Knauf Insulation Limited

Application for a Normal Variation of the Permit for Knauf Insulation Queensferry.

Technical Supporting Information Report

December 2016

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& Infrastructure UK Limited

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Document revisions

No.	Details	Date
1	Draft Report 16423i1	November 2016
2	Final Report 16434i1	December 2016

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Non-Technical Summary

Introduction

Knauf Insulation Limited (Knauf) is making an application for a normal technical variation of Environmental Permit number EPR/BR9383ID, to operate a mineral fibre works installation under the Environmental Permitting (England and Wales) Regulations 2010 (EPR), as amended, at its site in Queensferry, Flintshire.

The site is proposing to increase the nominal width of the main production line from 1.8 m to 2.0 m, which will allow the manufacture of a new range of products which will be exported primarily to Germany, with occasional supply to other parts of Europe in smaller volumes. This will increase the throughput of the site to the design figures given in the original permit application.

The proposed activities will comply with the requirements of the EPR, including the obligation to demonstrate Best Available Techniques (BAT) that will be used to control the processes, to minimise emissions and the impact on the environment as a whole. This report has been produced to satisfy those requirements.

As noted in 'Regulatory Context' below, this document should be read in conjunction with the Natural Resources Wales application forms EPR A, C2, C3 and F1 which are provided along with this supporting report.

This application is being submitted as a technical variation to the permit No. EPR/BR9383ID.

Proposed Activities

Background

Knauf Insulation Queensferry produces high density mineral (rock) insulation slabs for use as thermal insulation material in the building industry. The process produces mineral wool (stone wool) product in a multi-stage process. The first stage involves melting raw materials, coke, basalt, dolomite, anorthosite and blast furnace and steel slag in a furnace and then processing the molten mineral into fibres. A binder is applied to the fibres prior to a forming process which gives a stone mineral wool mat of the appropriate thickness. The fibres are collected on a moving grate under suction to allow a thin fibre blanket to be formed. This thin blanket is then folded back on itself multiple times to achieve the required weight, density and thickness for the final product specification. The blanket it is heated in a curing oven which sets the binder and fibre mat to the required thickness and density. After curing, the product is cooled and then trimmed to the final dimensions. Various facings can be applied as required and the products are then packed ready for dispatch. Scrape material is recycled back in to the process.

Emissions to atmosphere may arise during each stage of the process. Emissions from the melting stage result from combustion products and particulates generated in the furnace. Waste gas flows from the furnace are passed through a bag house filter system and a thermal oxidiser prior to being emitted to atmosphere via a 41 m stack along with the downstream forming emissions.

Emissions from the downstream, curing and cooling stages, consists of particulates and volatile organic materials used in the binder. These gas streams are passed through appropriate multi stage abatement systems before being emitted to atmosphere. These are discharged to atmosphere via separate downstream stacks (13 m and 29 m respectively).

Knauf Insulation operate a cascade water reuse system to maximise the reuse and recycling of water in the various stages of the process and as make up for the binder with any effluent discharges being regulated by Welsh Water.

Proposed Changes

Due to market sector changes Knauf Insulation is proposing to increase the nominal width of the main production line from 1.8 m to 2.0 m to increase its products range ~~a product~~ for export to Europe. This will be achieved by modifying the blanket forming process, and subsequent processing steps to accommodate the wider product.

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Cooling Zone after Curing Oven

The curing oven will be refurbished with new seals to minimise leakage around the blanket. Following curing the new products need to be sanded on at least one side to remove the marks left by the oven slat perforations. As a result a “grinding” machine will be installed between the foil facing equipment and the bandsaw. This will require the cooling zone conveyor after the curing oven to be shortened. However, with careful design the cooled “suction box” length will be very close to that of the existing conveyor. A larger fan and revised extract configuration will be installed to offset the effect of the shortened conveyor.

Expansion of Filtration System

The dust from the grinder will be handled by the existing dust extraction system that treats air from the toothed saw and cross cut saw units. The capacity of the filtration system will be increased slightly to accommodate the additional demand for dust handling capability.

Whilst the quantity of dust handled will increase, it will still be relatively small and the use of a bag filter means that there will be no significant change to the way dust generated in the process is handled. The use of the dust skips is expected to increase, and the dust handling system will be improved with a longer screw conveyor feeding the skips.

The existing dust cold end dust extraction system currently recirculates the extract filtered air back in to the main process building, due to the increased throughput Knauf are proposing to open the damper and discharge the filtered air to atmosphere via a new release point Y

Emissions and Monitoring

Point Source Emissions to Air

The primary emissions to atmosphere arising from the process are the products of combustion / dust generation including volatile organic compounds, ammonia, formaldehyde, phenol, amines, nitrogen oxide and particulate matter.

The site plan shows that the main release points to air are Points A to D, F to H, M, P1 to P7, Q, R, T, V and X. The proposed activities will not result in a new release points to air point Y for the cold end dust extraction filter No.2. However, minor changes to emissions are expected on release Points G due to a new fan on the cooling zone. The overall changes are as follows:

- Point G (Main Line Cooling Zone Stack): the proposed installation of a grinding machine between the foil facing equipment and the bandsaw will require the cooling conveyor to be shortened, therefore a larger fan will be installed with the potential of increasing the cooling volumetric flow rate to achieve the same level of cooling in the shorter zone. This could result in higher emission volumes and stack release velocity. The overall emission concentrations of pollutants from Point G is not expected to change; and
- Point Y (Cold End Dust Extraction Filter No2 adjacent to release point H): Introducing a new grinder will increase the quantity of dust handled by the modified dust extraction system, the existing toothed saw and cross cut saw discharge to this dust filtration unit. However, the amount of dust is expected to be relatively small and the use of a new bag filter will ensure negligible releases to the environment, but due to the increased volume flow this extraction system will now discharge to atmosphere rather than recirculate the air back to the process building.

Release points will continue to be routinely tested, as described within the original permit and any approved variations, to ensure that they comply with the emission limit values (ELVs) within the existing Environment Permit.

The other permitted point source emissions to air arising from the installation have been described within the original permit application.

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Point Source Emissions to Surface Water and Sewer

Figure 2.2 shows that the main discharge points to surface water are via Points L3, L4, L5 and L6. The figure also shows that there is one discharge location to Sewer (S1) within site. There will be no additional release points to surface water and sewer as a result of the proposed changes from this variation and no changes to the amount or quality of the discharge to water as described within the original permit and any approved variations.

Fugitive Emissions to Air

There will be no change in fugitive emissions to air as a result of widening the production line. However, part of the proposed changes is to improve the sealing of the curing oven, improve extraction through the cooling zone and divert the treated air from the cold end extraction filter no2 to atmosphere, all of these changes may reduce the expected to reduce fugitive emissions from the main process building.

Odour

The will be no change in odour emissions as a result of the proposed activity to widen the production line, therefore refer to the original permit application (EPR/BR9383ID).

Noise

Due to the nature of the mineral wool manufacturing plant and the location of the site, there will be no increase in noise and vibration levels from this variation, therefore, refer to the original permit application (EPR/BR9383ID) permit and any approved variations.

Monitoring of Emissions to Air

Monitoring of the emissions to air will not change as a result of the implementation of the proposed widening of production line, therefore refer to the original permit application and any subsequent amendments approved by NWR for future details.

