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GSK DAVID JACK RESEARCH CENTRE ENVIRONMENTAL PERMIT APPLICATION: ENVIRONMENTAL RISK ASSESSMENT

RAMBOLL

DAVID JACK RESEARCH CENTRE
ENVIRONMENTAL PERMIT APPLICATION: ENVIRONMENTAL RISK ASSESSMENT

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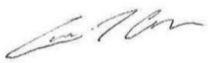

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INTRODUCTION

This document supports the application submitted by GlaxoSmithKline Research & Development Limited ("GSK") under the Environmental Permitting (England and Wales) Regulations 2016 (as amended) ("the EPR Regulations") for a Part A(1) Environmental Permit (application reference EPR/AP3631QN/A001) associated with the David Jack Research Centre located at Park Road, Ware, Hertfordshire, SG12 0DP (the "site" or the "Installation").

The application relates to the operation of combustion plant at the facility, comprising of gas-fired boilers and CHP units, and back-up diesel-fired generators with an aggregated net rated thermal input capacity of >50MWth.

The application process for bespoke permits requires that an Environmental Risk Assessment (ERA) is completed in accordance with the Environment Agency's guidance[1].

In accordance with the Environment Agency's guidance, this ERA is structured as follows:

- Identification and consideration of risks at the Installation and sources of the risks;
- Identification of receptors (people, animals, property and anything else that could be affected by the hazard) at risk from the Installation;
- Identification of possible pathways from the sources of the risks to receptors;
- Assessment of the risks relevant to the specific activities carried out at the Installation and consideration of which risks can be screened out as negligible; and
- Description of measures to control identified risks.

[1] https://www.gov.uk/guidance/risk-assessments-for-your-environmental-permit Environment Agency Website. Accessed on 16/04/2019

GENERAL LIMITATIONS AND RELIANCE

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1. RISK ASSESSMENT METHODOLOGY

1.1 Overview

This risk assessment has been developed in accordance with the Environment Agency guidance[2] for the preparation of risk assessments. The Environment Agency guidance promotes the following process:

- Identify and consider risks for the Installation, and the sources of the risks;
- Identify the receptors (people, animals, property and anything else that could be affected by the hazard) at risk from the Installation;
- Identify the possible pathways from the sources of the risks to the receptors;
- Assess risks relevant to the activity at the Installation and check they're acceptable and can be screened out;
- State what measures are applied control risks if they're too high; and
- Submit the risk assessment as part of the environmental permit application.

The risk assessment should identify whether any of the following risks could occur and what the environmental impact could be:

- any emission to air or discharge, for example sewage or trade effluent to surface or groundwater;
- accidents;
- odour;
- noise and vibration;
- uncontrolled or unintended ('fugitive') emissions, for which risks include dust, litter, pests and pollutants that shouldn't be in the discharge; and
- visible emissions (e.g. smoke or visible plumes).

1.2 Risk Assessment Layout

A qualitative assessment for generic risks identified at the Installation is provided in Section 5, and a quantitative assessments derived from specific operations and release points is provided in Section 6.

For the qualitative assessment, each actual or possible hazard is identified and the assessment is then tabulated taking into account the following criteria:

- the hazard - for example dust, litter, type of visible emission;
- the receptors - people, animals, property and anything else that could be affected by the hazard;
- the pathways - how the hazard can get to a receptor;
- what measures will be taken to reduce risks;
- probability of exposure, for example whether a risk is unlikely or highly likely;
- consequences - what harm could be caused; and
- what the overall risk is, based on what the information presented in the table - for example 'low if management techniques applied'.

For the quantitative assessment, it is possible to 'screen out' potential risks from emissions to air, discharges to water or deposition onto land by carrying out quantitative tests to check whether

[2] https://www.gov.uk/guidance/risk-assessments-for-your-environmental-permit Environment Agency Website. Accessed on 16/04/2019.

they're within acceptable limits or environmental standards. If they are, the risk to the environment is considered to be insignificant and no further assessment is required.

1.3 Assessing Likelihood and Consequence

Within the risk assessment each hypothesised relationships between contaminants, pathways and receptors is assessed to determine the likelihood of the receptor being exposed to pollution and the consequences of exposure using the rankings listed in the tables below.

