

AIR EMISSION RISK ASSESSMENT

**Wrexham Production Facility
New Manufacturing Line**

Prepared for: Kellogg's

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1.0 INTRODUCTION

Kellogg's are proposing to install a new manufacturing line at their production facility at Wrexham and have instructed SLR Consulting Limited (SLR) to undertake an Air Emissions Risk Assessment (AERA) in accordance with the Natural Resource Wales (NRW) guidance.

This report presents the approach and findings of the AERA in support of the application to vary the Environmental Permit for the facility.

1.1 Background

The Supporting Statement accompanying the Permit Variation Application should be referred to for a comprehensive background to the application and description of the proposed manufacturing line. The paragraph below provides only information of specific relevance to this assessment.

The proposed manufacturing line will result in the introduction of 4 new point source emissions to air associated with local exhaust ventilation and drying systems (natural gas-fired). These airstreams will be abated prior to release via particulate filtration systems and residual emissions could contain particulate matter (PM), carbon monoxide (CO) and oxides of nitrogen (NOx).

1.2 Report Structure

The remainder of the report is structured as follows:

- Section 2 details the relevant guidance and environmental quality standards/benchmarks;
- Section 3 describes the baseline environment with regard to sensitive receptors and prevailing meteorological conditions;
- Section 4 describes the methodology applied;;
- Section 5 details the emissions to air and screening assessment; and
- Section 6 concludes the assessment.

2.0 RELEVANT GUIDANCE AND ENVIRONMENTAL BENCHMARKS

2.1 NRW Guidance

NRW environmental permitting guidance indicates that the '*Air emissions risk assessment for your environmental permit*' guidance¹ (termed the 'AERA guidance' throughout the remainder of the report) produced by the Environment Agency (EA) should be applied. The AERA guidance is intended to assist operators in assessing risks to air when applying for a permit under the EP Regulations. Included in the AERA guidance are:

- an approach to screening assessment;
- guidance on when detailed atmospheric dispersion modelling is required; and
- Environmental Assessment Levels (EALs) for a range of pollutants not covered by other regulations, against which impact may be assessed.

2.2 Environmental Assessment Levels

The Environmental Assessment Levels (EALs) applied in this assessment are taken from the 'AERA guidance' which for some pollutants are taken from the Air Quality Strategy² (AQS) and Air Quality Standards Regulations 2010 (Statutory Instrument 2010 No. 1001, 11th June 2010).

The AQS sets out a comprehensive strategic framework within which air quality policy will be taken forward in the short to medium term, and the roles that Government, industry, the Environment Agency, local government, business, individuals and transport have in protecting and improving air quality.

The AQS contains air quality objectives based on the protection of both human health and vegetation (ecosystems) and have been set taking into account the air quality standards defined in the Air Quality Standards Regulations 2010.

The EALs that have been applied in this assessment are provided in Table 2-1.

Table 2-1
Applied EALs

Pollutant		Annual EAL ($\mu\text{g}/\text{m}^3$)	Short Term EAL ($\mu\text{g}/\text{m}^3$)	Ref
Nitrogen dioxide	(NO ₂)	40	200 (1-hour) not to be exceeded more than 18 times per year	AQSR
Carbon monoxide	(CO)	---	10,000 (Max 8-hour daily mean)/ 30,000 (1-hour)	AQSR/ AERA
Particulate matter with an aerodynamic diameter of less than 10 μm	(PM ₁₀)	40	50 (24-hour) not to be exceeded more than 35 times per year	AQSR

¹ <https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit> (accessed 1st March 2017).

² The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, DEFRA. July 2007

Pollutant		Annual EAL ($\mu\text{g}/\text{m}^3$)	Short Term EAL ($\mu\text{g}/\text{m}^3$)	Ref
Particulate matter with an aerodynamic diameter of less than $2.5\mu\text{m}$	($\text{PM}_{2.5}$)	25	-	AQSR

Defra has published technical guidance for use in Local Air Quality Management³. According to LAQM.TG(16) air quality standards should only apply to locations where *'members of the public are likely to be regularly present and are likely to be exposed for a period of time appropriate to the averaging period of the objective. Authorities should not consider exceedences of the objectives at any location where relevant public exposure would not be realistic'*. Thus short term standards such as the 1-hour standards should apply to footpaths and other areas which may be regularly frequented by the public even for a short period of time. Longer term standards such as daily means, should apply at houses or other locations which the public can be expected to occupy on a continuous basis. These standards do not apply to exposure at the workplace.

