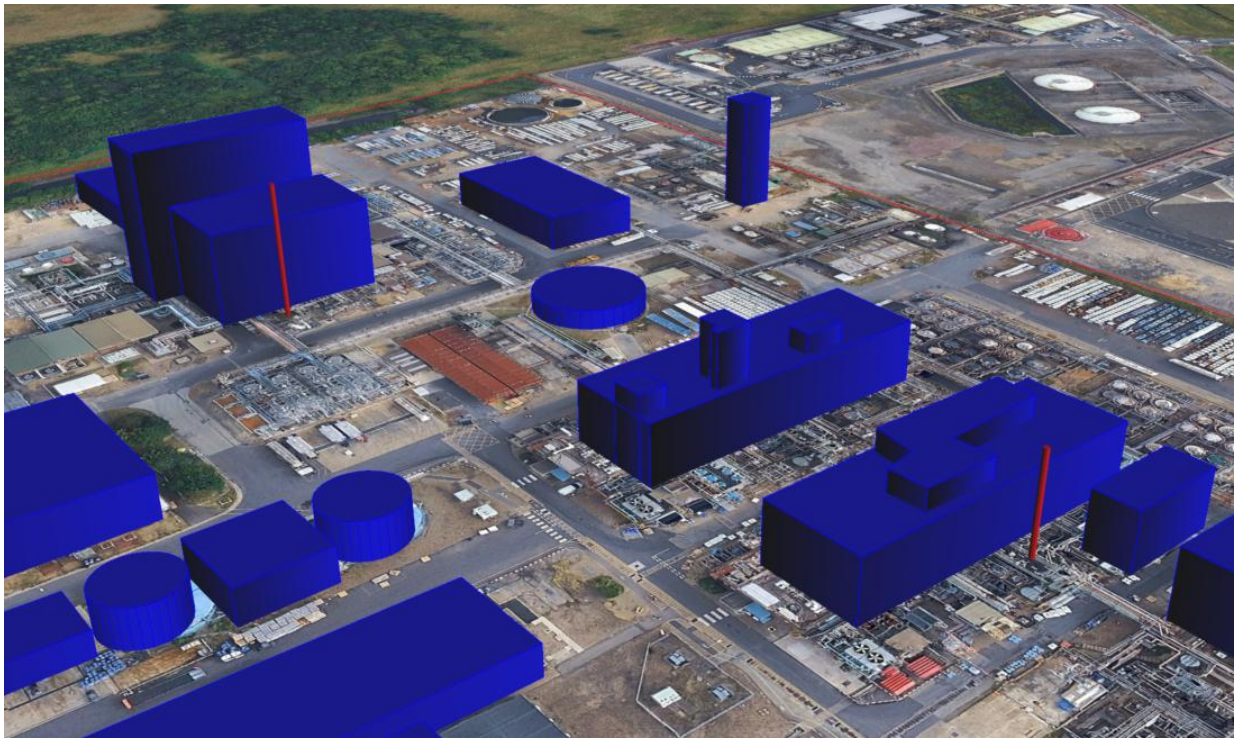


Figure 3-2 Modelled Buildings and Stack(s) 'A1/2' and 'A1/3'

3.2.3 Topography

The presence of elevated terrain can significantly affect the dispersion of pollutants and the resulting ground level concentration in a number of ways. Elevated terrain reduces the distance between the plume centre line and the ground level, thereby increasing ground level concentrations. Elevated terrain can also increase turbulence and, hence, plume mixing with the effect of increasing concentrations near to a source and reducing concentrations further away.

AERMOD utilises digital elevation data to determine the impact of topography on dispersion from a source. Topography was incorporated within the modelling using 30m resolution Shuttle Radar Topography Mission (SRTM) terrain data files. Data was processed by the AERMAP function within AERMOD to calculate terrain heights.

The site lies at approximately 7m above ordnance datum (AOD). The surroundings are relatively flat generally ranging between 0mAOD and 4mAOD. To the south east and north west the land rises to in excess of 20m AOD within approximately 4km. Topography has been incorporated into the model and is illustrated in Figure 3-3.