Table 2.1: Likelihood Rankings

Very Low	Low	Medium	High
Exposure to pollution is considered to be *highly unlikely*.	Exposure is considered to be *unlikely*.	Exposure is considered to be *likely*.	Exposure is considered to be *highly likely* to occur.

Table 2.2: Consequence Rankings

Very Low	Low	Medium	High
No impact or imperceptible impact on the receptor.	Low level impact easily and quickly mitigated or may not require any intervention to rectify any impact.	Moderate impact which will not be rectified without some mitigation / intervention.	High impact requiring significant intervention / mitigation and may have caused irreparable damage to the receptor.

1.4 Assessment of Risk

Following the determination of the likelihood and consequence rankings for the hypothesised relationships developed using the source-pathway-receptor concept the matrix in the table below is used to determine the overall risk of the pollution exposure occurring.

Table 2.3: Risk Matrix

		Likelihood			
		Very Low	**Low**	**Medium**	**High**
Consequence	**High**	Low	Medium	High	High
	Medium	Low	Medium	Medium	High
	Low	Low	Low	Medium	Medium
	Very Low	Very Low	Low	Low	Low

2. IDENTIFICATION OF RISKS

As part of the application GSK is required to identify the environmental risks (sources of potential contamination) which could occur during the operation of the Installation, including any risks which may arise from accidents. The EA online guidance[3] stipulates that GSK, as the operator of the site, must consider the following potential risks:

- any discharge (e.g. sewage or trade effluent to surface water or groundwater);
- accidents;
- odour;
- noise and vibration;
- uncontrolled and unintended ('fugitive') emissions (for which risks include dust, litter, pests; and pollutants that shouldn't be in the discharge); and
- visible emissions (e.g. smoke or visible plumes).

In considering the risk, GSK can determine that a potential risk is not considered to be significant in terms of its potential impact on the environment; however, a justification must be provided for any risk which is 'screened out'.

Based on the guidance summarised above the potential environmental risks at the Facility have been identified and have been determined either applicable or not applicable based on the potential environmental impact arising from the risk. A summary of these risks is presented in the table below which also provides justifications where risks are considered to be insignificant. The risks which have been identified as significant have been included in the risk assessment in Section 6 of this report.

Table 2.1: Screening of Environmental Risks

Environmental Risk	Applicability	Justification
Controlled discharges to surface waters	Not Applicable	GSK holds an Environmental Permit (formerly referred to as a Discharge Consent) (Ref. CTWC0228) issued in July 1985 for the discharge of other matter into the River Lea; however, there are no controlled discharges to surface waters from the combustion activities associated with the installation.
Controlled discharges to Groundwater	Not Applicable	There are no controlled discharges to groundwater from the Installation. This risk has not been considered for further assessment.
Accidents	Applicable	Plant or Equipment Failure: Large quantities of equipment are in-use across the Facility. The failure of plant or equipment may result in an incident occurring which could potentially impact on the environment. Materials Handling: Raw materials and wastes are stored on-site in bulk and are transported across the Facility via pipework and in IBCs on fork lift trucks. There is the potential for accidents (e.g. spills, leaks etc.) to occur during the filling of bulk storage vessels and the movement of materials, which may result in contaminated run-off. Vandalism: The Facility is located in a small urban area and may be a target for vandalism and theft. Operator Error: Delivery and transfer of fuel and/or oil.

[3] https://www.gov.uk/guidance/risk-assessments-for-your-environmental-permit#risks-from-your-site Environment Agency Website. Accessed on 16/04/2019.

