Knauf Insulation

St Helens Permit Variation

Best Available Techniques Assessment Report

WSP UK Limited – January 2024

Report for

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Document revisions

No.	Details	Date
P01	Initial Draft	March 2023
P02	Second issue	April 2023
P03	Updated for EA comments	January 2024

Executive summary

Purpose of this report

This report has been produced for the purpose of assessing the compliance status of arrangements implemented to comply with Best Available Techniques (BAT) in relation to the ongoing project being delivered at the Knauf Insulation (KI) installation in St. Helens, for the refurbishment of the melting furnace and changes to the downstream processes.

The manufacture of insulation materials and other associated activities are regulated by the Consolidated Environmental Permit ref (EPR/BQ4335IC/V007). This Permit will be required to be varied to enable:

- The use of recently acquired land for activities regulated by the Environmental Permit.
- The rebuild and expansion of the Melting Furnace.
- The introduction into service of the refurbished production line and other changes to operational activities.

In order the Environment Agency is able to grant the Variation Notice that will vary the requirements of the Environmental Permit outlined above, Knauf is required to demonstrate compliance with BAT (or otherwise justify the basis for not complying with the techniques). The techniques are specified in technical and regulatory guidance issued by the Environment Agency and the European Commission This is a requirement of the Environmental Permitting Regulations 2016 (as amended). Based on evidence provided and information provided by the Knauf project team, the findings of the assessment are summarised below.

We consider compliance with BAT has been previously demonstrated at Knauf St Helens (KSH) and the proposed variation does not alter compliance in the following areas:

- BAT Conclusion (c) 1 – EMS
- BATc 3 & 4 – Diffuse emissions
- BATc 6 & 7 – Raw materials and emissions
- BATc 9-11 - Emissions of CO, NH3 and Boron
- BATc 12 & 13 – Water usage
- BATc 14 – Solid waste
- BATc 15 – Noise
- BATc 56, 60 & 62 – Emissions of dust, HCl and metals

We consider compliance with BAT is demonstrated in the following areas:

- BATc 2 & 5 – Energy Efficiency
- BATc 8 & 63 – Abatement of air emissions
- BATc 15 - Noise
- BATc 57 & 59 – Combustion air emissions

No additional works are required to confirm compliance with BAT.

Contents

1. Introduction

1.1 Background and Context

The Knauf Insulation (KI) glass wool plant located on Stafford Road in St. Helens, Merseyside is a permitted installation under the Environmental Permitting Regulations 2016 as amended (EPR). The site currently operates subject to Environmental Permit (EPR/BQ4335IC/V007), 'the current permit' which was issued by the Environment Agency (EA) in 2015.

The last variation of the Permit (V007) consolidates all conditions and includes conditions to enable compliance with BAT Conclusions for Manufacture of Glass that are required to be complied with. The updated conditions were based upon information provided by KI to the Environment Agency in response to a Regulation 60 notice that required the business to confirm compliance status with BAT at this time (March 2015).

KI is looking to undertake a furnace rebuild in 2024 which will allow various process bottlenecks to be removed and expand the throughput of the factory, particularly on the Lower Density (LD) production line. In addition to the furnace rebuild and associated facility upgrades, KI has also purchased additional land adjacent to the current permitted facility and intends to use this area for the storage of finished goods (FG).

These changes mean that KI must apply for a substantial technical variation to their permit. As part of this variation, KI must demonstrate that future operations under the varied permit will continue to use the Best Available Techniques (BAT) for preventing and minimising emissions and impacts to the Environment.

This document reviews the requirements of BAT set by the EA and European Commission and either demonstrates how KI will comply with BAT or sets out actions for future compliance.

For clarity, KI refers to the operator of the St Helens Facility and KSH refers to the Knauf St Helens facility itself.

1.2 Summary of changes to site

There are five main aspects to the Project which are summarised with potential environmental impacts identified in Table 1.1.

Table 1.1 Summary of proposed changes

Change	Description of proposed changes	Potential environmental effects	Type of change
Additional land for storage	Inclusion of additional land within the installation boundary.	Release of run-off	Substantial Technical
Glass Melting Furnace rebuild	Rebuilding of the glass melting furnace including replacement of the melter and oxy-gas burner system to facilitate greater throughput	Energy use (gas and electricity) Emissions to air Water use Noise Increased raw materials (cullet, batch raw materials and oxygen)	Normal
Changes to downstream processes	Low Density production line will be expanded to increase the production throughput and allow production of products with higher thermal performance.	Energy use (gas and electricity) Emissions to air Water use (for binder and steam from the wet electrostatic precipitator Increased raw materials (air, binder, packaging) Noise	Normal
Ancillary system upgrades	Replace slab baggers with alternative packaging machines and installing an additional fourth multi-pack machine. Installation of additional transformer within the transformer room to support electrical assist heating. Two additional batch chargers from the backwall to charger larger volume of raw material to furnace. Replacement of the cullet and fiberiser (furnace) cooling towers. Replacement of the air compressors and associated cooling towers.	Noise Energy use (electricity and liquefied petroleum gas) Reduced water requirement. Reduced waste generation Dust	Minor
Removal of emission points	The wash water building was demolished in 2015. Therefore this building and the associated roof vent emission points (A100-A116) are to be removed from the Environmental Permit.	Not applicable	Minor
Redefine abnormal operating conditions	No change to plant or operational measures	Not applicable	Minor Operational

1.3 BAT Assessment

The reference documents given in Table 1.2 have been used as the basis of this BAT assessment.

Table 1.2 Reference Documents

Reference	Short title	Full document reference
[1]	Glass BREF	Best Available Techniques (BAT) Reference Document for the Manufacture of Glass
[2]	SGN 3.03	Integrated Pollution Prevention and Control (IPPC) Guidance for the Glass Manufacturing Sector (A1 processes)
[3]	Glass BATc	Commission Implementing Decision of 28 February 2012 establishing the 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 (2012/134/EU)

2. BAT Review

Variation Notice V007 outlined above includes conditions to enable the installation to comply with the BAT outlined in the BAT Conclusions. The design, operation, activities and management arrangements at KSH are therefore deemed to be compliant with BAT for current operations.

On this basis, this BAT Assessment considers only matters for which there is a material change to the design, operation, activities and management of activities regulated by the Environmental Permit. This includes requirements for raw materials and energy together with waste management and changes to emissions. This review has therefore been undertaken as a two-stage review for the relevant BAT requirements.

The first stage considers whether the modifications to the site operations materially impact any of the methods for compliance previously presented to the Environment Agency. Where this is the case, these requirements are considered in the second stage review. The second stage of the assessment considers the BAT status of the modifications.

As KI and the Environment Agency (EA) went through a comprehensive BAT review in response to the Regulation 60 process in 2013-15, these documents have been used as the primary basis for this review.

Where the approach to compliance with BAT requirements may be altered or will be re-substantiated as a result of this project, the relevant guidance from the Sector Guidance Note (SGN) has also been included.

2.1 Review of all BAT Requirements

This section confirms the stated BAT requirements of the reference documents in Table 1.2,. These are then reviewed in the context of the existing site operations, methods for compliance as described in the Regulation 60 responses and previous permit applications to determine whether the Project as described in Section 1.2 will materially alter the approach to compliance.

