

Anna Lewis
NRW Permitting Service (Cardiff)
Natural Resources Wales
Cambria House
29 Newport Road
Cardiff
CF24 0TP

30th May 2014

Dear Mrs Lewis,

Please find enclosed Rockwool's response to the Regulation 60(1) Notice issued by Natural Resources Wales and dated 27th February 2014.

Should you require any extra information, please do not hesitate to contact me directly.

Yours sincerely,

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CC Jeremy Walters
 Neil Herbert

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Introduction

This document forms the response of Rockwool Limited to the information request made by Natural Resources Wales under the Environmental Permitting (England and Wales) Regulations 2010 (as amended), Regulation 60(1). As stated in the Regulation 60(1) Notice, the applicable BAT document to Rockwool is the “Best Available Techniques (BAT) Reference Document for the Manufacture of Glass”, published on 8th March 2012.

This response document summarises the first 4 types of information requested, namely;

- (i) how we currently meet the revised standards,
- (ii) if we do not currently meet the revised standards,
- (iii) how we are planning to ensure that we meet revised standards,
- (iv) if we are proposing not to meet the revised standards and AELs.

As for the 5th information request:

“Where your permitted activity involves the use, production or release of a relevant hazardous substance, (as defined in Article 3(18) of the Industrial Emissions Directive), carry out a risk assessment considering the possibility of soil and groundwater contamination at the permitted installation with such substances. Where any risk of such contamination is established either:

- prepare and submit a baseline report containing information necessary to determine the current state of soil and groundwater contamination; or
- provide a summary report referring to information previously submitted where you are satisfied that such information represents the current state of soil and groundwater contamination,

so as to enable a quantified comparison to be made with the state of the soil and groundwater contamination upon definitive cessation of the activity.”

Research for a Site Protection Monitoring Plan was carried out over the course of 2008 - 2010 with baseline testing of soil, groundwater and gas carried out in 2011 and reported in a Final Report, dated January 2012. Rockwool submitted the report to the predecessor of Natural Resources Wales and therefore believes that this request has already been satisfied. Please inform us immediately if this is not the case.

Executive Summary

For the majority of the revised standards, Rockwool is already compliant or confident of proving our compliance by 2016. However, there are 3 areas where Rockwool is requesting a small change from the current permit and 2 areas where further testing is required to prove compliance. These are outlined below:

- **Suspended Solids in Surface Water**
 - The current limit of 30mg/l (equal to the revised AEL) is not being met 100% of the time. During times of heavy rain, Rockwool occasionally exceeds this limit.
 - Over the past 4 years, Rockwool has established many methods of reducing the suspended solids load, namely; installing a milled waste conveyor system and a briquette conveyor, installing the Downstream Defender, extending the covered raw materials bays, undertaking a stringent drain cleaning regime, lease hiring a road sweeper unit to clean all yard areas daily and conducting regular operator awareness training. Despite this, we still experience an occasional breach of the limit.
 - The actions listed above have entailed capital expenditure investment of more than £500K and ongoing operational costs are £4,000 per month.
 - Rockwool is continuing to work on the root causes of the occasional breach of the suspended solids limit and is aiming to be fully in compliance by 2016. However, should we find that all solutions have been exhausted and breaches are still occurring, then we may request the averaging period for the AEL to be extended from 24 hours to 1 week. Data from 2013 and 2014 show that a weekly average limit will be met.
 - Annual stream surveys (made available to Natural Resources Wales) have shown that historical minor breaches have had no detrimental impact on the quality of the local watercourse.
- **Hydrogen Chloride from Lines 1 & 2 Cupolas**
 - The current limit of 50mg/Nm³ is being met on all 3 lines, but the BAT reference document calls for the limit to be reduced to 30mg/Nm³. In 2012 and 2013 the results for Line 2 cupola (emission point A2) were 36.5 mg/Nm³ and 33.25 mg/Nm³ respectively.
 - It is Rockwool's belief that the BAT reference document has been written with the more common abatement system in mind – i.e. with the filter before the combustion system – where it is much easier to achieve values of less than 30mg/Nm³ for hydrogen chloride emissions. Lines 1 and 2 (emission points A1 and A2) do not have such a system and as a result, their HCl emissions are slightly elevated. It would cost millions for the abatement system to be swapped around, so Rockwool is requesting that the mass release limit of 0.075 kg/tonne is applied to A1 and A2.
- **Sulphur Dioxide from Cupolas**
 - Rockwool requests that the mass release figure of 3.5 kg/tonne is applied to all 3 cupolas.

