

ODOUR ABATEMENT MAINTENANCE PROCEDURE

1. Procedure Objectives

- This procedure details the checks and maintenance that must be carried out to:
- Ensure high performance of the odour abatement equipment
- Prevent the escape of odours from site

2. Scope

- This procedure covers the odour abatement equipment installed at the Biogen AD plants.

3. Health and Safety considerations

- Undertaking a number of these checks has the potential to expose personnel to dangerous gases such as H₂S and Ammonia; where this is the case the procedure defines area where checks are not to be undertaken.
 - Any at height work required by this procedure is to be conducted by competent staff using the appropriate access equipment
- 3.1. For Rae tube measuring Avoid contact with tube contents in case of accidental breakage. Exposure to tube contents can result in significant health hazards.
- 3.2. Site rules PPE to be worn at all times; 4 Gas monitors, G7 gas monitor, Hi Viz clothing, safety boots, hand gloves, safety glasses and hard hats, staff are issued with Hi Viz coats that provide warmth during cold weather operations

4. Environmental considerations

- Maintenance which requires complete shutdown of the odour abatement equipment should be undertaken when food waste processing is not being undertaken where possible to minimise the potential for odours offsite.
- 4.1. Dispose of spent tubes in site's sharps hazardous waste bin for safe disposal
- 4.2. Do not empty content into a water course or drain.

5. Responsibility

- The Site Manager is responsible for ensuring adequate checks are undertaken on all odour abatement equipment installed at the AD plant.
- The Compliance Director is responsible for ensuring the samples are tested as required.
- The Site Manager is responsible for ensuring records are kept of all checks and maintenance undertaken on the odour abatement equipment.
- The Site Manager is responsible for informing the Compliance Director in the event of a major breakdown of the odour abatement equipment.

6. Definitions

- Biofilter

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Biofilters contain organic filter media such as woodchip or shells covered in a thin biofilm containing microbes. These microbes absorb and digest the chemicals in the air including the odorous chemicals, making the air flow out less odorous.

- Carbon filter

Activated Carbon is a form of carbon which has been treated such that it has a very large surface area. It is in the form of pellets, granules or a powder, contained within a vessel. Air is passed through the filter in order that odorous (or polluting) chemicals are absorbed.

- 6.1. Gas detection tubes (RAE tubes) operate in the following manner: An air sample is drawn through a tube containing a reagent, causing a colour change. The concentration is then read from the length of the colour stain in the reagent.

RAE tubes are used to measure the concentration of ammonia (NH₃) and Hydrogen sulphide (H₂S) (in ppm).

7. Associated Documents

- All associated documents referred to in this Procedure are highlighted in bold and underlined.

8. Procedure

- Regular checks must be undertaken on odour abatement equipment installed on site. This procedure details the checks required for the different types of abatement equipment installed at the AD plants.
- Checks should be undertaken in accordance with the relevant guidance sections below and recorded on the check sheets found in the appendices. Sections include
 - PH measuring section 9
 - Shipping container section 10
 - Basingstoke Section 11
 - Weston Biofilters Section 12
 - Carbon filters Section 13
 - Coconut fibre Biofilter Section 14
 - Gas detection tube procedure 15

Daily checks:

- Water circulation Flow Rate
- Water circulation flow rate should be recorded daily from the Flow-Mon meter installed on the system. This must be recorded as a numeric value so that any deteriorations can be detected and flow can be compared to the specification
- Pressure Drop
- The pressure differential should be measured at the sample points on the inlet and outlet ducting of the unit. Typical readings should be less than 500Pa, if the pressure increases above 500Pa the media bed may be compacted and it may be necessary to replace it. In this event please contact the Compliance Director and Bord na Mona on the contact details below.
- Irrigation Inline Strainer and Irrigation Re-circulation Pump Strainer Basket

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- These strainers must be removed and inspected daily for signs of black slime. The pump should be switched off and the air released before removing the lid of the pump. If they are found to be dirty they must be thoroughly cleaned before placement back into the circulation pump. Large amounts of black slime could indicate a problem in the media; this should be noted on the recording forms in Appendix 1.

Weekly Checks:

- Sniff Tests on treated air
- Weekly sniff tests should be undertaken on the treated air exiting the system through the exhaust stack sample point or if deemed necessary from the exhaust. Under no circumstances should an operator try to sniff any odorous air direct from the equipment i.e. above the stack as this could prove to be dangerous or even fatal. Sniff tests should be carried out by an operative on arrival to site to ensure they are not desensitised.