Environmental Risk	Applicability	Justification
		Flooding: The southern periphery (10%) of the site is located in a Flood Zone 2 (Medium Probability) and therefore the risk associated with flooding cannot be discounted.
Odour	Not Applicable	There are no odour emissions from the Facility. This risk has not been considered for further assessment.
Noise & Vibration	Applicable	The operation of generators, boilers and the combined heat and power plant have the potential to generate noise and vibration
Visual Impact	Not Applicable	The Facility is positioned within an urban area with some commercial land uses and residential properties. Visible emissions from the Facility are limited to flue gases and steam. These emissions are not considered to be significant in terms of visual impact. There are no records of complaints regarding the visual impact of emissions at the Facility. Based on this, visual impact has not been considered to be significant and has not been included for further assessment.
Fugitive Emissions to Air and Water	Applicable	Surface Water: potential for blocked / damaged drains or misconnections in the drainage system to result in an uncontrolled release of process wastewater to ground or into the River Lea. Spillages: during refilling of the diesel-powered generators, there is a risk of human or mechanical error to produce leaks and spills. Storm water discharges: storm water run-off from the site roofs, yards, access roads and other external areas, with the discharge point to the south of the site. Potential for polluted discharges to enter the River Lea.
Controlled Releases to Air	Applicable	Air emissions associated with the Installation comprise flue gases from boilers, electricity generators and combined heat and power plant.

3. SITE LOCATION AND SENSITIVE RECEPTORS

A receptor is defined as something that could be adversely affected by a pollutant. Based on visual observations of the Facility and the information relating to its environmental setting (provided in the site condition report provided under separate cover)) Ramboll has identified the potential receptors within the vicinity of the site. A summary of the identified receptors is provided Table 3.1 below.

Table 3.1: Schedule of Receptors

Receptor Type		**Applicability to the Site**
Human	Homes, or groups of homes	Housing development (Hornbeam Court) directly opposite installation entrance. Two Housing Estates located from 30m north-east and 40m north-west.
	Schools, hospitals or other public buildings	St Catherine's C of E Primary School located 30m north. The Chauncy School located 110m north. Orchard House Pre-School 130m east.
	Factories and other businesses	Allensburys Sports and Social Club located 10m south-east. Fanshawe Pool and Gym located 50m north. ASDA Ware Superstore 250m north-east. Autobody Repairer located 470m north.
	Footpaths	Public Footpaths adjacent west and south of the site, with a Canal path 40m south.
	Roadways	Wengeo Lane, adjacent to the west. Park Road, adjacent to the north. Harris's Lane 70m east. The A10 340m west.
	Playing fields and playgrounds	Westfield Playing Fields 20m south. Pavilion and Playing Fields 160m west.
	Farms and allotments	Bardon Farm is located 850m west.
	Drains and sewer systems	Surface water drainage on-site goes through multiple interceptors, with drainage into the River Lea to the south of the site. Sewage drainage and discharge from laboratory research and development activities drains into two (2) discharge points at the north of the site.
	Historic/Listed buildings	There are 18 Listed Buildings within 500m of the site, the nearest is located approximately 220m west.
Environmental/Ecological	SAC/SPA/RAMSAR	None within 2km of the site.
	Sites of Special Scientific Interest	None within 2km of the site.
	National/Local Nature Reserve	No National Nature Reserves within 2km of the site. A Local Nature Reserve is located 450m south-east of the site.
	Ancient Woods	None within 2km of the site.
	Groundwater	The superficial rock aquifers on-site have an EA Aquifer Designation as Secondary A, with the

Receptor Type		**Applicability to the Site**
		underlying Upper Lee Chalk bedrock classified as a Principal Aquifer. The EA classified the groundwater with 'Poor' Overall, Quantitative and Chemical Status' under the Water Framework Directive.
	Geological sites	None within 2km of the site.
	Surface Water course	The River Lea runs approximately west to east and is located 20m south of the site. The site resides in the catchment area for the Lee Navigation; the EA classified the surface water Overall and Ecological Status' as 'Moderate', under the Water Framework Directive but the Chemical Status was 'Good'.
	Groundwater Source Protection Zone	The site is located in Zone 2 (Outer Zone) of a Groundwater Source Protection Zone. The nearest Zone 1 (Inner Zone) is located 20m south of the site.

4. POTENTIAL POLLUTION PATHWAYS

4.1 Identification Pollution Pathways

The potential pollution pathways between the sources identified in Section 2 (excluding those which have been screened out) and the receptors identified in Section 3 are summarised in the table below.