Table 2-2
Relevant Public Exposure

Averaging Period	AQOs should apply at:	AQOs don't apply at:
Annual mean	All locations where members of the public might be regularly exposed. Building façades of residential properties, schools, hospitals, care homes etc.	Building façades of offices or other places of work where members of the public do not have regular access. Hotels, unless people live there as their permanent residence. Gardens of residential properties. Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term.
24-hour mean and 8-hour mean	All locations where the annual mean objective would apply, together with hotels. Gardens of residential properties.	Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term.
1-hour mean	Any outdoor locations where members of the public might reasonably expected to spend one hour or longer.	Kerbside sites where public would not be expected to have regular access

2.3 Protection of Ecological Receptors

Sites of nature conservation importance at a European, national and local level, are provided environmental protection from developments, including from atmospheric emissions. EALs for the protection of ecological receptors are known as Critical Levels (for airborne concentrations).

³ Department for Environment, Food and Rural Affairs (DEFRA): Local Air Quality Management Review and Assessment Technical Guidance LAQM.TG(16), 2016

The AERA Guidance requires that ecological habitats should be screened against relevant standards if they are located within the following set distances from the facility:

- Special Protection Areas (SPAs), Special Areas of Conservation (SACs) or Ramsar sites within 10km of the installation; and
- Sites of Special Scientific Interest (SSSIs), National Nature Reserves (NNR), Local Nature Reserves (LNR), Local Wildlife Sites (LWS) and Ancient Woodland (AW) within 2km of the installation.

2.3.1 Critical Levels (C_{Le})

C_{Le} are a quantitative estimate of exposure to one or more airborne pollutants in gaseous form, below which significant harmful effects on sensitive elements of the environment do not occur, according to present knowledge. The relevant C_{Le} for the protection of vegetation and ecosystems is specified within the UK air quality regulations and AERA guidance (see Table 2-3).

Table 2-3
Relevant C_{Le} for the Protection of Vegetation and Ecosystems

Pollutant	Concentration ($\mu\text{g}/\text{m}^3$)	Habitat and Averaging Period	Ref
Nitrogen oxides (NOx)	30	Annual mean (all ecosystems)	AQSR
	75	Daily mean (all ecosystems)	AERA

3.0 ASSESSMENT METHODOLOGY

3.1 AERA Screening Method

The principal of the screening technique is based on dispersion factors for differing stack heights derived from atmospheric dispersion modelling. The method requires details of the pollutant emissions rate and effective release height. The predicted ground level concentration is then compared to EALs to determine if emissions are insignificant or whether detailed modelling is required.

In accordance with AERA guidance, emissions to air can be considered to be insignificant and not require further assessment if:

- the long term process contribution is <1% of the long term environmental standard; and
- the short term process contribution is <10% of the short term environmental standard

For process contributions that cannot be considered insignificant the need for detailed modelling is determined against the following threshold criteria:

- [Maximum Process Contribution (long term) + background concentration] > 70% of the Environmental Assessment Level; or
- Maximum Process Contribution (short term) > 20% of the difference between the short term environmental benchmark minus twice the long term background concentration.

3.2 Assessment of Impacts on Vegetation and Ecosystems

In addition to the AERA guidance, the NRW/EA's Operational Instruction 66_12⁴ details how the air quality impacts on ecological sites should be assessed. This guidance provides risk based screening criteria to determine whether impacts will have '*no likely significant effects (alone and in-combination)*' for European sites, '*no likely damage*' for SSSI's and '*no significant pollution*' for other sites, as follows:

- PC <1% long-term C_{Le} and/or C_{Lo} or that the PEC <70% long-term C_{Le} and/or C_{Lo} for European sites and SSSIs;
- PC <10% short-term C_{Le} for NO_x and HF (if applicable) for European sites and SSSIs;
- PC <100% long-term C_{Le} and/or C_{Lo} other conservation sites; and
- PC <100% short-term C_{Le} for NO_x and HF (if applicable) for other conservation sites.

