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Consulting

Dust Management Plan for Birch Tree Poultry Site

Birch Tree Poultry Site
Little Witley, Worcester, WR6 6LQ

March 2022
Ref CFL/10/DMP

Contents

Record of Changes

Version	Date	Change
1	Mar 2022	Initial version
2	Mar 2022	Receptor list revised
3	Mar 2022	Image of Site Manager Accommodation added
4		
5		

Birch Tree Poultry Site - Dust Management Plan

1. Introduction

1.1.1. This Plan has been prepared as part of the Environment Agency Environmental Management System for the permit associated with the operation of the Birch Tree Intensive Poultry Unit.

1.1.2. The purpose of this Plan is to: -

- Establish the likely sources of dust arising from the site during non emergency conditions, their release points and pathways to nearby receptors.
- Set out the procedures followed at Birch Tree Poultry Site in order to prevent or minimise dust levels.
- Formalise the procedures for monitoring of dust and dealing with any dust complaints.

1.1.3. Section 2 of this document sets out the likely sources of dust and the procedures followed to minimise dust levels.

2. Typical Dust Sources and Actions Taken to Minimise Dust

2.1. *Primary Source of Dust - Ventilation Fans*

2.1.1. The primary source of airborne emissions is the high speed ridge fans that are used to ventilate the pullet rearing houses.

2.1.2. The fans are operated on an automatic basis as required in order to maintain a constant temperature in the houses. This logic of this operation is to initially run a single fan per house, and if this is not sufficient to overcome the temperature increase, more fans are called to run until all fans are operational.
As a result, it is only in the most extreme circumstances that all of the fans will operate in automatic mode.

2.1.3. As part of the process for checking the operation of the fans, each fan is run up manually once per week. In order to minimise the dust release (and to ensure there is no un-due temperature drop in the buildings) this manual operation is kept to a minimum.

2.1.4. When the buildings have been cleaned out and washed down, the fans are operated in order to quickly dry out the buildings. This is undertaken in manual mode, but as the houses are unoccupied and clean, there is no dust release.

2.2. *Secondary Source - Manure at Clean out*

2.2.1. For 2 days every 20 weeks it is necessary to clean the manure from the houses before re-bedding and the introduction of the new flock.

2.2.2. At this time, it is necessary to open the buildings and load the manure onto tractors and trailers. This manure is then hauled to local fields to be spread as a fertiliser.

2.2.3. Whilst this operation does aerate the manure, which if it is particularly dry may risk causing a release of dust, but it is very localised and short lived.

2.2.4. Consideration should be given should the wind direction be such that any dust will be blown towards the nearest receptors, that the clean out operation be delayed until the wind direction changes.

2.2.5. All trailers loaded with manure are netted before transport in order to secure the load. This again reduces the aeration of the manure whilst it is being transported. Below is an assessment through the process of the potential sources of dust release and mitigation measures. This should be considered in parallel to the contents of the site risk register and Accident Management Plan.

2.3. *Secondary Source – Traffic Movements*

2.3.1. Vehicle movements have the risk of generating dust. The likelihood of this happening is linked to volume of traffic, speed of traffic and cleanliness of roadways.

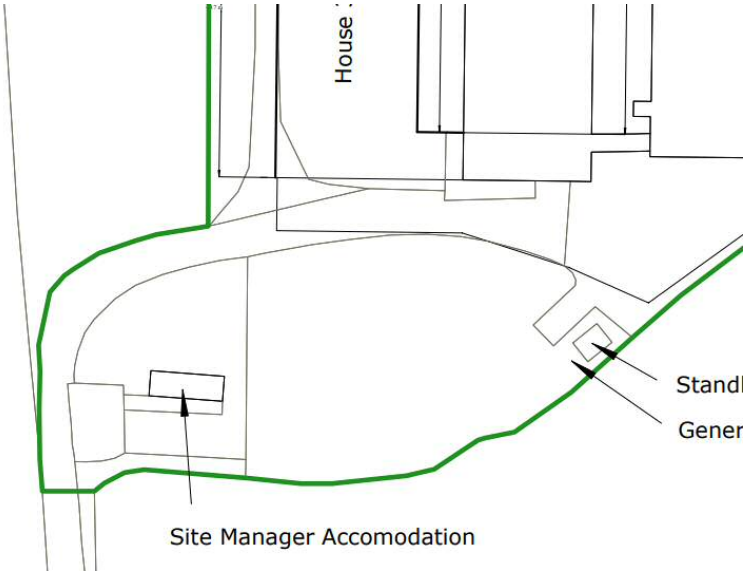
2.3.2. Therefore, this can be controlled by limiting speeds and, if necessary, cleaning roadways. If further cleaning of roadways is not practical (stone roadways for instance) then dampening down can be undertaken during high risk times.