Managing the Activities

Management Systems

Knauf has been operating the existing process under a permit issued by NRW since July, 2004. The site operates a management system that complies and is certified to ISO14001 and this system will be extended to cover the proposed grinder as that is new plant to the site, no other changes are expected. There will be no other changes to the management system that have previously been approved by NRW under the original permit or subsequent variations.

Accident Management

The safe operation of Knauf is underpinned by a comprehensive emergency plan to cater for a range of potential emergencies, a detailed induction plan for each competent person and training requirements identified to give operators the necessary skills to work in safety.

The environmental accident risks associated with the proposed works are considered low and will be controlled by existing mitigation measures in place at the site.

The new grinder, cooling fan and filter will be installed in accordance with the existing permit requirements. The accidents that can give rise to environmental consequences will not change as a result of the proposed works, therefore refer to the original permit application (EPR/BR9383ID).

Energy Efficiency

Energy consumption of the installation is not expected to increase significantly as a result of the installation of production line widening. Energy consumption and efficiency measures have been described within the original permit application and the site operates under a separate EU Emissions Trading Scheme permit.

The proposed works do not add significant increase in energy requirement. The additional energy will be the electricity required by the new grinder and additional 2 fans for the cooling zone after the curing oven and extension of dust filtration system.

Raw Materials

Due to the nature of the process, only a limited number of raw materials are routinely used on site, mainly stone, slag and coke.

The introduction of the proposed changes to widen the production line will not introduce new raw materials to the installation. The quantity of raw materials is expected to increase as the manufacturing levels are expected to return to those previously experienced, and therefore described in the original permit. The management and use of raw materials has been described within the original permit application (EPR/BR9383ID).

Avoidance, Recovery and Disposal of Wastes

The majority of the wastes generated by the operations at the Queensferry site have been described in detail in the original permit application. The proposed changes to the curing oven and cooling zone will not make any difference to the quantity of wastes produced by the installation.

Introducing a new grinder will increase the quantity of dust handled. Dust quantity will vary depending on which product thickness / density combination is being sanded the minimum amount of product will be removed to achieve the required surface quality. Typical dust rate could be about 200 - 250kg/h, and could go as high as 400kg/h. Currently, the majority of the saw dust generated is recycled into the product. However, the quantity and smaller particle size of the dust from the grinder may prevent this. Therefore, if the dust cannot be recycled options for disposal of the additional dust are being explored with Knauf's waste management company.

The waste management system is described within the original permit and any approved variations.

Closure

Current activities are expected to continue on site for many years However, upon closure and if required by the closure plan, investigation to confirm soil and groundwater conditions would be undertaken.

Environmental Impact Assessment

As the proposed process changes will emit a number of pollutants that can have an impact on local receptors a number of detailed risk assessments have been carried out including:

- Detailed dispersion modelling of air emissions, and
- Impact Assessment using the Agency's risk assessment methodology for emissions to air.

A number of the assessments have shown that the impact of the emissions from the plant, mainly emissions to air from the emission points G and Y, cannot be classed as insignificant, although no environmental assessment levels, (Air Quality Objectives) are breached. When there is a breach it is due to the existing background pollutant concentrations. The impact risk assessment concludes that the releases from the proposed changes at Knauf Insulation, Queensferry and the new emission point Y will not pose an unacceptable risk to human health or the environment

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1. Introduction

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The site is proposing to increase the nominal width of the main production line from 1.8 m to 2.0 m, which will allow the manufacture of a new range of products that will be exported primarily to Germany, with occasional supply to other parts of Europe.

The proposed activities will comply with the requirements of the EPR, including the obligation to demonstrate Best Available Techniques (BAT) will be used to control the processes to minimise emissions and the impact on the environment as a whole. This report has been produced to satisfy those requirements.

As noted in 'Regulatory Context' below, this document should be read in conjunction with the Natural Resources Wales (NRW) application forms EPR A, C2, C3 and F1 which are provided along with this supporting report.

This application is being submitted as a normal technical variation to the permit No. EPR/BR9383ID.

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2. About the Application

2.1 The Site and Operator

This document supports the application to vary the bespoke permit (permit No. EPR/BR9383ID) for the mineral fibre works installation, operated by Knauf, and located in Queensferry, Flintshire.

The site address is:

Queensferry Mineral Fibre Works
Chemistry Lane
Queensferry
Deeside, Flintshire
CH5 2DA

The installation manufactures mineral wool (stone wool) from molten stone produced by melting blast furnace slag and natural stone together in a blast furnace with a main flue gas treatment system and stack and an emergency bypass stack. The stone, slag and coke are weighed out and fed into the furnace by overhead conveyors. The raw materials are then blended to correct specification and fed into the cupola. Heat for melting the stone is produced by burning coke in the hot blast furnace with oxygen enriched air, if required. Prior to melting, the carboniferous rocks are thermally calcinated and subsequent reactions between the resultant oxides and the basalt rock produce the required melt.

Molten stone flows from the cupola by means of water cooled troughs onto the forming spinner. This spinner has wheels which rotate at high speed. Stone melt is spun into stone wool fibre which is then projected by high pressure air towards a collection chamber where binder is applied. The furnace waste gases are filtered to remove dust, then passed through an oxidiser burner to the stack.

The fibre is then collected on a moving grate which is under suction to allow the fibre to be laid down under controlled conditions into a thin blanket. The blanket is folded back upon itself multiple times on the forming belt to give the required weight, density and thickness per square metre. Waste gases from this process are removed and passed through a wet scrubber to a stack.

The blanket passes into a heated oven for curing, allowing the stone wool to establish the required physical properties. After this, the product passes over a cooling zone that draws ambient air through the product to cool the stone wool. Oven waste gases are burnt in an oxidiser tube. The product is then trimmed to required size and passed into a packaging area where it is packaged and stored awaiting dispatch. Scrap product is recycled back in to the process using an integrated fibre recovery and recycling plant. Waste water is recycled in the binder application and is filtered to remove stone wool prior to reuse.

2.2 Site Description

The Queensferry installation is located on Chemistry Lane close to Deeside, North Wales. The Knauf Insulation site, reference NGR: SJ 323679, is in the Flintshire County Council area. A location map is shown in Figure 2.1. The site is located in an industrial area with the North Wales Coast Railway Line running adjacent to the northern boundary.

The nearest residents are situated on Church View, approximately 100 metres south of the site boundary and 220 metres south of the main stack. The nearest European designated ecological site is the River Dee and Bala Lake Special Area of Conservation (SAC) located about 525 m to the north of site.