Table 2.1 Knauf Permit Reference Documents

Reference	Document Title	Author	Date
[4]	BATC gap analysis - Knauf St Helens Plant v2.xlsx	AMEC	May 2014
[5]	Knauf Insulation - St Helens Site - Regulation 60 Responses	AMEC	May 2014
[6]	V007 Decision Document	Environment Agency	March 2016
[7]	Support Document for IPPC Permit Application	Knauf Alcopor (now KI)	June 2002

Table 2.2 Project Information Reference Documents

Reference	Document Title	Author	Date
[8]	**Process Handbook - St Helens capacity increase, 4207-A-0423-.-2022 rev.0**	Knauf Insulation Engineering	June 2022
[9]	**Noise Impact Assessment**	WSP	January 2024
[10]	**Noise Management Plan**	WSP	January 2024
[11]	**Environmental Risk Assessment**	WSP	January 2024
[12]	**Air Quality Impact Assessment**	WSP	January 2024

3. Findings of BAT Assessment

Table 3.1 Review of all BAT Requirements – BAT Conclusions for Manufacture of Glass

BAT Conclusion	BAT Requirement	Relevance to Project	Review required?
BATc 1	BAT is to implement and adhere to an environmental management system (EMS) that incorporates all of the following features: (i) commitment of the management, including senior management; (ii) definition of an environmental policy that includes the continuous improvement for the installation by the management; (iii) planning and establishing the necessary procedures, objectives and targets, in conjunction with financial planning and investment; (iv) implementation of the procedures paying particular attention to: a. structure and responsibility b. training, awareness and competence c. communication d. employee involvement e. documentation f. efficient process control g. maintenance programmes h. emergency preparedness and response i. safeguarding compliance with environmental legislation. (v) checking performance and taking corrective action, paying particular attention to: a. monitoring and measurement (see also the reference document on the General Principles of Monitoring) b. corrective and preventive action c. maintenance of records d. independent (where practicable) internal or external auditing in order to determine whether or not the EMS conforms to planned arrangements and has been properly implemented and maintained; (vi) review of the EMS and its continuing suitability, adequacy and effectiveness by senior management; (vii) following the development of cleaner technologies; (viii) consideration for the environmental impacts from the eventual decommissioning of the installation at the stage of designing a new plant, and throughout its operating life; (ix) application of sectoral benchmarking on a regular basis.	The Operator still operates a certified environmental management system, which will incorporate all aspects of the modifications. The environmental management system is accredited for environmental management to ISO14001:2015 (Certificate No: 44 104 190742-021) and energy management to ISO50001:2018 (Certificate No.: 44 764 190742-021). The management systems are certified as compliant with these standards by TÜV NORD CERT GmbH and are valid until December 2025.	No
BATc 2	BAT is to reduce the specific energy consumption by using one or a combination of the following techniques: (i) Process optimisation, through the control of the operating parameters (The techniques are generally applicable) (ii) Regular maintenance of the melting furnace (The techniques are generally applicable) (iii) Optimisation of the furnace design and the selection of the melting technique (Applicable for new plants. For existing plants, the implementation requires a complete rebuild of the furnace) (iv) Application of combustion control techniques (Applicable to fuel/air and oxy-fuel fired furnaces) (v) Use of increasing levels of cullet, where available and economically and technically viable (Not applicable to the continuous filament glass fibre, high temperature insulation wool and frits sectors) (vi) Use of a waste heat boiler for energy recovery, where technically and economically (Applicable to fuel/air and oxy-fuel fired furnaces. The applicability and economic viability of the technique is dictated by the overall efficiency that may be obtained, including the effective use of the steam generated) (vii) Use of batch and cullet preheating, where technically and economically viable (Applicable to fuel/air and oxy-fuel fired furnaces. The applicability is normally restricted to batch compositions with more than 50 % cullet)	As described in the Regulation 60 response, KI operate a monitoring and management system to control the furnace and downstream processes with the ability to manipulate operating parameters to manage energy efficiency. Techniques i), ii) and v) are still applied at the site and the approach to implementation has not changed. However, with the furnace rebuild applicability of Technique iii), iv), vi) and vii) must be demonstrated. It is noted that the KI management system is certified to ISO50001.	**Yes**

BAT Conclusion	BAT Requirement	Relevance to Project	Review required?
BATc 3	BAT is to prevent, or where that is not practicable, to reduce diffuse dust emissions from the storage and handling of solid materials by using one or a combination of the following techniques: 1. Storage of raw materials (i) Store bulk powder materials in enclosed silos equipped with a dust abatement system (e.g. fabric filter) (ii) Store fine materials in enclosed containers or sealed bags (iii) Store under cover stockpiles of coarse dusty materials (iv) Use of road cleaning vehicles and water damping techniques 2. Handling of raw materials (i) For materials which are transported by above ground, use enclosed conveyors to prevent material loss (ii) Where pneumatic conveying is used, apply a sealed system equipped with a filter to clean the transport air before release (iii) Moistening of the batch (iv) Application of a slightly negative pressure within the furnace (v) Use of raw materials that do not cause decrepitation phenomena (mainly dolomite and limestone). These phenomena consist of minerals that 'crackle' when exposed to heat, with a consequent potential increase of dust emissions (vi) Use of an extraction which vents to a filter system in processes where dust is likely to be generated (e.g. bag opening, frits batch mixing, fabric filter dust disposal, cold-top melters) (vii) Use of enclosed screw feeders (viii) Enclosure of feed pockets	All solid materials will be stored within designated storage areas at the site that the EA accepts complies with this BAT conclusion. The additional land could be used for the storage of (pre-cleaned) cullet to provide buffer stock against future demand. While the cullet is not considered to be a dusty material, it will be stored under cover in accordance with BATc 3 1(iii). The current arrangements for the handling and transfer of cullet which the EA have previously accepted as complying with BAT will be extended to these areas (when used). The Project will lead to an increased throughput of raw materials, but these will all be handled in line with the current arrangements confirmed to be BAT. There will be two additional batch feeders transport batched raw materials from the existing batch plant to the melting furnace. Two enclosed screw conveyors will be used for this purpose in line with BATc 3 2(vii) It is acknowledged the frequency of raw material deliveries will increase but the storage and handling of the additional materials have been reviewed to demonstrate BAT is applied.	**No**
BATc 4	BAT is to prevent, or where that is not practicable, to reduce diffuse gaseous emissions from the storage and handling of volatile raw materials by using one or a combination of the following techniques: (i) Use of tank paint with low solar absorbency for bulk storage subject to temperature changes due to solar heating. (ii) Control of temperature in the storage of volatile raw materials. (iii) Tank insulation in the storage of volatile raw materials. (iv) Inventory management (v) Use of floating roof tanks in the storage of large quantities of volatile petroleum products. (vi) Use of vapour return transfer systems in the transfer of volatile fluids (e.g. from tank trucks to storage tank). (vii) Use of bladder roof tanks in the storage of liquid raw materials. (viii) Use of pressure/vacuum valves in tanks designed to withstand pressure fluctuations. (ix) Application of a release treatment (e.g. adsorption, absorption, condensation) in the storage of hazardous materials. (x) Application of subsurface filling in the storage of liquids that tend to foam.	The Project will utilise the existing site infrastructure that was previously accepted as BAT in the Regulation 60 response. While there will be no change to the use of volatile raw materials due to the project, the BAT justification as presented is given below. (i) No significant storage of volatile raw materials on- site. All storage tanks are either within buildings or internally bunded via a double skin system, painted with reflective paint or unpainted galvanised steel that will minimise loss of material due to solar radiation. (ii) Not applicable small storage volumes of volatile raw materials on site and use of internally bunded double skinned storage tanks (iii) Not applicable small storage volumes of volatile raw materials on site and use of internally bunded double skinned storage tanks (iv) SAP (propriety software) controlled via system minimum order volume. (v) Not applicable at Knauf St Helens, small volumes (vi) Vapour return line is installed on the ammonia tank. (vii) Not applicable at Knauf St Helens (viii) P/V Valve installed on the ammonia tank. (ix) The scrubber from the mixed binder tank is now operated as a water scrubber without sulphuric acid, since the change in binder removed phenols and formaldehydes from site. (x) Not applicable as liquids stored on site do not tend to foam	No
BATc 5	BAT is to reduce energy consumption and emissions to air by carrying out a constant monitoring of the operational parameters and a programmed maintenance of the melting furnace. The technique consists of a series of monitoring and maintenance operations which can be used individually or in combination appropriate to the type of furnace, with the aim of minimising the ageing effects on the furnace, such as sealing the furnace and burner blocks, keep the maximum insulation, control the stabilised flame conditions, control the fuel/air ratio, etc.	The Project will rebuild the melting furnace, and this may present an opportunity to improve the ability to monitor operational parameters and require a revised maintenance programme to maintain furnace performance.	**Yes**
BATc 6	BAT is to carry out a careful selection and control of all substances and raw materials entering the melting furnace in order to reduce or prevent emissions to air by using one or a combination of the following techniques: (i) Use of raw materials and external cullet with low levels of impurities (e.g. metals, chlorides, fluorides) (ii) Use of alternative raw materials (e.g. less volatile) (iii) Use of fuels with low metal impurities	The Project does not materially alter the approach to compliance with BAT described in the Regulation 60 response. The composition of the cullet and any other raw materials will not change.	No