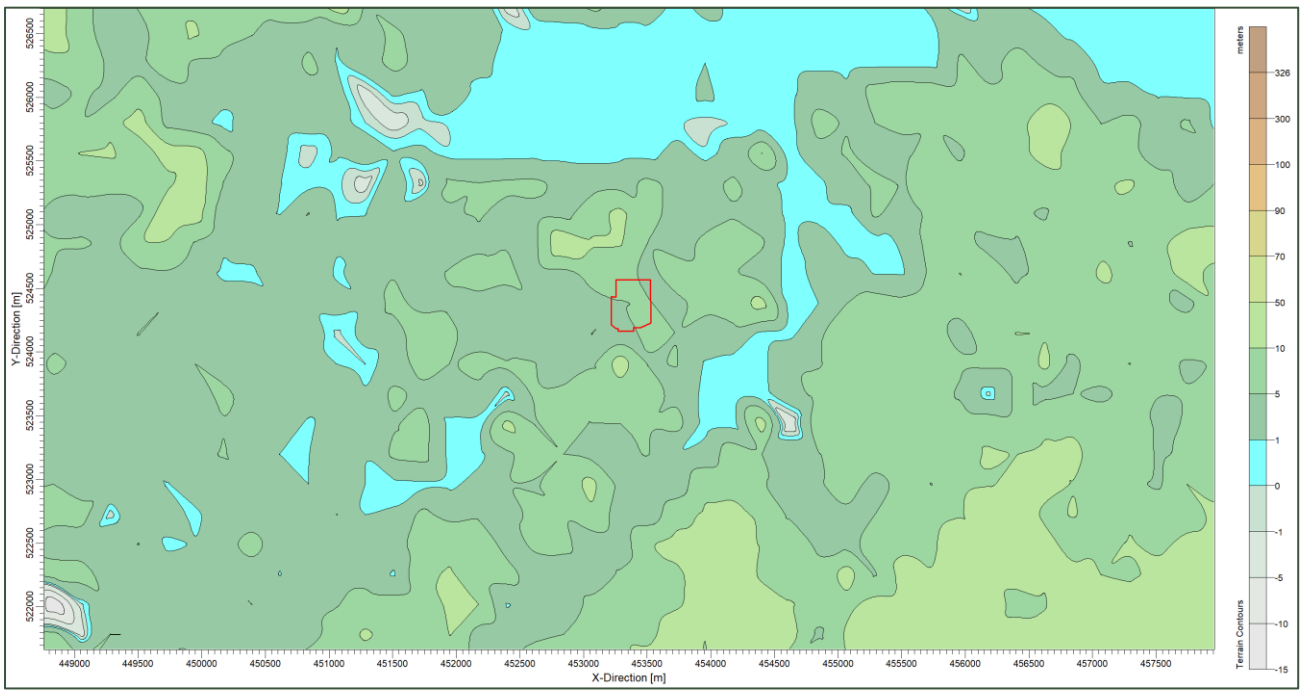


Figure 3-3 Surrounding Topography

3.2.4 Meteorological Data and Preparation

The observation site Durham-Tees Valley Airport has been selected for use in this assessment and is approximately 20km to the south-west of the Site.

To maintain a consistent approach to modelling across the permit variation(s) the previously utilised meteorological data (3 year hourly sequential data for 2017-2019 inclusive) has been maintained.

The data has been obtained in .met format from a data supplier and converted to the required surface and profile formats for use in AERMOD using AERMET View meteorological pre-processor. Details specific to the Site location have been used to define surface roughness, albedo and bowen ratio in the conversion (Table 3-3). A windrose is for

the data period is presented in Figure 3-4, with noticeable winds from the southwest sector being most frequent.