Where impacts cannot be classified as resulting in 'no likely significant effect', more detailed assessment may be required depending on the sensitivity of the feature in accordance with EAs Operational Instruction 67_12⁵. This can require the consideration of the potential for in-combination effects, the actual distribution of sensitive features within the site, and local factors (such as the water table).

The guidance provides the following further criteria:

- if the PEC<100% of the appropriate C_{Le} and/or C_{Lo} it can be assumed there will be no adverse effect;

⁴ NRW/EA Working Instruction 66_12 - Simple assessment of the impact of aerial emissions from new or expanding IPPC regulated industry for impacts on nature conservation.

⁵ NRW/EA Working Instruction 67_12 - Detailed assessment of the impact of aerial emissions from new or expanding IPPC regulated industry for impacts on nature conservation.

- if the background is below the C_{Le} and/or C_{Lo} , but a small PC leads to an exceedance – decision based on local considerations;
- if the background is currently above the C_{Le} and/or C_{Lo} and the additional PC will cause a small increase – decision based on local considerations;
- if the background is below the C_{Le} and/or C_{Lo} , but a significant PC leads to an exceedance – cannot conclude no adverse effect; and
- if the background is currently above the C_{Le} and/or C_{Lo} and the additional PC is large - cannot conclude no adverse effect.

4.0 BASELINE ENVIRONMENT

4.1 Site Location

The installation is located on Bryn Lane on the north-eastern extent of the Wrexham Industrial Estate (centred on NGR 338825, 350525), approximately 2km to the east of Wrexham in North Wales.

To the south and west the installation is bounded by the industrial estate with a range of commercial and industrial activities. To the north and east the site is bounded by agricultural land with scattered residential dwellings within 1km.

4.2 Sensitive Receptors

4.2.1 Human Receptors

The AERA methodology is highly cautious as it is based on the maximum ground level concentration and takes no account of the proximity sensitive receptors. However, of primary relevance to this assessment are the scattered residential properties (the closest of which is approximately 300m to the northwest of the site boundary) where the long-term (annual) and short-term (24-hour and 8-hour) EAL's will apply. The remaining industrial estate will be a relevant receptor for the short-term (1-hour) EALs.

4.2.2 Ecological Receptors

National and International designated sites within the relevant AERA screening distances are presented in Table 4-1

Table 4-1
National and International Designated Sites

Site (Designation)	Proximity	Closest Location (OSGR x,y)	Main habitat or Reason for designation
Midland Meres and Mosses Phase 2 (RAMSAR)	4km to the NW	336200, 353815	Diverse range of habitat from open water to bogs including rare plant species and bryophytes.
River Dee and Bala Lake (SAC)	8km to SW	331325, 347005	Predominately inland water bodies with grassland and broad-leaved deciduous woodland fringes
Johnston Newt Sites (SAC)	3km to E	341940, 351300	Great Crested Newt habitat - mix of water bodies, woodland, bogs and heath.

There are also LWS's located within 2km which the AERA guidance requires to be assessed.

4.3 Baseline Air Quality

4.3.1 Local Air Quality Management

The installation is located within the administrative boundary of Wrexham County Borough Council (WCBC) for Local Air Quality Management. According to the latest LAQM report⁶ there are no Air Quality Management Areas (AQMAs) designated within the borough.

4.3.2 Air Quality Monitoring

A review of the Automatic Urban and Rural Network (AURN) operated by the Welsh Government and Local Authority monitoring sites has been undertaken for locations that could be used to assign background concentrations for the assessment.

The AURN station on Victoria Road in Wrexham is a roadside monitoring location (defined as a site within 1m of the kerbside of a busy road) approximately 6km to the west; as such it is considered unlikely to be representative of background air quality at the site.

