Safran Landing Systems Services UK LTD

Meteor Business Park

Air Quality Assessment

April 2026

Document Control Sheet

Identification	
Client	Safran Landing Systems Services UK Limited
Document Title	Meteor Business Park Air Quality Assessment
Bureau Veritas Ref No.	30637505

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Configuration				
Version	**Date**	**Author**	**Reason for Issue/Summary of Changes**	**Status**
1.0	16 April 2026	J Cai	Issued for client comment	Draft

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Purpose of Report

Bureau Veritas has been commissioned by Safran Landing Systems Services UK Limited to provide air quality assessment support for a substantial variation to their environmental permit (EPR/BL0138IP) at Meteor Business Park, Gloucester.

Safran operates an electroplating facility and is installing a new zinc nickel plating line, which is already fully constructed and awaiting commissioning. This variation application introduces one new emission point to air.

This report presents the methodology and results of atmospheric dispersion modelling undertaken to evaluate the air quality impacts of the new zinc nickel line. The assessment focuses exclusively on emissions from the proposed new line and does not reassess existing permitted operations (chromium and cadmium plating lines), as these are not being modified under this variation.

Summary of Conclusions

With the proposed Zinc-Nickel line in operation, the modelling results show that the long-term and short-term concentrations of Nickel and Zinc are all below the relevant air quality objectives or environmental assessment levels at the assessed receptor locations.

The assessment also evaluated heavy metal deposition rates. . The results indicate that, with the proposed Zinc-Nickel line in operation, the process contribution of Nickel deposition (up to 27.1% of the deposition limit) and Zinc deposition (up to 6.8% of the deposition limit) is not expected to cause significant adverse effects.

Overall, the impacts of the Site's emissions from proposed Zinc-Nickel line on local air quality are considered to be acceptable.

1 INTRODUCTION

Safran Landing Systems Services UK Limited (Safran) operates an electroplating facility at Meteor Business Park in Gloucester under environmental permit EPR/BL0138IP. The facility provides metal plating services for aircraft landing gear components as part of the aerospace refurbishment industry. Safran is installing a new zinc nickel electroplating line at the site, which requires a substantial variation to the existing environmental permit. The new line is fully installed and awaiting commissioning. This installation introduces one new emission point to air, designated as emission point A3.

Bureau Veritas has been commissioned by Safran to provide the technical assessments required by the Environment Agency to support this permit variation application. This report presents the air quality impact assessment for the proposed zinc nickel line, evaluating whether emissions from the new operation will comply with relevant air quality standards and environmental assessment levels.

The assessment focuses exclusively on the incremental environmental impact of adding the new zinc nickel line. Existing permitted operations at the facility, including the chromium plating line (emission point A1) and the cadmium/nickel plating line (emission point A2), are not being modified under this variation and therefore are not reassessed in this report. These existing operations continue to be regulated under current permit conditions established in 2002 and varied in 2012.

The objective of this assessment is to demonstrate that emissions from the proposed zinc nickel line will not result in unacceptable pollutant concentrations at nearby residential receptors or sensitive environmental sites. The modelling evaluates compliance with UK Air Quality Strategy objectives and Environment Agency Environmental Assessment Levels for nickel and zinc compounds. Emission rates are based on permitted limits from the existing facility operations and Best Available Techniques guidance from the Surface Treatment of Metals and Plastics BREF[1] and EA Guidance Note EPR 2.07[2].

1.1 Process Description

Safran specialises in the refurbishment and electroplating of aircraft landing gear components for the aerospace industry. The Meteor Business Park facility processes landing gear through multiple surface treatment operations including cleaning, shot blasting, chemical pre-treatment, electroplating, and post-plating heat treatment.

The electroplating process deposits metal coatings onto aircraft components to provide corrosion resistance and wear protection. Components requiring refurbishment are first cleaned, dismantled, and stripped of existing coatings using chemical stripping tanks. Stripped components are then shot blasted with crush nut media, degreased, and subjected to non-destructive testing.

After inspection, suitable components proceed to one of the metal plating lines, cadmium, chromium, or nickel, depending on component specification.

The proposed zinc nickel line will employ similar processes to deposit zinc-nickel alloy coatings as an alternative to chromium plating.

There are currently two existing emission points to air from the electroplating facility: emission point A1 serving the chromium plating line, and emission point A2 serving the nickel and cadmium plating lines. This assessment focuses on the new emission point A3 serving the proposed zinc nickel line, to determine the incremental air quality impacts from the site in support of the EP variation application.

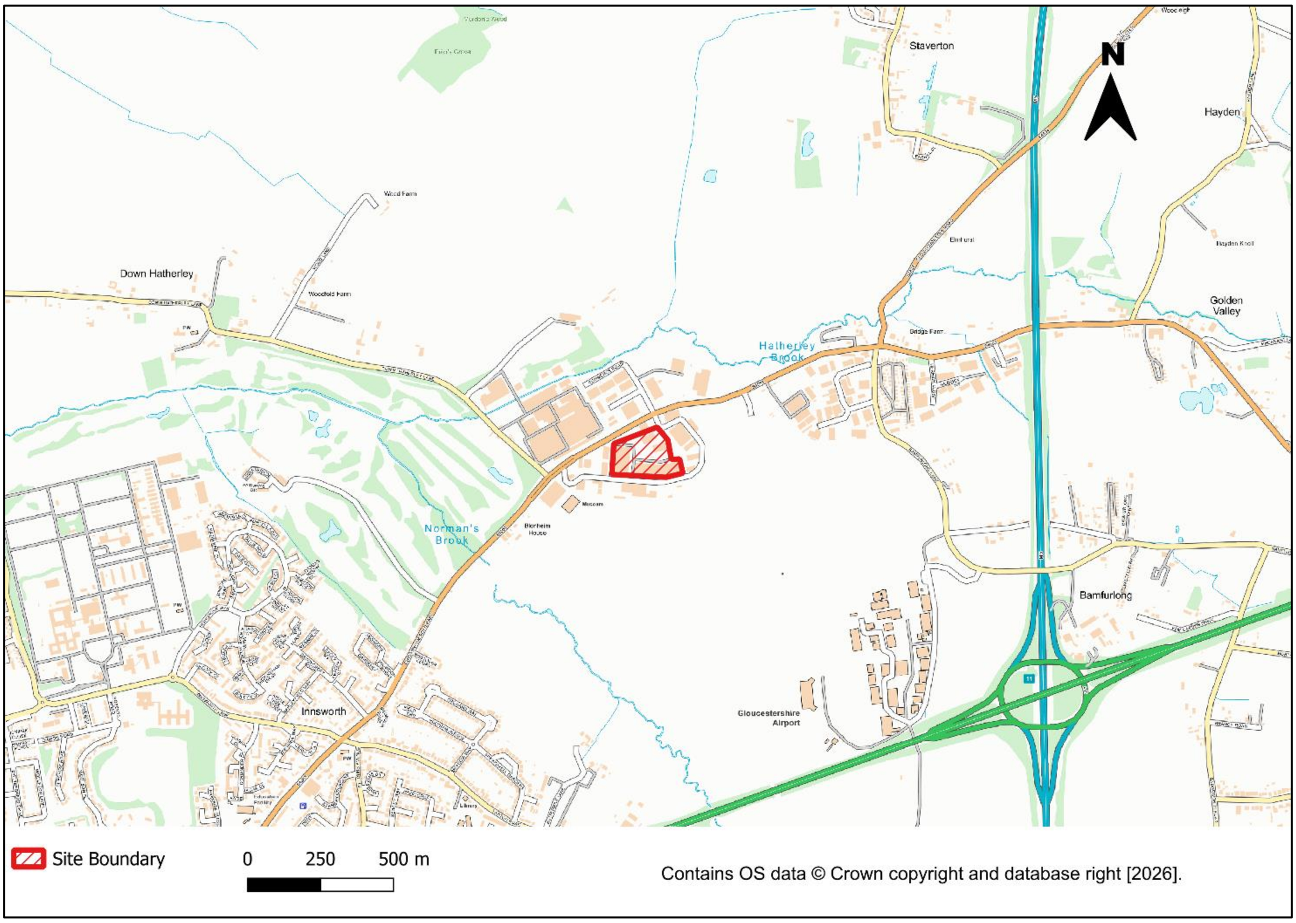
[1] European Commission (2006). Best Available Techniques Reference Document on the Surface Treatment of Metals and Plastics Industry. Integrated Pollution Prevention and Control (IPPC).
[2] Environment Agency (2009). The Surface Treatment of Metals and Plastics by Electrolytic and Chemical Processes (EPR 2.07)

1.1.1 Site Description

There are no Air Quality Management Areas (AQMAs) declared within 30 km of the site. The nearest AQMA is Worcester City AQMA, located approximately 31 km to the north, which has been declared by Worcester City Council due to exceedances of the annual mean objective for nitrogen dioxide (NO_2). The absence of nearby AQMAs indicates that background air quality in the area surrounding the facility is generally good and compliant with national air quality objectives.

Several residential properties are located within two km of the facility and have been identified as sensitive receptors requiring assessment. Further details on the specific receptor locations included in the atmospheric dispersion modelling are provided in Section 2.4 of this report. A figure showing the site location is provided below.

Figure 1.1 – Site Location



2 Dispersion Modelling Methodology

Detailed dispersion modelling was undertaken to assess the pollutant emissions to air. ADMS 6 Version 6.0.2.7 modelling software was used for this study.

ADMS 6 is an advanced atmospheric dispersion model that has been developed and validated by Cambridge Environmental Research Consultants (CERC). The model was used to predict the ground level concentration of products emitted to the atmosphere from the stacks at Meteor Business Park, Gloucester. The model has been used extensively throughout the UK for regulatory compliance purposes and is accepted as an appropriate air quality modelling tool by the EA and local authorities.

ADMS 6 parameterises stability and turbulence in the atmospheric boundary layer (ABL) by the Monin-Obukhov length and the boundary layer depth. This approach allows the vertical structure of the ABL to be more accurately defined than by the stability classification methods of earlier dispersion models such as R91 or ISCST3. In ADMS, the concentration distribution follows a symmetrical Gaussian profile in the vertical and crosswind directions in neutral and stable conditions. However, the vertical profile in convective conditions follows a skewed Gaussian distribution to take account of the inhomogeneous nature of the vertical velocity distribution in the Convective Boundary Layer (CBL).