Table 3-3 Applied Surface Characteristics

Zone (Start)	Zone (End)	Albedo	Bowen Ratio	Surface Roughness (m)
0	30	0.18	0.61	0.155
30	60			0.070
60	90			0.070
90	120			0.069
120	150			0.070
150	180			0.070
180	210			0.069
210	240			0.070
240	270			0.070
270	300			0.082
300	330			0.210
330	360			0.073

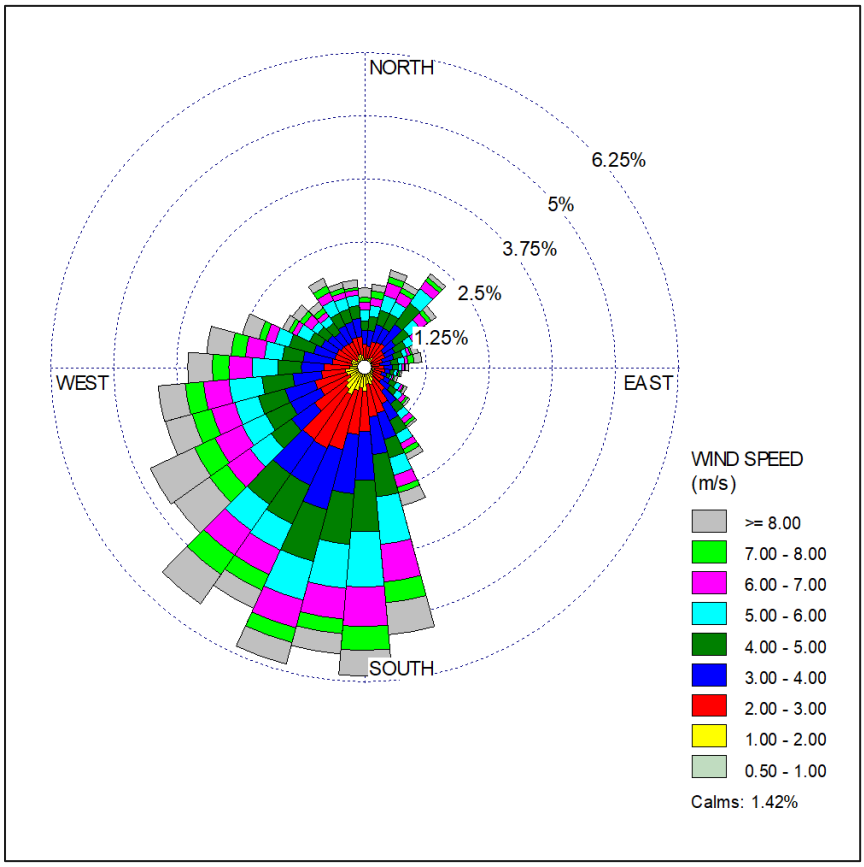


Figure 3-4 Windrose (2017-2019)

3.2.5 Dispersion Coefficients

The ‘rural’ option for dispersion coefficients was selected in accordance with AERMOD guidance[3].

3.2.6 Dispersion Model Uncertainty

Model validation studies[4] for AERMOD generally suggest that these dispersion models are for the vast majority of cases able to predict maximum short term high percentiles concentrations well within a factor of two and the latest evaluation study for AERMOD version shows the composite (geometric mean) ratio of predicted to observed short-term averages from ‘test sites’ (where real-time monitoring data is available to validate model performance), to be between 0.96 and 1.2.

[3] EPA, AERMOD Implementation Workgroup, Aermod Implementation Guide (August 3, 2015)

[4] AERMOD: Latest Features and Evaluation Results, EPA-454/R-03-003, June 2003 (United States Environmental Protection Agency)

4.0 BASELINE ENVIRONMENT

4.1 Site Setting and Sensitive Receptors

The Site is located at Seal Sands Road, Middlesbrough, TS2 1UB and is centred on National Grid Reference (NGR): x453400, y524380. The surrounding land-uses are largely industrial as the Site is situated within Middlesbrough Port area; the River Tees is approximately 400m east of the Site. The nearest residential properties lie approximately 3.5km south of the Site.

According to LAQM.TG(22), air quality standards should only apply to locations where members of the public may be reasonably likely to be exposed to air pollution for the duration of the relevant limit value.