Until the end of 2015 WCBC undertook automatic monitoring of NO₂ and PM₁₀ within the school grounds at Isycoed near to the main Industrial Estate; monitoring ceased as there were not any breaches of the air quality objectives over the nine years of monitoring. The measured annual average NO₂ concentrations were 16.0µg/m³ and 16.6µg/m³ for 2014 and 2015 respectively. The measured annual average PM₁₀ concentrations were 12.4µg/m³ and 12.2µg/m³ for 2014 and 2015 respectively.

Passive diffusion tube monitoring is undertaken by WCBC at locations throughout the Borough. The closest monitoring location is a 'Roadside' location at Llan-y-pwll, approximately 2km to the northwest. The measured annual mean NO₂ concentration was 24.6µg/m³ and 23.0µg/m³ for 2014 and 2015 respectively.

4.3.3 Predicted Background Concentrations

Defra provide modelled background pollutant concentration data on a 1km x 1km spatial resolution across the UK that is routinely used to support LAQM and Air Quality Assessments⁷. The projected 2017 backgrounds for the grid square containing the site are presented in Table 4-2. Background pollutant concentrations of NO₂, PM₁₀ and PM_{2.5} are based upon the 2013 base year Defra update⁸. Background pollutant concentrations of CO are based upon 2001 base year. Additionally APIS provide backgrounds for ecological receptors and pollutants on a 5km grid square which have been applied for NO_x

Table 4-2
Predicted Background Concentrations (µg/m³)

Grid Square (OSGR)	NO ₂	PM ₁₀	PM _{2.5}	NO _x	CO
x338500,y350500	13.5	13.9	9.7	15.6	108

These mapped background concentrations include contributions from existing industry; the backgrounds have not had this source contribution removed and as such the use of them may result in a degree of double counting the contribution from the installation. On this basis, WBC monitoring data from Isycoed has been used in preference where available.

⁶ LAQM Progress Report 2016, Wrexham County Borough Council, April 2016.

⁷ Defra, UK Air Information Resource (UK-AIR) website, <http://uk-air.defra.gov.uk/>, accessed 2nd March 2017.

⁸ Background mapping data for local authorities – <http://uk-air.defra.gov.uk/data/laqm-background-home>, accessed 2nd March 2017.

4.4 Baseline Conditions at Ecological Receptors

The APIS website⁹ is a support tool for assessment of potential effects of air pollutants on habitats and species developed in partnership by the UK conservation agencies and regulatory agencies and the Centre for Ecology and Hydrology. APIS has been used to provide information on identification of the habitats present at the site which are sensitive to effects caused by potential emissions and current baseline concentrations (Table 4-3).

Table 4-3
NO_x Concentrations at Ecological Receptors

Name / Type	APIS NO _x Background (µg/m ³)
Midland Meres and Mosses Phase 2 (RAMSAR)	15.6
River Dee and Bala Lake (SAC)	12.2
Johnston Newt Sites (SAC)	14.4
Local Wildlife Sites	15.6

⁹ <http://www.apis.ac.uk/>, accessed 2nd March 2017.

5.0 EMISSIONS TO ATMOSPHERE AND SCREENING

5.1 Emission Scenario

A precautionary (worst case) approach has been adopted by assuming that the new manufacturing line is running continuously with the following point sources:

- EP 120: Dry dust collector serving extruders, coating system and general conveyors – Cartridge filtration abatement system;
- EP 121: Wet dust collector serving coating dryer– Rotoclone wet abatement system;
- EP 122: Wet dust collector serving extruder and base dryer– Rotoclone wet abatement system; and
- EP 73: LEV dust extraction serving packaging area – Fabric filtration abatement.

5.2 Process Conditions

The emission parameters used in the assessment and to determine emission rates are provided in Table 5-1 below.

Table 5-1
Emission Characteristics

Parameter / Source	EP120	EP121	EP122	EP73
Height above roof (m)	8.0	8.0	8.0	6.0
Emission temperature (°C)	Ambient	~50	~50	Ambient
Air Flow (m ³ /s)	6.7	6.1	3.9	2.1

5.3 Applied Emission Rates

The emission rates have been calculated from the process conditions detailed in Table 5-1 and anticipated loading and typical performance standards of the abatement technology provided by the suppliers.