A number of complex modules, including the effects of plume rise, complex terrain, coastlines, concentration fluctuations, radioactive decay and buildings effects, are also included in the model, as well as the facility to calculate long-term averages of hourly mean concentration, dry and wet deposition fluxes, and percentile concentrations, from either statistical meteorological data or hourly average data.

A range of input parameters are required including, among others, data describing the local area, meteorological measurements and emissions data. The data used in modelling the emissions are given in the following sections of this chapter.

2.1 Process Emissions

Details of the existing and proposed emission points of the production line operation have been provided to Bureau Veritas by Safran. There are two existing emission points (A1 and A2) and one new emission point for proposed Zinc-Nickel line (A3).

The below scenarios have been modelled to assess the impact from the proposed emission point for the new Zinc-Nickel line:

- Baseline Scenario (BS): Current existing site operation with emission point A2 modelled
- Do Something Scenario (DS): New Zinc-Nickel line in operation with emission points A2 and proposed A3 modelled.

The location of the emission points included in the dispersion model is illustrated in Figure 2.1. Emission point parameters and emission rates used in the assessment are summarised in Table 2.1.

The calculation of all pollutant emission rates was undertaken using the latest emission testing report, Best available techniques Reference documents (BREF) and the guidance limit from The Surface Treatment of Metals and Plastics by Electrolytic and Chemical Processes (EPR 2.07). Details of the emission rates for all modelled pollutants is presented in Table 2.2. Details of the release characteristics to be considered have their base in the maximum allowable emission limits which will likely be imposed on the site operations. The BREF provides the typical emission range from the proposed process. As such, this air quality assessment has been undertaken considering the relevant emission rate ranges specified for the proposed emission points and operation activities and using the maximum emission rate from the range.

Table 2.1 – Model Input Parameters for the Emission Points

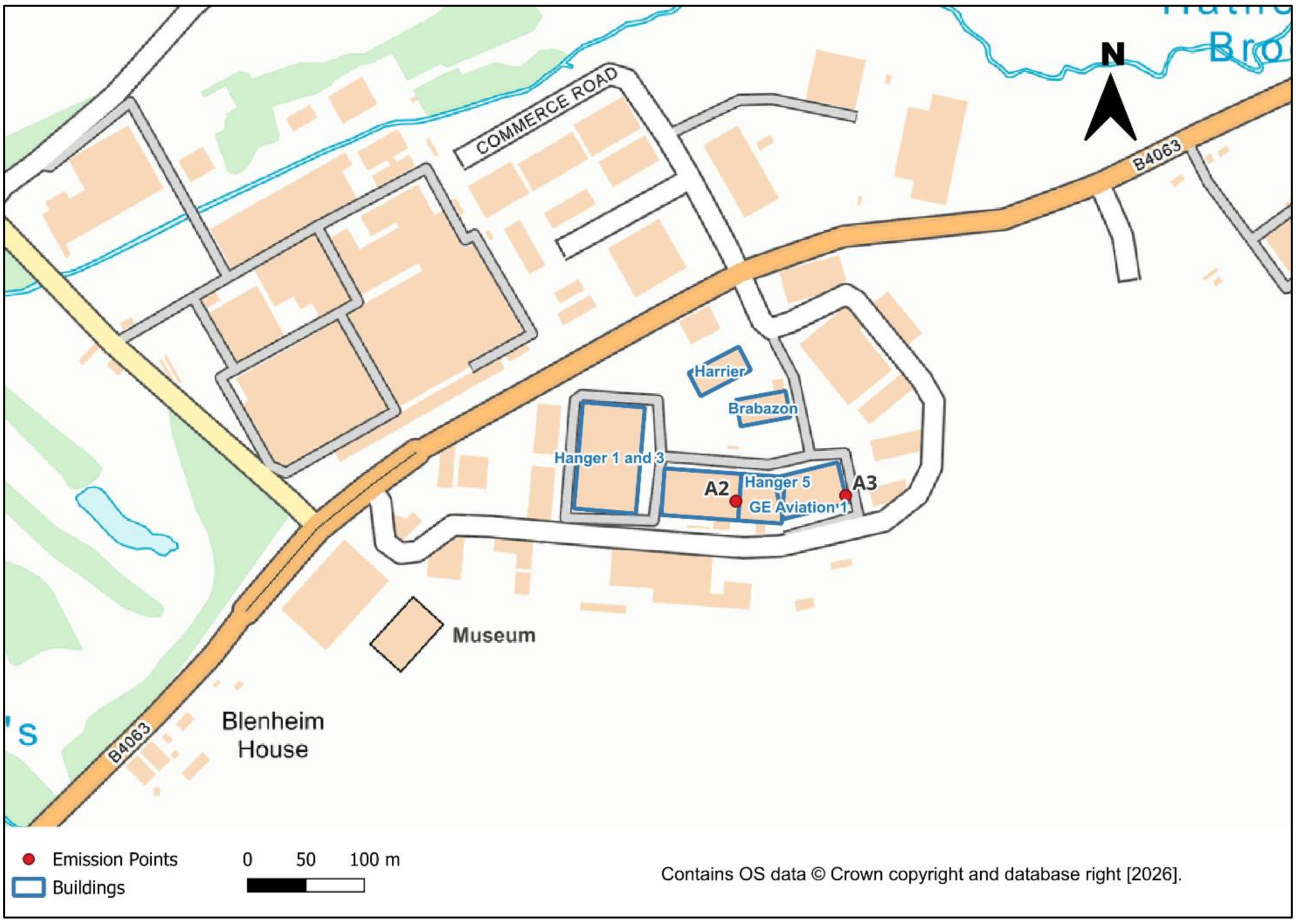
ID	X (m)	Y (m)	Height (m)	Diameter (m)	Flow Rate (Am^3/s)	Flow Rate (Nm^3/s)	Exit Temp (°C)	Exhaust Moisture Content (%)	Exhaust O_2 Content (%)
A2	388348	222007	14.4	1.97	21.28	19.64	23	1.63	20.9
A3	388442	222012	13.86	0.77	3.00	2.75	25	N/A	20.9

Note: Reference conditions are 273K, 101.3kPa without correction for water vapour

Table 2.2 –Emission Rates

Emission Point ID	Pollutants	Emission Rates (g/s)	Data Source
A2	Nickel	5.75×10^{-05}	SOCTEC Emission Testing Report
A3	Zinc	6.05×10^{-03}	Indicative BAT Standatds
A3	Nickel	5.50×10^{-03}	BREF typical emission range

Figure 2.1 – Emission Point Visualisation and Buildings



2.2 Meteorology

For meteorological data to be suitable for dispersion modelling purposes, a number of meteorological parameters need to be measured on an hourly basis. These parameters include wind speed, wind direction, cloud cover and temperature. There are only a limited number of sites where the required meteorological measurements are made. The year of meteorological data that is used for a modelling assessment can also have a significant effect on ground level concentrations.

This assessment has utilised Numerical Weather Prediction (NWP) data mainly based on data recorded at the Gloucestershire Airport meteorological station during across a five-year period (2021 to 2025). Figure 2.2 – Figure 2.6 illustrate the frequency of wind directions and wind speeds for the years considered.

ADMS cannot, as standard, model calm weather conditions, since this results in a discontinuity produced by a 'divide by zero' calculation. Most Gaussian plume models simply skip lines of meteorological data where calm conditions occur. Met lines will also be skipped where any of the required meteorological input parameters are missing. The generally accepted best practice requirement is to ensure that no more than 10% of meteorological data is omitted from the model run.

A check on the data quality of the dataset is summarised in Table 2.2. There are no missing hours in the NWP data sets. However, the model does not include 'calm' meteorological data (data with wind speed at 10 m, less than 0.75 m/s) in the model run. Consequently, the availability of usable hours of meteorological data is at least 98.5% for the years. This fulfils the minimum requirements of 85% valid observations for the year for dispersion modelling as advised in best-practice guidance[3].

Table 2.3 – Quality Check on Meteorological Data

ADMS Meteorological Inpit Data	2019	2022	2023	2024	2025
Number of hourly meteorological lines	8760	8760	8760	8784	8760
Number of meteorological lines with calm conditions at 10 m height) less than 0.75 m/s	135	126	58	117	74
Number of meteorological lines with inadequate data	0	0	0	0	0
Number of non-calm meteorological lines with wind speeds (at 10 m height) greater than 0.75 m/s	8625	8634	8702	8667	8686
Availability of Usable Hours of Meteorological Data	98.5%	98.6%	99.3%	98.7%	99.2%

[3] Defra Technical Guidance LAQM.TG(22), 2022. Available at: https://laqm.defra.gov.uk/wp-content/uploads/2022/08/LAQM-TG22-August-22-v1.0.pdf