Residential locations surrounding the site have been selected to inform the risk assessment in terms of relevant exposure (shown in Figure 4-1 as HR1 – HR15). Further, the dispersion modelling has been completed using a receptor grid to allow potential short-term exposure to be assessed at all locations surrounding the Site. Details of these receptors are shown in Table 4-1 and Figure 4-1.

Table 4-1 Human Receptors

Receptor ID	National Grid Reference (m)		Description
	X	Y	
HR1	448282	524740	Residential
HR2	447320	524545	School
HR3	446935	524095	Residential
HR4	447859	523187	Residential
HR5	449154	522448	Residential
HR6	450043	521669	Residential
HR7	450737	520675	Middlesbrough FC Riverside Stadium
HR8	452449	520835	Motor Sports Park
HR9	453324	520818	Residential
HR10	455051	520799	Residential
HR11	457831	523586	Residential
HR12	457601	525280	Golf Course
HR13	455551	527151	Residential
HR14	452300	528818	Residential
HR15	450073	526360	Residential

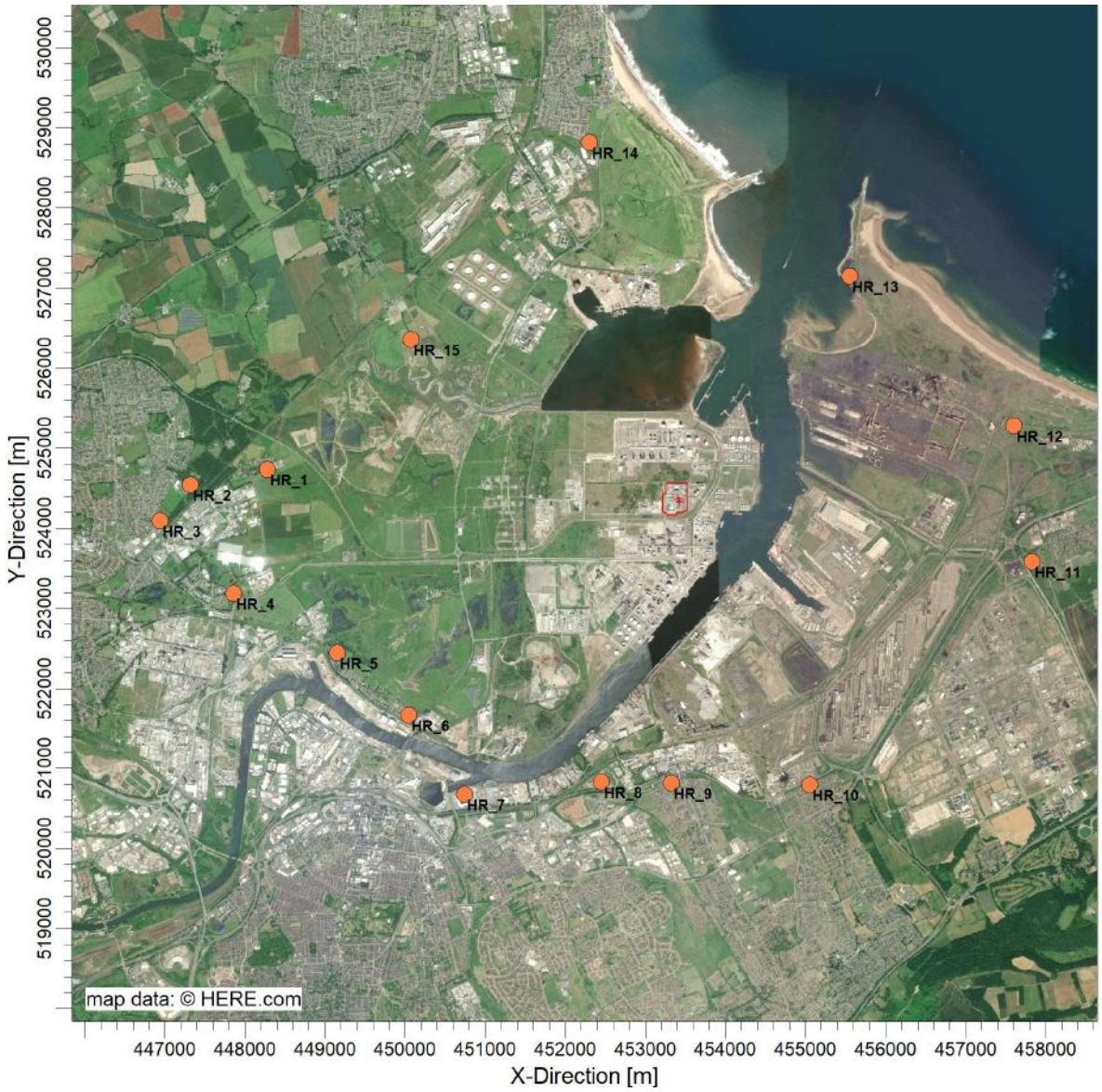


Figure 4-1 Modelled Discrete Human Receptor Locations

4.2 Baseline Concentrations

The Site is located within the administrative boundary of Stockton-on-Tees Borough Council (SoTBC), with the administrative boundaries of Hartlepool Borough Council (HBC), Redcar and Cleveland Borough Council (RCBC) and Middlesbrough Borough Council (MBC) all within the nearby locale. There are no Air Quality Management Areas (AQMA) declared within the assessment area.