- Metals from Cupolas
 - This is not a measurement currently required by the permit. Tests are scheduled for June 2014 and Rockwool does not envisage any problems.
 - Rockwool requests the option to measure the metal content of the raw materials in place of emissions to air. This is particularly important in the case of Cr_{VI}, as, at the time of writing, we believe there to be only one stack testing company in the UK who is accredited to measure this parameter.
- Amines from Spinning Chambers and Curing Ovens
 - This is not a measurement currently required by the permit and there is no data available from within the Rockwool Group. Tests are planned for Q1 2015 and whilst we do not foresee an issue, we are including it here owing to a degree of uncertainty at this stage.

BAT Conclusion Under Assessment:

5 BAT CONCLUSIONS FOR THE MANUFACTURE OF GLASS

5.1 General BAT conclusions for the manufacture of glass

5.1.1 Environmental management systems

Sub-element	Compliant?	Comments
BAT is to implement and adhere to an environmental management system (EMS) that incorporates all of the following features:	Y	Rockwool is accredited to ISO 14001 (BSI certificate number 70301).
(i) commitment of the management, including senior management	Y	An annual Management Review is held with the Board of Directors.
(ii) definition of an environmental policy that includes the continuous improvement for the installation by the management	Y	Rockwool has an Environmental Policy.
(iii) planning and establishing the necessary procedures, objectives and targets, in conjunction with financial planning and investment	Y	Targets and objectives are set annually. Investments are made when required.
(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.	Y	Rockwool utilises a 4 tier documentation set-up – Manual, Procedures, Work Instructions / Standard Operating Procedures and Forms / Checklists. Such a set-up is essential for ISO 14001.

(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	Y	Audits (internal and external), meetings and visits can all generate actions. A log of actions is kept and regularly reviewed by the Environmental Team at Rockwool.
(vi) review of the EMS and its continuing suitability, adequacy and effectiveness by senior management	Y	As stated in (i), an annual Management Review is held with the Board of Directors.
(vii) following the development of cleaner technologies	Y	This done locally in the UK and also on a global scale by the Rockwool Group.
(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	Y	Rockwool maintains an Aspects Register which considers the environmental impacts of its operations. A Site Protection Monitoring Plan has been written by an external consultant and was submitted to the predecessor of Natural Resources Wales.
(ix) application of sectoral benchmarking on a regular basis	Y	Benchmarking is carried out regularly within the Rockwool Group. Energy use is benchmarked in the glass / mineral sector.

BAT Conclusion Under Assessment:

5 BAT CONCLUSIONS FOR THE MANUFACTURE OF GLASS

5.1 General BAT conclusions for the manufacture of glass

5.1.2 Energy efficiency

Sub-element	Compliant?	Comments
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	Y	Process settings, values and performance are monitored continuously by trained process controllers and operators. Specialist advice is sought from Process Services and Rockwool Group when required.
(ii) Regular maintenance of the melting furnace	Y	The furnaces are inspected regularly and are re-bricked when required.

BAT Conclusion Under Assessment:

5 BAT CONCLUSIONS FOR THE MANUFACTURE OF GLASS

5.1 General BAT conclusions for the manufacture of glass

5.1.3 Materials storage and handling

Storage of raw materials

Sub-element	Compliant?	Comments
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:		
(i) Store bulk powder materials in enclosed silos equipped with a dust abatement system (e.g. fabric filter)	Y	Fly ash and cement are stored in enclosed silos
(ii) Store fine materials in enclosed containers or sealed bags	N/A	No such material on site
(iii) Store under cover stockpiles of coarse dusty materials	Y	The majority of Rockwool's raw material bays are covered. There are 3 bays that are not covered, but the materials held in these bays are not dusty.
(iv) Use of road cleaning vehicles and water damping techniques	Y	A road sweeper is contracted to be on site on weekdays