Figure 2.2 – 2021 Wind Rose

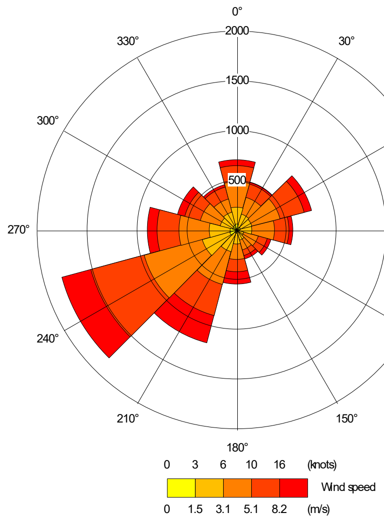


Figure 2.3 – 2022 Wind Rose

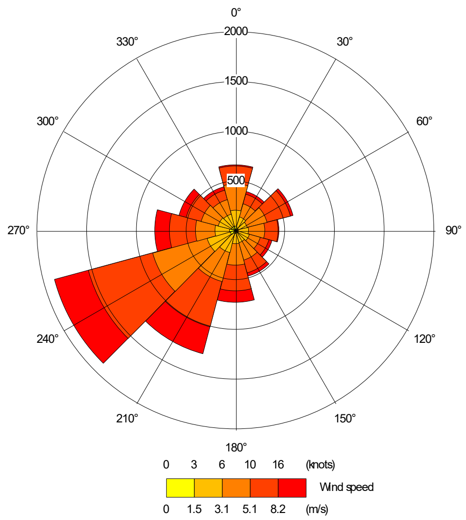


Figure 2.4 – 2023 Wind Rose

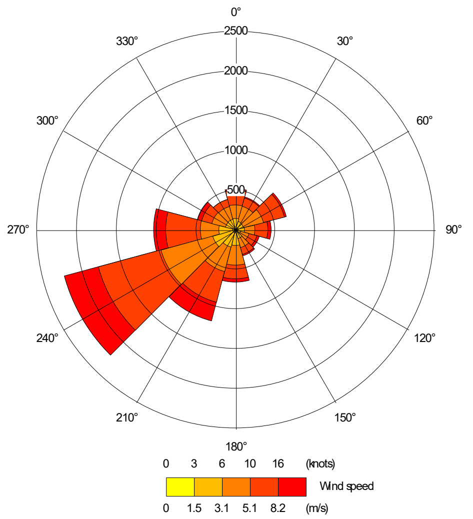


Figure 2.5 – 2024 Wind Rose

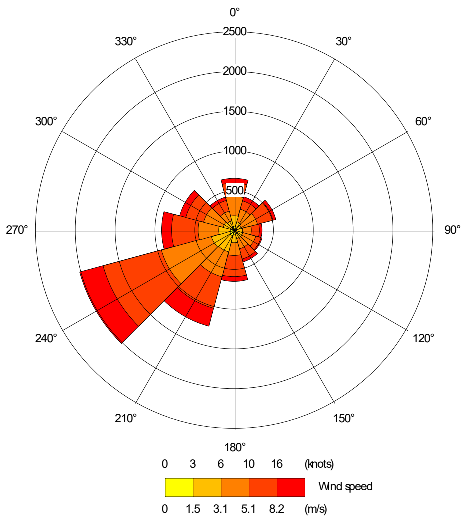
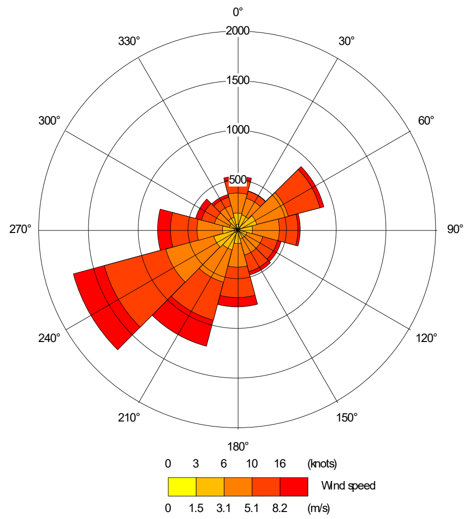


Figure 2.6 – 2025 Wind Rose



2.2.1 Surface Characteristics

The predominant surface characteristics and land use in a model domain have an important influence in determining turbulent fluxes and, hence, the stability of the boundary layer and atmospheric dispersion. Factors pertinent to this determination are detailed below.

2.2.2 Surface Roughness

Surface roughness length, z_0, represents the aerodynamic effects of surface friction and is physically defined as the height at which the extrapolated surface layer wind profile tends to zero. This value is an important parameter used by meteorological pre-processors to interpret the vertical profile of wind speed and estimate friction velocities which are, in turn, used to define heat and momentum fluxes and, consequently, the degree of turbulent mixing.

The surface roughness length is related to the height of surface elements; typically, the surface roughness length is approximately 10% of the height of the main surface features. Thus, it follows that surface roughness is higher in urban and congested areas than in rural and open areas. Oke (1987) and CERC (2003) suggest typical roughness lengths for various land use categories (Table 2.4).

Table 2.4 – Typical Surface Roughness Lengths for Various Land Use Categories

Type of Surface	z_0 (m)
Ice	0.00001
Smooth snow	0.00005
Smooth sea	0.0002
Lawn grass	0.01
Pasture	0.2
Isolated settlement (farms, trees, hedges)	0.4
Parkland, woodlands, villages, open suburbia	0.5-1.0
Forests/cities/industrialised areas	1.0-1.5
Heavily industrialised areas	1.5-2.0

Increasing surface roughness increases turbulent mixing in the lower boundary layer. This can often have conflicting impacts in terms of ground level concentrations:

- The increased mixing can bring portions of an elevated plume down towards ground level, resulting in increased ground level concentrations closer to the emission source; however; and
- The increased mixing increases entrainment of ambient air into the plume and dilutes plume concentrations, resulting in reduced ground level concentrations further downwind from an emission source.

The overall impact on ground level concentration is, therefore, strongly correlated to the distance and orientation of a receptor from the emission source.

2.2.3 Surface Energy Budget

One of the key factors governing the generation of convective turbulence is the magnitude of the surface sensible heat flux. This, in turn, is a factor of the incoming solar radiation. However, not all solar radiation arriving at the Earth's surface is available to be emitted back to atmosphere in the form of sensible heat. By adopting a surface energy budget approach, it can be identified that, for fixed values of incoming short and long wave solar radiation, the surface sensible heat flux is inversely proportional to the surface albedo and latent heat flux.

The surface albedo is a measure of the fraction of incoming short-wave solar radiation reflected by the Earth's surface. This parameter is dependent upon surface characteristics and varies throughout the year. Oke (1987) recommends average surface albedo values of 0.6 for snow covered ground and 0.23 for non-snow covered ground, respectively.

The latent heat flux is dependent upon the amount of moisture present at the surface. The Priestly-Taylor parameter can be used to represent the amount of moisture available for evaporation:

$$\alpha = \frac{1}{S(B+1)}$$

Where:

α = Priestly-Taylor parameter (dimensionless)

$S = \frac{s}{s+\gamma}$

$s = \frac{de}{dT}$

e_s = Saturation specific humidity (kg H_2O / kg dry air)

T = Temperature (K)

$\gamma = \frac{c_{pw}}{\lambda}$

c_{pw} = Specific heat capacity of water (kJ/kg^{-}/K)

λ = Specific latent heat of vaporisation of water (kJ/kg)

B = Bowen ratio (dimensionless)

Areas where moisture availability is greater will experience a greater proportion of incoming solar radiation released back to atmosphere in the form of latent heat, leaving less available in the form of sensible heat and, thus, decreasing convective turbulence. Holstag and van Ulden (1983) suggest values of 0.45 and 1.0 for dry grassland and moist grassland respectively.

2.2.4 Selection of Appropriate Surface Characteristics Parameters for the Site

A detailed analysis of the effects of surface characteristics on ground level concentrations by Auld et al. (2002) led them to conclude that, with respect to uncertainty in model predictions:

> *"…the energy budget calculations had relatively little impact on the overall uncertainty"*

In this regard, it is not considered necessary to vary the surface energy budget parameters spatially or temporally, and annual averaged values have been adopted throughout the model domain for this assessment.

As snow covered ground is only likely to be present for a small fraction of the year, the surface albedo of 0.23 for non-snow covered ground advocated by Oke (1987) has been used whilst the model default α value of 1.0 has also been retained.

From examination of 1:10,000 Ordnance Survey maps, it can be seen that within the immediate vicinity of the site, land use is predominately farmland and open areas. Consequently, a composite surface roughness length of 0.3 m is appropriate to take account of the respective land use categories in the model domain for dispersion site and a surface roughness length of 0.3 m is used for met measurement site.

2.3 Buildings

Any large, sharp-edged object has an impact on atmospheric flow and air turbulence within the locality of the object. This can result in maximum ground level concentrations that are significantly different (generally higher) from those encountered in the absence of buildings. The building 'zone of influence' is generally regarded as extending a distance of 5L (where L is the lesser of the building height or width) from the foot of the building in the horizontal plane and three times the height of the building in the vertical plane.

For this assessment, downwash effects were taken into account for the dominant buildings in the vicinity of the sources, by setting up six sets of buildings in the dispersion model (see Table 2.5 and Figure 2.1).

Table 2.5 – Modelled Buildings

Name	Centre Easting (m)	Centre Northing (m)	Height (m)	Length / Diameter (m)	Width (m)
Hanger 4	388319	222013	10.4	66	40
Hanger 1 and 3	388240	222044	10.4	53	91
GE Aviation 1	388370	222009	10.4	37	40
Hanger 5	388412	222016	10.4	57	36
Harrier	388335	222118	10.4	48	23
Brabazon	388372	222086	10.4	43	23

2.4 Modelled Domain and Receptors

2.4.1 Modelled Domain

A 2 km x 2 km Cartesian grid centred on the cement plant was modelled, with an approximate receptor resolution of 20 m, to assess the impact of atmospheric emissions from the site on local air quality.

The grid resolution has been selected to evaluate the nearby local receptors within the gridded area and the resolution is such that the maximum impact will be identified. The height of all receptors has been assumed to be 1.5 m to represent inhalation exposure.

2.4.2 Human Receptors

The receptors considered were chosen based on locations where people may be located and judged in terms of the likely duration of their exposure to pollutants and proximity to the site, following the guidance given in Section 4 of this report. Details of the locations of human receptors are given in Table 2.6 and Figure 2.7.