Table 5-2
Emissions from Plant

Pollutant	Unit	EP120	EP121	EP122	EP73
PM ₁₀	mg/m ³	1.0	1.0	1.0	1.0
CO	mg/m ³	N/A	100	100	N/A
NO _x	mg/m ³	N/A	10	10	N/A
PM ₁₀	g/s	0.007	0.006	0.004	0.002
CO	g/s	N/A	0.611	0.389	N/A
NO _x	g/s	N/A	0.061	0.039	N/A

5.4 Effective Release Height and Dispersion factors

For the AERA screening assessment 'effective stack heights' of 13.28m (calculated as 1.66 x 8m as per AERA guidance) have been applied for EP120, EP121 and EP122 and 9.96m for EP73 (calculated as 1.66 x 6m).

On this basis dispersion factors have been applied as follows (extrapolated from the values provided in the AERA guidance):

- For EP120, EP121 and EP122:
 - Long-term (LT) dispersion factor: 23.0 ($\mu\text{g}/\text{m}^3$ per g/s emitted); and
 - Short-term (ST) dispersion factor: 442.6 ($\mu\text{g}/\text{m}^3$ per g/s emitted) converted to appropriate averaging periods).
- For EP73:
 - Long-term (LT) dispersion factor: 32.5 ($\mu\text{g}/\text{m}^3$ per g/s emitted); and
 - Short-term (ST) dispersion factor: 593.3 ($\mu\text{g}/\text{m}^3$ per g/s emitted) converted to appropriate averaging periods).

5.5 Screening Results

5.5.1 Impacts on Air Quality

The inputs and results of the AERA guidance screening for air quality is provided in Table 5-3.

Table 5-3
AERA Air Quality Screening Results

Pollutant Averaging Period	PM ₁₀		PM _{2.5}	NO ₂		CO	
	24-hour	Annual	Annual	1-hour ⁽¹⁾	Annual	1hr	8-hour
Total Emission (g/s)	0.019	0.019	0.019	0.05	0.10	1.00	1.00
Process Contribution (PC) ($\mu\text{g}/\text{m}^3$)	5.10	0.45	0.45	22.1	2.3	442.6	309.8
EAL ($\mu\text{g}/\text{m}^3$)	50	40	25	200	40	30000	10000
PC (as %age of EAL)	10.2%	1.13%	1.81%	11.1%	5.75%	1.48%	3.10%
PC Insignificant?	No	No	No	No	No	Yes	Yes
Background Concentration ⁽²⁾ (B) ($\mu\text{g}/\text{m}^3$)	24.4	12.2	9.7	33.2	16.6	N/A	
B+PC ($\mu\text{g}/\text{m}^3$)	-	12.7	10.1	-	18.9		
B+PC (as %age of LT EAL)	-	32%	40.2%	-	47.3%		
ST EAL - 2*LT BG (headroom)	25.6	-	-	167	-		
PC as % of (ST EAL - 2*LT BG)	19.9%	-	-	13.3%	-		
Is detailed modelling required?	No	No	No	No	No	No	No

Table Note:

- 1) 50% of NO_x considered to be NO₂ for ST PC as per AERA guidance.
- 2) Predicted background values from Isycoed monitoring or DEFRA/APIS applied

On the basis of the AERA screening the following conclusions are reached:

- Potential impacts of PM₁₀ emissions are >1% of the annual PM₁₀ EAL and therefore consideration of the background concentration is required. As the overall PEC is <70% of the EAL, long-term PM₁₀ impacts do not require further consideration or detailed modelling;
- Potential impacts of PM₁₀ emissions are >10% of the 24-hour PM₁₀ EAL and therefore consideration of the background concentration is required. As the overall PEC is <20% of the 'headroom', short-term PM₁₀ impacts do not require further consideration or detailed modelling;
- Potential impacts of PM_{2.5} emissions are >1% of the annual PM_{2.5} EAL and therefore consideration of the background concentration is required. As the overall PEC is <70% of the EAL, PM_{2.5} impacts do not require further consideration or detailed modelling;
- Potential impacts of NO₂ emissions are >1% of the annual NO₂ EAL and therefore consideration of the background concentration is required. As the overall PEC is <70% of the EAL, long-term NO₂ impacts do not require further consideration or detailed modelling;
- Potential impacts of NO₂ emissions are >10% of the 1-hour NO₂ EAL and therefore consideration of the background concentration is required. As the overall PEC is <20% of the 'headroom', short-term NO₂ impacts do not require further consideration or detailed modelling; and
- Potential impacts of both 1-hour and 8-hour CO emissions on the EAL's are classified as 'insignificant' and do not require further consideration or detailed modelling.