BAT Conclusion	BAT Requirement	Relevance to Project	Review required?
BATc 7	BAT is to carry out monitoring of emissions and/or other relevant process parameters on a regular basis, including the following: (i) Continuous monitoring of critical process parameters to ensure process stability, e.g. temperature, fuel feed and airflow (ii) Regular monitoring of process parameters to prevent/reduce pollution, e.g. O_2 content of the combustion gases to control the fuel/air ratio. (iii) Continuous measurements of dust, NO_X and SO_2 emissions or discontinuous measurements at least twice per year, associated with the control of surrogate parameters to ensure that the treatment system is working properly between measurements (iv) Continuous or regular periodic measurements of NH_3 emissions, when selective catalytic reduction (SCR) or selective non-catalytic reduction (SNCR) techniques are applied (v) Continuous or regular periodic measurements of CO emissions when primary techniques or chemical reduction by fuel techniques are applied for NO_X emissions reductions or partial combustion may occur. (vi) Regular periodic measurements of emissions of HCl, HF, CO and metals, in particular when raw materials containing such substances are used or partial combustion may occur (vii) Continuous monitoring of surrogate parameters to ensure that the waste gas treatment system is working properly and that the emission levels are maintained between discontinuous measurements. The monitoring of surrogate parameters includes: reagent feed, temperature, water feed, voltage, dust removal, fan speed, etc.	The Project will not materially alter the approach to complying with BATc 7 in the Reg 60 response (described below) on the basis the emissions inventory will not require reconsideration or require a change to monitoring arrangements. It is anticipated the same monitoring regime as previously accepted by the EA will continue to represent BAT after the implementation of the Project. (i) Operational parameters are continually monitored for air flow and electrical current and raw material loading rate. Furnace temperature and CEMS data for particulates, CO, NOx and SOx constantly monitored via SCADA linked system. (ii) as (i) (iii) CEMS is fitted on the furnace stack for particulates, CO, NOx and SOx. This is in addition to half yearly MCERTS monitoring as required by the permit. For other release points included in the permit, half yearly or yearly monitoring is undertaken as required by the permit. For other release points, surrogate parameters such as water jet impinger flows, (which are alarmed at a pre-set flow limit), electrostatic precipitator fan speed/current, electrostatic precipitator unit voltages and pressure drop across filters, etc, are used to indicate the correct operation of the relevant abatement systems. Failure of such critical systems would alarm in the relevant control room. (iv) Not applicable to Knauf St Helens (v) CO is monitored through CEMS and half yearly MCERTS tests as required by the permit. (vi) Emissions are routinely tested using an MCERTs test team twice per year apart from metals which are tested annually (vii) For such release points, surrogate parameters such electrostatic precipitator fan speed/current and electrostatic precipitator unit voltages are used to indicate the correct operation of the dry EP abatement systems. Failure of such critical systems would alarm in the relevant control room.	No
BATc 8	BAT is to operate the waste gas treatment systems during normal operating conditions at optimal capacity and availability in order to prevent or reduce emissions	The Project will not materially alter the approach to compliance given in the Regulation 60 response except for two items below: Firstly, the Project will need to demonstrate that the existing abatement systems will be operated at 'optimal' effectiveness with the new flows and pollutant loads. This is screened in for review. Secondly, the wet electrostatic precipitators (WESPs) currently installed at the site have two sides which provide abatement to 50% of the flow. IC20 required KI to undertake a series of testing to evaluate the impact on emissions from operating on single sided abatement. Having assessed the impact of emissions to comply with IC20, KI requests Permit Conditions 2.3.4-2.3.6 and Schedule 6 are varied to redefine abnormal operations. This will be demonstrated as BAT below. Some activities such as maintenance or breakdown require that one side is closed down and the emissions are only abated on a single side. Currently Permit Conditions 2.3.4 – 2.3.6 require that single sided operation of each WESP is limited to a number of hours per year and the EA must be notified of abnormal operation (defined in Schedule 6 as a >30% reduction in abatement capacity). For planned abnormal operation, 48 hours advance notice must be provided and for unplanned abnormal operations, KI must notify 'immediately' via a Schedule 5 notification. Condition 2.3.4 sets a limit of 7 consecutive days for any signal period of abnormal operation and a total limit of 20 days per year. IC20 requires KI to undertake a series of testing to evaluate the impact on emissions from operating on single sided abatement. KI have provided monitored emissions data from an MCERTS accredited monitoring campaign which indicates the KSH can readily achieve the ELVs on emission points A2 and A4 while running on single sided operation of the WESP. It is proposed that abnormal operation for the WESP shall be redefined to mean 'non-operation' of the WESP and the hours running on single sided operation should be reported to the EA annually as part of the annual returns prescribed in Section 4.2 of the Permit. This is considered to be BAT so is not screened in for further review.	**Yes**