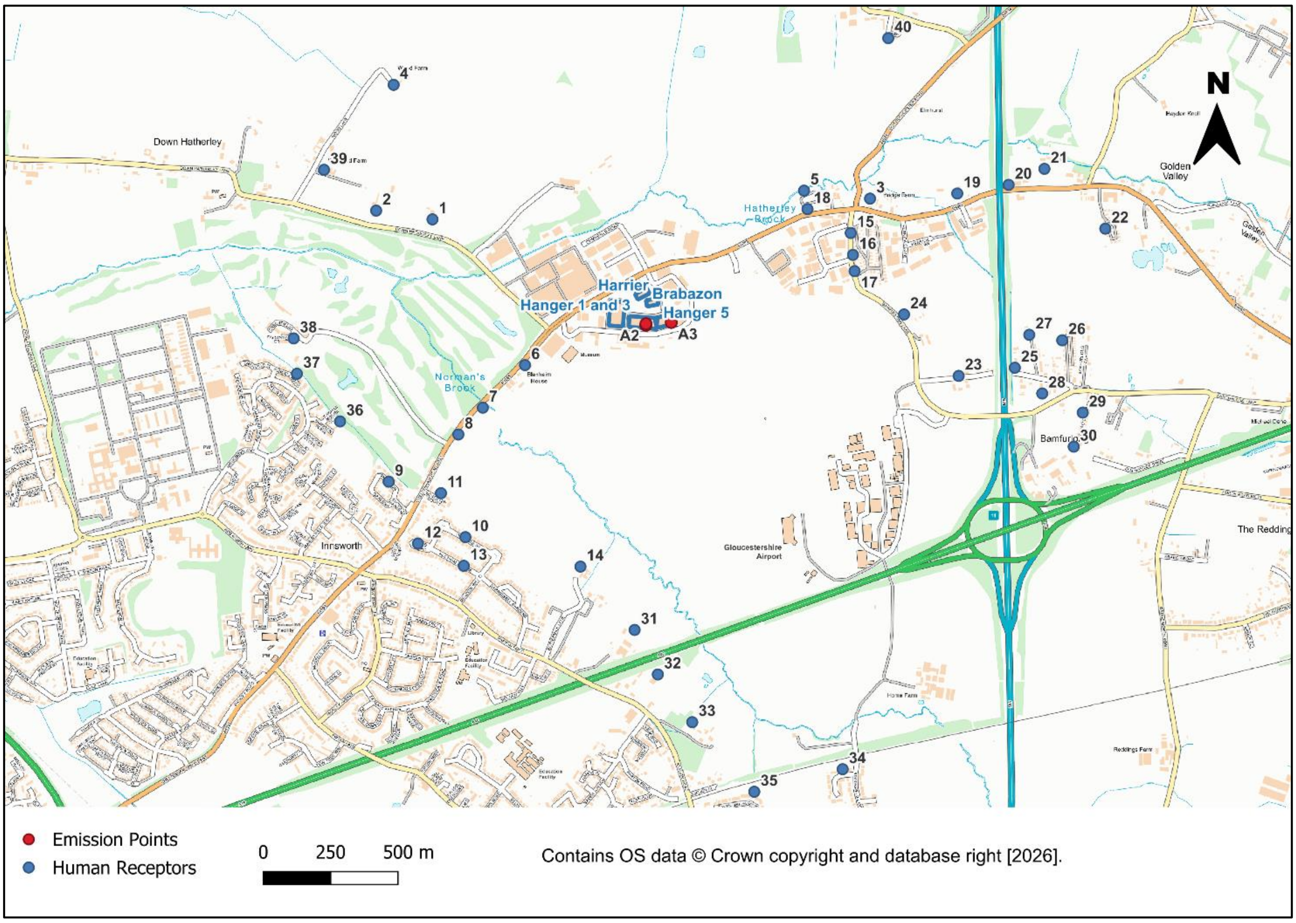
Concentrations have been predicted at 40 specific receptor locations within a radius of 2 km from the site. All the human receptors included are at residential locations including residential dwellings and farms.

Table 2.6 – Assessed Human Receptors

ID	Easting (m)	Northing (m)	ID	Easting (m)	Northing (m)
1	387557	222395	**21**	389828	222577
2	387348	222428	**22**	390054	222355
3	389181	222468	**23**	389508	221811

4	387414	222893	**24**	389306	222039
5	388936	222498	**25**	389717	221841
6	387899	221855	**26**	389893	221942
7	387742	221698	**27**	389771	221963
8	387651	221599	**28**	389818	221746
9	387392	221425	**29**	389969	221675
10	387676	221219	**30**	389935	221549
11	387586	221382	**31**	388304	220874
12	387500	221196	**32**	388389	220709
13	387670	221113	**33**	388517	220532
14	388103	221109	**34**	389075	220357
15	389109	222341	**35**	388746	220274
16	389117	222260	**36**	387212	221648
17	389123	222200	**37**	387052	221825
18	388949	222430	**38**	387041	221956
19	389505	222486	**39**	387155	222579
20	389695	222518	**40**	389250	223061

Figure 2.7 – Location of Modelled Human Receptors



2.4.3 Ecological Receptors

Designated nature conservation sites and habitats nearby the Site are reviewed for the assessment on ecological receptors, following the Environment Agency's screening guidance. Details of the ecological receptor locations are provided in Table 2.7 and Figure 2.8.

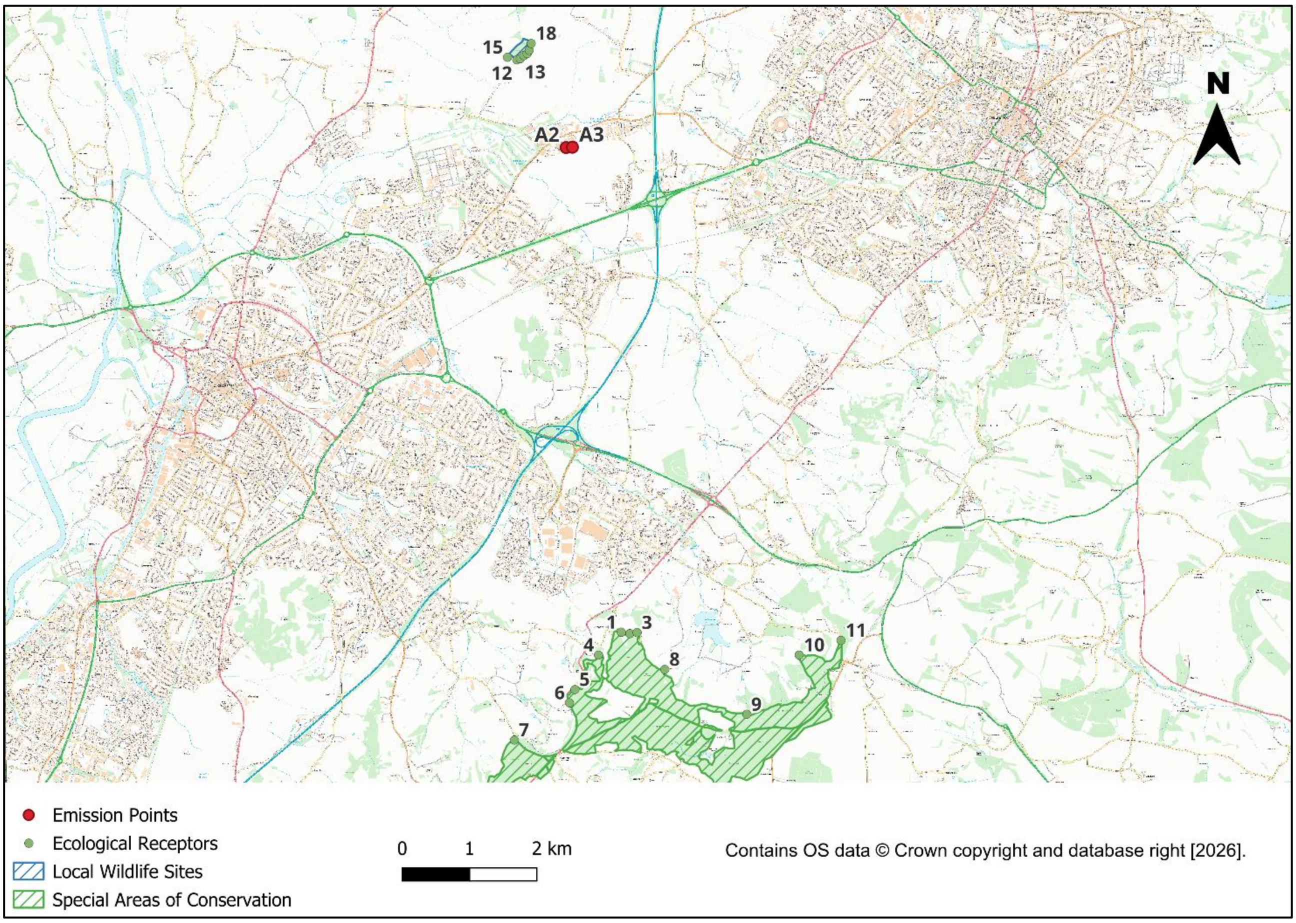
One Local Wildlife Site (LWS) and Ancient Woodland, Prior's Grove, is located approximately 1.5 km north of the Site. One Special Area of Conservation (SAC), Cotswold Beechwoods, is situated approximately 7.2 km south of the Site. In total, 18 discrete ecological receptor locations have been modelled across these designated sites to assess potential impacts from the proposed emissions.

While the Environment Agency screening assessment identifies zinc and nickel as pollutants of concern, there are currently no established assessment levels for air emissions of these metals at ecological receptors. Consequently, the assessment focuses on pollutant deposition at the ecological receptor locations, which are compared against relevant deposition limits on soil and leaves.

Table 2.7 – Assessed Ecological Receptors

ID	Easting (m)	Northing (m)	ID	Easting (m)	Northing (m)
E1	389151	214831	**E10**	391796	214487
E2	389279	214809	**E11**	392418	214704
E3	389387	214826	**E12**	387620	223306
E4	388813	214493	**E13**	387671	223322
E5	388461	213982	**E14**	387724	223368
E6	388379	213785	**E15**	387481	223344
E7	387558	213235	**E16**	387773	223397
E8	389797	214277	**E17**	387804	223448
E9	391015	213611	**E18**	387834	223546

Figure 2.8 – Location of Modelled Ecological Receptors

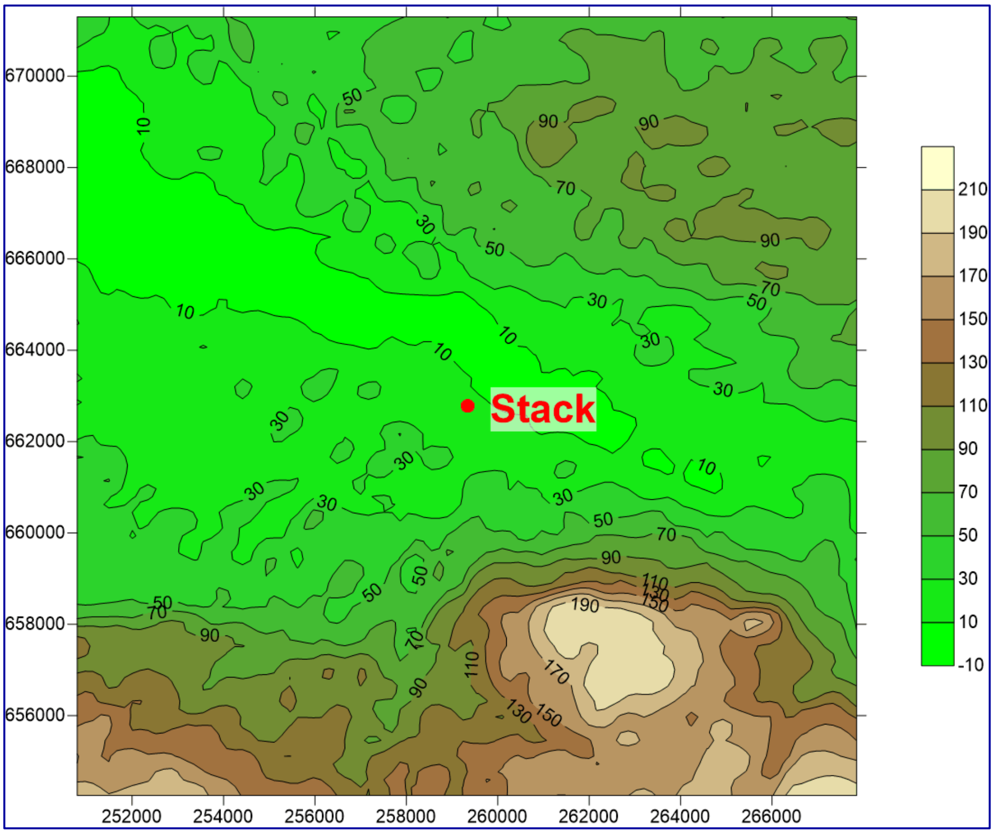


2.5 Terrain

Complex terrain can have a significant effect on the dispersion of a stack plume. As a result, pollutant concentrations at ground level may be higher or lower than on a flat area, depending on the topography. This effect can be taken into account by the dispersion model.