Table 4.1: Potential Pollution Pathways

Source	Potential Pathway	Receptor
Noise and Vibration: arising from the operation of the combustion plant present at the Installation (i.e. boilers, generators, combined heat and power plant).	Transmitted through the air and through ground vibration.	Humans including: workers present at the Installation workers / visitors; workers on adjacent premises; local residents; intermittent presence on pedestrian routes / roadways surrounding the Installation.
Accidents: including plant or equipment failure; materials handling; vandalism; fire; and, flooding.	Over site surfaces; through site drainage systems; and through the air.	Surface water; Groundwater; Ground; Atmosphere, and Humans including: workers / visitors present at the Installation /; workers on adjacent premises; local residents; intermittent presence on pedestrian routes / roadways surrounding the Installation.
Fugitive Emissions: including spillages and surface water run-off.	Over Facility surfaces and through Facility drainage systems.	Surface water; groundwater; ground; atmosphere, and humans including: workers / visitors present at the Installation /; workers on adjacent premises; local residents; intermittent presence on pedestrian routes / roadways surrounding the Installation.
Controlled release to air: from point sources.	Through the air; windblown.	Atmosphere, and humans including: workers / visitors present at the Installation /; workers on adjacent premises; local residents; intermittent presence on pedestrian routes / roadways surrounding the Installation.

5. RISK ASSESSMENT

5.1 Noise

There is a potential for noise to arise from the operation of the boilers, generators and combined heat and power plant (CHP). The occasional movement of refuelling / chemical supply vehicles is also a potential source of noise associated with the Installation. The risk assessment for individual noise sources is provided in the table below.

Ongoing monitoring of ambient noise levels at the site boundary do not indicate any significant risk of impact at receptors (See section 5.2. of the Operations Report).

Table 5.1: Noise

Source-Pathway-Receptor Hypothetical Model			Risk Management Techniques	Assessing the Risk		
Source of Pollution	**Receptor**	**Pathway**		**Likelihood of Exposure**	**Consequence of Exposure**	**Overall Risk**
Noise: arising from the movement of refuelling vehicles, and engine noise / alarms when visiting the site.	*Humans including:* Facility workers / visitors; workers on adjacent premises; local residents; intermittent presence on pedestrian routes / roadways surrounding the factory	Through the air and ground vibration	• A site speed limit of 10 miles per hour is in operation across the Facility to minimise engine noise. • The oil deliveries are located adjacent to the oil storage tank, situated at distance from the nearest sensitive receptor (residential housing and school located approximately 100m to the north). • Deliveries are infrequent, limiting potential for disturbance. • Generators are only used as a back-up; therefore, do not require regular refuelling.	Low	Low	**Low**
Noise and vibration: arising from the operation of plant (comprising boiler, CHP plant and generators)			• The boilers, generators and CHP plant are all contained within buildings or noise-attenuated containers. • All plant at the site is maintained in accordance with manufacturers' specifications to minimise excessive noise from poor performance.	Medium	Low	**Medium**

Source-Pathway-Receptor Hypothetical Model			Risk Management Techniques	Assessing the Risk		
Source of Pollution	**Receptor**	**Pathway**		**Likelihood of Exposure**	**Consequence of Exposure**	**Overall Risk**
			• An independent acoustic contractor evaluated the CHP plant to not exceed 60dB(A) at 10m distance, significantly below dangerous levels. The plant is located at the south-western corner of the site and so situated at distance (nearest approximately 200m north) from residential properties.			

5.2 Accidents

The risk assessment for accidents at the site is included in the table below.

Table 5.2: Accidents

Source-Pathway-Receptor Hypothetical Model			Risk Management Techniques	Assessing the Risk		
Source of Pollution	**Receptor**	**Pathway**		**Likelihood of Exposure**	**Consequence of Exposure**	**Overall Risk**
Accident: Failure in containment of light fuel oil storage tank and associated equipment (valves, pipes etc.).	*Ground* *Groundwater* *Surface Water* *Groundwater* *Surface Water*	Over Installation surfaces; and, through Installation drainage systems.	• The light fuel oil storage tank has a maximum capacity of 196,000 litres and is of single skinned mild steel construction. The tank is located within a concrete bund located externally adjacent to the engineering building (Building 7). The bund was designed to hold three (3) tanks of 196,000 litre capacity; however, only one tank is present within the bund and the bunds is therefore considered to be oversized (with a capacity >110% of the tank). Any releases from the tank would be contained within the bund. • The tank is maintained in accordance with GSK's program of planned preventative maintenance. • GSK has a spillage emergency response procedure in place which is	Very Low	High	**Low**