Monthly Checks:

- pH testing of irrigation water
- Monthly testing of the irrigation water must be undertaken. The water should be maintained between 6.5-8pH units. If the pH is not within this range please inform the Compliance Director who will contact Bord na Mona on the contact details below.
- Performance Checks
- Performance checks should be carried out monthly using low range H₂S gas detection tubes (**also see section 13**). Samples should be taken from both the inlet and outlet and the efficiency calculated. If necessary, further performance checks can be carried out using a Jerome or olfactory sampling and analysis using odour bags.
- Performance and distribution of irrigation water nozzle
- The top of the biofilter is fitted with a hatch that will allow access for inspection and maintenance of the irrigation nozzle. A monthly check should be undertaken to ensure an even distribution and ensure there are no blockages
- Check Biofilter flow meter
- Remove bolts on the flow meter.
 - Lift pipe and carefully remove the flow meter, careful of the positioning pins.
 - Use a cleaning solution to remove all grit and debris from around the Vane.
 - Manually open and close the vane checking that indication is given on the display.
 - Relocate the flow meter into position, again being careful of the positioning pins.
 - Replace and tighten the bolts

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- When returned to service, check the operation of the flow meter by opening and closing the regulating valve.
- When confident with the operation, set the flow to roughly 18 l/min.
- Check the physical condition of the shell media
- The shell media should be inspected to observe any signs of change to the physical condition of the media, in particular undulations on the surface, degradation and/or slime build up. The Compliance Director should be made aware of any change in the physical condition of the shell media.

Six Monthly Checks

- Fan Maintenance.
- Finna Fans recommend that routine maintenance checks are undertaken on the biofilter fan every six months. This maintenance includes condition of belts, tension of belts, ductwork, motor, bearing and other parameters detailed in the fan maintenance checklist.
- Air Flow measurement
- The air flow to the filter unit should be measured six monthly to ensure it complies with the design specification and thus ensuring the residence time can be met in the biofilter. The biofilter has been designed to treat 250m³/hr and can treat up to a maximum of 400m³/hr.

9. PH measuring section

- Take representative biofilter woodchips sample, mix this in distilled water and test for PH using the PH scale in the lab - value should be (6.5 - 8).

10. Shipping container biofilters

Weekly checks:

- Flow rate
- The flow rate into the biofilter shall be checked weekly to ensure that the fan is functioning correctly and the biofilter is being 'fed' with odours for the microbes to break down. This should be recorded on the checks sheet at the end of this procedure.
- Media Moisture
- The moisture in the media should be checked weekly to ensure that there is adequate moisture for the microbes to survive. Moisture should be in the range of 40 -65% wet basis and should be checked in at least two locations within the biofilter.
- Sniff Tests on treated air
- Weekly sniff tests shall be undertaken on the treated air exiting the system from the top of the filter where possible. Sniff tests should be carried out by an operative on arrival to site to ensure they are not desensitised.

Six Monthly checks

- Media Inspection

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- The media in the biofilter should be inspected for signs of degradation or compression. If the media is found to have degraded to a point where there is no longer enough media for
- Fan Maintenance
- Routine maintenance checks should be undertaken on the fan every six months. This should include the condition of the belts, tension of belts, ductwork, motor and bearings.

11. Basingstoke biofilters

Monitoring of parameters on table 1 will be completed as per the specified frequencies and recorded on the site's sharepoint location below

- https://biogenuk.sharepoint.com/:x:/r/sites/BasingstokeADPlant/_layouts/15/Doc.aspx?sourcedoc=%7BDDE149E0-44CA-452D-834E-2561FA9FC01F%7D&file=Biofilter%20Monitoring%20-%20Basingstoke.xlsx&action=default&mobileredirect=true

Daily checks:

- Flow rate and Pressure
- The flow rate into the biofilter shall be checked weekly to ensure that the fan is functioning correctly and the biofilter is being 'fed' with odours for the microbes to break down. This should be recorded on the checks sheet at the end of this procedure. Flow should be greater than 21,870m³/hr typically greater than 12.1m/s from the Biofilter panel.
- Pressure from the Biofilter panel should read less than 750Pa, if over 750Pa, this may indicate compaction of the media or overflowing causing pressure drop. Contact the compliance director immediately.

Weekly checks

- Media Moisture (top and bottom bed)
- The moisture in the media should be checked weekly to ensure that there is adequate moisture for the microbes to survive. Moisture should be in the range of 50 - 55% wet basis and should be checked in at least two locations within the biofilter.