The EDC and MeOH are not routinely monitored by local authorities as part of LAQM requirements, similarly Defra do not provide predicted background maps for any of the pollutants emitted.

5.0 ASSESSMENT RESULTS

The maximum predicted long-term and short-term process contributions (PC), anywhere outside of the Site boundary are presented in Table 5-1 and Table 5-2 respectively.

Table 5-1 Long Term (annual average) PC

Species	EAL	PC (µg/m^3)	PC as % of EAL
EDC	3	0.014	0.48%
MeOH	2,660	21.50	0.81%

Table 5-2 Short Term (1-hour average) PC

Species	EAL	PC (µg/m^3)	PC as % of EAL
Methanol	33,300	2,199	6.6%

The results of the modelling assessment demonstrate that:

- all long-term impacts are well below 1% of the EALs and therefore all impacts can be considered insignificant.
- All short-term impacts are well below 10% of the EALs can be considered insignificant.

The PC at modelled discrete receptors are significantly less than the maximum PC anywhere outside the Site boundary and are therefore omitted from the results tables.

Isopleth plots have been presented for long term and short-term averaging periods in Appendix A.

6.0 CONCLUSIONS

The conclusions of the detailed atmospheric dispersion modelling assessment are that process contributions are insignificant and there are no predicted exceedances of the EALs for the protection of human health at the point of maximum ground level impact or any human exposure location outside the site boundary.

Appendix A Isopleth Plots

Figure A-1: EDC Long Term (annual average) Process Contribution (µg/m³)