As the area around the plant is hilly, local topography is likely to have an effect on the dispersion of pollutants. Therefore, the terrain module operated within ADMS 6 has been used to generate a high resolution terrain file. Topographical data for the surrounding area has been obtained from Ordnance Survey (OS) OpenData, covering an area of approximately 15 km × 15 km centred on the Site. The resulting terrain grid is shown is shown below in Figure 2.9.

Figure 2.9 – Terrain Data Input to the ADMS 6 Model



2.6 Deposition

The predominant route by which emissions will affect land in the vicinity of a process is by deposition of atmospheric emissions. Potential receptors can be sensitive to the deposition of pollutants. The heavy metals deposition is required to indicate the impact of heavy metals emissions on the sensitive receptors.

The Environment Agency (EA) provides the methodology for calculating the deposition in the Guidance –Air emissions risk assessment for environmental permit[4] :

"The impact on the soil is known as 'PC to ground'. You calculate this as follows. PC_{ground}.

$$PC_{ground} = \frac{(PC_{air} \times 0.01 \times 3 \times 86400)}{1000}$$

[4] Environment Agency. Guidance: Air emissions risk assessment for environmental permit. Published 2016. Available at: https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit#environmental-standards-for-air-emissions

Where:

PC_{ground} = *process contribution to daily deposition rate (mg/m²/day)*
The value of 0.01 is deposition velocity (taken to be 0.01 m/s)
The value of 3 is a nominal factor to convert dry deposition to total deposition and the value 86,400 is a correction factor from days to seconds.
PC_{air} = *Process contribution to air (µg/m³)"*

3 Background Pollutant Concentrations

The dispersion model has been used to predict the contribution of the emission points at the Site, or Process Contribution (PC), to ambient air concentrations. Existing background concentrations have then been added to the Process Contribution in order to report total pollutant concentrations, or Predicted Environmental Concentration (PEC) at specific locations and on the grid of receptors. The total concentration can then be compared against the relevant Air Quality Standard/Objective (AQS/O) or the relevant Environmental Assessment Limit (EAL) and the likelihood of an exceedance determined. In order to determine background concentration levels, local monitoring sites have been considered.

For the modelled heavy metals, the monitoring data in the latest available year at the nearest monitoring site Fenny Compton have been used. Fenny Compton is a rural background monitoring site located 61 km northeast to the Site.

It is not technically rigorous to add predicted short-term or percentile concentrations to ambient background concentrations not measured over the same averaging period, since peak contributions from different sources would not necessarily coincide in time or location. Without short-term ambient background monitoring data available it is difficult to make an assessment against the achievement or otherwise of the short-term AQS/O. For the current assessment, conservative short-term ambient levels have been derived by applying a factor of two to the annual mean background data as per the recommendation in EA Guidance.

Background annual mean concentrations used in the assessment are detailed in Table 3.1

Table 3.1 – Background Annual Mean Concentrations used in the Assessment

Pollutant	2024 Background Annual Mean (ng/m³)
Nickel	0.35
Zinc	10.24
*Maximum Chromium annual mean concentration is reported here as the majority of monthly measurements were below the analytical detection limit (indicated by "<")s.	

3.1 Sensitivity Analysis and Uncertainty

3.1.1 Sensitivity Analysis

Wherever possible, this assessment has used worst-case scenarios, which will exaggerate the impact of the emissions on the surrounding area, including emissions, operational profile, ambient concentrations, meteorology and surface roughness. This assessment has considered the years predicting the highest ground-level concentrations at the nearest sensitive receptor for comparison with the AQS objectives.

Sensitivity analysis has been undertaken for a number of model input parameters to investigate the results of the model with respect to changes in buildings., surface roughness and terrains.

3.1.1.1 Buildings

A sensitivity analysis has been undertaken to investigate the impact of modelling with and without buildings on the modelled results. Results have been normalised by the value obtained from the parameter resulting in the highest ground level process contribution at the receptor location with the highest concentration in the worst-case scenario year. The results are presented in Table 3.2.

Table 3.2 – Building Inclusion Sensitivity Analysis

Buildings	Normalised Maximum Ground Level Concentration
	Modelled Pollutant Annual Mean
With buildings	0.98
Without buildings	1.00

From the above ground level predicted concentrations, the inclusion of buildings in the model results in a slightly lower concentration. However, the model used in this assessment still included buildings to demonstrate a realistic prediction.

3.1.1.2 Surface Roughness

A sensitivity analysis has been undertaken to investigate the impact of modelling different surface roughness lengths at the dispersion site of 0.3 m, 0.5 m, and 1.0 m. There are composite surface roughness lengths averaged over the entire model domain.

Results have been normalised by the value obtained from the surface roughness length resulting in the highest ground level process contribution at the modelled receptor location with the highest concentration in the worst-case scenario year. The results are presented in Table 3.3.

Table 3.3 – Surface Roughness Sensitivity Analysis

Surface Roughness (m)	Normalised Maximum Ground Level Concentration
	Modelled Pollutant Annual Mean
0.3	1.00
0.5	0.94
1.0	0.74

The model used in this assessment has used a composite roughness length of 0.3 m as the land use is predominately farmland and open areas within the immediate vicinity of the site. The sensitivity analysis has shown that the 0.3 m surface roughness results in the highest concentrations. Therefore, the 0.3 m surface roughness length is used in the model assessment.

3.1.1.3 Terrain

A sensitivity analysis has been undertaken to investigate the impact of modelling with and without terrain on the modelled results. Results have been normalised by the value obtained from the parameter resulting in the highest ground level process contribution at the modelled receptor location with the highest concentration in the worst-scenario year. The results are presented in Table 3.4.

Table 3.4 – Terrain Exclusion Sensitivity Analysis

Terrain	Normalised Maximum Ground Level Concentration
	Modelled Pollutant Annual Mean
With terrain	1.00
Without terrain	0.92

From the above predicted ground level concentrations, it can be seen that the omission of terrain in the model results in lower concentrations. Therefore, the model has included the terrain data to reflect the actual conditions.

3.1.2 Model Uncertainty

Dispersion modelling is inherently uncertain, but is nonetheless a useful tool in plume footprint visualisation and prediction of ground level concentrations. The use of dispersion models has been widely used in the UK for both regulatory and compliance purposes for a number of years and is an accepted approach for this type of assessment.

This assessment has incorporated a number of worst-case assumptions, as described above, which will result in an overestimation of the predicted ground level concentrations from the process. Therefore, the actual predicted ground level concentrations would be expected to be lower than this and, in some cases, significantly lower.

The model is well validated with observed concentrations for a number of scenarios; however, as the complexity of the modelled domain increases, modelled concentrations deviate from observed concentrations.

4 Relevant Legislation and Guidance

4.1 UK Legislation

4.1.1 The Environmental Permitting (England and Wales) Regulations 2016

The Environment Permit Regulations 2016 (as amended) (the 'Regulations') establish a unified permitting regime for certain industrial and waste management activities in England, Wales, and Scotland. These Regulations transpose Directive 2010/75/EU (the Industrial Emissions Directive) into UK legislation and came into force on 12th January 2017, replacing the previous Environmental Permitting (England and Wales) Regulations 2010.

The Regulations define an 'Environment Permit' as a permit granted by a Regulator (the Environment Agency, Natural Resources Wales, or Scottish Environment Protection Agency) authorising the operation of an activity or mobile plant. Environment Permits are legally binding authorisations that set out specific conditions and requirements which operators must comply with during the operation of their facilities. These conditions are based on the application of Best Available Techniques (BAT) and are designed to prevent or, where that is not practicable, to reduce emissions to air, water, and land, and to prevent the generation of waste.

The Regulations apply to certain scheduled activities listed in Schedule 1, including combustion plants, waste incineration facilities, and other industrial installations. For activities subject to permitting requirements, operators must obtain an Environment Permit prior to commencing operation. The permit conditions specify emission limit values (ELVs) for relevant pollutants, monitoring and reporting requirements, and operational controls necessary to ensure compliance with environmental quality standards and the Air Quality Standards Regulations 2010. Where an activity is located in proximity to sensitive receptors or in an area designated as an Air Quality Management Area (AQMA), the Regulator may impose more stringent conditions to protect air quality and human health. Operators are required to notify the Regulator of any breach of permit conditions and to implement corrective measures to restore compliance.

4.1.2 The Air Quality Standards Regulations 2010

The Air Quality Standards Regulations 2010 (the ‘Regulations’) came into force on the 11th June 2010 and transpose Directive 2008/50/EC into UK legislation. The Directive’s limit values are transposed into the Regulations as ‘Air Quality Standards’ (AQS) with attainment dates in line with the Directive.

These standards are legally binding concentrations of pollutants in the atmosphere which can broadly be taken to achieve a certain level of environmental quality. The standards are based on the assessment of the effects of each pollutant on human health including the effects of sensitive groups or on ecosystems.

