RISK & HAZARD MANAGEMENT

011 - Energy and Resource Efficiency

Saffil Ltd (also known as Unifrax/Alkegen)
Line 4 Permit Variation

Document History

Version	Issue	Date	Notes	Author	Reviewer
1	-	23/03/22	Working draft with client.	J. Carroll R. Nibbs	C. Nicholls
2	-	01/07/22	Final draft.	J. Carroll R. Nibbs	C. Nicholls R. Ritchie R. Nibbs
3	1	11/07/22	Issue as part of permit application.	J. Carroll R. Nibbs	C. Nicholls R. Ritchie R. Nibbs

Contents

1 Introduction

This document is submitted as part of Form C3 of the environmental permit variation covering the installation of an additional production line (Line 4) at the Alkegen Widnes Site.

Please note that this document refers to the site as Unifrax Widnes and to the owning company as Unifrax. Unifrax was the name of the American company that owns Widnes site. A further complexity is added because due to a recent merger, Unifrax has changed its name to Alkegen. So, it is possible in correspondence or discussions that the site may be referred to as Alkegen.

The legal entity that owns the site at Widnes is however called Saffil Ltd and remains so despite the name changes to Unifrax and now Alkegen – and it is in this name that the EPR application is made on the accompanying forms.

Line 4 will have the capability to make a new Silica fibre, a key raw material in the manufacture of a new Lithium ion battery anode material called SiFAB™. Line 4 will also have capability to make other Saffil and M-Fil fibres in order to fill capacity and maintain sales revenue as the market for SiFAB™ develops.

Line 4 is being built to service demand for SiFAB™, a new pure silicon fibre product developed by Alkegen for use as an anode material in Lithium ion rechargeable batteries. SiFAB™ offers significant advantages in charge density and physical size compared with other materials in this sector due to its chemistry. The material presents a very significant opportunity to improve, for example, portable battery life, electric vehicle range and reduce weight in hand-held devices.

SiFAB™ is therefore expected to be a leading material in the manufacture of rechargeable batteries, a key environmentally related industry of today and the future.

SiFAB™ is made by converting the silica fibre made at Widnes into the required silicon fibre by chemical reduction. The first commercial production line for SiFAB™ is currently in construction in Indiana, USA. Silica fibre from Widnes will be exported from Line 4 to this facility for conversion into SiFAB™.

Other fibres to be made on Lines 2,3 and 4 are traditionally specified as thermal insulation, either as fibre or as a secondary manufactured piece or board, in order to maintain energy efficiency of high temperature applications like boilers, ovens and furnaces. Other applications include specialist shapes and boards, modules and filtration applications.

Automotive applications form a larger part of the overall volume with the main application being gaskets in catalytic converters (autowraps). Fibre from Widnes is exported to sister factories in North Wales and South Africa for conversion into autowraps using a wet laid process. These are sold world-wide. It is also supplied to other customers who operate similar processes. Other automotive applications include heat protection, battery separators, metal matrix reinforcement and diesel particulate filters.

Current fibre production from Widnes serves a wide range of customers in industrial and automotive applications. Most customers are overseas. The site therefore serves as a major exporter and local employer.

In summary, the use of fibre made at Widnes worldwide in a wide range of environmentally related applications helps our customers achieve their energy efficiency, environmental and sustainability targets. SiFAB™ presents an exciting opportunity to expand this contribution to a new level.

2 Energy

2.1 Climate Change Agreement

The fibre production and steam raising plants are covered by the Climate Change Agreement (CCA) Registered number BCC/T00086 (provided in Appendix 1) through the parent company and administered by the British Ceramics Confederation. The SEC target for TP5 (1 January 2021 to 31 December 2022) has yet to be agreed with the EA.

Specific Energy Consumption (SEC) targets were agreed for the fibre manufacturing facility as part of the CCA. SEC performance (monitored quarterly) has consistently outperformed the target.

The last CCA reporting period of 2019/2020 demonstrated that SEC has improved from 106,917 kWhr/te to 74,799 kWhr/te, a 30% reduction since the original CCA baseline target was set in 2008.