Source-Pathway-Receptor Hypothetical Model			Risk Management Techniques	Assessing the Risk		
Source of Pollution	**Receptor**	**Pathway**		**Likelihood of Exposure**	**Consequence of Exposure**	**Overall Risk**
			detailed in the EMS (Ref: EHS-SWI-0006). • Interceptors are present on surface water drainage systems prior to discharge into the River Lea. • A shut-off valve is in place at the discharge point, which can be closed in the event of a loss of containment • The light fuel oil distribution system is contained within concrete lined service ducts. Sections of the distribution pipework is fitted with leak detection equipment.			
Accident: Flooding potential to impact drainage system, generators associated with emission point A12 / A13, and the CHP engines.	*Surface Water*	Through flood water, over surfaces & through Installation drainage systems discharging directly into the River Lea.	• All storage tanks are bunded to 110% capacity, in case of accidents and breaching of the tank or connective piping. Bunding also provides some protection against ingress of water in the event of flooding. • Metal and concrete construction of the tanks, connective pipework and containment infrastructure, so that there is minimal risk of water damage leading to	Very Low	High	**Low**

Source-Pathway-Receptor Hypothetical Model			Risk Management Techniques	Assessing the Risk		
Source of Pollution	**Receptor**	**Pathway**		**Likelihood of Exposure**	**Consequence of Exposure**	**Overall Risk**
			spillage in a single flooding event. • Generator day tanks are elevated and within building			
Accidents (Fire): Fire and arson attacks	*Humans including:* workers / visitors present at the Installation; workers on adjacent premises; local residents; intermittent presence on pedestrian routes / roadways surrounding the factory *Ground*	Over Facility surfaces; through the air; and, through Installation drainage systems.	• Security personnel are present at the site on a 24/7 basis. • Fencing is present along the site perimeter, and CCTV is in use as a deterant. • A Site Emergency Evacuation Plan is in place and displayed throughout the Facility. • The fire alarm can be activated through the use of break glass points. • Fire wardens are in place to respond to alarms. • Firefighting equipment is available on site for handling small fires. • Manage and control any fire directly and rapidly through early detection, suppression /	Very Low	High	**Low**

Source-Pathway-Receptor Hypothetical Model			Risk Management Techniques	Assessing the Risk		
Source of Pollution	**Receptor**	**Pathway**		**Likelihood of Exposure**	**Consequence of Exposure**	**Overall Risk**
			sprinkler systems and an on-site response team. • Penstock valves on surface water discharge points to seal drains & retain firewater in the event of a fire			
Accidents (Vandalism): Damage / theft of externally located equipment / tanks	*Surface Water* *Atmosphere* Surface Water	Over site surfaces; and, through drainage systems.	• CCTV covers the site, which is secured by fencing and turnstile type gates with authorised access only. All visitors and contractors enter through the reception area and are escorted by site personnel when on site. The on-site security personnel and strict security policy at the Installation, means that any person trespassing on the premises would be easily identified and escorted off-site. • The site is operational 24-hours a day, with security personnel on-site at all times monitoring CCTV and patrolling the site and specifically perimeter, which prevent security breaches.	Very Low	Medium	**Low**

5.3 Fugitive Emissions

The risk assessment for fugitive emissions is presented in the table below.