Similar to Directive 2008/50/EC, the Regulations define ambient air as;

> *“…outdoor air in the troposphere, excluding workplaces where members of the public do not have regular access.”*

With direction provided in Schedule 1, Part 1, Paragraph 2 as to where compliance with the AQS’ does not need to be assessed:

> *“Compliance with the limit values directed at the protection of human health does not need to be assessed at the following locations:*
>
> *a) any location situated within areas where members of the public do not have access and there is no fixed habitation;*
>
> *b) on factory premises or at industrial locations to which all relevant provisions concerning health and safety at work apply;*
>
> *c) on the carriageway of roads and on the central reservation of roads except where there is normally pedestrian access to the central reservation.”*

4.1.3 The Air Quality Strategy for England, Scotland, Wales and Northern Ireland

The 2007 Air Quality Strategy for England, Scotland Wales and Northern Ireland provides a framework for improving air quality at a national and local level and supersedes the previous strategy published in 2000.

Central to the Air Quality Strategy are health-based criteria for certain air pollutants; these criteria are based on medical and scientific reports on how and at what concentration each pollutant affects human health. The objectives derived from these criteria are policy targets often expressed as a maximum ambient concentration not to be exceeded, without exception or with a permitted number of exceedances, within a specified timescale. At paragraph 22 of the 2007 Air Quality Strategy, the point is made that the objectives are:

> *"…a statement of policy intentions or policy targets. As such, there is no legal requirement to meet these objectives except where they mirror any equivalent legally binding limit values…"*

The AQOs, based on a selection of the objectives in the Air Quality Strategy, were incorporated into UK legislation through the Air Quality Regulations 2000, as amended.

Paragraph 4(2) of The Air Quality (England) Regulations 2000 states:

> *"The achievement or likely achievement of an air quality objective prescribed by paragraph (1) shall be determined by reference to the quality of air at locations –*
>
> *a) which are situated outside of buildings or other natural or man-made structures above or below ground; and*
>
> *b) where members of the public are regularly present*

Consequently, compliance with the AQOs should focus on areas where members of the general public are present over the entire duration of the concentration averaging period specific to the relevant objective.

4.1.4 Environment Act 2021

The Environment Act 2021 came into force on 9th November 2021, with Part 4 of the Act (and associated Schedules 11 and 12) reserved for matters pertaining to air quality.

The Environment Act 2021 includes amendments to Environment Act 1995 and the Clean Air Act 1993 to give Local Authorities more power. It also requires the Secretary of State to set at least one long-term target in relation to air quality.

4.2 Local Air Quality Management

Part IV of the Environment Act 1995, as amended by the Environment Act 2021, requires that Local Authorities periodically review air quality within their individual areas. This process of LAQM is an integral part of delivering the Government's AQOs.

To carry out an air quality Review and Assessment under the LAQM process, the Government recommends a three-stage approach. This phased review process uses initial simple screening methods and progresses through to more detailed assessment methods of modelling and monitoring in areas identified to be at potential risk of exceeding the objectives in the Regulations.

Review and assessments of local air quality aim to identify areas where national policies to reduce vehicle and industrial emissions are unlikely to result in air quality meeting the Government's air quality objectives by the required dates.

For the purposes of determining the focus of Review and Assessment, Local Authorities should have regard to those locations where members of the public are likely to be regularly present and are likely to be exposed over the averaging period of the objective.

Where the assessment indicates that some or all of the objectives may be potentially exceeded, the Local Authority has a duty to declare an AQMA. The declaration of an AQMA requires the Local Authority to implement an Air Quality Action Plan (AQAP), to reduce air pollution concentrations so that the required AQOs are met.

4.3 Other Guideline Values

In the absence of statutory standards for the other prescribed substances that may be found in the emissions, there are several sources of applicable air quality guidelines.

4.3.1 Environmental Assessment Levels (EALs)

The EA's Guidance provides methods for quantifying the environmental impacts of emissions to all media. The EA guidance contains long and short-term Environmental Assessment Levels (EALs) and Environmental Quality Standards (EQS) for releases to air derived from a number of published UK and international sources. For the pollutants considered in this study, these EALs and EQS are equivalent to the AQS and AQOs set in force by the Air Quality Strategy for England, Scotland Wales and Northern Ireland.

4.4 Criteria Appropriate to the Assessment

Table 4.1 sets out those AQS, AQOs, and EALs that are relevant to the assessment with regard to human receptors. There is no direct AQS/O or EAL for Zinc, therefore Zinc concentration is compared with Zinc oxide EAL.

Table 4.1 – Air Quality Standards, Objectives and Environmental Assessment Levels

Pollutant	AQS/AQO	Averaging Period	Value
Nickel	AQS	Annual mean	20 ng/m^3
	EAL	1-hour mean	0.7 µg/m^3
Zinc oxide	EAL	1-hour mean	1000 µg/m^3
	EAL	Annual mean	50 µg/m^3

Table 4.2 sets out the deposition limits of heavy metals that are relevant to the assessment.

Table 4.2 – Deposition Limits of Heavy Metals

Pollutant	Deposition Limits (mg/m^2/day)
Nickel	0.11
Zinc	0.48

5 Dispersion Modelling Results

This section sets out the results of the dispersion modelling and compares predicted ground level concentrations to ambient air quality standards or environmental assessment levels, if available. The predicted concentrations resulting from the process are presented with background concentrations and the percentage contribution that the predicted environmental concentrations would make towards the relevant AQS/AQO/EAL. Ground level concentrations based on the reported emission rates of each pollutant, as described in Section 2, have been modelled.

5.1 Heavy Metals Impacts

5.1.1 Nickel Impacts

Table 5.1 and Table 5.2 details the predicted annual mean and 1 hour mean Nickel impacts on human receptors from the existing emission point and proposed Zinc-Nickel line on the Site.

Table 5.1 – Nickel Impacts at Human Receptors – Annual Mean

ID	Nickel Annual Mean (ng/m^3)						
	AQS	BS PC	BS PEC	DS PC	DS PEC	% DS PC of AQS	% DS PEC of AQS
1	20	0.01	0.37	1.49	1.85	7.5	9.2
2	20	0.01	0.36	1.17	1.52	5.8	7.6
3	20	0.05	0.40	6.85	7.20	34.2	36.0
4	20	0.01	0.36	1.05	1.40	5.3	7.0
5	20	0.08	0.43	10.70	11.06	53.5	55.3
6	20	0.06	0.41	5.34	5.69	26.7	28.5
7	20	0.04	0.39	3.66	4.01	18.3	20.0
8	20	0.03	0.38	2.98	3.33	14.9	16.6
9	20	0.02	0.37	1.92	2.27	9.6	11.4
10	20	0.01	0.37	1.85	2.20	9.2	11.0
11	20	0.02	0.37	2.23	2.59	11.2	12.9
12	20	0.01	0.37	1.69	2.04	8.5	10.2
13	20	0.01	0.36	1.54	1.90	7.7	9.5
14	20	0.02	0.37	2.40	2.75	12.0	13.7
15	20	0.05	0.41	7.80	8.15	39.0	40.7
16	20	0.05	0.40	7.14	7.49	35.7	37.4
17	20	0.04	0.40	6.56	6.92	32.8	34.6
18	20	0.08	0.43	11.51	11.86	57.5	59.3
19	20	0.03	0.38	3.66	4.01	18.3	20.0
20	20	0.02	0.37	2.73	3.09	13.7	15.4
21	20	0.02	0.37	2.32	2.68	11.6	13.4
22	20	0.01	0.37	1.63	1.98	8.1	9.9
23	20	0.01	0.37	2.16	2.52	10.8	12.6
24	20	0.02	0.38	3.74	4.09	18.7	20.4
25	20	0.01	0.36	1.75	2.10	8.8	10.5
26	20	0.01	0.36	1.59	1.94	7.9	9.7
27	20	0.01	0.37	1.83	2.19	9.2	10.9
28	20	0.01	0.36	1.47	1.82	7.3	9.1
29	20	0.01	0.36	1.23	1.58	6.1	7.9
30	20	0.01	0.36	1.19	1.54	6.0	7.7
31	20	0.02	0.37	2.27	2.62	11.3	13.1
32	20	0.01	0.37	1.88	2.23	9.4	11.1
33	20	0.01	0.36	1.44	1.79	7.2	9.0

34	20	0.01	0.36	0.82	1.17	4.1	5.8
35	20	0.01	0.36	0.99	1.34	4.9	6.7
36	20	0.01	0.37	1.50	1.85	7.5	9.3
37	20	0.01	0.36	1.23	1.58	6.1	7.9
38	20	0.01	0.36	1.29	1.64	6.4	8.2
39	20	0.01	0.36	0.87	1.22	4.3	6.1
40	20	0.03	0.38	3.88	4.23	19.4	21.2

AQS = Air Quality Standard; EAL = Environmental Assessment Level; BS = Baseline Scenario; DS = Do Something Scenario; PC = Process Contribution; PEC = Predicted Environmental Concentration (PC + Background).