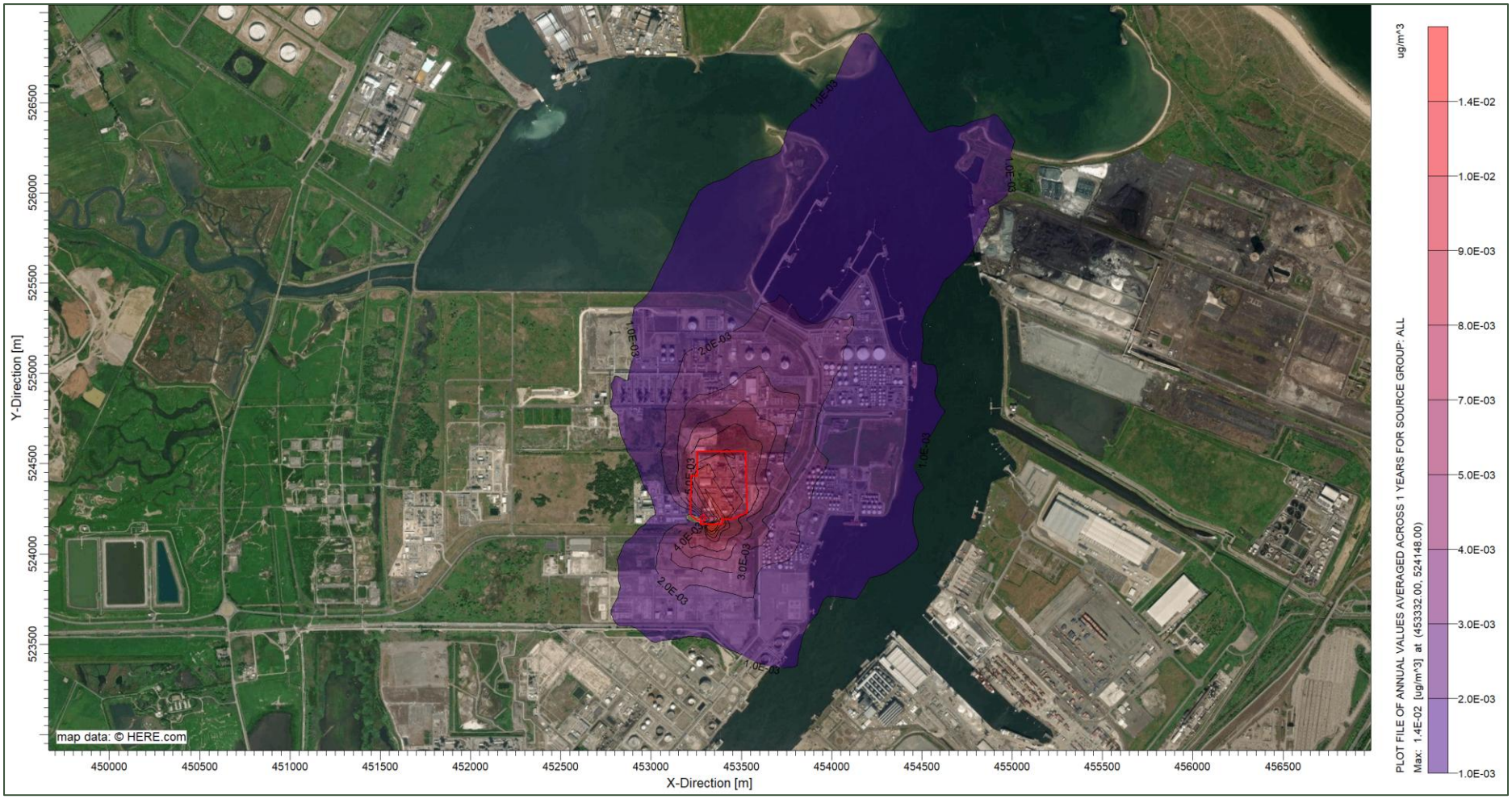


Figure A-2: MeOH Long Term (annual average) Process Contribution (µg/m³)

