REPORT

Activated Charcoal Scrubber Stack Testing - Odour and Neopentyl Glycol

AkzoNobel Sunshine North

Submitted to:

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1x Golder Associates Pty Ltd

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1.0 INTRODUCTION

Golder Associates Pty Ltd (Golder) was commissioned by AkzoNobel Pty Ltd (AkzoNobel) to conduct an odour and neopentyl glycol sampling programme at the AkzoNobel site located at 51 McIntyre, Sunshine North (the site). The purpose of the monitoring programme was to assess odorous and neopentyl glycol emissions to air from the activated charcoal scrubber servicing the resin plant accordance with the scope outlined in Golder Change Order No. 19130795-018-CO-Rev0, issued on 06 July 2021.

The assessment has been conducted in response to a Clean Up Notice (CUN No. 90011933) and Pollution Abatement Notice (PAN No. 90011934) issued to AkzoNobel by the Environment Protection Authority (EPA VIC) issued on 23 April 2021.

The sampling of the activated charcoal scrubber was conducted on 01 September 2021 with replicate odour and neopentyl glycol samples taken from the inlet and outlet of the scrubber. Golder was informed by AkzoNobel that sampling occurred during worst case operating conditions (i.e. maximum capacity). The following parameters were measured for each source:

- Exhaust gas velocity, flowrate and moisture content
- Odour concentration and rate of emission.
- Neopentyl glycol concentration and rate of emission.

Odour analysis was conducted at the Air Quality and Noise Laboratory at Golder Associates, Richmond (NATA accreditation No. 1910).

Neopentyl glycol emission results were unavailable at the time of this report due to laboratory analysis delays and will be included in the next revision of this report.

The following report describes the test methods used and the results obtained from the monitoring programme.

2.0 TEST METHODS

2.1 Exhaust gas velocity

For stack emissions, velocity profiles were obtained across the flue utilizing an L-type pitot static tube and a TSI DP-Calc micromanometer.

Positions for velocity pressure measurement were determined to be at the centre of equal areas over the cross section of the sampling plane.

The micromanometer was calibrated against reference manometer 7970 (NATA Calibration Report No. A35450PA – 01/03/2020). Manometer readings were corrected in accordance with the test results.

The test methods used were in accordance with Golder Source Test Method V2, *"Velocity and Volume Flowrate: For Source Emissions"*.

When sampling plane conditions comply with the requirements of Australian Standard AS 4323.1 – 1995, "*Stationary Source Emissions: Method 1: Selection of Sampling Positions*", a conservative estimate of the measurement uncertainty involved in the determination of exhaust gas average velocity with a pitot tube and micromanometer is ± 5% (for velocities greater than 5 m/sec). At lower velocities the uncertainty is substantially increased.

2.2 Exhaust gas temperature

Exhaust gas temperature was determined using an electronic thermometer equipped with a chromel/alumel thermocouple. The thermometer was calibrated against AMA mercury in glass thermometer 526.10938 (NATA Calibration Report No. NT200434.02 – 18/08/2020).

2.3 Exhaust gas moisture content

Moisture content was determined by wet and dry bulb psychometry, in accordance with Golder Source Test Method M5, *"Moisture Content".* This Golder Source Test Method has a basis in the following U.S. Environmental Protection Agency Method; 4, “Determination of Moisture Content in Stack Gases.”

2.4 Odour/Dynamic Olfactometry

Samples were taken in accordance with Golder Source Test Method B1, *“Bag Sampling in Ambient Air and Source Emissions”*.

Samples were obtained by creating a vacuum within a rigid plastic drum, which draws in the sample gas at a through a polytetrafluoroethylene (PTFE) tube and into a Nalophan sample bag, sealed with a stainless steel plug. The analysis conducted was in accordance with the following standards, methodology and guidelines:

- Australian Standard AS/NZS 4323.3 “Determination of Odour Concentration by Dynamic Olfactometry”
- Golder Associates Source Test Method No. O4, "Odour (Dynamic Olfactometry) In Ambient Air and Source Emissions"
- EPA VIC Publication 1666.1 “Determination of Odour Concentration by Dynamic Olfactometry”.

Using a series of calibrated mass flow controllers, the Nalophan bag of sample was dynamically diluted to various concentrations with dry odour free air and passed through a mixing chamber.

The diluted sample was then presented to a panel of up to six people where their individual odour threshold was recorded. The odour level is determined from the geometric mean of the individual panellist odour threshold estimates, multiplied by the sample pre dilution factor.

All items of equipment in contact with the sample, or diluted sample, were constructed from PTFE, stainless steel or glass to prevent contamination.

The accepted range for a known reference material (n-butanol) of panel detection threshold concentration is between 20 – 80 parts per billion by volume (ppb).