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Figure 2.1 Site location map (site and installation boundary in green)

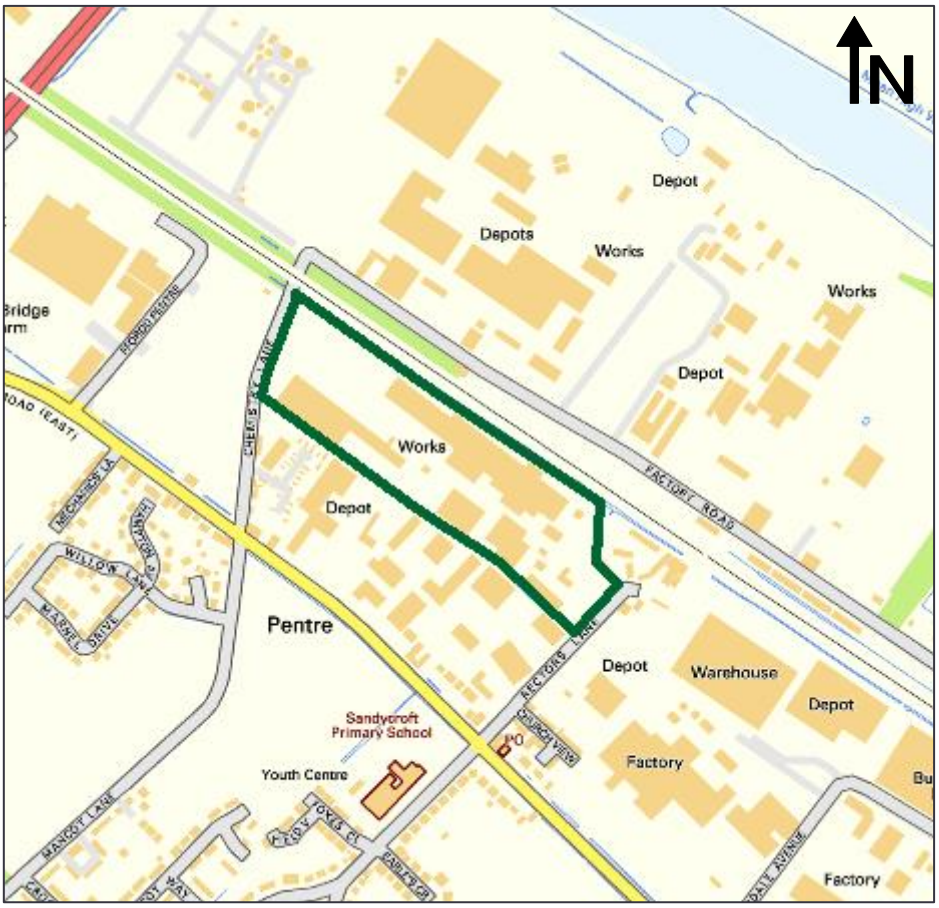

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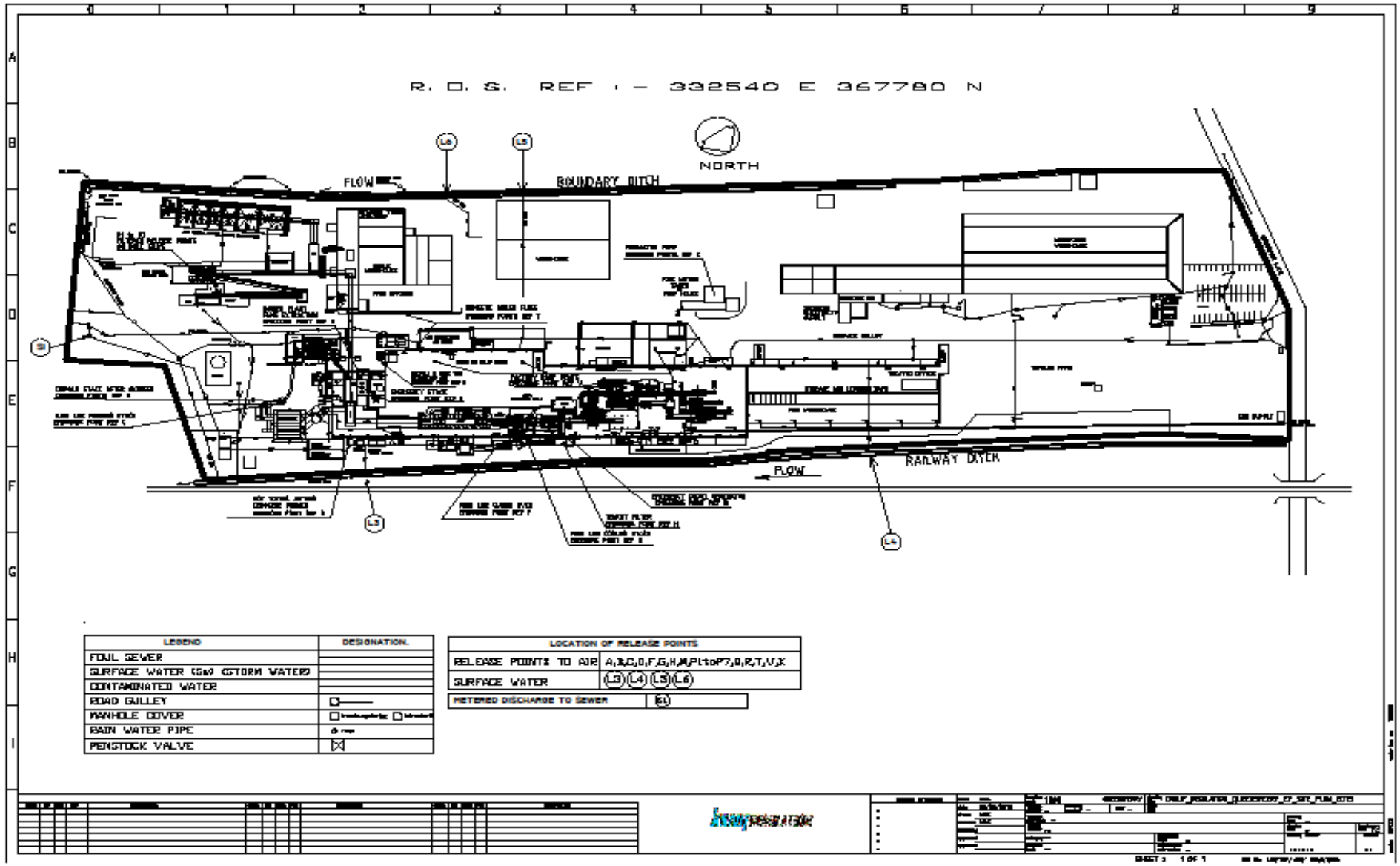
Figure 2.2 Site plan showing process units and release points to air, surface water and sewer (Appendix B1)



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2.3 Reason for the Application

The operator is proposing a modification to its process at the site and wishes to formally notify NRW of this change in operation through this application for a normal technical variation.

This application is being submitted as a technical variation to the permit No. EPR/BR9383ID.

2.4 Permitted Activities at the Installation

The permit details for the current installation are given in Table 2.1 below.

Table 2.1 Knauf – Currently Permitted Installation Activities

Installation Reference Number	Installation Schedule 1 Reference	Description of the Activity
BR9383ID	Section 3.4 Part A(1), Paragraph (a)	Melting mineral substances in plant with a melting capacity of more than 20 tonnes per day R5: Recycling/reclamation of other inorganic materials R13: Storage of wastes pending any of the operations R1 to R12 (excluding temporary storage, pending collection, on the site where it is produced.