Table 5.2 - Nickel Impacts at Human Receptors – 1-Hour Mean

ID	Nickel 1 Hour Mean (µg/m^3)						
	EAL	BS PC	BS PEC	DS PC	DS PEC	% DS PC of AQS	% DS PEC of AQS
1	0.7	<0.01	<0.01	0.25	0.25	35.3	35.4
2	0.7	<0.01	<0.01	0.18	0.18	25.4	25.5
3	0.7	<0.01	<0.01	0.30	0.30	43.4	43.5
4	0.7	<0.01	<0.01	0.15	0.15	21.0	21.1
5	0.7	<0.01	<0.01	0.37	0.37	53.3	53.4
6	0.7	<0.01	<0.01	0.38	0.38	53.7	53.8
7	0.7	<0.01	<0.01	0.27	0.27	38.1	38.2
8	0.7	<0.01	<0.01	0.23	0.23	32.3	32.4
9	0.7	<0.01	<0.01	0.15	0.15	21.0	21.1
10	0.7	<0.01	<0.01	0.20	0.20	29.2	29.3
11	0.7	<0.01	<0.01	0.18	0.18	25.6	25.7
12	0.7	<0.01	<0.01	0.17	0.17	24.6	24.7
13	0.7	<0.01	<0.01	0.18	0.18	26.2	26.3
14	0.7	<0.01	<0.01	0.23	0.23	33.1	33.2
15	0.7	<0.01	<0.01	0.37	0.37	52.7	52.8
16	0.7	<0.01	<0.01	0.34	0.34	48.2	48.3
17	0.7	<0.01	<0.01	0.35	0.35	49.8	49.9
18	0.7	<0.01	<0.01	0.41	0.41	58.5	58.6
19	0.7	<0.01	<0.01	0.21	0.21	29.8	29.9
20	0.7	<0.01	<0.01	0.16	0.16	22.6	22.7
21	0.7	<0.01	<0.01	0.14	0.14	20.0	20.1
22	0.7	<0.01	<0.01	0.13	0.13	18.0	18.1
23	0.7	<0.01	<0.01	0.22	0.22	32.0	32.1
24	0.7	<0.01	<0.01	0.30	0.30	42.4	42.5
25	0.7	<0.01	<0.01	0.18	0.19	26.3	26.4
26	0.7	<0.01	<0.01	0.16	0.17	23.5	23.6
27	0.7	<0.01	<0.01	0.18	0.18	26.1	26.2
28	0.7	<0.01	<0.01	0.17	0.17	24.0	24.1
29	0.7	<0.01	<0.01	0.15	0.15	21.5	21.6
30	0.7	<0.01	<0.01	0.16	0.16	22.3	22.4
31	0.7	<0.01	<0.01	0.19	0.19	26.8	26.9
32	0.7	<0.01	<0.01	0.21	0.21	29.7	29.8
33	0.7	<0.01	<0.01	0.24	0.24	33.6	33.7
34	0.7	<0.01	<0.01	0.15	0.15	21.2	21.3
35	0.7	<0.01	<0.01	0.18	0.18	25.3	25.4
36	0.7	<0.01	<0.01	0.14	0.14	20.1	20.2
37	0.7	<0.01	<0.01	0.12	0.12	17.5	17.6

38	0.7	<0.01	<0.01	0.15	0.15	20.9	21.0
39	0.7	<0.01	<0.01	0.16	0.16	22.5	22.6
40	0.7	<0.01	<0.01	0.16	0.16	23.1	23.2
AQS = Air Quality Standard; EAL = Environmental Assessment Level; BS = Baseline Scenario; DS = Do Something Scenario; PC = Process Contribution; PEC = Predicted Environmental Concentration (PC + Background).							

Table 5.1 indicates that long term PECs of annual mean Nickel are below the respective assessment metric at all applicable human receptors. The highest predicted annual mean Nickel (PEC) was at receptor 18. Receptor 18 is a residential building located 650 m northeast of the Site.

Table 5.2 indicated that PECs of 1 hour mean Nickel are below the respective assessment metric at all applicable human receptors. The highest predicted 1 hour mean Nickel (PEC) was at receptor 18.

Consequently, Nickel emissions from the Site with the Zinc-Nickel line in operation are not expected to cause adverse effects upon the health of the local population.

5.1.2 Zinc Impacts

Table 5.3 details the predicted annual mean and 1 hour mean Zinc impacts on human receptors from the existing emission point and proposed Zinc-Nickle line on the Site. Please note that there is no Zinc emission in the Baseline Scenarios, therefore all the BS PC are zero and all the BS PEC are equal to the background concentration.

Table 5.3 – Zinc Impacts at Human Receptors – Annual Mean

ID	Zinc Annual Mean ($\mu g/m^3$)						
	AQS	BS PC	BS PEC	DS PC	DS PEC	% DS PC of AQS	% DS PEC of AQS
1	50	0	0.01	<0.01	0.01	<0.1	<0.1
2	50	0	0.01	<0.01	0.01	<0.1	<0.1
3	50	0	0.01	<0.01	0.02	<0.1	<0.1
4	50	0	0.01	<0.01	0.01	<0.1	<0.1
5	50	0	0.01	0.01	0.02	<0.1	<0.1
6	50	0	0.01	<0.01	0.02	<0.1	<0.1
7	50	0	0.01	<0.01	0.01	<0.1	<0.1
8	50	0	0.01	<0.01	0.01	<0.1	<0.1
9	50	0	0.01	<0.01	0.01	<0.1	<0.1
10	50	0	0.01	<0.01	0.01	<0.1	<0.1
11	50	0	0.01	<0.01	0.01	<0.1	<0.1
12	50	0	0.01	<0.01	0.01	<0.1	<0.1
13	50	0	0.01	<0.01	0.01	<0.1	<0.1
14	50	0	0.01	<0.01	0.01	<0.1	<0.1
15	50	0	0.01	<0.01	0.02	<0.1	<0.1
16	50	0	0.01	<0.01	0.02	<0.1	<0.1
17	50	0	0.01	<0.01	0.02	<0.1	<0.1
18	50	0	0.01	0.01	0.02	<0.1	<0.1
19	50	0	0.01	<0.01	0.01	<0.1	<0.1
20	50	0	0.01	<0.01	0.01	<0.1	<0.1
21	50	0	0.01	<0.01	0.01	<0.1	<0.1
22	50	0	0.01	<0.01	0.01	<0.1	<0.1
23	50	0	0.01	<0.01	0.01	<0.1	<0.1
24	50	0	0.01	<0.01	0.01	<0.1	<0.1
25	50	0	0.01	<0.01	0.01	<0.1	<0.1
26	50	0	0.01	<0.01	0.01	<0.1	<0.1
27	50	0	0.01	<0.01	0.01	<0.1	<0.1
28	50	0	0.01	<0.01	0.01	<0.1	<0.1
29	50	0	0.01	<0.01	0.01	<0.1	<0.1
30	50	0	0.01	<0.01	0.01	<0.1	<0.1
31	50	0	0.01	<0.01	0.01	<0.1	<0.1
32	50	0	0.01	<0.01	0.01	<0.1	<0.1
33	50	0	0.01	<0.01	0.01	<0.1	<0.1
34	50	0	0.01	<0.01	0.01	<0.1	<0.1
35	50	0	0.01	<0.01	0.01	<0.1	<0.1
36	50	0	0.01	<0.01	0.01	<0.1	<0.1
37	50	0	0.01	<0.01	0.01	<0.1	<0.1
38	50	0	0.01	<0.01	0.01	<0.1	<0.1
39	50	0	0.01	<0.01	0.01	<0.1	<0.1
40	50	0	0.01	<0.01	0.01	<0.1	<0.1

AQS = Air Quality Standard; EAL = Environmental Assessment Level; BS = Baseline Scenario; DS = Do Something Scenario; PC = Process Contribution; PEC = Predicted Environmental Concentration (PC + Background).

Table 5.4 – Zinc Impacts at Human Receptors – 1 Hour Mean

ID	Zinc 1 Hour Mean (µg/m^3)						
	EAL	BS PC	BS PEC	DS PC	DS PEC	% DS PC of EAL	% DS PEC of EAL
1	1000	0	0.01	0.27	0.29	<0.1	<0.1
2	1000	0	0.01	0.19	0.21	<0.1	<0.1
3	1000	0	0.01	0.33	0.35	<0.1	<0.1
4	1000	0	0.01	0.16	0.18	<0.1	<0.1
5	1000	0	0.01	0.41	0.43	<0.1	<0.1
6	1000	0	0.01	0.41	0.43	<0.1	<0.1
7	1000	0	0.01	0.29	0.31	<0.1	<0.1
8	1000	0	0.01	0.25	0.27	<0.1	<0.1
9	1000	0	0.01	0.16	0.18	<0.1	<0.1
10	1000	0	0.01	0.22	0.24	<0.1	<0.1
11	1000	0	0.01	0.20	0.22	<0.1	<0.1
12	1000	0	0.01	0.19	0.21	<0.1	<0.1
13	1000	0	0.01	0.20	0.22	<0.1	<0.1
14	1000	0	0.01	0.25	0.27	<0.1	<0.1
15	1000	0	0.01	0.40	0.42	<0.1	<0.1
16	1000	0	0.01	0.37	0.39	<0.1	<0.1
17	1000	0	0.01	0.38	0.40	<0.1	<0.1
18	1000	0	0.01	0.45	0.47	<0.1	<0.1
19	1000	0	0.01	0.23	0.25	<0.1	<0.1
20	1000	0	0.01	0.17	0.19	<0.1	<0.1
21	1000	0	0.01	0.15	0.17	<0.1	<0.1
22	1000	0	0.01	0.14	0.16	<0.1	<0.1
23	1000	0	0.01	0.25	0.27	<0.1	<0.1
24	1000	0	0.01	0.32	0.35	<0.1	<0.1
25	1000	0	0.01	0.20	0.22	<0.1	<0.1
26	1000	0	0.01	0.18	0.20	<0.1	<0.1
27	1000	0	0.01	0.20	0.22	<0.1	<0.1
28	1000	0	0.01	0.18	0.20	<0.1	<0.1
29	1000	0	0.01	0.17	0.19	<0.1	<0.1
30	1000	0	0.01	0.17	0.19	<0.1	<0.1
31	1000	0	0.01	0.21	0.23	<0.1	<0.1
32	1000	0	0.01	0.23	0.25	<0.1	<0.1
33	1000	0	0.01	0.26	0.28	<0.1	<0.1
34	1000	0	0.01	0.16	0.18	<0.1	<0.1
35	1000	0	0.01	0.19	0.21	<0.1	<0.1
36	1000	0	0.01	0.15	0.17	<0.1	<0.1
37	1000	0	0.01	0.13	0.15	<0.1	<0.1
38	1000	0	0.01	0.16	0.18	<0.1	<0.1
39	1000	0	0.01	0.17	0.19	<0.1	<0.1
40	1000	0	0.01	0.18	0.20	<0.1	<0.1

AQS = Air Quality Standard; EAL = Environmental Assessment Level; BS = Baseline Scenario; DS = Do Something Scenario; PC = Process Contribution; PEC = Predicted Environmental Concentration (PC + Background).

Table 5.3 indicates that long term PECs of annual mean Zinc are below the respective assessment metric at all applicable human receptors. The highest predicted annual mean Zinc (PEC) was at receptor 18. Receptor 18 is a residential building located 650 m northeast of the Site.

PECs of 1 hour mean Zinc are below the respective assessment metric at all applicable human receptors. The highest predicted 1 hour mean Zinc (PEC) was at receptor 18.

Consequently, Zinc emissions from the Site with the Zinc-Nickel line in operation are not expected to cause adverse effects upon the health of the local population.

5.2 Heavy Metal Deposition

5.2.1 Nickel Deposition

Table 5.5 details the predicted Nickel deposition at sensitive receptors from the existing emission point and proposed Zinc-Nickle line on the Site. NB the data below is in units of µg/m2/day to keep units between results tables of the same magnitude.