Table 5.3: Fugitive Emissions

Source-Pathway-Receptor Hypothetical Model			Risk Management Techniques	Assessing the Risk		
Source of Pollution	**Receptor**	**Pathway**		**Likelihood of Exposure**	**Consequence of Exposure**	**Overall Risk**
Surface Water: Potential for blocked / damaged drains, or misconnections in the drainage system to result in an uncontrolled release of process wastewater into the discharge point to the south of the site.	*River Lea*	Through drainage systems	• Minimal handling of oils and other fuels takes place in external areas, to reduce contaminated material within the discharge. • GSK has a fuel storage and offloading procedure (Ref: EHS-SWI-0009), with preventative procedures to reduce contaminative materials being present in the drainage system. • Interceptors are located between the fuel oil tanker area and the discharge point into the River Lea, reducing the risk of contaminated material within an uncontrolled release discharge. • Drainage systems and interceptors are checked by Responsible persons on a regular basis for blockages, misconnections and other deteriorations. • CCTV surveys of the site drainage systems are undertaken periodically (last survey in 2017).	Very Low	Medium	**Low**
Storm water discharges: Storm water run-off from the site roofs and yard areas, with the discharge point to the south of the	*River Lea*	Through drainage systems	• Minimal handling of oils and other fuels takes place in external areas, to reduce contaminated material within the discharge. • GSK has a fuel storage and offloading procedure (Ref: EHS-SWI-0009), with preventative procedures to prevent	Medium	Very Low	**Low**

Source-Pathway-Receptor Hypothetical Model			Risk Management Techniques	Assessing the Risk		
Source of Pollution	**Receptor**	**Pathway**		**Likelihood of Exposure**	**Consequence of Exposure**	**Overall Risk**
site directly into the River Lea.			contaminative materials being present in the drainage system. • Interceptors are located between the fuel oil tanker area and the discharge point into the River Lea, minimising the risk of contaminated material within an uncontrolled release discharge. • Drainage systems and interceptors are checked by Responsible persons on a regular basis for blockages, misconnections and other deteriorations.			

Fugitive Discharge to Surface Water: Spillage / operator error during filling or transfer from oil tank.	River Lea	Overground Flow via surface water drainage system	• Interceptors are located between the fuel oil tanker filling area and the discharge point into the River Lea.
			• Distance to the discharge point is substantial enough so as to be able to react to minor spills and mitigate before being discharged.
			• GSK has a spillage emergency response procedure in place which is detailed in the EMS (Ref: EHS-SWI-0006); and, a fuel storage and offloading procedure (Ref: EHS-SWI-0009), with preventative procedures including:
			  • Management systems in place so as to have a Responsible Person supervising Tank refills;
			  • Connections, valves and sufficient space in storage Tank checked prior to commencement of offloading of the fuel oil;
				Very Low	High	**Low**

Source-Pathway-Receptor Hypothetical Model			Risk Management Techniques	Assessing the Risk		
Source of Pollution	**Receptor**	**Pathway**		**Likelihood of Exposure**	**Consequence of Exposure**	**Overall Risk**
			• Spillage equipment, including absorbing material and barriers, placed locally before offloading commences; and • Routes for pollution including surface water gullies are covered and drain mats and drip trays are placed under hose connections before offloading.			

5.4 Controlled Releases to Air

The risk assessment for controlled releases to air is presented in the table below.

Table 5.4 Controlled Releases to Air

Source-Pathway-Receptor Hypothetical Model			Risk Management Techniques	Assessing the Risk		
Source of Pollution	**Receptor**	**Pathway**		**Likelihood of Exposure**	**Consequence of Exposure**	**Overall Risk**
Controlled Releases to Air: Boiler and CHP Stack Emissions	*Atmosphere* *Humans including:* workers / visitors present at the installation; workers on adjacent premises; local residents; intermittent presence on pedestrian routes / roadways surrounding the installation.	Through the air	• Boilers and CHP stacks designed to achieve adequate dispersion, minimising off-site exposure. Boiler and CHP Plant are maintained by an Engineer under a service agreement with a third-party contractor; who undertake inspections and carry out any required maintenance on a weekly basis. During maintenance the exhaust gases from the CHP plant are analysed for NO_x, PH, CO and Nitrite. The temperature and efficiency are also recorded. GSK has an operation and maintenance of steam boilers procedure (Ref: INS_399358), containing a schedule of routine checks; with boilers shut down and serviced yearly. • GSK has an operation and maintenance of steam boilers procedure (Ref: INS_399358), containing a schedule of routine checks; with boilers shut down and serviced yearly.	Medium	Low	**Medium**
Controlled Releases to Air: Generator emissions.	*Atmosphere* *Humans including:* workers / visitors present at the installation ; workers on		• Generators run very infrequently (<50 hours a year) • Generators are maintained by an Engineer under a service agreement, undertaking inspections and carrying out any required maintenance.	Low	Low	**Low**

	adjacent premises; local residents; intermittent presence on pedestrian routes / roadways surrounding the Installation.					