2.5 Application Guidance

The permit variation application has been prepared using the Natural Resources Wales's environmental permitting guidance, in particular the following documents have been referred to during preparation of the application:

- Environmental Permitting application forms (Part A, C2, C3 and F1);
- Environmental Permitting (England and Wales) Regulations SI 2010 No.675 as amended;
- Best available techniques (BAT) conclusions under Directive 2010/75/EU of the European Parliament and of the Council on industrial emissions for the manufacture of glass; and
- NRW guidance on environmental permitting (via website).

2.6 Report Structure

This application has been structured, as far as possible, to follow the relevant EPR guidance and the current environmental permit and should be read in conjunction with the permit variation application forms which are provided along with this supporting technical report.

Table 2.2 outlines the structure of this variation application report.

Table 2.2 Application Report Structure

Section Ref.	Title	Brief Description
2.0	About the Application	This section describes the need for a variation to the Environmental Permit and how the Regulations apply.
3.0	Proposed Activities	A description of the proposed operational changes demonstrating how BAT has been employed.
4.0	Emissions & Monitoring	Details of the point source and fugitive emissions associated with this permit variation and the process and environmental monitoring to be carried out.
5.0	Managing the Activities	This section provides a description of the environmental management system arrangements at the site and a discussion of the environmental accident risks and mitigation in place.
6.0	Environmental Impact Assessment	This section discusses the environmental impact from the Installation.
7.0	Forward Actions	This section lists forward actions that have identified as pat the site's continuous improvement plan.
Appendix A	Glossary	Provides details of terminology used, in particular abbreviations.
Appendix B	Application Forms	Completed copies of Application Forms Part A, C2, C3 and F1
Appendix C	EP Opra Profile Spreadsheet	Revised EP Opra Spreadsheet
Appendix D	Air Dispersion Modelling Report	Air Dispersion Modelling Report
Appendix E	Risk Assessment Database	Risk Assessment Database
Appendix F	Drawings and Certificates	Drawings and Certificates

2.7 Best Available Techniques (BAT)

The over-riding principle under the EPR and EP regime is the use of BAT to prevent and, where it is not practicable, generally to reduce emissions and the impact on the environment as a whole.

The term 'Best Available Techniques' is defined (using the definition in Article 2 of the IEPR Directive) as follows:

- **Best** means most effective in achieving a high general level of protection of the environment as a whole but not at a disproportionate cost;
- **Available** means those techniques that are developed on a scale which allows implementation in the relevant industrial sector, under economically and technically viable conditions, taking into consideration the costs and advantages, as long as they are reasonably accessible to the operator; and
- **Techniques** include both the technology used and the way in which the installation is designed, built, maintained, operated and decommissioned.

Most of the UK Technical Guidance on what is BAT is based on the "BAT Reference documents" (BREFs) produced by the European Commission. UK Technical Guidance Notes are designed to complement BREFs,

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and take into account information contained in relevant BREFs in setting out indicative BAT standards and expectations for England and Wales, Scotland and Northern Ireland. The sector guidance is primarily focused at a national level, rather than at a European level.

Most of the UK Technical Guidance on what is BAT is based on the “BAT Reference documents”

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3. About the Proposed Changes

3.1 Description of Proposed Changes

The raw materials and hot end parts of the process comprising binder preparation, melting and forming, will be unchanged and the environmental systems for these processes will therefore be unaffected.

Changes will be made from the forming conveyor below the fibre blanket pendulum through to the packaging to accommodate the change in line width. Many of the existing conveyors and equipment are already wide enough and the changes have been minimised to the critical areas for the new product widths.

The existing curing oven carcass will be retained, but the slats within it will be changed for new ones with a wider perforated area. The oven will incorporate adjustable side seals to allow continued efficient manufacture of the majority of the existing products which are based on the existing line width. New seals at the oven inlet and outlet will improve the sealing around the fibre slab and allow the increase widths to be manufactured.

The proposed changes are shown in figure 3.1 and additional drawing in appendix

Cooling Zone after Curing Oven

Some of the new products need to be sanded on at least one side to remove the marks left by the oven slat perforations, due to the customer specifications. As a result a “grinding” machine will be installed between the foil facing equipment and the bandsaw. This will require the cooling zone conveyor after the curing oven to be shortened. However, with careful design the cooled “suction box” length will be very close to that of the existing conveyor. A larger fan will be installed to offset the effect of the shortened conveyor. The typical volume of extracted air may increase from approximately 15,000 m^3/h to 30,000 m^3/h. Like the curing oven, the cooling zone will have adjustable side seals and the extract point within the cooling zone will change from side to bottom extracting improving the cooling air flow pattern.

The new larger cooling zone fan speed will be adjusted automatically to a pre-set speed based on the curing oven speed. It has been determined by the operators that the fan needs to run faster when the line speed is slower (i.e. when making higher density or thicker products) to ensure adequate cooling of the product. The control logic set points have been determined to ensure that the temperature of the air below the mat at the exit of the cooling zone is less than 40°C which is known to give the required slab temperature throughout the slab ensuring there are no residual hotspots. The operators have the ability to manually control cooling if they detect that the cooling is insufficient. In addition there is an alarm if the temperature of the air below the slab exceeds 40°C. The repositioning of the cooling zone extract point/duct will give a more even extraction across the slab promoting even cooling.

Automatic feedback control from the temperature probe at the end of the cooling zone has been tried but the product can take a few minutes to pass over the cooling zone, meaning that a lot of product would be left uncooled before the system stabilises.

Expansion of Filtration System

The dust from the grinder will be handled by the existing cold end dust extraction system No.2 that treats air from the toothed saw and cross cut saw units. The capacity of the filtration system will be increased slightly to accommodate the additional demand for dust handling capability.

Specification of existing reverse jet filter to be extended:

- 34 banks of 12 filter bags to give a nominal 500 m^2;
- 408 Filter bags, 3360mm long x 121mm diameter; and
- 2 of GR710 fans, 45kW, 2960rpm.

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Filter Extension:

- 8 banks of 12 bags, hence 96 extra bags;
- This will be well maintained to enable achieving emissions with less than 10 mg/m^3 concentration of particulate matter;
- 1 of GR710 fan, 45kW, 2960rpm; and
- Final design and running speeds will be optimized in operation.

Whilst the quantity of dust handled will increase, it will still be relatively small and the use of a bag filter means that there will be no significant change to the way dust generated in the process is handled. The use of the dust skips is expected to increase, and the dust handling system will be improved with a longer screw conveyor feeding the skips.

The cold end dust extraction system No.2 currently recirculated the filtered air back in to the main factory production building, due to the potential increased volume flowrate it is proposed to open the recirculation damper and allow the filtered air to be discharged to atmosphere, this will be a new emission point Y.

New Stretch Hooding Machine

The end of line packaging equipment will be modified to incorporate a new, larger stretch hooding machine suitable for the new products. The line will therefore be extended into the back stock shed and additional buffer capacity for pallets included on the conveyors at the end of line to make transfer to stock more efficient. This change will not have any impact on the permit as described in the original application or any approved variations.