Table 5.5 – Nickel Deposition at Sensitive Receptors

ID	Nickel Deposition (µg/m^2/day)					
	PC to Ground Limit	BS PC	BS PEC	DS PC	DS PEC	% DS PC of Limit
1	110	0.03	0.95	3.87	4.78	3.5
2	110	0.02	0.94	3.02	3.94	2.7
3	110	0.13	1.04	17.75	18.67	16.1
4	110	0.02	0.93	2.73	3.64	2.5
5	110	0.20	1.12	27.74	28.66	25.2
6	110	0.15	1.07	13.85	14.76	12.6
7	110	0.10	1.01	9.47	10.39	8.6
8	110	0.08	0.99	7.72	8.63	7.0
9	110	0.05	0.96	4.98	5.89	4.5
10	110	0.04	0.95	4.80	5.71	4.4
11	110	0.05	0.97	5.79	6.71	5.3
12	110	0.04	0.95	4.39	5.30	4.0
13	110	0.03	0.95	4.00	4.91	3.6
14	110	0.05	0.97	6.21	7.12	5.6
15	110	0.14	1.05	20.21	21.12	18.4
16	110	0.13	1.04	18.50	19.41	16.8
17	110	0.11	1.03	17.01	17.92	15.5
18	110	0.21	1.12	29.83	30.75	27.1
19	110	0.07	0.99	9.48	10.39	8.6
20	110	0.06	0.97	7.08	8.00	6.4
21	110	0.05	0.96	6.03	6.94	5.5
22	110	0.03	0.95	4.21	5.13	3.8
23	110	0.04	0.95	5.61	6.52	5.1
24	110	0.06	0.98	9.69	10.60	8.8
25	110	0.03	0.95	4.54	5.45	4.1
26	110	0.03	0.94	4.11	5.02	3.7
27	110	0.03	0.95	4.75	5.66	4.3
28	110	0.03	0.94	3.81	4.72	3.5
29	110	0.02	0.94	3.18	4.09	2.9
30	110	0.02	0.94	3.09	4.00	2.8
31	110	0.04	0.96	5.87	6.79	5.3
32	110	0.03	0.95	4.86	5.78	4.4
33	110	0.02	0.94	3.73	4.65	3.4
34	110	0.01	0.93	2.12	3.03	1.9
35	110	0.02	0.93	2.55	3.47	2.3
36	110	0.04	0.95	3.89	4.81	3.5
37	110	0.03	0.94	3.18	4.09	2.9
38	110	0.03	0.94	3.34	4.26	3.0
39	110	0.02	0.93	2.25	3.16	2.0
40	110	0.08	0.99	10.05	10.97	9.1
E1	110	<0.01	0.92	0.32	1.24	0.3
E2	110	<0.01	0.92	0.31	1.23	0.3

E3	110	<0.01	0.92	0.31	1.22	0.3
E4	110	<0.01	0.92	0.30	1.21	0.3
E5	110	<0.01	0.92	0.26	1.17	0.2
E6	110	<0.01	0.92	0.24	1.16	0.2
E7	110	<0.01	0.92	0.24	1.16	0.2
E8	110	<0.01	0.92	0.23	1.15	0.2
E9	110	<0.01	0.92	0.18	1.09	0.2
E10	110	<0.01	0.92	0.21	1.12	0.2
E11	110	<0.01	0.92	0.17	1.09	0.2
E12	110	0.02	0.93	1.79	2.70	1.6
E13	110	0.02	0.93	1.81	2.72	1.6
E14	110	0.02	0.93	1.80	2.72	1.6
E15	110	0.01	0.93	1.66	2.57	1.5
E16	110	0.02	0.93	1.83	2.75	1.7
E17	110	0.02	0.93	1.82	2.74	1.7
E18	110	0.02	0.93	1.79	2.71	1.6
PC = Process Contribution; PEC = Predicted Environmental Concentration (PC + Background); BS = Baseline Scenario; DS = Do Something Scenario.						

The above table indicates that PCs of Nickel deposition are below the respective assessment metric at all sensitive receptors including human receptors and ecological receptors. The highest predicted Nickel deposition (PC) was at receptor 18. Receptor 18 is a residential building located 650 m northeast of the Site.

Consequently, it can be concluded that impact of Nickel deposition results from the stack emission are likely to be insignificant with the proposed Zinc-Nickel line in operation.

5.2.2 Zinc Deposition

Table 5.6 details the predicted Zinc deposition at sensitive receptors from the existing emission point and proposed Zinc-Nickle line on the Site. Please note that there is no Zinc emission in the Baseline Scenarios, therefore all the BS PC are zero and all the BS PEC are equal to the background deposition. NB the data below is in units of μg/m2/day to keep units between results tables of the same magnitude.

Table 5.6 – Zinc Deposition at Sensitive Receptors

ID	Zinc Deposition (μg/m^2/day)					
	PC to Ground Limit	BS PC	BS PEC	DS PC	DS PEC	% DS PC of Limit
1	480	0	26.53	4.23	30.76	0.9
2	480	0	26.53	3.31	29.84	0.7
3	480	0	26.53	19.40	45.93	4.0
4	480	0	26.53	2.98	29.51	0.6
5	480	0	26.53	30.30	56.84	6.3
6	480	0	26.53	15.06	41.60	3.1
7	480	0	26.53	10.31	36.85	2.1
8	480	0	26.53	8.40	34.94	1.8
9	480	0	26.53	5.42	31.96	1.1
10	480	0	26.53	5.24	31.77	1.1
11	480	0	26.53	6.32	32.85	1.3
12	480	0	26.53	4.79	31.32	1.0
13	480	0	26.53	4.37	30.90	0.9
14	480	0	26.53	6.77	33.31	1.4
15	480	0	26.53	22.07	48.61	4.6
16	480	0	26.53	20.21	46.74	4.2
17	480	0	26.53	18.59	45.12	3.9
18	480	0	26.53	32.60	59.13	6.8
19	480	0	26.53	10.35	36.88	2.2
20	480	0	26.53	7.73	34.26	1.6
21	480	0	26.53	6.58	33.11	1.4
22	480	0	26.53	4.60	31.14	1.0
23	480	0	26.53	6.13	32.66	1.3
24	480	0	26.53	10.59	37.12	2.2
25	480	0	26.53	4.96	31.49	1.0
26	480	0	26.53	4.49	31.02	0.9
27	480	0	26.53	5.19	31.72	1.1
28	480	0	26.53	4.16	30.69	0.9
29	480	0	26.53	3.48	30.01	0.7
30	480	0	26.53	3.38	29.91	0.7
31	480	0	26.53	6.41	32.94	1.3
32	480	0	26.53	5.31	31.85	1.1
33	480	0	26.53	4.08	30.61	0.8
34	480	0	26.53	2.31	28.84	0.5
35	480	0	26.53	2.79	29.32	0.6
36	480	0	26.53	4.24	30.77	0.9
37	480	0	26.53	3.46	30.00	0.7
38	480	0	26.53	3.65	30.18	0.8
39	480	0	26.53	2.45	28.99	0.5
40	480	0	26.53	10.97	37.51	2.3
E1	480	0	26.53	0.35	26.89	<0.1
E2	480	0	26.53	0.34	26.87	<0.1
E3	480	0	26.53	0.33	26.87	<0.1

E4	480	0	26.53	0.33	26.86	<0.1
E5	480	0	26.53	0.28	26.81	<0.1
E6	480	0	26.53	0.26	26.80	<0.1
E7	480	0	26.53	0.27	26.80	<0.1
E8	480	0	26.53	0.25	26.79	<0.1
E9	480	0	26.53	0.19	26.73	<0.1
E10	480	0	26.53	0.23	26.76	<0.1
E11	480	0	26.53	0.19	26.72	<0.1
E12	480	0	26.53	1.95	28.48	0.4
E13	480	0	26.53	1.97	28.50	0.4
E14	480	0	26.53	1.96	28.50	0.4
E15	480	0	26.53	1.81	28.34	0.4
E16	480	0	26.53	2.00	28.53	0.4
E17	480	0	26.53	1.99	28.52	0.4
E18	480	0	26.53	1.96	28.49	0.4
PC = Process Contribution; PEC = Predicted Environmental Concentration (PC + Background); BS = Baseline Scenario; DS = Do Something Scenario.						

The above table indicates that PCs of Zinc deposition are below the respective assessment metric at all applicable receptors. The highest predicted Nickel deposition (PC) was at receptor 18.

Consequently, it can be concluded that impact of Zinc deposition results from the Site are likely to be insignificant with the proposed Zinc-Nickel line in operation.

6 CONCLUSIONS

To support Safran Landing Systems Services UK Limited's application for the Environment Permit Variation for their proposed new Zinc-Nickel line, Bureau Veritas has been commissioned to undertake a detailed dispersion modelling assessment. The objective of this assessment is to evaluate the potential air quality impacts from the emission from the proposed new line and demonstrate that the operations will not result in unacceptable pollutant levels for the surrounding residents.

Atmospheric dispersion modelling demonstrates that with the proposed zinc nickel line in operation, predicted concentrations of nickel and zinc remain below relevant air quality objectives and environmental assessment levels at all assessed receptor locations.

Heavy metal deposition modelling shows maximum process contributions of 27.1% for nickel and 6.8% for zinc at human receptors - both well within acceptable limits and not expected to cause significant adverse environmental effects. Metal deposition

Overall, the impacts of the Site's emissions from proposed Zinc-Nickel line on local air quality are considered to be acceptable.

Appendix A – Terms and Definitions

Term	Definition
ADMS	Atmospheric Dispersion Modelling System
AQMA	Air Quality Management Area
AQO	Air Quality Objective
AQS	Air Quality Standard
BAT	Best Available Technique
BAT AELs	Best Available Technique Achievable Emissions Levels
BREF	BAT Reference Documents
CBL	Convective Boundary Layer
CERC	Cambridge Environmental Research Consultants
EA	Environment Agency
EAL	Environmental Assessment Level
EQS	Environmental Quality Standard
IED	Industrial Emissions Directive
EU	European Union
LAQM	Local Air Quality Management
NWP	Numerical Weather Prediction
PC	Process Contribution
PEC	Predicted Environmental Concentration
PEDR	Predicted Environmental Deposition Rate
PPC	Pollution Prevention and Control