Handling of raw materials

Sub-element	Compliant?	Comments
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:		
(i) For materials which are transported by above ground, use enclosed conveyors to prevent material loss	Y	All external conveyors are enclosed.
(ii) Where pneumatic conveying is used, apply a sealed system equipped with a filter to clean the transport air before release	N/A	
(iii) Moistening of the batch	N/A	
(iv) Application of a slightly negative pressure within the furnace	N/A	
(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	Y	Dolomite and limestone are not used as raw materials.
(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)	N/A	None of these processes are practised on site.
(vii) Use of enclosed screw feeders	N/A	Not used for raw materials.
(viii) Enclosure of feed pockets	N/A	

Diffuse gaseous emissions

Sub-element	Compliant?	Comments
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.	Y	Ammonia and oxygen tanks.
(ii) Control of temperature in the storage of volatile raw materials.	Y	Formalin, phenol and pre-made resin tanks are temperature controlled.
(iii) Tank insulation in the storage of volatile raw materials.	Y	Formalin, phenol and pre-made resin tanks are insulated.
(iv) Inventory management	Y	
(v) Use of floating roof tanks in the storage of large quantities of volatile petroleum products.	N	
(vi) Use of vapour return transfer systems in the transfer of volatile fluids (e.g. from tank trucks to storage tank).	Y	On oxygen tanker.
(vii) Use of bladder roof tanks in the storage of liquid raw materials.	N	
(viii) Use of pressure/vacuum valves in tanks designed to withstand pressure fluctuations.	Y	

(ix) Application of a release treatment (e.g. adsorption, absorption, condensation) in the storage of hazardous materials.	N/A	
(x) Application of subsurface filling in the storage of liquids that tend to foam.	N/A	

BAT Conclusion Under Assessment:

5 BAT CONCLUSIONS FOR THE MANUFACTURE OF GLASS

5.1 General BAT conclusions for the manufacture of glass

5.1.4 General primary techniques

Energy reduction

Sub-element	Compliant?	Comments
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.	Y	Planned maintenance jobs are programmed in for the 2 or 3 weeklong stops in a year (Easter, Summer & Christmas).
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.	Y	Process conditions are monitored continuously by the cupola process controller. Fuel/air ratio is controlled and we try to maintain stable flame conditions.

Control of raw materials

Sub-element	Compliant?	Comments
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)	Y	The types of raw material used by Rockwool have been refined over the years and, where possible, we seek to minimise the impurities present.
(ii) Use of alternative raw materials (e.g. less volatile)		
(iii) Use of fuels with low metal impurities		

Monitoring of emissions

Sub-element	Compliant?	Comments
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	Y	Critical parameters are measured continuously and are monitored by the process controller.
(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.	Y	Process parameters are measured continuously and are monitored by the process controller.
(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	Y	Dust, NO _x and SO ₂ are measured continuously.
(iv) Continuous or regular periodic measurements of NH ₃ emissions, when selective catalytic reduction (SCR) or selective non-catalytic reduction (SNCR) techniques are applied	N/A	
(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.	Y	CO is measured continuously.
(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	Partial	CO measured continuously. HCl and HF measured annually. Metals not currently measured.

(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.	N/A	The functionality of the waste gas treatment system is monitored continuously by the measurements of dust and CO emissions.
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Waste gas treatment

Sub-element	Compliant?	Comments
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	Y	The filter bags and combustion system on all cupolas are operated at their optimum performance during production runs. Lime abatement is used on Lines 1 & 2 to reduce SO₂ emissions.

Limit CO emissions

Sub-element	Compliant?	Comments
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	Y	Rockwool's CO emissions are well controlled by maintaining the appropriate air/fuel ratio and by maintaining optimum process conditions in the combustion system

BAT AEL

Sub-element		Compliant?	Comments
Parameter	BAT AEL	Y	Rockwool already meets the AEL.
	(mg/Nm ³)		
Carbon monoxide	<100		

Limit ammonia emissions

Sub-element	Compliant?	Comments
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	N/A	SCR and SNCR are not used at Rockwool.