BAT Conclusion	BAT Requirement	Relevance to Project	Review required?
BATc 9	BAT is to limit carbon monoxide (CO) emissions from the melting furnace, when applying primary techniques or chemical reduction by fuel, for the reduction of NO_X emissions. Primary techniques for the reduction of NO_X emissions are based on combustion modifications (e.g. reduction of air/fuel ratio, staged combustion low-NO_X burners, etc.). Chemical reduction by fuel consists of the addition of hydrocarbon fuel to the waste gas stream to reduce the NO_X formed in the furnace. The increase in CO emissions due to the application of these techniques can be limited by a careful control of the operational parameters	The Project will implement the same approach i.e. low NOx burners with an oxy-gas fuel source, with electrical boost. KI is confident that this arrangement and type of burner provided the best available NOx control for technologies which are currently proven in the glass wool application. The electrical booster heating available will be increased as part of the project to allow better control of furnace temperature and NOx emissions.	No
BATc 10	BAT is to limit ammonia (NH_3) emissions, when applying selective catalytic reduction (SCR) or selective non-catalytic reduction (SNCR) techniques for a high efficiency NO_X emissions reduction. The technique consists of adopting and maintaining suitable operating conditions of the SCR or SNCR waste gas treatment systems, with the aim of limiting emissions of unreacted ammonia.	Not applicable to the site or Project. SCR/SNCR are not used on site.	N/A
BATc 11	BAT is to reduce boron emissions from the melting furnace, when boron compounds are used in the batch formulation, by using one or a combination of the following techniques: (i) Operation of a filtration system at a suitable temperature for enhancing the separation of boron compounds in the solid state, taking into account that some boric acid species may be present in the flue-gas as gaseous compounds at temperatures below 200 °C, but also as low as 60 °C (ii) Use of dry or semi-dry scrubbing in combination with a filtration system (iii) Use of wet scrubbing	The furnace emissions are abated using a dry electrostatic precipitator (Dry EP) that will remove particulate phase boron. It is operated at optimum temperature for the electrostatic precipitator and removal of particulate. KI has completed a previous Improvement Condition (IC19) and submitted this to the EA to demonstrate the techniques applied on site are BAT. Confirmation of this position has not been acknowledged in writing by the EA.	No
BATc 12	BAT is to reduce water consumption by using one or a combination of the following techniques: (i) Minimisation of spillages and leaks (ii) Reuse of cooling and cleaning waters after purging (iii) Operate a quasi-closed loop water system as far as technically and economically feasible	The Project does not propose to change the operating intent or techniques for the water systems on site, but these will be partially expanded to accommodate additional cooling and wash water flows. The extension of the wash water system includes an additional water return sump, solids removal system and water storage tank (30m^3). Upgraded dewatering screws will be installed to the new and existing parts of the wash water system to decrease water content in the waste materials and recycle this water into the closed loop system. With the exception of the dewatering screws, which are an improvement, the same techniques will be applied as previously communicated to the Environment Agency. The cooling water system will be extended using the same techniques as the existing system to provide additional flows to the expanded melting furnace and additional fiberizers. The site water systems which were previously accepted as BAT operate using a cascade approach where water is continually cleaned and reused sequentially for tasks requiring a lower grade of water. The systems are essentially closed loop systems, except for the loss of wash water via the WESP stacks (A2 and A4) and cooling water via the cooling towers. Other than the improved dewatering described above, it is not considered technically feasible to increase reuse of water. KI will continue to operate a maintenance system which ensures any leaks or spills from the system are minimised through a combination of proactive and reactive maintenance and inspection. There will be an increased water requirement as the increased throughput will give rise to proportionate evaporative losses released from the wash water system via the HD Line Stack and the LD Line Stack (Emission Points A2 and A4). The wash water system will be continuously recycled for re-use in the abatement and binder systems.	No
BATc 13	BAT is to reduce the emission load of pollutants in the waste water discharges by using one or a combination of the following waste water treatment systems: (i) Standard pollution control techniques, such as settlement, screening, skimming, neutralisation, filtration, aeration, precipitation, coagulation and flocculation, etc. Standard good practice	The Project will not generate wastewater for release to the environmental, nor will it require modification of the current arrangements for management of waste water. This does not form part of the variation application. The Project will not increase discharges of trade effluent (volume or composition).	No

BAT Conclusion	BAT Requirement	Relevance to Project	Review required?
	techniques to control emissions from storage of liquid raw materials and intermediates, such as containments, inspection/testing of tanks, overfill protection, etc (ii) Biological treatment systems, such as activated sludge, biofiltration to remove/degrade the organic compounds (iii) Discharge to municipal waste water treatment Plants (iv) External reuse of waste waters	The additional land will only generate clean surface water run-off which will be discharged to the existing surface water drainage systems.	
BATc 14	BAT is to reduce the production of solid waste to be disposed of by using one or a combination of the following techniques: (i) Recycling of waste batch materials, where quality requirements allow for it (ii) Minimising material losses during the storage and handling of raw materials (iii) Recycling of internal cullet from rejected production (iv) Recycling of dust in the batch formulation where quality requirements allow for it (v) Valorisation of solid waste and/or sludge through appropriate use on-site (e.g. sludge from water treatment) or in other industries (vi) Valorisation of end-of-life refractory materials for possible use in other industries (vii) Applying cement bonded briquetting of waste for recycling into hot blast cupola furnaces where quality requirements allow for it	The Project will lead to a slight increase in solid waste in line with increased production. The Project does not propose to change the arrangements for the management of solid waste, therefore it is considered that this meets BAT.	No
BATc 15	BAT is to reduce noise emissions by using one or a combination of the following techniques: (i) Make an environmental noise assessment and formulate a noise management plan as appropriate to the local environment (ii) Enclose noisy equipment/operation in a separate structure/unit (iii) Use embankments to screen the source of noise (iv) Carry out noisy outdoor activities during the day (v) Use noise protection walls or natural barriers (trees, bushes) between the installation and the protected area, on the basis of local conditions.	The noise rating of all equipment has been included within the specification for procurement. It is noted that the majority of the changes represent upgrades or expansion of existing equipment. However, the equipment will have a large capacity and some are located closer to residential receptors, so noise impact should be thoroughly evaluated. There will also be an increase in vehicle movements and material handling. Loading and operational hours for noisy activities will not change.	**Yes**
BATc 56	BAT is to reduce dust emissions from the waste gases of the melting furnace by applying an electrostatic precipitator or a bag filter system	The site will continue to abate emissions using a Dry EP. It has been confirmed by KI Engineering that the predicted future flows and pollutant loads from the melting furnace are within the rated design capacity of the Dry EP and will therefore be operated in optimal conditions. The Project does not propose to change the current Dry EP installed to abate emissions from the furnace.	No
BATc 57	BAT is to reduce NO_X emissions from the melting furnace by using one or a combination of the following techniques: (i) Combustion modifications (a) Reduction of air/fuel ratio (b) Reduced combustion air temperature (c) Staged combustion: i. Air staging ii. Fuel staging (d) Flue-gas recirculation (e) Low-NO_X burners (f) Fuel choice (ii) Electric melting (iii) Oxy-fuel melting	The melting furnace will be entirely rebuilt, so BATc 57 is screened in for review.	**Yes**
BATc 58	When nitrates are used in the batch formulation for glass wool production, BAT is to reduce NOX emissions by using one or a combination of the following techniques: (i) Minimising the use of nitrates in the batch formulation (ii) Electric melting (iii) Oxy-fuel melting	Nitrates are not added to batch formulations so BATc 58 does not apply.	N/A