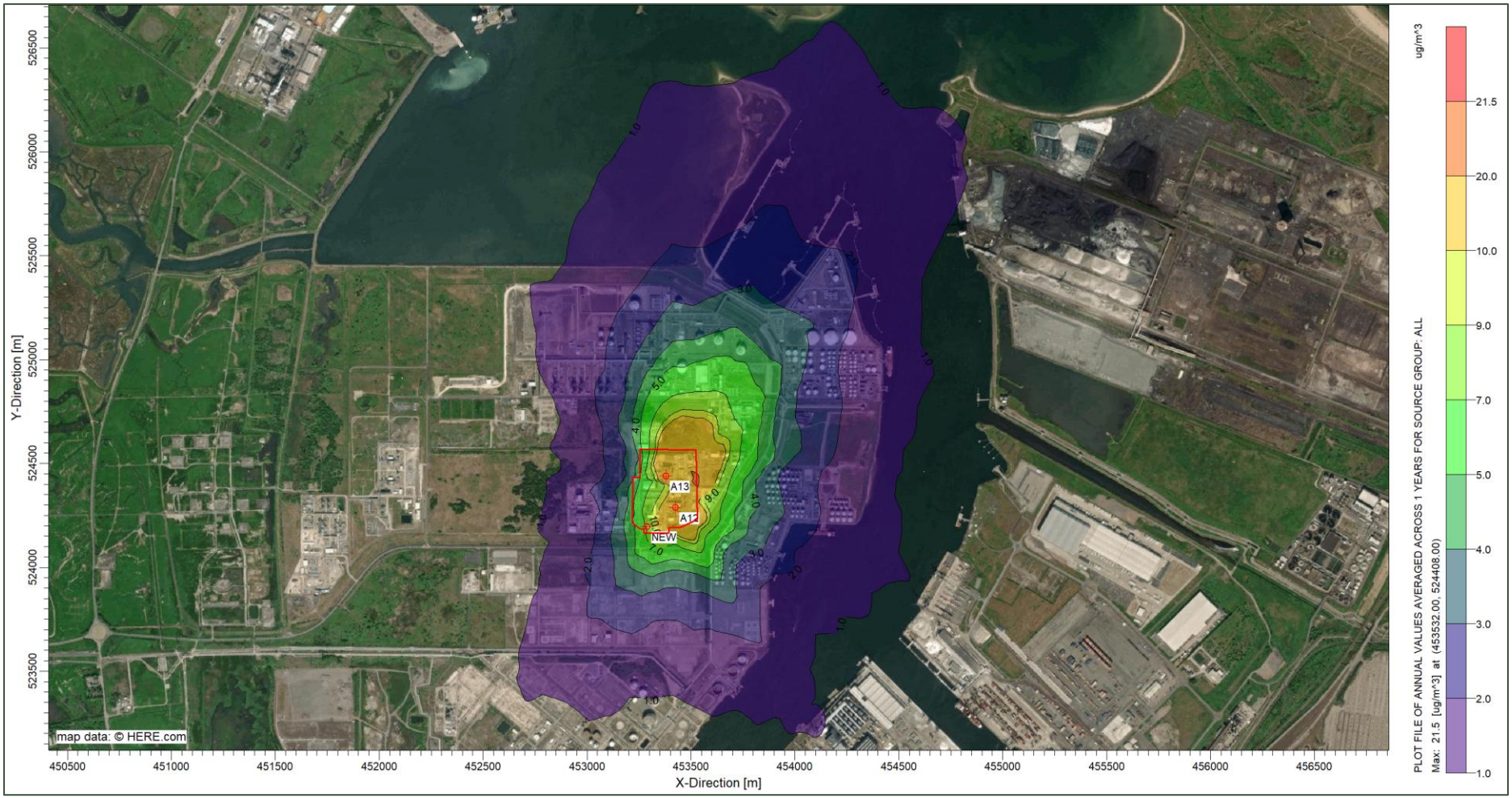


Figure A-3: MeOH Short Term (1 hour average) Process Contribution (µg/m³)