11.1. Top and bottom nozzles

- Check that these are operational and unblock if required
- Wood chips visual checks.
- Check that the wood chips are evenly moistened on the top bed and no sign of dry patches. If media appears dry, check the spray nozzles and fix to ensure that moisture is now distributed evenly across the top of the media.
- ORP and P^H of the sump water should be tested weekly
- typical values of ORP should be greater than -50mV and P^H should be between 6.5 - 8 (section 9)
- Sniff tests on treated air (Top bed outlet only when completing other monitoring)
- Weekly sniff tests shall be undertaken on the treated air exiting the system from the top of the filter where possible. Sniff tests should be carried out by an

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operative while completing other weekly monitoring and should be completed before sense of smell becomes affected and staff to ensure they are not desensitised.

- Monthly checks

check the Biofilter fan; amps and speed of the motor monthly.

Six Monthly checks

- Media Inspection
- The media in the biofilter should be inspected for signs of degradation or compression. If the media is found to have degraded and has build-up of slime the contact the compliance director immediately.
- Fan Maintenance

Routine maintenance checks should be undertaken on the fan every six months. This should include the condition of ductwork, motor and bearings, check the amps and speed of the motor monthly.

12. Weston Biofilter

12.1 The moisture in the media should be checked weekly to ensure that there is adequate moisture for the microbes to survive. Moisture should be in the range of 50 - 55% wet basis and should be checked in at least two locations within the biofilter.

12.2 Test woodchip PH (section 9) using the PH scale in the lab - value should be (6.5 - 8).

12.3 Sniff test to be completed on outlet air and rated on a scale of (0 – 6) as per the daily check odour check rating

12.4 Air flow will be taken weekly using the air flow meter from the inlet and outlet sample point and recorded

12.5 All parameters measured will be recorded on share point at <https://biogenuk.sharepoint.com/:x:/r/sites/WestonADPlant/ layouts/15/Doc.aspx?sourcedoc=%7BF7E92BA6-2534-47F1-836F-CF87FB2F8000%7D&file=Biofilter%20Monitoring%20-%20Weston%20Super%20Mare.xlsx&action=default&mobileredirect=true>

13. Carbon Filters

Weekly checks:

13.1. Flow rate

- The fan speed/flow rate to the carbon filter shall be checked weekly to ensure it is functioning correctly.

13.2 Sniff tests on treated air

- Weekly sniff tests shall be undertaken on the treated air exiting the system from the top of the filter where possible. Sniff tests should be carried out by an operative on arrival to site to ensure they are not desensitised.

Monthly checks:

13.3 Performance checks

- Performance checks shall be carried out monthly using colorimetric gas absorption tubes (**also see section 13**). Samples shall be taken from both the inlet and outlet and the efficiency calculated. If necessary, further performance

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checks can be carried out using a Jerome or olfactory sampling and analysis using odour bags. The routine performance monitoring will be undertaken by the onsite team; where additional monitoring is required the Compliance Team will assist.

Six Monthly checks:

13.4 Media Inspection

- The media in the carbon filter shall initially be sampled and sent for carbon absorption testing after 6 months of operation, thereafter it will be sampled at the frequency advised by the testing laboratory. The reports will be filed on site.
- To send sample to laboratory, staff should take a representative 2L sample from a safe access point to the carbon filter, this should be labelled and sent to the approved lab for analysis.
- Level of media is to be checked to ensure there's enough carbon filling the blanked 1m top section of the system. In the event of level drop, this should be recorded and carbon filter level should be topped up.

14. Coconut fibre Biofilter Section

14.1. Appendix 1A states maintenance requirements for the Pure Air Solutions biofilter at Hoddesdon.

Daily Checks:

- Check water supply line i.e. strainer and waterflow
- Records of water circulation Flow Rate - Water circulation flow rate should be recorded daily from the Flow~Mon meter installed on the system.
 - This must be recorded as a numeric value so that any deteriorations can be detected, and flow can be compared to the specification
- Sniff Tests on treated air
 - Daily sniff tests should be undertaken on the treated air exiting the system through the exhaust stack sample point or if deemed necessary from the exhaust. Under no circumstances should an operator try to sniff any odorous air direct from the equipment i.e. above the stack as this could prove to be dangerous or even fatal. Sniff tests should be carried out by an operative on arrival to site to ensure they are not desensitised.