5.5.2 Impacts on Ecological Receptors

The inputs and results of the AERA guidance screening for ecological receptors is provided in Table 5-4.

Table 5-4
AERA Ecological Receptors Screening Results

Pollutant	NOx	
	Annual	24-hour
Total Emission (g/s)	0.10	0.10
Process Contribution (PC)	2.3	26.1
EAL (µg/m ³)	30	75
PC (as %age of EAL)	7.67%	34.8%
PC Insignificant?	No	No
Background Concentration (B) (µg/m ³)	15.6	31.1
B + PC (µg/m ³)	17.9	57.2
B + PC (as %age of EAL)	59.5%	76.3%
Is detailed modelling required?	No	No

On the basis of the screening the following conclusions are reached:

- Potential impacts of NOx emissions are >1% of the annual NOx C_{Le} and therefore consideration of the background concentration is required. As the overall PEC is <70% of the C_{Le} , annual NOx impacts are insignificant and do not require further consideration or detailed modelling; and
- Potential impacts of NOx emissions are >10% of the 24-hr NOx C_{Le} and therefore consideration of the background concentration is required. As the overall short-term PEC is <100% of the C_{Le} and the significant separation distance; 24-hour NOx impacts are not considered to require further assessment.

6.0 CONCLUSIONS

On the basis of the AERA screening the following conclusions are reached:

- Potential impacts of PM₁₀ emissions are >1% of the annual PM₁₀ EAL and therefore consideration of the background concentration is required. As the overall PEC is <70% of the EAL, long-term PM₁₀ impacts do not require further consideration or detailed modelling;
- Potential impacts of PM₁₀ emissions are >10% of the 24-hour PM₁₀ EAL and therefore consideration of the background concentration is required. As the overall PEC is <20% of the 'headroom', short-term PM₁₀ impacts do not require further consideration or detailed modelling;
- Potential impacts of PM_{2.5} emissions are >1% of the annual PM_{2.5} EAL and therefore consideration of the background concentration is required. As the overall PEC is <70% of the EAL, PM_{2.5} impacts do not require further consideration or detailed modelling;
- Potential impacts of NO₂ emissions are >1% of the annual NO₂ EAL and therefore consideration of the background concentration is required. As the overall PEC is <70% of the EAL, long-term NO₂ impacts do not require further consideration or detailed modelling;
- Potential impacts of NO₂ emissions are >10% of the 1-hour NO₂ EAL and therefore consideration of the background concentration is required. As the overall PEC is <20% of the 'headroom', short-term NO₂ impacts do not require further consideration or detailed modelling;
- Potential impacts of both 1-hour and 8-hour CO emissions on the EAL's are classified as 'insignificant' and do not require further consideration or detailed modelling;
- Potential impacts of NOx emissions are >1% of the annual NOx C_{Le} and therefore consideration of the background concentration is required. As the overall PEC is <70% of the C_{Le}, annual NOx impacts are insignificant and do not require further consideration or detailed modelling; and
- Potential impacts of NOx emissions are >10% of the 24-hr NOx C_{Le} and therefore consideration of the background concentration is required. As the overall short-term PEC is <100% of the C_{Le} and the significant separation distance; 24-hour NOx impacts are not considered to require further assessment.

7.0 CLOSURE

This report has been prepared by SLR Consulting Limited with all reasonable skill, care and diligence, and taking account of the manpower and resources devoted to it by agreement with the client. Information reported herein is based on the interpretation of data collected and has been accepted in good faith as being accurate and valid.

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