Reduce boron emissions

Sub-element	Compliant?	Comments
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:	N/A	Boron compounds are not used at Rockwool.
(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		

BAT Conclusion Under Assessment:

5 BAT CONCLUSIONS FOR THE MANUFACTURE OF GLASS

5.1 General BAT conclusions for the manufacture of glass

5.1.5 Emissions to water from glass manufacturing processes

Reduction of water consumption

Sub-element	Compliant?	Comments
BAT is to reduce water consumption by using one or a combination of the following techniques		
(i) Minimisation of spillages and leaks	Y	Any leaks identified are reported to the Maintenance team and are fixed as soon as possible.
(ii) Reuse of cooling and cleaning waters after purging	Y	Any water used for cleaning purposes is contained within the process water loop and is used for other purposes – such as binder production.
(iii) Operate a quasi-closed loop water system as far as technically and economically feasible	Y	Rockwool operates a quasi-closed loop process water system. It is added to by rainwater that falls on bunded yard areas (and can be supplemented if required by surface water from the settlement tank) and is used for a variety of process operations. The pipes and tanks that transfer and hold process water are in a small, contained area of the site.

Reduction of pollutants

Sub-element	Compliant?	Comments
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 techniques to control emissions from storage of liquid raw materials and intermediates, such as containments, inspection/testing of tanks, overfill protection, etc.	Y	Surface water run-off from site flows through a Downstream Defender and a settlement tank before being discharged to stream. All liquid storage tanks are contained within bunds and are subjected to an inspection regime.
(ii) Biological treatment systems, such as activated sludge, biofiltration to remove/degrade the organic compounds	N	Not used at Rockwool
(iii) Discharge to municipal waste water treatment plants	Y	Domestic waste water and reject water from the 2 softening plants is sent to sewer
(iv) External reuse of waste waters	N/A	

BAT AELs

Sub-element			Compliant?	Comments																	
Parameter	Unit	BAT-AEL																			
pH	-	6.5-9	Y	As part of our current EPR Permit, Rockwool is only required to measure pH, total suspended solids, COD, ammonia and phenol. 3 separate composite samples were sent away in 2013 and analysed for the remaining parameters; the results were well within the BAT AELs specified and <i>Rockwool consequently requests that the frequency of test for these parameters is set at an appropriately long timescale (based on low risk to the environment and cost).</i>																	
Total suspended solids	mg/l	<30	N																		
Chemical oxygen demand (COD)	mg/l	<5-130	Y																		
Sulphates, expressed as SO ₄ ²⁻	mg/l	<1000	Y																		
Fluorides, expressed as F ⁻	mg/l	<6	Y																		
Total hydrocarbons	mg/l	<15	Y																		
Lead, expressed as Pb	mg/l	<0.05-0.3	Y																		
Antimony, expressed as Sb	mg/l	<0.5	Y	The current permitted limit for total suspended solids is also 30mg/l. For the majority of the time, this limit is met, but we can record breaches during times of heavy rainfall. Rockwool has been working on a solution to this and has succeeded in reducing the number of breaches from 96 in 2012 to 42 in 2013. This has been achieved by:																	
Arsenic, expressed as As	mg/l	<0.3	Y																		
Barium, expressed as Ba	mg/l	<3.0	Y																		
Zinc, expressed as Zn	mg/l	<0.5	Y																		
Copper, expressed as Cu	mg/l	<0.3	Y																		
Chromium, expressed as Cr	mg/l	<0.3	Y																		
Cadmium, expressed as Cd	mg/l	<0.05	Y																		
Tin, expressed as Sn	mg/l	<0.5	Y	<table><tr><th>Activity</th><th>Cost</th></tr><tr><td>Installing a conveyor to charge briquettes directly to L1&2 cupolas</td><td>£140K</td></tr><tr><td>Installing rod-milled waste conveyor system</td><td>£200K</td></tr><tr><td>Fitting roofing to raw materials bay and extending the rod-milled waste bay</td><td>£120K</td></tr><tr><td>Installing Downstream Defender</td><td>£100K</td></tr><tr><td>Quarterly drain cleaning regime</td><td>£2,500 pa</td></tr><tr><td>Annual cleaning of settlement tank</td><td>£4,000 pa</td></tr><tr><td>Roadsweeper on site Mon-Fri</td><td>£50,000 pa</td></tr></table>		Activity	Cost	Installing a conveyor to charge briquettes directly to L1&2 cupolas	£140K	Installing rod-milled waste conveyor system	£200K	Fitting roofing to raw materials bay and extending the rod-milled waste bay	£120K	Installing Downstream Defender	£100K	Quarterly drain cleaning regime	£2,500 pa	Annual cleaning of settlement tank	£4,000 pa	Roadsweeper on site Mon-Fri	£50,000 pa
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Quarterly drain cleaning regime	£2,500 pa																				
Annual cleaning of settlement tank	£4,000 pa																				
Roadsweeper on site Mon-Fri	£50,000 pa																				
Nickel, expressed as Ni	mg/l	<0.5	Y																		
Ammonia, expressed as NH ₄	mg/l	<10	Y																		
Boron, expressed as B	mg/l	<1-3	Y																		
Phenol	mg/l	<1	Y																		