3. Pathways & Receptors

3.1. *Neighbouring Properties within 100m of the installation boundary*

3.1.1. A review of the local mapping reveals the only receptor within 100m of the installation is the site managers accommodation, which is within the installation boundary, at the southern end of the site.

3.1.2. The location of the site managers accommodation is identified on the image below:

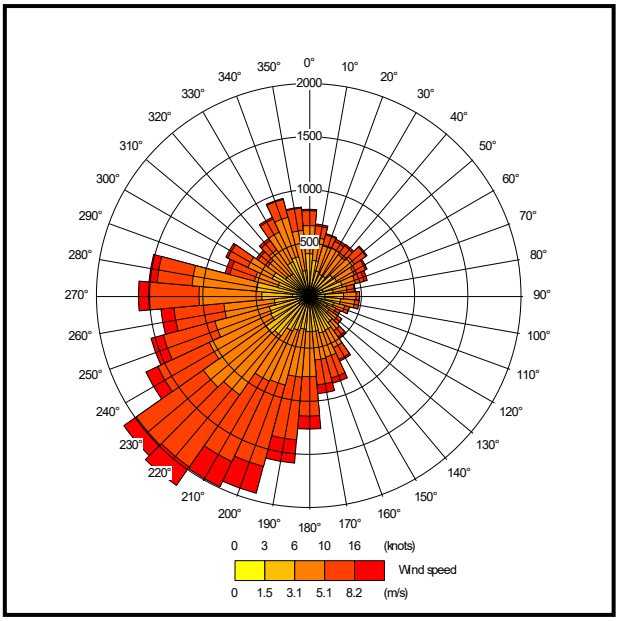


3.2. *Nature Conservation Areas*

3.2.1. There are no areas within 100m of the installation boundary.

3.3. *Prevailing Wind Direction*

3.3.1. The wind rose below shows the direction of the prevailing wind for the site.



3.3.2. Considering the locality of the receptor above, dispersion of dust will most likely occur towards them when the wind is from the North, which is not the direction of the prevailing wind. When the wind is such that dust may disperse from the site towards the receptors, every effort should be made to minimise activities that may generate such dusts.

4. Dust Monitoring

4.1.1. Using the information on page 14, routine monitoring for dust should be carried out around the site to comply with the permit; to investigate a complaint; or after there has been any change to the operations process. A record of this monitoring shall be kept on the Dust Diary (Appendix C) in order to identify trends in dust generation against particular conditions or operations.

4.1.2. All of the identified residential receptors above have been given a copy of the contact information sheet in Appendix D attached. A similar notice is posted at the entrance to the site.

4.1.3. If at any time a receptor wishes to make a complaint, they can use the contact information to contact Steve Isaacs. Should they not be available then the farm office should be contacted where the operator will be able to take details of the complaint.

4.1.4. Whoever is the designated manager, they will be fully conversant with the operation of the site, the emergency procedures together with knowledge of the contents of this Dust Management Plan.

4.1.5. Daily, the operator shall check the wind direction. If the wind is coming from NE through to NW, then the operator shall walk the perimeter of the site on the opposite side to that of the wind.

4.1.6. If an issue is identified, the procedure page 12 shall be followed.

5. Dust Complaint Procedures

5.1.1. Any dust complaint received will be dealt with by either Mr Steve Isaacs (the manager of the site). In their absence a designated trained operator of the plant will deal with all complaints. This operator shall be trained in the full operation (and shutdown) of the plant, the emergency procedures, and the contents of this dust management plan.

