Schedule 5 Request for Further Information

Question 1(C)

A demonstration that acid/alkali scrubber system is a suitable method of odour abatement based on the speciation of odour compounds that need to be treated in the odour fume from the process the scrubber serves. Demonstration of BAT to be supported by a quantitative risk assessment. The point source emissions to atmosphere from the proposed scrubber have been omitted from the odour model. Provide a quantitative assessment to demonstrate the odour impacts from these 2 new point sources (in combination with other sources – therefore the installation as a whole) in your odour model.

Process to be abated:

Sterilisation and drying of blood to produce blood meal, with the air stream from the dryer to be abated through a scrubbing unit prior to being treated further in a biofilter.

Proposed Methodology

In development of the blood lines, two different methods are now being reviewed for the treatment of the air from the drying process.

Mixed species blood – a 2-stage alkali / acid scrubber consisting of two towers packed with polypropylene. This utilises dilute sulphuric acid with either sodium hydroxide or sodium hypochlorite to alter the pH of the scrubbing solution.

Poultry blood –as an alternative proposal the vapour will be treated by water sprays and pH monitoring within a single scrubbing tower.

Effectiveness of a scrubber system:

- The majority of solids will be washed out of the airstream.
- Any substance soluble in water, will to some extent be dissolved into the water stream, and a dilution will take place by the pH regulating system on the scrubber, that ensures replacement of the water / solution, when pH is going up or down beyond the setpoints. This keeps it on the side of alkaline, but more water added if the re-circulating water becomes more acidic.

The principle of the pH system is that there are acid conditions for the removal of ammonia, amines and other nitrogen compounds. These form non-volatile salts that are removed in the scrubber effluent. Ammonia also dissolves readily in water, although at a more alkaline pH it will be released as a gas. The alkaline conditions will oxidise acidic compounds such as hydrogen sulphide and reduced sulphur compounds.

Information on the composition of the air stream has been provided by the manufacturer and is representative of the air streams normally experienced with animal by-product material. Testing was carried out by Odournet and the results are shown below.

Sample Location	H2S (ppm)	NH3 (ppm)	Odour Units (OU_E m^3)
Outlet from Dryer	0.5	0.25	17,879
	0.5	0.25	15,932
	0.5	0.25	13,392

At 85-95% efficiency this will be reduced to 780-2300 odour units. The biofilter would reduce this again to 40- 200 units, based on current efficiency.

Further analysis of the air stream by GCMS confirmed the higher percentage of the compounds to be aldehydes, alcohols, organic acids and sulphur compounds – indicating that an alkaline environment would be more effective at reducing the levels of odour compounds.

The effectiveness of odour removal will be assessed during commissioning to ascertain which is the more effective and the chemical inputs adjusted accordingly.

Reviews of various packing materials have indicated that the use of carbon-based products may not be suitable for the moist air stream.

Background Information

The table below shows results from equivalent uses of this technology within rendering.

	Typical Inlet Odour Concentration OU_E/m^3	Typical Outlet Odour Concentration OU_E/m^3	Typical Odour abatement efficiency
Combustion methods	3,600,000	5,000	>99%
Bio-filters	7,500 to 50,000	250 to 2,500	85 – 95%
Chemical scrubbers	7,500 to 50,000	250 to 2,500	85 – 95%

	Chemical scrubber	Biofilter
Typical achievable odour concentration (OU_E/m^3)	2,000 – 3,000	2,000 – 3,000
Percentage abatement	95%	95%
Retention time (sec)	2	>30
Water consumption	Low	Medium
Energy consumption $MJ(m^3/hr)^{-1}$ air treated [(a)]	18.4	16.5
Chemical consumption	Approx.14T/yr	Low - for pH control
Land (footprint) [(a)]	$1/25^{th}$ of biofilter	1
Capex	Low	Medium – low
Opex	Low	Low
Maintenance	Low	High
Dispersion - vertical stack	Yes	Not unless covered filter

Monitoring	Scada based dosing control, in stack sampling ports for extractive olfactometry or chemical species tests if required	Grab sampling for olfactometry if uncovered
Waste arisings	Spent liquors to ETP – low volumes and impact	Media replacement. Non-hazardous (approx. every 3 years for organic media)

(a) "A sustainability analysis of odour abatement technologies"
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Outlet from scrubber:

The exit air from the scrubbing system is to be directed to a biofilter for further abatement until the outlet air stream is tested and deemed to be suitable for emission direct to atmosphere. Samples of air will be periodically tested on exit from the scrubber for odour units and /or gas tech tubes to monitor for hydrogen sulphide and ammonia.

The existing biofilters have availability capacity to deal with the additional air and have been operating at greater than 95% efficiency. Biofilter 3 (for the poultry blood line) has 30% available capacity and Biofilter 1 (for the mixed species blood) has 40% available capacity.

The air flow through the scrubber is adjustable and will therefore be monitored to ensure adequate residence time in both the scrubber unit and the biofilter.

References:

- Integrated Pollution Prevention and Control Reference Document on
  Best Available Techniques in the Slaughterhouses and Animal By-products Industries
  May 2005
- ER32 Review of Odour Monitoring and Control Techniques at Rendering Plants - Ricardo-AEA (March 2013).