				Rockwool is continuing to search for solutions that will give us full compliance with the total suspended solids limit and is aiming to achieve this by 2016. Rockwool is currently arranging for microscopy analysis to be carried out, so that we can better understand the types of suspended solids that are passing through the systems designed to catch them. Once we have obtained this knowledge, we will be in a better position to state how confident we are of meeting the 30mg/l limit in all weather conditions and will be able to state whether or not we need to apply for derogation. Should we need to apply for derogation, we will be requesting an increase in the averaging time for the AEL – i.e. a weekly average limit rather than a 24 hour AEL. This would be supported by evidence gathered in annual stream surveys that show Rockwool's emissions to the local watercourse have a negligible impact.
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BAT Conclusion Under Assessment:

5 BAT CONCLUSIONS FOR THE MANUFACTURE OF GLASS

5.1 General BAT conclusions for the manufacture of glass

5.1.6 Waste from the glass manufacturing processes

Reduction of solid waste

Sub-element	Compliant?	Comments
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	Y	All process waste produced on site is recycled back into the process and used to form new product.
(ii) Minimising material losses during the storage and handling of raw materials	Y	Raw materials are stored in discrete bays or silos and handling is kept to a minimum. Some loads of lump material are unloaded directly into the charging plant.
(iii) Recycling of internal cullet from rejected production	N/A	
(iv) Recycling of dust in the batch formulation where quality requirements allow for it	Y	All process waste produced on site is recycled back into the process and used to form new product.
(v) Valorisation of solid waste and / or sludge through appropriate use on-site (e.g. sludge from water treatment) or in other industries	N/A	
(vi) Valorisation of end-of-life refractory materials for possible use in other industries	N/A	
(vii) Applying cement bonded briquetting of waste for recycling into hot blast cupola furnaces where quality requirements allow for it	Y	The cement briquette plant was built and commenced operation in 2008.

BAT Conclusion Under Assessment:

5 BAT CONCLUSIONS FOR THE MANUFACTURE OF GLASS

5.1 General BAT conclusions for the manufacture of glass

5.1.7 Noise from the glass manufacturing processes

Reduction of noise emissions

Sub-element	Compliant?	Comments
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	Y	Rockwool has a noise management in place that has been approved by NRW (see CAR 05386).
(ii) Enclose noisy equipment/operation in a separate structure/unit	Y	Noisy equipment (e.g. exhausters fans) are housed in separate, suitable units.
(iii) Use embankments to screen the source of noise	N	Noisy areas are well shielded by buildings, so no embankments exist.
(iv) Carry out noisy outdoor activities during the day	Y	Crushing and screening of pit waste takes place 0800-1600 in winter time.
(v) Use noise protection walls or natural barriers (trees, bushes) between the installation and the protected area, on the basis of local conditions.	Y	Trees were planted on the southern boundary as part of the Line 3 project.

BAT Conclusion Under Assessment:

5 BAT CONCLUSIONS FOR THE MANUFACTURE OF GLASS

5.7 BAT conclusions for mineral wool manufacturing

5.7.1 Dust emissions from melting furnaces

Reduction of dust emissions

Sub-element	Compliant?	Comments
BAT is to reduce dust emissions from the waste gases of the melting furnace by applying an electrostatic precipitator or a bag filter system	Y	Rockwool has bag filters in place on all 3 cupolas.