6. QUANTITATIVE RISK ASSESSMENTS

A copy of the H1 risk assessment tool is provided in Appendix 1. Details on the outputs of specific quantitative risk assessments are provided below.

6.1 Emissions to Air

An air dispersion modelling exercise has been undertaken so as to:

- Assess the impact on local air quality as a result of the anticipated pollutant emission levels identified in Table 6.1; and
- Confirm the heights of the Release Point stacks so as to ensure adequate dispersion to ensure acceptable impacts at receptors.

A copy of the air quality assessment is included in Appendix 2.

Table 6.1: Schedule of Emission Points

Emission Point ID	Description	Parameters[4]	Emission Limits (ref. standard conditions)[5]
A1	Boiler 2	Oxides of Nitrogen (NO_x)	200mg/Nm^3
A2	Boiler 3	Oxides of Nitrogen (NO_x)	200mg/Nm^3
A3	Boiler 4	Oxides of Nitrogen (NO_x)	200mg/Nm^3
A4	Building 7 - Generator 1	Oxides of Nitrogen (NO_x)	-
A5	Building 7 - Generator 2	Oxides of Nitrogen (NO_x)	-
A6	Building 2 - Generator 1	Oxides of Nitrogen (NO_x)	-
A7	Building 1 - Generator 2	Oxides of Nitrogen (NO_x)	-
A8	Building 27 - Generator 1	Oxides of Nitrogen (NO_x)	-
A9	Building 5 - Generator 1	Oxides of Nitrogen (NO_x)	-
A10	Building 5 - Generator 2	Oxides of Nitrogen (NO_x)	-
A11	Building 2 - Generator 3	Oxides of Nitrogen (NO_x)	-

[4] Parameters and associated emission limit values are not proposed for electricity generator plant as these are not use routinely for electricity generation and in any case only in an emergency in the event of the power supply to the installation from the CHP or distribution network being interrupted.

[5] As listed in Annex II, Part 1 of Directive (EU) 2015/2193 of the European Parliament and of the Council of 25 November 2015 on the limitation of emissions of certain pollutants into the air from medium combustion plants. All emission limit values are defined at a temperature of 273,15 K, a pressure of 101,3 kPa and after correction for the water vapour content of the waste gases and at a standardised O_2 content of 3 % for medium combustion plants, other than engines and gas turbines, using liquid and gaseous fuels and 15% for engines and gas turbines.

Emission Point ID	Description	Parameters[4]	Emission Limits (ref. standard conditions)[5]
A12	Building 9 - Generator 1	Oxides of Nitrogen (NO_x)	-
A13	Building 9 - Generator 2	Oxides of Nitrogen (NO_x)	-
A14	CHP Engine 1	Oxides of Nitrogen (NO_x)	190mg/Nm^3
A15	CHP Engine 2	Oxides of Nitrogen (NO_x)	190mg/Nm^3

6.1.1 Impact on Local Air Quality

The scope of the air quality assessment included:

- Review of local air quality data surrounding the Site;
- Desk study to reaffirm the building arrangements, locations of human and ecologically sensitive receptors;
- Detailed analyses of operating scenarios for the combustion plant present on Site; and
- Air dispersion modelling of the operational thermal plant and generator emissions to predict process contributions (PC) at identified sensitive receptors for comparison against relevant ambient National Air Quality Objectives (NAQOs).

It should be noted that the modelling is considered to be conservative for the following reasons:

- The maximum concentrations from five years of meteorological data were assessed within the results; representing a worst-case meteorological year;
- The equipment is assumed to be operating continuously all year round whereas in reality, there will be periods when it is not operational.
- The modelling includes adjacent non-permitted boilers (located in the amenities centre)

The maximum annual mean combined PC (thermal plant and generator) at a relevant receptor location of 5.2 µg/m^3 (13.0% of the AQO) is predicted to occur at RR125, a residential façade to the north of Park Road.