Weekly Checks

- The quencher is a continuous pre-air conditioning system installed inside the air duct and with a droplet separator at the end which collects the remaining droplets to prevent entering the biofilter. Water is recycled continuously but will include dust particles from the process air. Drain the water weekly or biweekly depending on ORP readings and clean tank. Where water has deteriorated beyond -70, water shall be drained
- Check nutrient dosing pump and nutrient volume in the nutrient tank

Monthly Checks:

Performance and distribution of irrigation water nozzle

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- The top of the biofilter is fitted with a hatch that will allow access for inspection and maintenance of the irrigation nozzle. A monthly check should be undertaken to ensure an even distribution and ensure there are no blockages
- Remove and clean irrigation spray nuzzles
- Inspect and clean quencher nozzles
- Inspect and clean quencher housing flange

pH testing of irrigation water

- Monthly testing of the irrigation water must be undertaken. The water should be maintained between 6.5-8pH units. If the pH is not within this range drain and replace the water.

Performance Checks

- Performance checks should be carried out monthly using low range H₂S gas detection tubes (**also see section 14**). Samples should be taken from both the inlet and outlet and the efficiency calculated.

Check Biofilter flow meter

- Check the physical condition of the coconut media and carryout a moisture test by squeezing the media
- The media should be inspected to observe any signs of change to the physical condition of the media, in particular undulations on the surface, degradation and/or slime build up. The Compliance Director should be made aware of any change in the physical condition of the shell media.

Six Monthly Checks

Fan Maintenance.

- Routine maintenance checks are undertaken on the biofilter fan every six months. This maintenance includes condition of belts, tension of belts, ductwork, motor, bearing and other parameters detailed in the fan maintenance checklist.

Air Flow measurement

- The air flow to the filter unit should be measured six monthly to ensure it complies with the design specification and thus ensuring the residence time can be met in the biofilter.

Note* Replacement of media shall be as stated in the equipment manual e.g 6 yearly (Hoddesdon) or according to test results of the media samples.

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15. Gas detection tube procedure

15.1 Break both ends of the RAE tube by inserting the tube approximately 1 mm into the tip breaker located on the side of the pump. Ensure this is done gently to prevent the whole tube from shattering.

15.2. Insert the tube securely into the rubber pump inlet with tube's arrow pointing towards the pump indicating direction of air flow

15.3. Insert the end of the tube carefully into the sampling point (from the Carbon filter or the biofilter (inlet and outlet as in 12.3 and 9.7 respectively)

15.4. Select the desired sample volume (100mL), by pulling the handle until it latches with a click and aligns with the red dot.

15.5. Hold the tube in the air flow until the sample is completed, indicated by the circle on the bottom of the pump turning full white

15.6. Remove and read tube- taking the furthest distance along the tube that the colour change just becomes visible

15.7. Remove tube safely and return plunger and stroke counter to original position. Empty the tube tip into the site's sharps bin

- Note (if in doubt contact Research/ compliance or refer to booklet on the Rae tubes/ pump is available on ACTIV – File Manager-Global- HSE Management- Rae Tube manual)

Table 1. Basingstoke Biofilter Monitoring schedule (Monitored and recorded on site's sharepoint)

Parameter	Monitoring Frequency	Operational parameter	Corrective action required
Average top bed moisture	weekly	50% - 55%	If below 49 % irrigate and maintain if within limit else stop irrigating to prevent flooding
Average bottom bed moisture	weekly	50% - 55%	If below 49 % irrigate and maintain if within limit else stop irrigating to prevent flooding
Visual media check	Weekly	Check for evidence of dry patches around the top media	Check the top spray nozzles and amend as necessary to allow for even distribution of moisture across the media surface.

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Sniff test	weekly	Not odorous	Check all parameters and apply specified corrective actions if required
Top bed only			
Air flow	Daily	➤ 21,870m ³ /hr	Check that fans are running correctly
Pressure	daily	< 750 Pa	Ensure there are no upstream blockages such as over-irrigation
Top nozzle	Weekly	Operational	Check for blockages
Bottom nozzle	Weekly	Operational	Check for blockages
P ^H	Weekly	6.5 – 8	Refresh sump water if outside range
ORP (sump water)	Weekly	➤ - 50mV	Refresh sump with clean water if less than -50mV and tending anaerobic

APPENDIX 1: BORD NA MONA BIOFILTER CHECK SHEETS



	Mon	Tues	Wed	Thurs	Fri	Sat	Sun	Notes
Initials								
Time								
Daily Checks								
Visual integrity check of associated pipe work (internal/external)								
Flow rate								
Irrigation water flow rate (value)								
Pressure drop (value) Expected value <500pa								
Inspection and cleaning of strainers Cleaned Y/N								
Weekly Checks								
Sniff test on treated air	Date:		Time:		Findings:			

Daily and Weekly Checks (Bord Na Mona Biofilter)

Week Commencing

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Monthly Checks (Bord Na Mona Biofilter)

Year.....