BAT AEL

Sub-element			Compliant?	Comments
Parameter	BAT AEL		Y	Rockwool already meets the concentration AEL.
	(mg/Nm ³)	(kg/tonne melted glass)		
Dust	<10-20	<0.02-0.05		

BAT Conclusion Under Assessment:

5 BAT CONCLUSIONS FOR THE MANUFACTURE OF GLASS

5.7 BAT conclusions for mineral wool manufacturing

5.7.2 Nitrogen oxides (NO_x) from melting furnaces

Reduction of NO_x emissions

Sub-element	Compliant?	Comments
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: — Air staging — Fuel staging (d) Flue-gas recirculation (e) Low-NO_x burners (f) Fuel choice	Y	Low NO _x burners are used and the air / fuel ratio has been optimised to minimise NO _x emissions
(ii) Electric melting	N/A	
(iii) Oxy-fuel melting	Y	Oxygen is used as a supplementary fuel on Lines 1 and 2.

BAT AEL

Sub-element	BAT AEL		Compliant?	Comments
Parameter	(mg/Nm ³)	(kg/tonne melted glass)	Y	Rockwool already meets the concentration AEL.
NO _x expressed as NO ₂	<400-500	<1.0-1.25		

Reduction of NOx emissions

Sub-element	Compliant?	Comments
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:	N/A	
(i) Minimising the use of nitrates in the batch formulation.		
The use of nitrates applied as an oxidising agent in batch formulations with high levels of external cullet to compensate for the presence of organic material contained in the cullet.		
(ii) Electric melting.		
(iii) Oxy-fuel melting.		

BAT AEL

Sub-element			Compliant?	Comments
Parameter	BAT AEL		N/A	
	(mg/Nm ³)	(kg/tonne melted glass)		
NOx expressed as NO ₂	<500-700	<1.0-1.4		

BAT Conclusion Under Assessment:

5 BAT CONCLUSIONS FOR THE MANUFACTURE OF GLASS

5.7 BAT conclusions for mineral wool manufacturing

5.7.3 Sulphur oxides (SO_x) from melting furnaces

Reduction of SO_x emissions

Sub-element	Compliant?	Comments
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	N	Raw materials such as cement and slag have a relatively high sulphur content. However, cement briquettes are a recognised part of BAT and the slags bring benefits to the melting process which help save coke and gas and thereby reduce CO ₂ emissions.
(ii) Use of low sulphur content fuels	Y	The coke used by Rockwool has a sulphur content of <0.8%.
(iii) Dry or semi-dry scrubbing, in combination with a filtration system	N/A	
(iv) Use of wet scrubbing	N/A	

BAT AEL

Sub-element			Compliant?	Comments
Parameter	BAT AEL		N	Current emission values would not meet the 1400 limit at all times. <i>Rockwool is therefore requesting that the mass release limit for sulphur dioxide is applied to all 3 cupolas (emission points A1, A2 and A19).</i>
	(mg/Nm ³)	(kg/tonne melted glass)		
SOx expressed as SO ₂	<1400	<3.5		

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5.7.4 Hydrogen chloride (HCl) and hydrogen fluoride (HF) from melting furnaces

Reduction of HCl and HF emissions

Sub-element	Compliant?	Comments
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	Y	Existing raw materials have low chlorine and fluorine content and any potential new raw materials are thoroughly analysed before trials are allowed to take place.
(ii) Dry or semi-dry scrubbing, in combination with a filtration system	N/A	

BAT AEL

Sub-element			Compliant?	Comments
Parameter	BAT AEL			
	(mg/Nm ³)	(kg/tonne melted glass)		
Hydrogen chloride, expressed as HCl	<10-30	<0.025-0.075	N	Rockwool's current permitted limit for HCl is 50 mg/Nm³. This is achieved on all 3 cupolas. However, owing to the layout of the abatement system on Lines 1 & 2 (combustion before the filter), chloride preferentially moves to the gaseous state rather than into the fly ash. A limit of 30 is not attainable for the so called "dirty" combustion system. Conversely, the abatement system on Line 3 is known as a "clean" system (filter before combustion) and Rockwool is compliant with the proposed new limit of 30 mg/Nm³. <i>Rockwool therefore requests that the mass release limit for HCl is applied to Lines 1 & 2 cupolas (emission points A1 and A2).</i>
Hydrogen fluoride, expressed as HF	<1-5	<0.002-0.013	Y	Rockwool currently complies with the concentration limit.