BAT Conclusion	BAT Requirement	Relevance to Project	Review required?
BATc 59	BAT is to reduce SO_x emissions from the melting furnace by using one or a combination of the following techniques: (i) Minimisation of the sulphur content in the batch formulation and optimisation of the sulphur balance (ii) Use of low sulphur content fuels (iii) Dry or semi-dry scrubbing, in combination with a filtration system (iv) Use of wet scrubbing	The melting furnace will be entirely rebuilt, so BATc 59 is screened in for review.	**Yes**
BATc 60	BAT is to reduce HCl and HF emissions from the melting furnace by using one or a combination of the following techniques: (i) Selection of raw materials for the batch formulation with a low content of chlorine and fluorine (ii) Dry or semi-dry scrubbing, in combination with a filtration system	The Project does not propose to change the approach to compliance with BATc 60 as presented and accepted in the Regulation 60 response. i.e that (i) the batch formulation has a low chlorine/fluorine content as no salts are added. (ii) Dry electrostatic precipitation is applied to the furnace exhaust emissions. Therefore the facility is still considered to meet BAT.	No
BATc 61	BAT is to reduce H_2S emissions from the melting furnace by applying a waste gas incineration system to oxidise hydrogen sulphide to SO_2.	Not applicable to a glass wool facility.	N/A
BATc 62	BAT is to reduce metal emissions from the melting furnace by using one or a combination of the following techniques: (i) Selection of raw materials for the batch formulation with a low content of metals (ii) Application of a filtration system	The Project does not propose to change the approach to compliance with BATc 62 as presented and accepted in the Regulation 60 response. i.e. that (i) KSH has an external cullet specification that includes metal contents and quality control of the feedstock is monitored through the QMS. (ii) Dry EP is applied to the furnace exhaust emissions and will reduce all particulates including metals Therefore the facility is still considered to meet BAT.	No
BATc 63	BAT is to reduce emissions from downstream processes by using one or a combination of the following techniques: (i) Impact jets and cyclones (ii) Wet scrubbers (iii) Wet electrostatic precipitators (iv) Stone wool filters (v) Waste gas incineration	The Project does not propose to change the approach to compliance with BATc 63 as presented and accepted in the Regulation 60 response. i.e. that (i) The emissions captured from the downstream processes are abated using a minimum of multiple impact jets and cyclones and wet electrostatic precipitators. The blowing wool line uses a combination of impact jets, drop out boxes and cyclones The process water from the impact jets is recycled. (ii) Not applicable (iii) The emissions from the low density and high density fibre lines are abated using impact jets, cyclones and wet electrostatic precipitators. (iv) Not used at KSH (v) Not used at KSH Therefore, as the facility emissions monitoring has shown that the facility is able to meet the permitted limits, the facility is still considered to meet BAT. However, in line with BATc 8, Knauf will need to demonstrate that the emissions can be abated optimally.	**Yes**

From the European BREF document, the following conclusion are screened in for the Project to demonstrate BAT compliance: BATc 2, 5, 8, 57, 59, and 63.

These have been subdivided into four categories: **Energy efficiency** (BATc 2 and 5), **Abatement of air emissions** (BATc 8 and 63), **Combustion air emissions** (BATc 57 and 59) and **Noise** (BATc 15). For each of these categories, the Indicative BAT Requirements from the SGN (3.03) have also been included in the relevant tables below. While it is noted that while the SGN is particularly dated (2001) it is still considered to broadly represent good practice requirements for UK Environmental Permitting.

3.1 Energy Efficiency

Two BATc were screened in for review in relation to energy efficiency as the project will entirely rebuild the melting furnace which provides an opportunity to improve energy efficiency.

Additionally, two relevant paragraphs in Section 2.7 of the SGN were also identified.

Table 3.2 Detailed BATc Review – Energy Efficiency

BAT Reference	BAT Guidance requirement	BAT Justification	Compliance Status
BATc 2	BAT is to reduce the specific energy consumption by using one or a combination of the following techniques: (i) Process optimisation, through the control of the operating parameters (The techniques are generally applicable) (ii) Regular maintenance of the melting furnace (The techniques are generally applicable) (iii) Optimisation of the furnace design and the selection of the melting technique (Applicable for new plants. For existing plants, the implementation requires a complete rebuild of the furnace) (iv) Application of combustion control techniques (Applicable to fuel/air and oxy-fuel fired furnaces) (v) Use of increasing levels of cullet, where available and economically and technically viable (Not applicable to the continuous filament glass fibre, high temperature insulation wool and frits sectors) (vi) Use of a waste heat boiler for energy recovery, where technically and economically viable (Applicable to fuel/air and oxy-fuel fired furnaces. The applicability and economic viability of the technique is dictated by the overall efficiency that may be obtained, including the effective use of the steam generated) (vii) Use of batch and cullet preheating, where technically and economically viable (Applicable to fuel/air and oxy-fuel fired furnaces. The applicability is normally restricted to batch compositions with more than 50 % cullet)	As described in the Regulation 60 response, KI operate a monitoring and management system to control the furnace and downstream processes with the ability to manipulate operating parameters to manage energy efficiency. Techniques i), ii) and v) are still applied at the site and the approach to implementation has not changed. However, with the furnace rebuild applicability of Technique iii), iv), vi) and vii) must be demonstrated. iii) The furnace design has been optimised for use in oxy-gas furnaces across the KI business including a sister plant in Cwmbran. The furnace design is considered to be proprietary as the furnace design and reduction in energy usage are key elements in cost control of the glass manufacturing sector. KI has extensive experience in designing, building, and operating glass melting furnaces across multiple plants in the UK, and Europe. On the basis of this experience and engagement with vendors, KI believe their proposed furnace design represents BAT for minimising energy usage and will be a significant improvement on the current installed furnace. As part of the design process for the furnace and supporting studies, KI is satisfied that they have considered and optimised the heat transfer, refractory, furnace geometric design, furnace insulation and balance of electrical/oxyfuel melting so far as is practical for this application. Currently the plant is operating at 919 kWh/ton of glass melted (average 2021/22), and this is projected to decrease to 833 kWh/ton following the furnace rebuild as a result of improvements and efficiency savings. The BREF does not provide an energy efficiency benchmark for oxy-gas glass wool furnaces but Table 3.8 of the BREF provides values for an oxy-gas container glass furnace at 3050-3500 kJ/kg and a glass wool furnace with recuperative air preheating at 4300-6500 kJ/kg. For comparison, 833 kWh/ton is equivalent to 2999 kJ/kg and therefore is lower than the energy efficiency benchmark for both glass wool and oxy-gas furnaces as given in the BREF. iv) Low NOx burners designed for this type of service have been specified to maximise energy efficiency while minimising potential NOx. vi) Steam is not used on site, the heat produced from the furnace is relatively small due to the use of the electric boost system. Prior to the electrostatic precipitator the entrained particulate matter would make fouling of heat transfer surfaces an issue, after the electrostatic precipitator the temperature is too low to generate sufficient useful heat. The KI sustainability strategy roadmap is regularly reviewing the ability reuse this waste heat with lessons learned shared across sister sites. vii) Batch cullet pre-heating is not carried out at KSH as a combination of the energy efficiency measures above are carried out. The KI management system is certified to ISO50001.	Compliant