5.1.2. If a complaint is made, the form included in Appendix B of this Plan will be completed and this will be available for inspection by the Environment Agency. Any calls received will be investigated immediately and contact made with the complainant within 4 hours to confirm the action which has/is being undertaken to stop the generation of dust. This may potentially include shutting down of the plant until the problem can be resolved.

5.1.3. Information will normally be collected by visiting the complainant, although in some cases, contact may be made by telephone.

5.1.4. After details of the complaint have been compiled, the cause(s) will be investigated, with reference to:

The activities taking place on the farm at the time.

The timing of the complaint and whether weekday, weekend etc.

The weather conditions at the time.

5.1.5. The daily monitoring regime at the site boundary & the complainant's property will also be undertaken to identify the specific dust which is the cause of complaint.

5.1.6. The likely reasons for the complaint will be added to the form and the complainant will be contacted as appropriate.

5.1.7. The feasibility of making changes to the activities responsible for the complaint will be considered. Should changes be possible, the operating procedures shall be amended such that there is no repeat of the dust generation, or it is undertaken when the wind direction is such that the dust is dispersed away from any receptors.

5.1.8. Further Dust Monitoring shall be undertaken at the site boundary and the location of the complainant to confirm that the dust problem has been resolved.

5.1.9. If changes are made, the Dust Management Plan will be amended accordingly.

6. Review Procedures

6.1.1. The Dust Management Plan shall be reviewed at least every three years or as soon as practicable after a complaint (whichever is the earlier) and changes recorded.

6.1.2. Improvement programme to reduce dust

6.1.3. In Appendix F are a number of possible actions which could be considered / undertaken, should any issues of dust occur.

7. Dust reporting form

7.1.1. An assessment may need to be carried out either to work out whether dust emissions are complying with the permit, or as a part of an investigation into a complaint.

7.1.2. Weekly assessments can be used to build up a picture of the impact the dust has on the surrounding environment over time. This can develop 'worst case' scenarios by doing assessments during adverse weather conditions or during particularly cycles of an operation. Ideally, the same methodology should be used to follow up complaints.

7.1.3. Where you test will depend on:

- whether you are responding to a complaint;
- whether you are checking your state of compliance at sensitive receptors;
- whether you are trying to establish the source of dust generation;
- wind direction.

7.1.4. The assessment may involve someone walking along a route that you have selected either because of these factors, or in response to the conditions they found when they got there. Another option is to choose fixed points so that you can evaluate the changing situation over several weeks or months. Or the test points may vary from test to test according to local conditions, which would help you identify worst case conditions.

7.1.5. You should also keep a note of any external activities (such as agricultural practices) that could be either be the source of the dust, contribute to the dust, or be a confounding factor.

7.1.6. You should also take the factors given in the EPR 6.09 Sector Guidance Note Appendix 11 Assessing dust control measures on intensive poultry installations into account.

Appendix A – Dust Report Form					Date
Time of test					
Location of test e.g. street name etc					
Weather conditions (dry, rain, fog, snow etc):					
Temperature (very warm, warm, mild, cold, or degrees if known)					
Wind strength (none, light, steady, strong, gusting)					
Wind direction (e.g. from NE)					
Intensity (see below)					
Duration (of test)					
Constant or intermittent in this period					
What does it smell like?					
Location sensitivity (see below)					
Is the source evident?					
Any other comments or observations					

Sketch a plan of where the tests were taken, the potential source(s).

North

Intensity (Detectability)	**Location sensitivity where dust detected**
1 No detectable dust 2 Faint dust (barely detectable) 3 Moderate dust (dust easily detected) 4 Strong dust (vision partially obscured) 5 Very strong dust (vision completely obscured)	0 not detectable 1 Remote (no housing, commercial/industrial premises or public area within 500m) 2 Low sensitivity (no housing, etc. within 100m of area affected by dust) 3 Moderate sensitivity (housing, etc. within 100m of area affected by dust) 4 High sensitivity (housing, etc. within area affected by dust) 5 Extra sensitive (complaints arising from residents within area affected by dust)