The maximum annual mean combined PEC (thermal plant and generator) at a relevant receptor location of 23.7 µg/m^3 (59.3% of the AQO) is predicted to occur at SC2, a school façade to the north of Park Road. This is below the 70% threshold of significance for long-term air quality impacts.

The maximum combined thermal plant (boiler and CHP) PC at a relevant receptor location of 19.0 µg/m^3 (9.5% of the AQO) is predicted to occur at CR1, a commercial façade to the north of Park Road. This is below the 10% insignificance threshold for short-term air quality impacts.

The modelling has demonstrated that the normal operation of the thermal plant and generators would not have a significant impact on local human and ecological receptors. In addition, it has demonstrated that the normal operation of the site's back-up generators (total of 20 hours per unit per annum) would result in less than 1% probability of exceedance of the short-term nitrogen dioxide objective, and would therefore be highly unlikely.

The highest impacts from the site combustion plant arise at receptors located along Park Road to the north of the site. The modelling has demonstrated that at these locations air quality would meet relevant NAQOs with the combustion plant fully operational.

The maximum predicted annual mean NO_x PCs at identified nature conservation sites is less than 1% of the critical level at which concentrations can be screened out as insignificant. The need for analysing critical loads and 24-hourly mean concentrations was therefore screened out of the assessment.

6.2 Emissions to Water/Sewer

Emissions to water from the installation consist of surface run-off from areas with impermeable surfacing (roadways, roofing etc). Under normal operations, the collected surface water is expected to be free from contaminants at a level that could affect the receiving watercourse. A detailed H1 assessment of the surface water run-off has not been conducted based upon this position.

The consent to discharge trade effluent into the sewer in Park Road covers effluent from both permitted (combustion) and non-permitted (R&D) activities at the installation and includes emission limit values for a range of potential contaminants. The limits include a number of hazardous pollutants (cyanide, silver, chromium, copper, lead, zinc, nickel and mercury); however, these are not present within the materials used in the operation and maintenance of the plant. As a consequence, a detailed H1 assessment of the discharge has not been conducted as the identified contaminants are not relevant to the permitted operation.

6.3 Global Warming Potential

The release of greenhouse gas emissions is anticipated primarily from:

- Direct emissions produced or associated with energy use. This is mainly gas combustion at the installation, with a limited contribution from diesel; and
- Indirect emissions associated with power imported into the installation. As the facility generates its own electricity with a net export, this is applied as a negative value (with the CO_2 emitted from the generation process captured by the gas consumption emissions).

The anticipated emission of carbon dioxide resulting from the installation as a consequence of the consumption / generation of energy is presented in the table below.

Table 6.2: Primary Energy Consumption

	Primary Energy Consumption		
Energy Source	**MWh**	**CO_2 emission factor (tonnes/MWh)**	**Annual CO_2 emissions (tonnes)**
Electricity (Public Supply)	-2000	0.166	-797
Gas	93,602.3	0.19	17,784
Diesel	700	0.25	175
Total	-	-	**17,162**

6.4 Site Waste Assessment

Waste generated as a consequence of the operation and maintenance of the combustion plant is expected to be limited to maintenance waste from the boiler plant and generators (removed by the third-party contractor conducting the maintenance operations) and waste oil and other maintenance wastes generated by the CHP plant. The majority of the waste is removed at the point of generation, with only waste oil from the CHP plant accumulating to a maximum of $5m^3$ within a bunded tank. Due to the low volumes involved and the limited information available, a site waste assessment has not been completed.

7. CONCLUSIONS

The review of potential environmental impacts at the Ware R&D installation has identified a range of potential impacts from releases to air, noise generation and accidents at the installation. The site applies both physical and procedural measures to reduce the risks from these activities to a level considered to represent BAT for the installation.

APPENDIX 1

H1 ASSESSMENT TOOL

APPENDIX 2

AIR QUALITY ASSESSMENT REPORT