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5.7.5 Hydrogen sulphide (H₂S) from stone wool melting furnaces

Reduction of H₂S emissions

Sub-element	Compliant?	Comments
BAT is to reduce H ₂ S emissions from the melting furnace by applying a waste gas incineration system to oxidise hydrogen sulphide to SO ₂		
(i) Waste gas incinerator system	Y	Rockwool has a combustion system with 2 burners on each line

BAT AEL

Sub-element			Compliant?	Comments
Parameter	BAT AEL		Y	Rockwool currently complies with the concentration limit.
	(mg/Nm ³)	(kg/tonne melted glass)		
Hydrogen sulphide, expressed as H ₂ S	<2	<0.005		

BAT Conclusion Under Assessment:

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5.7.6 Metals from melting furnaces

Reduction of metal emissions

Sub-element	Compliant?	Comments
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	Y	Existing raw materials have low metals content and any potential new raw materials are thoroughly analysed before trials are allowed to take place.
(ii) Application of a filtration system	Y	Rockwool has a bag filter system in place on all 3 cupolas.

BAT AEL

Sub-element	BAT AEL		Compliant?	Comments
Parameter	(mg/Nm ³)	(kg/tonne melted glass)		
Σ (As, Co, Ni, Cd, Se, Cr _{VI})	<0.2-1	<0.4 - 2.5x10 ⁻³	Y	Metals are not currently required to be monitored at Rockwool. Tests are scheduled for June 2014. No problems are expected.
Σ (As, Co, Ni, Cd, Se, Cr _{VI} , Sb, Pb, Cr _{III} , Cu, Mn, V, Sn)	<1-2	<2 - 5x10 ⁻³		

BAT Conclusion Under Assessment:

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5.7.7 Emissions from downstream processes

Reduction of emissions from downstream processes

Sub-element	Compliant?	Comments
BAT is to reduce emissions from downstream processes by using one or a combination of the following techniques:		
(i) Impact jets and cyclones	N/A	
(ii) Wet scrubbers	N/A	
(iii) Wet electrostatic precipitators	N/A	
(iv) Stone wool filters	Y	Rockwool has Rockwool slab filters in place on the spinning chamber exhausts on all 3 lines. The filters are replaced weekly.
(v) Waste gas incineration	Y	Rockwool has afterburners in place on the curing oven exhausts of all 3 lines.

BAT AEL – Forming Area-Combined forming and curing emissions-Combined forming, curing and cooling emissions

Sub-element			Compliant?	Comments
Parameter	BAT AEL			
	(mg/Nm ³)	(kg/tonne finished product)		
Total particulate matter	<20-50	-	Y	Rockwool currently complies with the concentration limits for 5 parameters. Amines have never been measured before. A test is scheduled for Q1 2015. No problems are expected.
Phenol	<5-10	-	Y	
Formaldehyde	<2-5	-	Y	
Ammonia	30-60	-	Y	
Amines	<3	-	Unknown	
Total volatile organic compounds, expressed as C	10-30	-	Y	

BAT AEL – Curing oven emissions

Sub-element			Compliant?	Comments
Parameter	BAT AEL			
	(mg/Nm ³)	(kg/tonne finished product)		
Total particulate matter	<5-30	<0.2	Y	Rockwool currently complies with the concentration limits for 6 parameters. Amines have never been measured before. A test is scheduled for Q1 2015. No problems are expected.
Phenol	<2-5	<0.03	Y	
Formaldehyde	<2-5	<0.03	Y	
Ammonia	<20-60	<0.4	Y	
Amines	<2	<0.01	Unknown	
Total volatile organic compounds, expressed as C	<10	<0.065	Y	
NO _x , expressed as NO ₂	<100-200	<1	Y	