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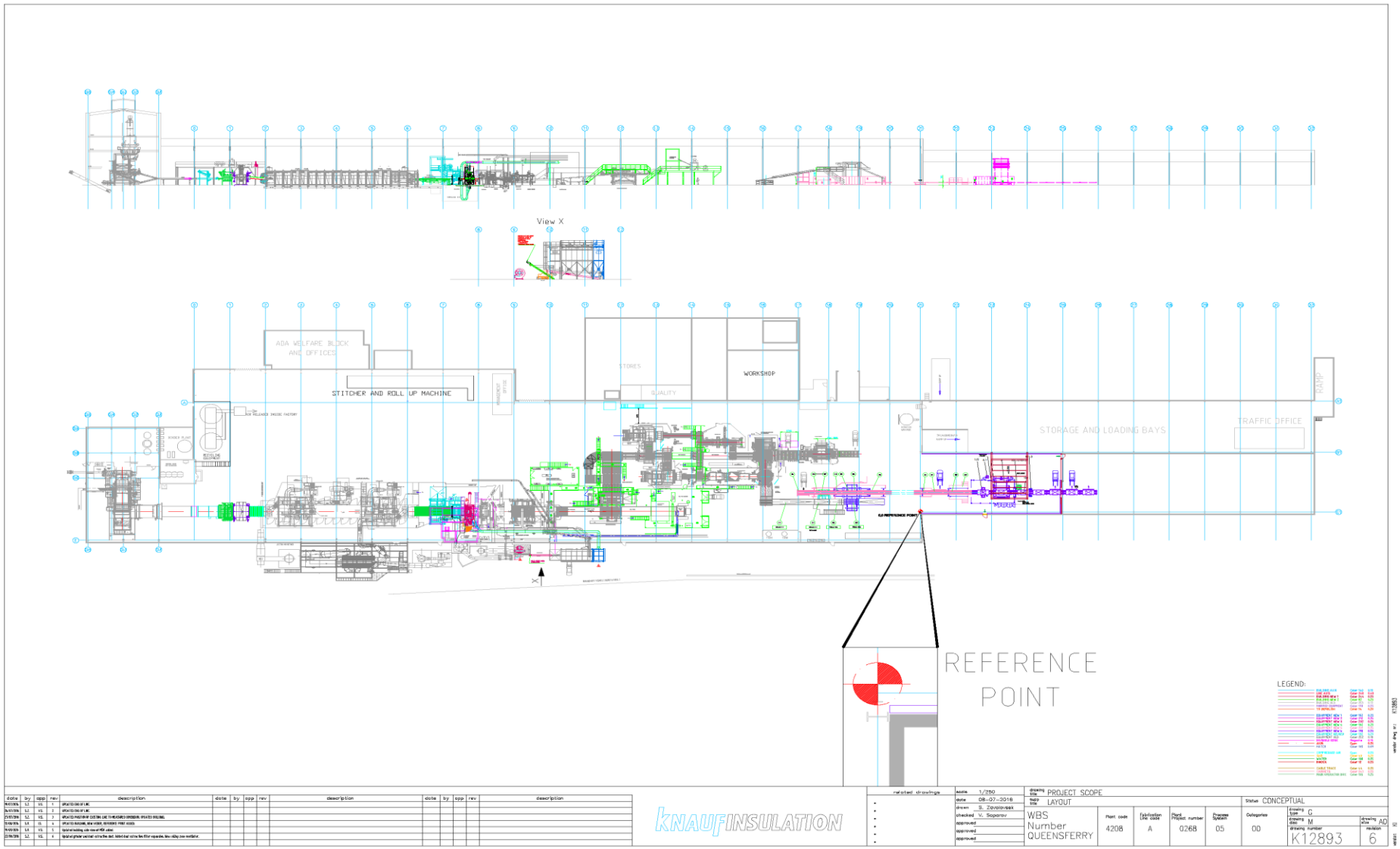
Figure 3.1 Proposed Changes



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4. Emissions and Monitoring

4.1 Emissions to Air, Water and Land

Point Source Emissions to Air

The primary emissions to atmosphere arising from the process are the products of combustion / dust generation including volatile organic compounds, ammonia, formaldehyde, phenol, amines, nitrogen oxide and particulate matter.

The site plan in Figure 2.2 shows that the main release points to air are Points A to D, F to H, M, P1 to P7, Q, R, T, V and X. The proposed activities will result in a single new release points to air Y from the cold end dust extraction system No.2.

However, minor changes to emissions are expected on release Points G due to a new fan on the cooling zone. The overall changes are as follows:

- Point G (Main Line Cooling Zone Stack): the proposed installation of a grinding machine between the foil facing equipment and the bandsaw will require the cooling conveyor to be shortened, therefore a larger fan will be installed with the potential of increasing the cooling volumetric flow rate to achieve the same level of cooling in the shorter zone. This could result in higher emission volumes and stack release velocity. The overall emission concentrations of pollutants from Point G is not expected to change; and
- Point Y (Cold End Dust Extraction Filter No2 adjacent to release point H): Introducing a new grinder will increase the quantity of dust handled by the modified dust extraction system. However, the amount of dust is expected to be relatively small and the use of a new bag filter will ensure negligible releases to the environment, but due to the increased volume flow this extraction system will now discharge to atmosphere rather than recirculate the air back to the process building.

Release points will continue to be routinely tested, in accordance with the existing Environmental Permit, to ensure that they comply with the emission limit values (ELVs) within the existing Environment Permit, where appropriate. The results of any monitoring will be reported to NRW as is currently required within the Environmental Permit.

The other permitted point source emissions to air at the installation have been described within the original permit application.

The details of the new release point are shown in table 4.1 and 4.2.

Table 4.1 New Point Source Emissions to Air

Emission point number	Location	Nature of emissions	Further consideration?
Y	Adjacent to cold end extraction filter No.2	Particulate matter	✓

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Table 4.2 Point Source Emissions to Air Considered Further

Release Point	Type	Location	Effective height m	Efflux velocity m/s	Total Flow	Temp ºC
					Nm3/hr (at reference conditions	
Y	Point Source	332611, 367798	13	16.95	61,000	25-30

Note there is no correction for oxygen content or moisture

Benchmark Emissions to Air

Based on the extraction of the grinder process air the exhaust from the cold end dust extraction unit No.2 will emit particulate matter only. Table 4.3 below gives the assumed emission limit values for the proposed emission point Y based on the dust limit values given in the BAT conclusions document for the Glass sector.

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Table 4.3 Benchmarks for Releases to Air for the Proposed Spark Ignition Engines

Pollutant	Release Point	Proposed Benchmark mg Nm^{-3}
Particulate Matter (total)	Y	50
Particulate Matter (PM_{10})	Y	50
Particulate Matter ($PM_{2.5}$)	Y	50
Note: All emission concentrations are quoted at reference conditions of 273 K, 101.3 kPa, with no correction for oxygen content and dry gas.		

Table 4.4 gives the expected inventory of releases to air for emission point Y.

Table 4.4 Inventory of Releases to Air (based on Emission Limit Values)

Release Point number	Substance	Emissions			Continuous (C), or intermittent (I) (%)	Calculated (C), measured (M), or estimated (E)	Comments: Current release, variability, EQS / benchmark
		Nm^3/hr	mg/m^3	tonnes/year			
Y	Particulate Matter	61,000	50	26	C	C	The values given here are for grinder operating at the emission limit values continuously as a maximum operation although the grinder is likely to only operate for part of the operating cycle.

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For the environmental impact risk assessment it has been assumed that the grinder will operate continuously, however it will only operate when required which will result in lower emission and hence impacts from emission point Y.

