An assessment of odour abatement choices and how they demonstrate BAT, having regard for the operational nature of the facility and the composition of the odorous gases.

Abatement in Place	Areas Treated	Capability	Investigations	Further Information	BAT References
Thermal oxidation	Process fume Foul air (from cooker discharge, presses, centrifuges, buffer bins)	The two existing oxidisers will deal with 10,600 Kg/hr of vapour for the Bradford Oxidiser and 9,000 Kg/hr for the Penrith Oxidiser. This is with 2,000 Kg/hr of foul air shared between the two. The minimum required for extracting foul air from the presses, centrifuges and buffer bin has been calculated at 1,640 Kg/hr (from extraction under a closed hood on presses/ void space over bins). These are design figures - there is scope to reduce the foul air if more space for vapour is required.	The ratio of foul air to vapour is not fixed and can be altered with different combustion settings, as per a defined algorithm. The different air streams are also mixed in a collector vessel prior to entering the combustion chamber and are therefore treated as one stream by the oxidisers. The measurements taken (indicating a typical production scenario) show that the parameters are not being exceeded. Figures for the maximum foul air throughput range from 2504 to 2625 kg/hr Figures for the maximum vapour range from 17,250 to 18,975 Kg/hr	Although the oxidisers are sufficient to manage the loading, a new piece of equipment is to be installed. This will provide an insurance against the existing equipment failing or becoming less reliable. The capacity will be larger, allowing some room air to be diverted from the bio filters to the oxidiser for treatment. Planning permission obtained and a permit variation has been submitted.	Thermal oxidation is recognised as BAT (SG8 – 39 and 49)

Abatement in Place	Areas Treated	Capability	Investigations	Further Information	BAT References
		Combustion air is taken from the feather plant and supplements the abatement for this area provided by the bio filters.	Continuous monitoring of temperature as a key parameter shows how the abatement is functioning.		
Air cooled condensers	Process fume / foul air as above	The two units in place will deal with 15m^3 of air Condenser A - ref CON/A/5, effluent handling capacity 5 m^3 /hr (referred to as 'Small'). Condenser B - serial number 25051/01, effluent handling capacity 10m^3 /hr(referred to as 'Large').	These are used as back up or for support on start up (prior to cookers fully heating up) Daily checks are carried out on the equipment ref EN01) – checking particularly for leaks in the system (non condensable fans and pipework). The units are used at least weekly (see App I for details of use).	The required capacity for back up use will be reviewed on implementation of the new oxidiser.	Air cooled condensers are recognised as BAT for primary odour abatement (SG8 – 39). The back up system is in place (as per SG8 – 51)
Bio Filters	Room air (tipping and processing areas), tank vents, tanker venting operations.	These wood chip bio filters were designed to provide more abatement capacity than required, thus allowing re-direction of air flow should one unit need to be switched off for maintenance when production is running.	Investigations have been carried out to check the loading on the bio filters – measuring the ammonia and hydrogen sulphide in the inlet air. This was done at different times to ensure a range of scenarios (normal	The odour from certain storage tanks (feather water and blood) are being abated by means of an in-line carbon filter so as to reduce any opportunity for shock loading of the bio filters.	Temperature, humidity and back pressure are continuously monitored and recorded. Monitoring procedures are in place for residence time, weed

Abatement in Place	Areas Treated	Capability	Investigations	Further Information	BAT References
	Not currently dealing with air from effluent treatment plant, condensate tanks or effluent & sludge storage tanks – these sources have been removed, thus reducing overall load.	The inlet air flow and residence time are checked periodically to ensure this is still the case. Room air flows and air changes per hour are also cross checked against this to ensure a balance of suitable extraction rates and residence times.	production, start up, shut down) are all covered. Work to date has indicated no sustained risk of shock loading from normal activity and monitoring results (including odour testing) have indicated good odour removal efficiency (this was presented to the EA in reports IC5 and IC8).	Consideration has been given as to whether the bio filters require any further abatement (such as chemical scrubbers on the inlet gases) – it has been found that providing the humidifier cleaning, general maintenance, routine checks on efficiency are all maintained and deficiencies promptly acted on – the units will continue to function effectively. Addition of clear action levels on the process controls ensures that deficiencies are addressed in a timely manner. With the implementation of the new oxidiser – more room air will be able to be directed to this equipment as combustion air and then further reduce the loading on the bio filters	control, flows, moisture. (SG8 – 48) In addition to BAT recommendations in SG8 : The microbiological status of the media and the pH is also monitored. Annual odour testing is carried out – the results have been benchmarked against current operating conditions and results from routine monitoring.

Abatement in Place	Areas Treated	Capability	Investigations	Further Information	BAT References
Waste Heat Evaporator	Feather line process fumes	This is primarily designed for energy efficiency in the feather process, but also has the effect of condensing odorous air from the hydrolyser, thus reducing the flow to the thermal oxidiser.	n/a	Feather condensate is piped directly to the effluent treatment plant and no longer stored in a tank.	BAT for odour abatement (SG8 – 38) and for energy efficiency (SG8 – 80)
Carbon filters	Fugitive emissions from effluent plant tanks, feather water and blood tanks	These deal with low level / low flow odour streams in situ, as an alternative to ducting the air stream to the bio filters (or as an in-line method of additional abatement prior to the bio filters)	Implemented on blood tanks (March/April 2019) Installed on feather water tank (at the end of June 2018) Installed in the covers over sections of the effluent treatment plant (July / Aug 2018)	Renewal frequency based on manufacturer's data / instructions and in house testing of the units (looking for levels of H2S as an indicator) and checking the water content of the filters.	BAT for storage (SG8 – 41)
Containment	Containment of room air (where not directly extracted to abatement plant)	Building integrity checks – visual checks carried out weekly (EID07)	Hoods, presses, ducting included Bio filter structures, fans and humidifiers included Cleaning of ducting to maintain extraction Smoke testing carried out.	Various measures implemented to control leakage of hot materials (including steam) and pipework insulation to reduce loss of heat. Effectiveness of room air extraction independently assessed in 2019. No	Ensuring that all operations which generate emissions to air are contained (SG8 1) Operations controlled to minimise fugitive emissions (SG8 – 20)