2.5 Neopentyl Glycol

A sample of stack gas was drawn through a XAD-7 OVS sorbent cartridge. The inlet of the sampling cartridge was located at approximately a quarter of the flue diameter from the wall.

Sample volume was determined by placing a calibrated critical orifice in the sample train. The critical orifice was calibrated using a transfer standard flowmeter. Sorbent tubes consist of sample and control section. Sections were analysed individually to determine if there had been significant break-through from the sample section.

The sorbent cartridge was analysed using Gas Chromatography (GC) and conducted by SGS, NATA Laboratory Accreditation No. 2562.

The test method used was based on the National Institute for Occupational Safety and Health (NIOSH) Method 5523 “Glycols”.

3.0 RESULTS

A summary of the results of the odour emission assessment are presented in Table 1. Detailed results from each source are presented in Table 2 and Table 3.

Table 1: Emission Assessment - Summary of Results

Source	Average Odour Level (ou)	Average Odour Rate (ou.vol/min)	Neopentyl Glycol Concentration	Neopentyl Glycol Rate
Activated Charcoal Scrubber – Inlet	6,500	820	TBC	TBC
Activated Charcoal Scrubber – Outlet	5,200	810	TBC	TBC

Notes: o.u. = odour units; o.u vol/min = odour units volume per min (wet gas basis) / TBC To be confirmed - Neopentyl Glycol results were unavailable at the time of this report due to laboratory analysis delay.

Table 2: Emission Results – Activated Charcoal Scrubber Inlet

Sampling Details	
Company	AkzoNobel, 51 McIntyre, Sunshine North, 3020 VIC
Sample Date	01/09/2021
Location	Resin Plant – Activated Charcoal Scrubber Inlet
Process Conditions	Worst case operating conditions
Sampling Plane Description	One access port, <1 diameter downstream from a fan and <1 diameter upstream from a bend.
Sampling Plane Compliance	Not compliant with the dimensional requirements of Australian Standard AS 4323.1 “Method 1: Selection of Sampling Positions”. Additional sampling points were conducted, and the velocity/temperature traverse results indicate compliance with exhaust gas requirements a – e. Therefore, the sampling plane is classified as non-ideal.
Testing Officers	Florence Damour
Test Conditions	
Stack dimensions (mm)	550 (diam)
Av. stack gas temperature (°C)	21
Barometric pressure (kPa)	102.35
Duct static pressure (kPag)	-0.667
* Average velocity (m/s)	9.5
* Actual gas flowrate (m^3/min)	135
Gas flowrate at S.T.P. (Nm^3/min)	126
Dry gas flowrate at S.T.P. (Nm^3/min)	125
% H_2O v/v	1.2
O_2 (%v/v)	21

AS 4323.1 Compliance			
Requirements	Criteria	Sampling Plane	Status
Distance from downstream disturbance	2 D min.	< 1 D	**X**
Distance from upstream disturbance	6 D min.	< 1 D	**X**
Flow direction at all points	Same direction	Same direction	✓
Velocity at all points	> 3 m/s at all points	> 3 m/s at all points	✓
Cyclonic component	< 15°	< 15°	✓
Difference between points	< 10% absolute temperature	< 10% absolute temperature	✓
Difference between mean and points	< 10% absolute temperature	< 10% absolute temperature	✓
Highest to lowest pitot pressure	< 9 : 1	< 9 : 1	✓
Highest to lowest gas velocity	< 3 : 1	< 3 : 1	✓
Gas temperature	> dew point	> dew point	✓
Overall Classification			Non-Ideal

Test Results – Activated Charcoal Scrubber Inlet		
Odour		
Sample number	21-1578	21-1579
Sample period (hours)	09:12 – 09:22	09:33 – 09:43
Analysis date	01 September 2021	01 September 2021
Odour laboratory temperature (°C)	21	21
n-butanol panel threshold (ppb)##	33	33
Pre-dilution factor	1	1
Concentration (ou)**	6,000	7,100
Mass rate (ou.m^3/min)	750	890
Average mass rate (ou.m^3/min)	820	
Neopentyl Glycol		
TBC - Neopentyl Glycol Results were unavailable at the time of this report due to laboratory analysis delays.		

Notes

*Actual gas flowrate and velocity at stack gas temperature and pressure

** Wet gas basis.

Panel n-butanol detection threshold concentration in parts per billion by volume (ppb). Certified reference material n-butanol 61.6 ppm (Cylinder No. 385935; certificate date: 30/10/2018)

Deviations from AS/NZS 4323.3: 2001 "Stationary Source Emissions – Part 3: Determination of Odour Concentration by Dynamic Olfactometry": Nil.