Best Available Technique (BAT) for point source emissions to air

The Table 4.5 reviews current and proposed operations against BAT requirements for the emissions to air from the mineral wool manufacturing process, as the proposed changes only are on the curing, cooling and forming sections the impact on the BAT table is limited.

Table 4.5 Indicative BAT Requirement for Point Source Emissions to Air

Indicative BAT	Comment
Dust emissions from the waste gases of the melting furnace must be reduced by applying an electrostatic precipitator or a bag filter system.	Bag filter system is implemented. Electrostatic precipitators do not apply to cupola furnaces for mineral wool production, due to the explosion risk from the ignition of CO produced within the furnace.
Implementation of waste gas incinerator system to reduce H_2S emissions from the melting furnace by oxidising H_2S to SO_2, and CO to CO_2.This technique is generally applicable to stone wool cupola furnaces.	Waste gas incinerator system is currently in place on the melting furnace.
The main chemical constituents for all emissions should be identified.	Precise composition of chemicals emitted to air is given in Table S3.1 of the original permit. These typically contain particulate matter, NO_2, SO_2, CO, H_2S, fluorides, Volatile Organic Compounds, ammonia, formaldehyde, phenol and amines. Monitoring of the emissions from release points is included in the existing monitoring programme.
Significant release points should be assessed for dispersion and environmental impact	See Environmental Risk assessment in the original application and the summary in this report for the emissions that will vary due to this proposed change, A copy of the risk assessment database is included on the CD version of the variation
Visible plumes and condensing plumes should be minimised	The formation of plumes will not change as a result of this variation, see the original application for details.

Point Source Emissions to Surface Water and Sewer

Figure 2.2 shows that the main discharge points to surface water are via Points L3, L4, L5 and L6. The figure also shows that there is one discharge location to Sewer (S1) within site. There will be no additional release points to surface water and sewer as a result of the proposed changes from this variation. The quantity and quality of the discharge will not change as a result of the variation, refer to the original permit and any approved variations for details.

Fugitive Emissions to Air

There will be no change in fugitive emissions to air as a result of widening the production line. However, part of the proposed changes is to improve the sealing of the curing oven, improve extraction through the cooling zone and divert the treated air from the cold end extraction filter No2 to atmosphere, all of these changes may reduce the expected to reduce fugitive emissions from the main process building.

Odour

The will be no change in odour emissions as a result of the proposed activity to widen the production line, therefore refer to the original permit application (EPR/BR9383ID) and any approved variations.

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Noise

Due to the nature of the mineral wool manufacturing plant and the location of the site, there will be no significant increase in noise and vibration levels from this variation, therefore, refer to the original permit application (EPR/BR9383ID) and any approved variations.

4.2 Monitoring of Emissions to Air

Monitoring of the emissions to air will not change as a result of the implementation of the proposed widening of production line, therefore refer to the original permit application and any subsequent amendments approved by NWR for details on the emissions monitoring methodologies.

5. Managing the Activities

5.1 Management Systems

Knauf has been operating the existing process under an Environmental Permit issued by NRW since July, 2004. The site operates a comprehensive management system that complies and is certified to ISO14001 and this system will be extended to cover the proposed grinder as that is the only new plant on site, the other items are modifications of existing equipment that is already covered by the management system. A copy of the ISO14001 certificate is provided in Appendix C. There will be no other changes to the management system that have previously been approved by NRW under the original permit or subsequent variations.

5.2 Accident Management

The safe operation of Knauf is underpinned by a comprehensive emergency plan to cater for a range of potential emergencies, a detailed induction plan for each competent person and training requirements identified to give operators the necessary skills to work in safety.

The environmental accident risks associated with the proposed changes to the installation described within this variation are considered low and will be controlled by existing mitigation measures in place at the site.

The new grinder, cooling fan and filter will be installed in accordance with the existing permit requirements. The accidents that can give rise to environmental consequences will not change as a result of the proposed works, therefore refer to the original permit application (EPR/BR9383ID) and any approved variations.

5.3 Energy Efficiency

Energy consumption of the installation is not expected to increase significantly as a result of the installation of production line widening. Energy consumption and efficiency measures have been described within the original permit application.

The proposed works do not add significant increase in energy requirement. The additional energy will be the electricity required by the new grinder and additional 2 fans for the cooling zone after the curing oven and extension of dust filtration system.

5.4 Raw Materials

Due to the nature of the process, only a limited number of raw materials are routinely used on site, mainly stone, slag and coke.

The introduction of the proposed changes to widen the production line will not introduce new raw materials to the installation. The quantity of raw materials is expected to increase as the manufacturing levels are expected to return to those previously experienced, and therefore described in the original permit. The management and use of raw materials has been described within the original permit application (EPR/BR9383ID).

5.5 Avoidance, Recovery and Disposal of Wastes

The majority of the wastes generated by the operations at the Queensferry site have been described in detail in the original permit application. The proposed changes to the curing oven and cooling zone will not make any difference to the quantity of wastes produced by the installation.

Introducing a new grinder will increase the quantity of dust handled. Dust quantity will vary depending on which product thickness / density combination is being sanded the minimum amount of product will be removed to achieve the required surface quality. Typical dust rate could be about 200 - 250kg/h, and could

go as high as 400kg/h. Currently, the majority of the saw dust generated is recycled into the product. However, the quantity and smaller particle size of the dust from the grinder may prevent this. Therefore, if the dust cannot be recycled options for disposal of the additional dust are being explored with Knauf's waste management company.

The waste management system is described within the original permit and any approved variations

5.6 Closure

There are no plans that the installation will close, this variation will enable the site to produce a wider range of products and increase the throughput to the levels described in the original application. However, upon closure and if required by the closure plan, investigation to confirm soil and groundwater conditions would be undertaken.

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6. Environmental Impact Assessment

6.1 Impact Assessment

The following section seeks to describe and assess the environmental impact resulting from the proposed changes at the Knauf Mineral Wool manufacturing in plant in Queensferry, and to identify the nearby receiving environments and sensitive receptors which may be affected by discharges from the activities undertaken at the site.

The impacts of the releases from the proposed activities at the site are discussed in this section, and present the outputs of the following assessments:

- Air Quality Impact Assessment (dispersion modelling); and
- Risk assessments for your environmental permit (previously H1).

Location and Setting

The local environment, receptors and pathways which may be affected by the releases from the proposed activities have been described in detail in the original application and the dispersion modelling report given in Appendix C to this report.

It is understood that there are no new ecological designations in the vicinity of the site.

6.2 Emissions Summary

The majority of the existing and future impacts are associated with emissions to air under this variation and the basis of the assessment of these is set out in this section:

- Calculation of process contributions (PC);
- Estimation of predicted environmental concentrations (PEC); and
- Conclusions of impact assessment for emissions to air.

Emissions to sewer are not expected to change as a result of this variation, and will be within the levels described in the original permit application. Therefore, these have not been assessed further.

Emissions to Air

Emissions to air from this variation and the sources are described in Section 4.1 above and the Air Dispersion Modelling report in Appendix C.