BAT Reference	BAT Guidance requirement	BAT Justification	Compliance Status
BATc 5	BAT is to reduce energy consumption and emissions to air by carrying out a constant monitoring of the operational parameters and a programmed maintenance of the melting furnace. The technique consists of a series of monitoring and maintenance operations which can be used individually or in combination appropriate to the type of furnace, with the aim of minimising the ageing effects on the furnace, such as sealing the furnace and burner blocks, keep the maximum insulation, control the stabilised flame conditions, control the fuel/air ratio, etc.	The Project will rebuild the melting furnace and this may present an opportunity to reduce energy and improve monitoring. The new furnace will reduce the energy requirements per tonne of glass produced. Currently the plant is operating at 919 kWh/ton of glass melted (average 2021/22), and this is projected to decrease to 833 kWh/ton following the furnace rebuild as a result of improvements and efficiency savings. The furnace will be fitted with a range of operational control and monitoring parameters including: gas flow rate, oxygen flow rate, oxy-gas fuel ratio, electrical heat input, furnace temperature in various locations. There is a regular programme of maintenance to maintain the furnace integrity and efficiency including 6-monthly furnace inspection by a specialist KI engineering team. These will allow energy use to be minimised. The KI management system is certified to ISO50001.	Compliant
SGN 3.03 Section 2.7 Part 1	Indicative BAT requirements: The following techniques should be implemented where they are judged to be BAT based on a cost/ benefit appraisal according to the methodology provided in Appendix 4 of the Energy Efficiency Guidance Note (Reference 14). 1. Energy-efficiency techniques Within IPPC it is valid to consider both the emission of direct (heat and emissions from on-site generation) and indirect (emissions from a remote power station) pollution when considering options for energy efficiency. • Choice of melting technique and furnace design: - Increase the quantity of refractory bricks employed in regenerator furnaces; - Improve heat transfer by using specially shaped packing and fusion cast materials, for example, fusion cast corrugated cruciforms; - Furnace geometry changes; - Use of electrical melting or oxy-fuel melting, where feasible. - Increased level of furnace insulation, for example sprayed fibre insulation when applied to the regenerator structure. • Combustion control and fuel choice: - Natural gas firing; - Use of low NOx burners. • Cullet usage: - Recycling of all internal cullet (exceptions: continuous filament glass fibre, stone wool, frit). • Use of waste heat boiler where applicable and economically feasible. • Batch and cullet preheating by direct or indirect means	• The approach to ensuring the furnace design is described above in the response to BATc2. • Combustion control and fuel choice ○ The furnace uses natural gas as a primary fuel with oxygen to increase the flame temperature and reduce heat losses. ○ Low NOx burner design has been incorporated into the furnace design. • Cullet usage ○ All internal cullet is recycled. • Waste heat boiler not considered to be technically or economically feasible – see above. • Batch and cullet pre-heating – not used at KSH as a combination of other techniques are applied.	Compliant
SGN 3.03 Section 2.7 Part 2	Indicative BAT requirements: The following techniques should be implemented where they are judged to be BAT based on a cost/ benefit appraisal according to the methodology provided in Appendix 4 of the Energy Efficiency Guidance Note (Reference 14). 2. Energy supply techniques The following techniques should be considered: • use of Combined Heat and Power (CHP); • recovery of energy from waste; • use of less polluting fuels. The Operator should provide justification that the proposed or current situation represents BAT, irrespective of whether a CCA or Trading Agreement is in place, where there are other BAT considerations involved, such as: • the choice of fuel impacts upon emissions other than carbon, for example, sulphur in fuel; • where the potential minimisation of waste emissions by recovery of energy from waste conflicts with energy efficiency requirements.	• Use of CHP was evaluated in 2019 and was not considered to be economically feasible to generate onsite heat and power. • In line with the approach previously described, all wastes are reviewed against the waste hierarchy to minimise waste streams and then will be disposed of via the best option. There are not considered to be any significant on site waste streams that would provide sufficient fuel for the operation of the site processes. • Oxy-gas fuel is currently considered to be the least polluting widely available option. Electrical furnace not considered viable at this scale. The sustainability strategy is evaluating lower carbon fuel options.	Compliant

3.2 Abatement of air emissions

Two BATc was screened in for review in relation to the abatement of emissions to air.

This is on the basis that the site proposes to utilise the same abatement plant which was previously accepted as BAT during the Regulation 60 process. On the basis that the nature of the abatement plant is considered to be BAT, most of the BATc which relate to abatement of emissions were not screened in for review. This position is dependent on the Project successfully demonstrating that the existing abatement plant will be able to accommodate additional throughput with comparable abatement efficiency to maintain the same level of environmental protection, which is inculcated in BATc 8.

Table 3.3 Detailed BATc Review – Abatement of air emissions

BAT Reference	BAT Guidance requirement	BAT Justification	Compliance Status
BATc 8	BAT is to operate the waste gas treatment systems during normal operating conditions at optimal capacity and availability in order to prevent or reduce emissions	**Change in flow rates through abatement systems.** Flow rates are changed through two main processes, the melting furnace and the LD Production line: **LD Production line:** The flow through the WESP on the LD Production line will be increased from typically 304,000 (average monitored result 2019-2022) Nm³/h by 58% to 480,000 Nm³/h with the stack emission velocity increased to 12.3 m/s. When the WESP was initially installed, it was oversized to allow for future expansion, and the increased flows will be within the rated design capacity of the WESP. **Melting Furnace:** The flow through the Dry EP is variable depending on the utilisation of the furnace and the percent usage of cullet. Greater cullet usage will lead to lower flows and velocities in the furnace abatement, the worst case is 50% cullet but this is not a normal operational mode. In the worst case, flows from the melting furnace will be increased from typically 24,188 (average monitored result 2020-2022) Nm³/h by 38% to 30,800 Nm³/h (dry) with the stack emission velocity increased to 18.2 m/s. When the Dry EP was initially installed, it was oversized to allow for future expansion, and the increased flows are within the rated design capacity of the Dry EP.	Compliant
BATc 63	BAT is to reduce emissions from downstream processes by using one or a combination of the following techniques: (i) Impact jets and cyclones (ii) Wet scrubbers (iii) Wet electrostatic precipitators (iv) Stone wool filters (v) Waste gas incineration	The LD production line is the only 'downstream process' with changes to the production line. On the LD production line, the flow rate through the impact jets and knock out boxes will remain the same through the existing fans. New extraction fans will be installed on the new forming cooling hood to an equivalent capacity of the current provision utilising equivalent impact jets, cyclones and knock out boxes, the flow from these will then be routed through the existing WESP. The flow through the WESP on the LD Production line will be increased from typically 304,000 (average monitored result 2019-2022) Nm³/h by 58% to 480,000 Nm³/h with the LD Line Stack emission velocity increased to 12.3 m/s. These parameters are within the rated design capacity of the WESP. Stone wool filters and waste gas incineration are not applied at KSH as a combination of Techniques (i), (ii) and (iii) are applied to abate emissions.	Compliant

3.3 Combustions air emissions

Two BATc were screened in for review in relation to combustion air emissions as the project will replace the furnace combustion system. Given the furnace combustion system will be more entirely rebuilt, then the design of the melting furnace needs to be demonstrated to meet BAT. Additionally, one paragraph of Section 2.3 of the SGN was also identified as relevant to the project.