Abatement in Place	Areas Treated	Capability	Investigations	Further Information	BAT References
				recommendations made with regard to re-balancing any areas or for re-positioning any ducting.	
Chemical Scrubbers	Blood Drying	Chemicals are dosed automatically and the pH/REDOX levels will be monitored. Tests on the outlet air will include regular monitoring of H2S and Ammonia using gastech tubes and periodic testing by olfactometry to measure efficiency of odour removal. A cleaning programme will be in place to ensure any carry over of product into scrubber reservoirs is removed.	Efficiency to be evaluated on commissioning of the equipment – units have been designed specifically to handle the air from the process.	Selected for the treatment of 'wet' air emissions high in ammonia and possibly hydrogen sulphide.	Recognised as BAT (SG8 – 45) and the control measures in place will reflect BAT (SG8 – 46)

Further Work

Following the installation of the new thermal oxidiser and changes to processing plant planned for 2019/ 2020, further work will need to be done on confirming the air flows going for treatment – including foul air sources and room air – with a view to increasing the room air volumes going to the oxidiser and leaving less odorous / high volume air (such as the trailer shed and mill areas) for bio filter treatment.

Following installation of the changes to blood processing, the chemical scrubber efficiency will need to be formally evaluated.

References:

Airmatic report on extraction - SR1218-ARM-01i2 Final Report

Associated Improvement Condition Reports:

IC2 - A review to identify and characterise all sources of odour and the options available to effectively treat odour at the installation

IC4 - A review to provide justification for the abatement systems used to treat each odour source and demonstrate how they are fit for purpose and represent BAT.

IC7 - A procedure to ensure meaningful process control of the biofilters is undertaken at the installation, including but not limited to trigger levels, corrective actions and contingency arrangements.

IC5 – A review of the monitoring of extracted air to review trends and identify variation in load.

IC8 - A review of the efficiency of each biofilter, having regard for the variability in load upon each biofilter bed and the impact of this upon performance, in particular the Empty Bed Residence Time (EBRT).

IC3 - A report detailing a comprehensive review of ventilation and air extraction systems on site, undertaken by a suitably qualified engineer.

IC9 – Installation of additional odour abatement measures (carbon filters) on tanks which are identified as having a high odour potential (especially sludge tanks and feather water tanks) to further mitigate against the risk of odorous emissions from the installation.

IC10 – Installation of a Cleaning in Place (CiP) system on tanks identified as having a high odour potential (especially blood, sludge and feather water tanks) to further mitigate against the risk of odorous emissions from the installation.

IC12 – Odour Management Plan – details of abatement measures, capacity and contingency operations.

Appendix I

Further Information on the Use of Air Cooled Condensers

During normal operation process fume and foul air sources are drawn into the effluent collector vessel and treated by both oxidisers. The small condenser remains on auto standby, available to run on failure of one (or both) oxidiser(s). The large condenser was fitted after installation of the PAP line, but it is not required for normal use when the thermal oxidisers are operational.
The condensers are part of the back up abatement system designed to take air from the effluent collector when the thermal oxidisers are not available. In addition to this the small condenser will be run at start up, when the offal cooker(s) are being warmed up, to contain residual odours from the system as it gets warmer. It can also come on line when there are variations on the amount of process fume (effluent) being released from the cooking process. – this is a normal effect from processing raw material that varies in moisture content. This has the effect of 'smoothing' the treatment of odour through the system instead of allowing the effluent collection fan to stop and start causing variations in processing temperatures. When the pressure (mbar) increases above a pre-set level in the effluent collector, a message is sent to Condenser A and a damper opens to allow fume to be passed to it from the offal ducting. When the pressure changes back the operation is reversed.

With condenser B the operation is manual when the operator observes the mbar signal in relation to fume from the MBM (PAP) cooker. This material is drier than the poultry offal, therefore the most common scenario would be manual operation on start up (if required) or when the back up abatement is required (failure scenario).

The effluent circulates within the condensers as a sealed system, no effluent air is released to atmosphere from this process. Pressure relief on the whole system is provided by steam release valves.
When one or both of the oxidisers are running (support scenario) the non-condensable gases are combusted in the oxidiser chamber, in the case of both oxidisers failing (back up scenario) they are combusted in the steam raising boiler.

The flow rate of condensate to effluent treatment is logged using flow meters.

In the event of oxidiser failure, the steam raising boiler and air-cooled condenser(s) operate as a back-up system, but the capacity for abatement is much reduced. The overloading of this capacity is avoided due to the fact that the steam requirements for processing cannot be physically achieved and the cookers will not operate unless they are at the set temperatures.