Some specific major hardware projects have contributed to this significant improvement:

Table 1 Major Hardware Projects – SEC Improvement

Year	Project
2012	Oil fired boilers replaced with modern natural gas fired boilers – Significant reduction in energy and carbon dioxide per te steam
2013	Line 3 commissioned – improved hardware Increased fibre production rate and reduced losses
2015-date	Development/optimisation of spinning solution recipes and preparation - Increased fibre production rate and reduced losses
2017	Installation of improved extraction hoods on Line 3 ovens – Increased fibre production rate and reduced losses
2018	Line 1 decommissioned – Low rate fibre production associated with this line removed

The improvement in SEC has also been due to a continued focus on improving production rates and reducing yield losses, tracked using daily, weekly, monthly production management metrics and reporting.

Other features and projects have also been implemented consistently throughout this period to reduce energy consumption and yield losses on the facility, some of which are referred to in this section.

Proposed improvements associated with Line 4 design and operation are also listed in this section.

2.2 Basic Energy Requirements – Energy Consumption Information

The table below indicates predicted site energy consumption:

Table 2 Predicted Maximum Energy Consumption

Energy source	Energy Consumption	
	Delivered, MWh	Primary, MWh
Electricity	65,000	169,000* (see note below)
Gas	85,000	85,000
Diesel	Minimal – emergency back up boiler fuel only	Approx. 0

* Note: The factor 2.6 to calculate primary from delivered electrical usage is a historical factor used in previous reporting to the Environment Agency and does not reflect improvements in generation efficiency or use of renewables.

The maximum energy figures in the table above are estimated based on approximately 3,500 te/year fibre production split across Lines 2, 3 and 4 and are based on installed gas fired and electrical loads. In optimised operation, an improved overall SEC of considerably less than 70,000 kWhr/te is expected.

Generally, Line 4 will use less electrical energy than either Lines 2 or 3 because the heat treatment ovens and furnaces are likely to be direct or indirect gas-fired rather than electrically fired as they are on the other lines.

2.3 Basic Energy Requirements- Energy Minimisation Measures

The site management team aims to continually improve energy efficiency at the installation. The following tables give a summary of recent work completed and future work planned in this area.

2.3.1 Operating, maintenance and housekeeping measures

Production rate and yield (Table 3)

Date	Improvement Process/Project
Continuous - ongoing	Continuous improvement of production rate and yield to improve SEC – reflected in budgeting, production tracking and reporting.
Continuous - ongoing	Plant availability and OEE measurement to reduce energy usage associated with plant breakdowns and restarts.
2021	CG fibre quality improvement – reduction in production costs and reduced waste to landfill
2021	Spinning candle reduction project – reduction in waste product to landfill
2022	Launch of energy management committee – improvement team focused on energy efficiency improvement across the facility

Line 4 - future	Significant production rate increase compared with Line 1 (which is to be formally removed from service) – reducing SEC

Equipment selection (Table 4)

Date	Improvement Process/Project
Continuous - ongoing	Use of high efficiency motors
2021	Variable speed drive (VSD) air compressor installed to save energy usage compared with existing on-line air compressors
2022	Installation of small screw air compressor – energy savings
2022	Improvements to boiler economisers – energy savings
Line 4	New gas-fired technology to be used (instead of electrical) for the heat treatment equipment (subject to design verification)
Line 4	Process design to include waste heat recovery options, for example in the heating of secondary air using furnace or process vents waste heat
Line 4	Gas-fired heat treatment ovens and furnaces including energy efficiency and heat recovery options in the selection of the equipment. To be a key part of the equipment tender and selection process.
Line 4	Process design of extraction hoods to allow improved control of heat loss from heat treatment equipment
Line 4	Energy efficiency or heat recovery considerations in the selection of the regenerative oxidiser
Line 4	Planned installation of an additional gas fired boiler fitted with economiser and inverter driven variable speed drives on combustion air fans
Line 4	Develop boiler condensate recycling system to include new boiler
Line 4	Variable speed drives on primary air, secondary air, scrubber vent and heat treatment fans
Line 4	Energy efficient air compressor upgrade – plus control to minimise idle running and even out running hours across duty and standby machines
Line 4	Closed loop cooling tower (including VSD fan) – also reducing legionella exposure risks
Other	Use Line 4 equipment improvements to implement similar improvements on Lines 2 and 3 (where economically and technically feasible)