Dispersion modelling has been undertaken for the process emissions from Stack G (Main Line Cooling Zone Stack) and Stack Y (Cold End Dust Extraction Filter No.2) at the Queensferry installation. Two scenarios have been modelled in order to compare the difference in air quality effects as a result of the variation:

- Scenario 1: emissions from Stack G as currently operating, Cold End Dust Extraction Filter No.2 on full recirculation, i.e. no emission to air; and
- Scenario 1: emissions from Stacks G and Y following the proposed changes.

Emission rates for Stack G have been derived from monitoring data from the periodic monitoring undertaken in October 2015 (see Appendix B of the dispersion modelling report). The maximum monitoring result for each pollutant was taken forward for use in this assessment to ensure worst case conditions have been specified. Emission rates for Stack Y were derived from the Best Available Technique (BAT) conclusions report relating to particulate matter emissions from the mineral wool sector for cooling, curing and forming process.

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Details of stack parameters modelled are given in Table 6.1 and Table 6.2 below and illustrated in Figure 6.1.

Table 6.1 Modelled stack parameters – Scenario 1

Input	Value		Units
	Emission Point G	Emission Point Y	
Exhaust conditions			
Temperature	27	27	°C
Stack diameter	1.00	1.1	m
Stack height	13	N/A	m (above ground level)
Velocity	5.24	N/A	m/s
Volume flowrate	4.12	13.89	m^3/h
Emission Concentrations			
Ammonia	22	-	mg/Nm^3
VOC	0.85	-	mg/Nm^3
Formaldehyde	4.6	-	mg/Nm^3
PM_{10}	17	50	mg/Nm^3
$PM_{2.5}$	17	50	mg/Nm^3
Amines	<0.17	-	mg/Nm^3
Phenol	<0.73	-	mg/Nm^3
Mass emission rate			
Ammonia	0.091	-	g/s
VOC	0.004	-	g/s
Formaldehyde	0.019	-	g/s
PM_{10}	0.070	N/A	g/s
$PM_{2.5}$	0.070	N/A	g/s
Amines	<0.001	-	g/s
Phenol	<0.003	-	g/s

N/A – not applicable, unit on full recirculation

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Table 6.2 Modelled stack parameters – Scenario 2

Input	Value		Units
	Emission Point G	Emission Point Y	
Exhaust conditions			
Temperature	27	27	°C
Stack diameter	1.00	1.1	m
Stack height	13	13	m (above ground level)
Velocity	10.61	17.83	m/s
Volume flowrate	8.33	16.95	m^3/h
Emission Concentrations			
Ammonia	22	-	mg/Nm^3
VOC	0.85	-	mg/Nm^3
Formaldehyde	4.6	-	mg/Nm^3
PM_{10}	17	50	mg/Nm^3
$PM_{2.5}$	17	50	mg/Nm^3
Amines	<0.17	-	mg/Nm^3
Phenol	<0.73	-	mg/Nm^3
Mass emission rate			
Ammonia	0.18	-	g/s
VOC	0.007	-	g/s
Formaldehyde	0.038	-	g/s
PM_{10}	0.14	0.85	g/s
$PM_{2.5}$	0.14	0.85	g/s
Amines	<0.0014	-	g/s
Phenol	<0.006	-	g/s

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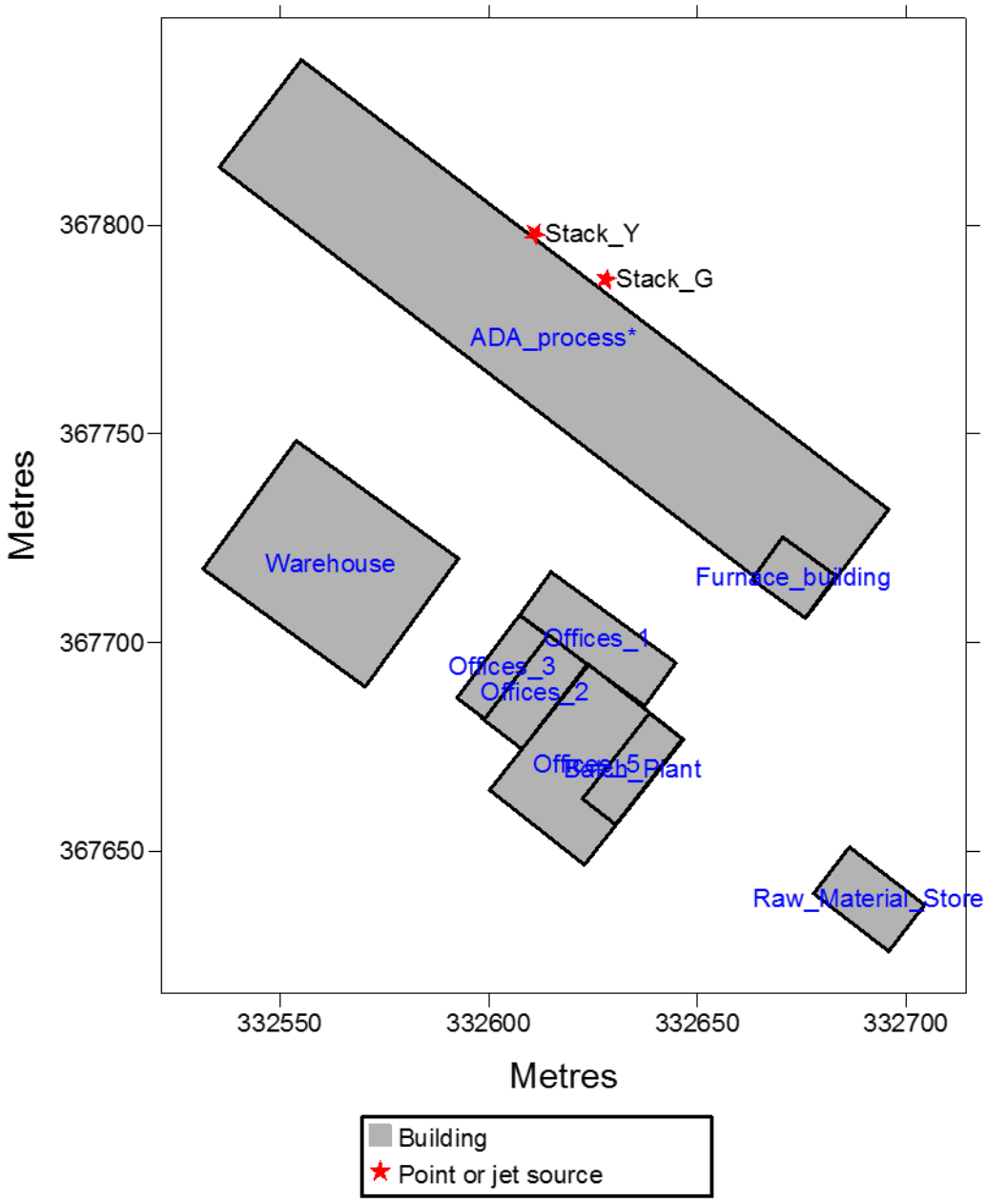
Figure 6.1 Building and emission source visualisation



Environmental Assessment Levels (EALs)

The Natural Resources Wales's Risk Assessment for a specific activity (previously Horizontal Guidance Note H1) provides methods for quantifying the environmental impacts of emissions to all media. Air emission risk assessment for environmental permit 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.