Table 3.4 Detailed BATc Review – Combustion Air Emissions

BAT Reference	BAT Guidance requirement	BAT Justification	Compliance Status
BATc 57	BAT is to reduce NO_X emissions from the melting furnace by using one or a combination of the following techniques: (i) Combustion modifications (a) Reduction of air/fuel ratio (b) Reduced combustion air temperature (c) Staged combustion: i. Air staging ii. Fuel staging (d) Flue-gas recirculation (e) Low-NO_X burners (f) Fuel choice The applicability is limited by the constraints associated with the availability of different types of fuel, which may be impacted by the energy policy of the Member State (ii) Electric melting (iii) Oxy-fuel melting	The design of the existing melting furnace was determined to be BAT during the Regulation 60 process. The Project will rebuild the furnace utilising the same techniques, namely oxy-gas fuelled low NO_X burners, and increase the amount of electrical boost on the melting furnace which will further reduce NO_X emissions. However the criteria have been reviewed below: (i) Combustion modifications considered below: (a) Not applicable to oxy gas burner (b) Not applicable to oxy gas burner (c) Not applicable to oxy gas burner (d) Not applicable to KSH as Boron content of the flue gas makes it technically not feasible. (e) The oxy-gas burners will be low NO_X type burners. Based upon the experience of KI from several glass plants operated in Europe and regulated by the Industrial Emissions Directive, the Eclipse Primefire 400 burners have been selected as the most suitable burners for this application. Due diligence has confirmed these burners provide the best control over NOx generation through the use of partial gas cracking to increase flame luminosity and heat transfer and reduce flame temperature. They also utilise a flat flame geometry to promote heat transfer without increasing flame temperature (and therefore thermal NOx). (ii) Electric melting furnaces are not applicable to large scale melting or furnaces with high turndown, which apply here. Electrical boost heating is to be included within the furnace design. (iii) The burner will use an oxy-gas fuel. It is also noted that the furnace rebuild will provide a new furnace with improved integrity over the current arrangements. There are currently some areas of air ingress in the furnace which are leading to NOx generation, which will be removed as part of the rebuild. On the basis that oxy-gas is used for combustion in low NO_X burners, supported by electrical boost heating, then KSH is considered to be applying BAT.	Compliant
BATc 59	BAT is to reduce SO_X emissions from the melting furnace by using one or a combination of the following techniques: (i) Minimisation of the sulphur content in the batch formulation and optimisation of the sulphur balance (ii) Use of low sulphur content fuels (iii) Dry or semi-dry scrubbing, in combination with a filtration system (iv) Use of wet scrubbing	The relevant techniques have been considered in the minimisation of SO_X in the furnace emissions. (i) The batch formulation is not changed by the Project so this is considered to still represent BAT as presented in the Regulation 60 response. (ii) The furnace will still be fuelled by natural gas and oxygen, which should have negligible sulphur content. (iii) Dry electrostatic precipitation is used to abate the furnace emissions. (iv) Not employed at KSH. It is also noted that in the previous three years, the highest SO_X emission monitored was 6.09 mg/m^3 (expressed as SO_2) against a permitted ELV of 150 mg/m^3. On the basis that the batch formulation has not changed substantially, the same low sulphur fuels will be used and the same effective air abatement (Dry EP) will be used to abate the furnace emissions, it is considered that KSH meets BAT.	Compliant
SGN 3.03 Section 2.3.6	The following techniques are recommended to reduce oxides of nitrogen discharged to the atmosphere: Primary NOx measures: 19. The following combustion modifications should be used to minimise the formation of thermal NOx in the furnace: • Reduced air/fuel ratio;	19. Low NOx burners are used with an oxy-gas fuel source at KSH, reduced temperatures or combustion staging are not applicable to oxy-gas systems. 20. Not applicable. Nitrates are not added to the process at KSH. 21. A regenerator furnace is not used at KSH. 22. Not applicable. SCR is not used at KSH as high sulphur fuels are not used.	Compliant

	• Air or fuel staged combustion; • Low NOx burners; • Choice of fuel. These primary measures should be optimised by a demonstrable sustained period of gradual experimentation and monitoring combined with a high degree of technical expertise and experience 20. Nitrate levels should be reduced, by demonstrable experimentation, to the minimum commensurate with product and melting. 21. The '3R' process. For regenerator furnaces, where hydrocarbon fuels are added to the waste gas stream (at the furnace entrance), i.e. the '3R' process, additional measures are required to control CO_2 emissions, e.g. heat recovery. 22. Selective Catalytic Reduction (SCR). Where high sulphur fuels (oil or gas) are used, the formation of SO_3 and subsequent reaction to ammonium bisulphate should be controlled, to prevent the catalyst from being poisoned and causing fouling and corrosion of the equipment. Air should be blown through the catalyst bed on a regular basis to prevent blinding and blockages by the remaining fine dust. 23. A dust removal unit is required prior to the SCR unit. Dust levels should be in the region of 10 - 15mg/m^3 prior to entering the SCR unit. Where an EP is used, acid gas scrubbing is also required upstream of the EP. 24. Ammonia levels should be maintained below a ratio of 1.1:1 (NH_3:NO_x) to limit the potential for ammonia breakthrough. Ammonia emissions must be controlled and maintained at below 10mg/m3 . 25. Selective Non catalytic Reduction (SNCR). The following factors must be controlled to maintain the efficiency of the technique: • Temperature; • Initial NOx concentration; • Uniform reagent and flue gas mixing; • Ammonia to NO_x ratio; and • Reaction time (1 to 2 seconds required) 26. Operators should provide a cost benefit study using the methodology in H1 (Reference 6), to demonstrate the relative merits of primary measures, SNCR and SCR for the installation. The comparison will show the cost per tonne of NO_x abated over the projected life of the plant using the asset lives and typical discount rates given in that document.	23. SCR is not used at KSH as high sulphur fuels are not used. A Dry EP is used for dust removal but acid gas scrubbing is not required, ammonia and SO3 have been previously demonstrated to not be significant issues at KSH. 24. Not applicable, SCR is not used at KSH. 25. Not applicable, SNCR is not used at KSH. 26. SNCR/SCR is not applied at KSH as a combination of furnace design, operating parameters, selection of raw materials, oxy-gas firing of low NOx burners and control on the quench system are applied to minimise NOx generation.	
SGN 3.03 Section 2.3.6	Sulphur dioxide The following techniques are recommended to minimise releases of SO_2. 27. Fuel selection. Maximum sulphur limit for any fuels should be 1%. 28. Determination of what represents the best protection of the environment as a whole is usually site specific. A process sulphur mass balance should be calculated in order to determine emission levels commensurate with BAT. The calculation should also consider the implications of recycling filter dust into the process. 29. The most important environmental targets related to SO_x abatement are: • High cullet recycling rates; • Minimisation of waste production through internal or external dust recycling; • Waste heat recovery; • Other atmospheric emission reduction.	27. Oxy-gas is the primary fuel for the melting furnace and the concentration of sulphur content is much less than 1%. The natural gas is drawn from the national transmission system where the regulatory requirement is for < 50mg/m^3 total sulphur content. EA research [13] indicates that typically the typical value is closer to 0.5mg/m3. 28. The incoming sulphur content of fuel is so low that a process sulphur mass balance is not considered to be required, as there are no practical options for further reduction. 29. The site uses a high percentage of internal and external cullet within batches and re-uses all internal cullet. Waste heat recovery is not considered technically and economically viable as described in response to BATc 2	Compliant