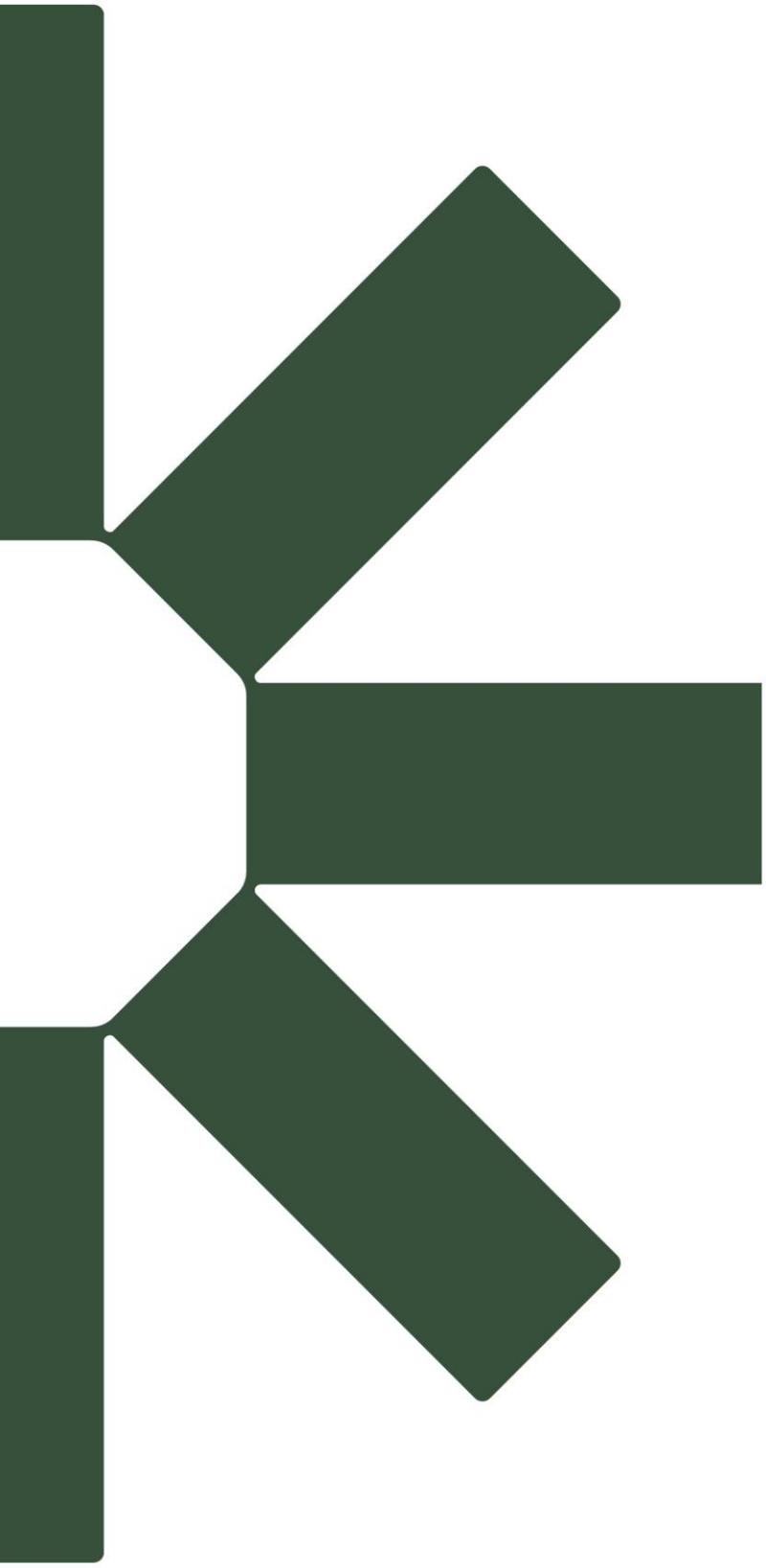
Appendix B Modelling Checklist

Table A- 1: Modelling Checklist

Item	Yes/No	Details / reason for omission
Location map	Yes	Figure 3-1 & Figure 3-2
Site plan	Yes	Figure 3-1 & Figure 3-2
Pollutants modelled and relevant standards	Yes	Section 2.2
Details of modelled scenarios	Yes	Section 3.1
Details of relevant ambient concentrations	Yes	Not applicable
Model description and justification	Yes	Section 3.2
Special model treatment used	Yes	Section 3.1
Table of emission parameters used	Yes	Table 3-1 and Table 3-2
Details of modelled domain and receptors	Yes	Section 3.2.1
Details of meteorological data used	Yes	Section 3.2.4
Details of terrain treatment	Yes	Section 3.2.2
Details of building treatment	Yes	Section 3.2.3
Model uncertainty and sensitivity	Yes	Section 3.2.6
Assessment of impacts	Yes	Section 5.0
Contour plots	Yes	Appendix A
Model input files	Yes	Appendix B

Appendix C Model Files (electronic only)

File Name	Modelled Emission
LSS_EDC_19	EDC
LSS_MeOH_19	MeOH



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