Month						Notes
Initials						
Time						
Performance checks Inlet reading: Outlet reading: Performance:						
Irrigation nozzles, check for even distribution Cleaned Y/N						
Description of shell media There should be no undulations on the surface of the media.						
Irrigation flow meter - all grit and debris removed from around the Vane. Flow meter is						
pH of irrigation water (6.5-8pH)						

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Six Monthly Checks (Bord Na Mona Biofilter)

Name..... Date..... Time.....

Maintenance checklist	Checked Y/N	Findings and remedial action taken
Fan Maintenance:		
Check condition of belts and re-tension or replace as required		
Remove inlet ductwork and check for build up in the fan casing or on the impeller. Jet wash the casing and impeller as required.		
Hold the impeller and move it up and down to check the condition of the motor and bearing assembly. If you find there is movement then replace the motor or bearing assembly as required.		
Unscrew the impeller cone and check the impeller retaining bolt is secured tightly. If it is found to be loose, remove it, apply stud grade solution and replace it in a secure and tight manner.		
Check that all component fixing bolts and nuts are secured tightly.		
Check that there is no build up of deposits on the motor as this will cause overheating.		
Check the motor current against the nameplate current to avoid overloading.		
General maintenance		
Air flow to filter unit: Expected valued 250m ³		

**APPENDIX 2: SHIPPING CONTAINER BIOFILTER
CHECK SHEETS**

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Weekly Checks (Shipping container biofilter)

	Week commencing		Week Commencing	
Weekly Checks: Flow rate & visual integrity check of associated pipe work (internal/external)	Date: Time:		Date: Time:	
	Findings:		Findings:	
	Completed by.....		Completed by.....	
Weekly Checks: Moisture Level in Media	Date:	Time:	Date:	Time:
	Moisture reading 1:		Moisture reading 2:	
	Notes:		Completed by.....	
Sniff test	Date:	Time:	Date:	Time:
	Findings:		Findings:	
	Completed by.....		Completed by.....	



APPENDIX 3: CARBON FILTER CHECK SHEETS

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Weekly Checks (Carbon Filter checks)

	Week commencing.....			Week Commencing.....		
Weekly Checks: Flow rate & visual integrity check of associated pipe work (internal/external)	Date: Time:		Findings:	Date: Time:		Findings:
	Completed by.....			Completed by.....		
Sniff test	Date:	Time:	Findings:	Date:	Time:	Findings:
	Completed by.....			Completed by.....		



Monthly Checks (Carbon Filter checks)

Month						Notes
Initials						
Time						
Performance checks Inlet reading: Outlet reading: Performance:						
Month						Notes
Initials						
Time						
Performance checks Inlet reading: Outlet reading: Performance:						

6 - Monthly Checks (Carbon Filter checks)

Month						Notes
Initials						
Time						
Media level within 1m of top blacked section						

Month						Notes
Initials						
Time						
2 Ltrs sent to laboratory for testing (Y/N) ?						



APPENDIX 4: HODDESDON BIOFILTER

CHECK SHEETS

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	Mon	Tues	Wed	Thurs	Fri	Sat	Sun	Notes
Initials								
Time								
Daily Checks								
Sniff test on treated air								
Visual integrity check of associated pipe work (internal/external)								
Pressure drop (value) Expected value <500pa								
Irrigation water flow rate (value)								
Water Cabinet (strainer and flow through FI-01)								
Nutrient dosing pump (NP-01) working Y/N								
Inspection and cleaning of strainers								
Weekly Checks								
Air Flow rate								
pH System (PH-W01) – (to be between 6.5 – 8)								
Volume in nutrient tank								



Performance checks								
Inlet reading:								
Outlet reading:								
Performance:								

Monthly/Quarterly

Monthly							Notes
Initials							
Time							
Irrigation nozzles, check for even distribution							
Cleaned Y/N							
Quarterly Checks	Date:	Time:	Initials:	Date:	Time:	Initials:	
Description of biomass media. Should be moist. No excessive water/weeds or moss. White spots are not a problem i.e. mould (Done through inspection hatches. check via BF-01 and BF-02							
Spraying system evenly distributed (Done through inspection hatches) -. Flow meter is working							
Record of pressure drops across each bed. Sudden changes indicate biomass deterioration							
Calibration of pH probes (PH-W01)							
Inspect and clean quencher to prevent dust build up. Check quencher spray pattern.							
Inspect/clean nozzles							
Annual Checks							
Olfactory Testing							