3.4 Noise

One BATc was screened in for review in relation to noise as the project will replace several sets of cooling towers and compressors external to the main building. While these systems are expected to be newer and more efficient, given their external location and increase size, then their design and operation needs to be demonstrated to meet BAT. Additionally, one paragraph of the SGN was also identified as relevant to the project.

Table 3.5 Detailed BATc Review – Noise

BAT Reference	BAT Guidance requirement	BAT Justification	Compliance Status
BATc 15	BAT is to reduce noise emissions by using one or a combination of the following techniques: (i) Make an environmental noise assessment and formulate a noise management plan as appropriate to the local environment (ii) Enclose noisy equipment/operation in a separate structure/unit (iii) Use embankments to screen the source of noise (iv) Carry out noisy outdoor activities during the day (v) Use noise protection walls or natural barriers (trees, bushes) between the installation and the protected area, on the basis of local conditions.	The proposed modifications including compressors and cooling towers have been specified to reduce noise at source. The new compressor cooling towers have been specified to incorporate a 'low sound' fan providing 4-7 dB reduction on the standard fan. Compressor cooling towers have been specified to operate on reduced load, with two or three towers operating simultaneously at 33-50% capacity depending on outside temperature. The cullet and fiberiser cooling towers are to be installed in the same location as the existing systems. Low noise fans have been specified for these cooling towers to minimise offsite noise emission. The fiberiser cooling towers are to be fitted with: • Lowered fan speed to reduce fan noise and extra fan blade added to compensate. • Noise attenuators added to the water basin to reduce noise from falling water. The operating duties will typically be 66% during the daytime and 50% at night. Maximum operating duty will only occur on the hottest days (ambient 35degC or higher). The cullet cooling towers are to be fitted with: • Low noise fan. • 'Noise mat' and acoustic louvre to air intake. In addition to these measures, the following actions have been taken to meet apply BAT for noise: (i) A noise impact assessment compliant with BS4142 has been completed by specialist acoustic consultants and is attached as Appendix G to this application. This assessment demonstrates that there will be no appreciable increase in noise levels compared to the current background levels. A Noise Management Plan (NMP) has been updated for the site to consider the proposed modifications and latest Environment Agency guidance, this is attached to the application for approval as Appendix H. The NMP identifies some minor areas for improvement to be evaluated. (ii) The compressors and associated equipment are to be located within dedicated insulated GRP enclosure that has a specified with a Sound Reduction Index of 24 dB. It is not viable to locate the cooling towers within an enclosure as their performance requires air flow through the unit to maximise heat transfer. (iii) Existing embankments are present to the north-east of the site partially shielding the Shire estate from noise emissions, but the noise modelling indicates that the reduction at source and other measures in the NMP do not require further screening. (iv) Offloading activities will be restricted to daytime hours (7-5) as per current operations. (v) The cullet and furnace cooling towers are located closed the main building and the old compressor house which provides a level of screening for noise sensitive receptors Noise protection walls are not considered to be required on the basis of the measures described above. On this basis, it is considered that the Project is applying BAT for noise.	Compliant
SGN 3.03 Section 2.9	1. The Operator should employ basic good practice measures for the control of noise, including adequate maintenance of any parts of plant or equipment whose deterioration may give rise to	1. The approach to the management of noise is detailed in the NMP (Appendix H) but includes details of the Preventative Inspection and Maintenance Plan, which operates to minimise	

increases in noise (for example, maintenance of bearings, air handling plant, the building fabric as well as specific noise attenuation measures associated with plant, equipment or machinery).
2. The Operator should also employ such other noise control techniques to ensure that the noise from the installation does not give rise to reasonable cause for annoyance, in the view of the Regulator and, in particular, should justify where either Rating Levels (LAeq,T) from the installation exceed the numerical value of the Background Sound Level (LA90,T), or the absolute levels of 50dB LAeq by day or 45 by night are exceeded. Reasons why these levels may be exceeded in certain circumstances are given in Reference 20.
3. In some circumstances “creeping background” (see Reference 20) may be an issue. Where this has been identified in pre application discussions or in previous discussions with the local authority, the Operator should employ such noise control techniques as are considered appropriate to minimise problems to an acceptable level within the BAT criteria.
4. Noise surveys, measurement, investigation (which can involve detailed assessment of sound power levels for individual items of plant) or modelling may be necessary for either new or existing installations depending upon the potential for noise problems. Operators may have a noise management plan as part of their management system. More information on such techniques is given in Part 2 of Reference 20.

noise emissions associated with wear and tear of equipment and deterioration of equipment.
2. The Noise Impact Assessment (Appendix G) assesses the potential for noise impacts at Noise Sensitive Receptors. The assessment concludes that the proposed modifications ‘are likely to have a low impact on the nearest noise sensitive receptors.’
3. The collection of background sound levels has been addressed in the Noise Impact Assessment (Appendix G).
4. Noise modelling has been undertaken for this application and is described in Appendix G. A noise management plan has been prepared for the application and is included at Appendix H.

4. Key Findings

A screening review of the Proposed Variances to the permit was undertaken against the approaches described as BAT in the BREF documents in Table 3.1. Where there were changes which may alter the approach to compliance for the site, these were screened in for more detailed review in Table 3.2 to 3.5

The topics screened in for more detailed review of BAT compliance were energy efficiency (BATc 2 and 5), noise (BATc 15) combustion air emissions (BATc 57 and 59) and the abatement of air emissions (BATc 8 and 63).

Following a detailed review of the BAT Conclusions, the proposed approach for the project was determined to be consistent with the Best Available Techniques for all matters, with no recommendations or further actions required to substantiate these positions.

5. References

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[7] Knauf Alcopor, “Support document for IPPC Permit Application,” 2002.

[8] Knauf Insulation Engineering, “Process Handbook - St Helens capacity increase Rev 0,” 2022.

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[10] WSP, “Noise Management Plan,” 853177-WOOD-RP-OA-00001_P01 , 2024.

[11] WSP, “Environmental Risk Assessment,” 2024.

[12] WSP, “Air Quality Impact Assessment,” P03, 2024.

[13] Environment Agency, “Material comparators end-of-waste decisionsReport : SC130040/R15,” August 2016. [Online]. Available: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/545567/Material_comparators_for_fuels_-_natural_gas.pdf.

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