Table 3: Emission Results – Activated Charcoal Scrubber Outlet

Sampling Details			
Company	AkzoNobel, 51 McIntyre, Sunshine North, 3020 VIC		
Sample Date	01/09/2021		
Location	Resin Plant – Activated Charcoal Scrubber Outlet		
Process Conditions	Worst case operating conditions		
Sampling Plane Description	One access port, <1 diameter downstream from a fan and <1 diameter upstream from an exit point.		
Sampling Plane Compliance	Not compliant with the dimensional requirements of Australian Standard AS 4323.1 "Method 1: Selection of Sampling Positions". Additional sampling points were conducted, and the velocity/temperature traverse results indicate compliance with exhaust gas requirements a – e. Therefore, the sampling plane is classified as non-ideal.		
Testing Officers	Florence Damour		
Test Conditions			
Stack dimensions (mm)	550 (diam)		
Av. stack gas temperature (°C)	19		
Barometric pressure (kPa)	102.35		
Duct static pressure (kPag)	-0.017		
* Average velocity (m/s)	11.8		
* Actual gas flowrate (m^3/min)	168		
Gas flowrate at S.T.P. (Nm^3/min)	158		
Dry gas flowrate at S.T.P. (Nm^3/min)	156		
% H_2O v/v	1.5		
O_2 (%v/v)	21		
AS 4323.1 Compliance			
Requirements	Criteria	Sampling Plane	Status
Distance from downstream disturbance	2 D min.	> 2 D	**X**
Distance from upstream disturbance	6 D min.	5 D	**X**
Flow direction at all points	Same direction	Same direction	✓
Velocity at all points	> 3 m/s at all points	> 3 m/s at all points	✓
Cyclonic component	< 15°	< 15°	✓
Difference between points	< 10% absolute temperature	< 10% absolute temperature	✓
Difference between mean and points	< 10% absolute temperature	< 10% absolute temperature	✓
Highest to lowest pitot pressure	< 9 : 1	< 9 : 1	✓
Highest to lowest gas velocity	< 3 : 1	< 3 : 1	✓
Gas temperature	> dew point	> dew point	✓

Overall Classification		Non-Ideal
Test Results – Activated Charcoal Scrubber Outlet		
Odour		
Sample number	21-1584	21-1585
Sample period (hours)	9:12 – 9:22	9:33 – 9:43
Analysis date	01 September 2021	01 September 2021
Odour laboratory temperature (°C)	21	21
n-butanol panel threshold (ppb)##	33	33
Pre-dilution factor	1	1
Concentration (ou)**	6,000	4,400
Mass rate (ou.m^3/min)	930	690
Average mass rate (ou.m^3/min)	810	
Neopentyl Glycol		
TBC - Neopentyl Glycol Results were unavailable at the time of this report due to laboratory analysis delays.		

Notes
* Actual gas flowrate and velocity at stack gas temperature and pressure
** Wet gas basis.
Panel n-butanol detection threshold concentration in parts per billion by volume (ppb). Certified reference material n-butanol 61.6 ppm (Cylinder No. 385935; certificate date: 30/10/2018)
Deviations from AS/NZS 4323.3: 2001 "Stationary Source Emissions – Part 3: Determination of Odour Concentration by Dynamic Olfactometry": Nil.

4.0 DISCUSSION

A summary of the results of the odour emission results for the monitoring conducted on the 01 September 2021 is presented in Table 5. Neopentyl glycol emission results were unavailable at the time of this report due to laboratory analysis delays and will be included in the next revision of this report.

Table 4: Odour Emission Assessment - Summary of Results

Source	Average Odour Level (ou)	Average Odour Rate (ou.vol/min)
Caustic Scrubber – Inlet	6,500	820
Caustic Scrubber – Outlet	5,200	810

Notes: o.u. = odour units; o.u vol/min = odour units volume per min (wet gas basis)

The measured inlet and outlet odour emission rates for the caustic scrubber are used to calculate the scrubber's odour removal efficiency. The calculated average removal efficiency of the activated charcoal scrubber is 1%.

5.0 IMPORTANT INFORMATION

Your attention is drawn to the document titled - “Important Information Relating to this Report”, which is included in Appendix A of this report. The statements presented in that document are intended to inform a reader of the report about its proper use. There are important limitations as to who can use the report and how it can be used. It is important that a reader of the report understands and has realistic expectations about those matters. The Important Information document does not alter the obligations Golder Associates has under the contract between it and its client.

Signature Page

If you have any questions, please don't hesitate to contact us.

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https://golderassociates.sharepoint.com/sites/115853/project files/6 deliverables/025-r- ac stack testing - odour-npg/19130795-025-r-rev0 - ac stack testing - odour-npg - september 2021.docx

APPENDIX A

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