Air emission risk assessment for environmental permit provides a three-tiered approach to assessing the significance of emissions to atmosphere. The first stage is to 'screen out' insignificant emissions to air; these are emissions which are emitted in such small quantities that they are unlikely to cause a significant impact on the receiving environment. This procedure is detailed in Box 1.

Box 1	Screening out Insignificant Emissions to Air

Identify which emissions can be excluded from further assessment by applying the criteria below:

- **Long-term Process Contribution (PC) < 1% of the relevant long-term EAL; and**
- **Short-term PC < 10% of the relevant short-term EAL.**

Those releases which **satisfy the above criteria** can be classed as **insignificant** and excluded from further assessment. Those releases which **do not satisfy the above criteria** can be classed as **not insignificant** and warrant further assessment.

The second stage is to assess the need for detailed dispersion modelling of emissions to air (Box 2). If the second stage indicates that further investigation is warranted, a detailed assessment of emissions to air should be undertaken using an appropriate dispersion model, such as ADMS or AERMOD (the third stage assessment).

Box 2	Identifying the Need for Detailed Modelling of Emissions to Air

For those releases which cannot be screened by the criteria detailed in Box 1, the following approach should be used in identifying whether detailed modelling of emissions to air is required.

Long Term Impacts

1. Obtain information on the annual mean background concentrations (BG) of releases to air
2. Calculate the Predicted Environmental Concentration (PEC) of that substance by summing the PC and BG, i.e., **PEC = PC + BG**
3. Detailed dispersion modelling **is required** if **PEC > 70% of the EAL**

Short Term Impacts

1. Calculate the difference between the long-term background concentration and short-term EAL (model headroom)
2. Detailed dispersion modelling **is required** if the **short-term PC > 20% of model headroom**

These significance criteria are used in the Air emission risk assessment for environmental permit for the determination of whether detailed dispersion modelling is required. Where one or both of the above criteria (Box 2) are predicted to be achieved and where the EALs are not breached for a pollutant when the existing background is included, the release is not considered likely to have a significant negative effect on local air quality.

6.3 Impact Assessment

Air Quality Impact Assessment

An air quality impact assessment has been undertaken of emissions to air from the proposed activities that are covered within this variation application. The full air quality report is provided in Appendix C of this application.

The impact assessment shows that predicted concentrations exceedances of any AQS, EAL, critical level or critical load are unlikely and the additional contribution from the proposed plant is not considered to be significant.

Impact Assessment – Air emission risk assessment Methodology (previously H1 Methodology)

The Air emission risk assessment for environmental permit submitted as part of this variation application assesses the impact of emissions arising from the stack G and Y only, as these are the stacks that the emissions will vary from that given in the original permit and any approved variations. The results of the impact assessment for the before and after changes are shown in Tables 6.3 and 6.4 below. The results are for the receptor experiencing the higher predicted ground level concentration.

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Table 6.3 Air impact modelling results (Existing)

Substance	Long term					Short Term			
	EAL	Air background concentration	PC	PEC	% PEC of EAL	EAL	PC	PEC	% PEC of EAL
		µg/m^3	µg/m^3	µg/m^3			µg/m^3	µg/m^3	
Particulate matter (PM10)	40	14.9	0.5	15.97	39.9	50	1.54	32.0	64.0
Particulate matter (PM2.5)	25	11.0	0.5	14.49	48.3	-	-	-	-
Ammonia (NH_3) (Human)	180	2.35	0.65	3.00	1.7	2500	9.56	14.26	0.6
Ammonia (NH_3) (Ecology)	3	2.35	0.11	2.46	81.9	-	-	-	-
Volatile Organic Compounds as Benzene	5	0.35	0.03	0.38	7.5	195	0.37	1.07	0.5
Formaldehyde	5	-	0.14	0.14	2.7	100	2.00	2.00	2.0
Phenol	200	-	0.02	0.02	<0.1	3900	0.32	0.32	<0.1
Amines	-	-	<0.01	-	-	-	0.07	-	-

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Table 6.4 Air impact modelling results (Proposed)

Substance	Long term					Short Term			
	EAL	Air background concentration	PC	PEC	% PEC of EAL	EAL	PC	PEC	% PEC of EAL
		µg/m^3	µg/m^3	µg/m^3			µg/m^3	µg/m^3	
Particulate matter (PM10)	40	14.9	4.34	19.2	48.0	50	13.68	43.4	86.8
Particulate matter (PM2.5)	25	11.0	4.34	15.3	61.2	-	-	-	-
Ammonia (NH_3) (Human)	180	2.35	1.1	3.45	2.0	2500	12.62	17.3	0.7
Ammonia (NH_3) (Ecology)	3	2.35	0.18	2.53	84.4	-	-	-	-
Volatile Organic Compounds as Benzene	5	0.35	0.04	0.39	7.8	195	0.49	1.19	0.6
Formaldehyde	5	-	0.23	0.23	4.6	100	2.64	2.64	2.6
Phenol	200	-	0.04	0.04	<0.1	3900	0.42	0.42	<0.1
Amines	-	-	<0.01	-	-	-	0.10	-	-

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The results of the impact assessment for the proposed changes in the emissions from Stack G and H show that none of the pollutants considered cause a breach of any of the EAL/AQS/AQO values at any of the receptors identified. The highest impact is the ammonia on the ecological receptor the River Dee, where the majority of the impact is from the existing background rather than the contribution from the plant emissions.

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7. Forward Actions

The following forward actions have been identified relating to the Environmental Permit and associated issues, as part of Knauf's continuous improvement procedure, are identified in Table 7.1**.**

Table 7.1 Proposed forward action plan

No	Forward action	Timescale
1	Once the proposed changes have been implemented, at the next annual emissions monitoring review the impact of the changes on the pollutant emission concentration of the stacks G and, Y and F, Report the emissions to NRW and if significantly different to those described within the variation update the risk assessment	6 months after the annual monitoring of the changed process
2	Where continuing exceedances of the existing Environmental Permit emission limit values are identified during routine monitoring undertake the following items; • Detailed impact assessment to identify any breaches of air quality object values, environmental assessment levels using dispersion modelling; and • Review the raw material formulations and binders with the aim to reduce emissions of key pollutants. Submit the findings of the investigations in a report to NRW including a plan for implementation of any improvements identified.	9 months after the emission test results showing an issue
3	Undertake detailed assessment to reduce the concentration of emitted HCl if the annual emission tests show a level above the ELV in the permit, Submit the findings of the investigations in a report to NRW including a plan for implementation of any improvements identified.	12 months after the next annual emission test
4	Review the configuration of the discharge extracts to air from the forming, curing and cooling zones, to allow them to be combined, therefore, complying with the approach given within the BAT conclusions document.	12 months after issue of the variation

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Appendix A
Glossary and References

Term	Explanation
BAT	Best Available Techniques
BREFs	BAT Reference documents
ELV	Emission Limit Value
EPR	Environmental Permitting (England and Wales) Regulations
Knauf	Knauf Insulation Limited
NRW	Natural Resources Wales

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Appendix B
Application Forms

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Appendix C
EP - Opra Spreadsheet

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Appendix D
Air Dispersion Modelling Report

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Appendix E
Risk Assessment Database

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Appendix F
Drawings and Certificates

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