Plant optimisation (Table 5)

Date	Improvement Process/Project
Continuous - ongoing	Improved HT and LT Furnace door arrangements

Continuous - ongoing	Modifications to spinning chambers to reduce fibre losses
2022	Improved metering on new site high voltage switchgear currently being replaced – to be extended into low voltage systems (assuming project approval)
2022	3.3 kV high voltage electrical distribution system decommission
Line 4	Decommission existing diesel fired standby boiler

Housekeeping and maintenance (Table 6)

Date	Improvement Process/Project
Continuous - ongoing	Boiler water dosing, blowdown control and maintenance in order to manage scale formation and optimise boiler efficiency.
Continuous - ongoing	Energy usage monitoring through CCA agreement as mentioned above.
Continuous - ongoing	Maximise recycle of secondary air heater condensate to heat primary air
2021	Insulation and thermal surveys on all lines to reduce energy usage
Line 4 - future	LED lighting to be used throughout new/extended buildings

2.3.2 Basic, low cost, physical techniques (Table 7)

Date	Improvement Process/Project
Continuous - ongoing	Improved insulation of ovens and furnaces
Continuous - ongoing	Refurbishment of insulation and furnace doors is carried out during plant overhauls
Continuous - ongoing	Process controls and sensors within DCS control system to ensure that energy is used efficiently to setpoint.
Line 4 - future	Selection of insulation to minimise heat input to heat treatment equipment to maintain set-point

2.4 Energy Plan

The site energy plan is focused on minimising the amount of energy used per tonne of fibre manufactured by:

- Maximising production rate
- Maximising plant availability
- Minimising the amount of scrap fibre
- Operating and maintenance to minimise energy loss during operation

Progress against stated objectives in each of these areas is tracked by the energy management committee, chaired by a member of the process engineering team and supported by technical and engineering resources.

Improvement areas for attention have been identified and are detailed below:

2.4.1 Compressed air

- Site air survey
- Compressor running in low cost periods
- VSD installation

2.4.2 Production

- Phased site shutdown strategy
- Line management of setpoints
- Supervisor training in energy management

2.4.3 Lighting and Metering

- Site lighting reduction
- Lighting survey and scope of work
- Steam mains survey
- Energy metering of site consumers

2.4.4 Process

- Trace heating setpoints
- Energy shutdown rounds
- Solution preparation chillers optimisation
- Thermal line survey
- Review oxidiser operation
- Boiler house energy audit
- HT/LT furnace element life
- Steaming oven efficiency
- Condensate return to boilers
- Opportunities for heat transfer

3 Appendix

The following appendix is included within this document

- Appendix 1: Climate Change Agreement extract

3.1 Appendix 1

Extract from CCA identifier: BCC/T00086 v2

UNDERLYING CLIMATE CHANGE AGREEMENT FOR THE CERAMICS SECTOR
Agreement Dated: 19 December 2020
TU Identifier: BCC/T00086

SCHEDULE 6

TARGET UNIT TARGETS

Target Unit Identifier	Target Period	Target Type	Throughput Unit	Baseline Throughput	Primary Consumption Unit	Baseline	Numerical target	(Percentage reduction from base year)
BCC/T00086	TP1 (1 Jan 2013 to 31 Dec 2014)	Relative	Tonne	1,209.000	kWh	129,263,839.320	103,765.374	(2.949%)
	TP2 (1 Jan 2015 to 31 Dec 2016)	Relative	Tonne	1,209.000	kWh	129,263,839.320	102,714.505	(3.931%)
	TP3 (1 Jan 2017 to 31 Dec 2018)	Relative	Tonne	1,209.000	kWh	129,263,839.320	101,663.636	(4.914%)
	TP4 (1 Jan 2019 to 31 Dec 2020)	Relative	Tonne	1,209.000	kWh	129,263,839.320	100,612.767	(5.897%)
	TP5 (1 Jan 2021 to 31 Dec 2022)	tbc	tbc	tbc	tbc	tbc	tbc	tbc

Template Version 4.0 21