Appendix B - Dust Complaint Report Form

Time and date of complaint:	Name and address of complainant:
Telephone number of complainant:	

Date of Dust issue:		
Time of issue:		
Location of dust, if not at above address:		
Weather conditions (i.e., dry, rain, fog, snow):		
Temperature (very warm, warm, mild, cold or degrees if known):		
Wind strength (none, light, steady, strong, gusting):		
Wind direction (e.g. from NE):		
Complainant's description of dust: ○ What does it look like?		
○ Intensity (see below):		
○ Duration (time):		
○ Constant or intermittent in this period:		
○ Does the complainant have any other comments about the dust?		
Are there any other complaints relating to the installation, or to that location? (either previously or relating to the same exposure):		
Any other relevant information:		
Do you accept that dust likely to be from your activities?		
What was happening on site at the time the dust occurred?		
Operating conditions at time the dust occurred:		
Actions taken:		
Form completed by:	Date	Signed

Intensity (Detectability)
1 No detectable dust
2 Faint dust (barely detectable)
3 Moderate dust (dust easily detected)
4 Strong dust (vision partially obscured)
5 Very strong dust (vision completely obscured)

Appendix C - Dust Diary	Sheet No
Name: Telephone Number:	Address:

Date of dust event:				
Time of event:				
Location of dust, if not at above address:				
Weather conditions (dry, rain, fog, snow etc):				
Temperature (very warm, warm, mild, cold or degrees if known):				
Wind strength (none, light, steady, strong, gusting):				
Wind direction (e.g. from NE):				
What does it look like, how intense was it?				
Intensity – How strong was it? (see below 1-5):				
How long did go on for? (time):				
Was it constant or intermittent in this period:				
What do believe the source/cause to be?				
Any actions taken or other comments:				

Intensity (Detectability)
1 No detectable dust
2 Faint dust (barely detectable)
3 Moderate dust (dust easily detected)
4 Strong dust (vision partially obscured)
5 Very strong dust (vision completely obscured)

Appendix D - Contact Information Sheet

Birch Tree Poultry Site,
Little Witley,
Worcester,
WR6 6LQ

Emergency and Complaints Contact Information

Should you wish to make a complaint about emissions from this plant, or in case of emergency, please contact the following;

Mr Steve Isaacs Tel: 07XXX XXXXX

Corbett Farms Main Farm Office Tel: 01568 708351

Any comments you wish to make in writing should be made to the above address, or by e-mail to:

bb@cfl.farm

Appendix E - EPR 6.09 Sector Guidance Note - Appendix 11 - Assessing dust control measures on intensive poultry installations

EPR 6.09 Sector Guidance Note

How to comply with your environmental permit for intensive farming

Appendix 11

Assessing dust control measures on intensive poultry installations

Version 1

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Record of changes

Version	Date	Change
Version 1	March 2011	

Introduction

This appendix provides guidance on the sources of dust from poultry farms and the measures to minimise these dust emissions.

Dust is a general name for solid particles with diameters less than 500 microns. Particulates or particulate matter (PM) are tiny subdivisions of solid or liquid matter suspended in a gas or liquid. PM_{10} particles are 10 microns or less in size (smaller than the diameter of a human hair).

The UK National Atmospheric Emissions Inventory shows that poultry husbandry accounts for 9 ktonnes per year of PM_{10} (2008). This is around 6% of the total released from commercial and domestic human activities.

The IPPC Directive states that appropriate measures must be taken to minimise dust emissions by the adoption of 'Best Available Techniques' (BAT). The chapters of this document specify the measures that we expect you to consider to minimise dust emissions.

PM_{10} objectives

The Air Quality Strategy (AQS) for England, Scotland, Wales and Northern Ireland has set objectives for both PM_{10} and $PM_{2.5}$ to protect human health. For PM_{10}, there must be no more than 35 exceedances of the daily average of 50 µg/m^3 in a year. The objectives should apply at 'all locations where members of the public might be regularly exposed. Building facades of residential properties, schools, hospitals, care homes together with hotels and some parts of the gardens of residential properties' (based on Box 1.4, Local Air Quality Management. Technical Guidance LAQM.TG(09) Defra). 'Some parts of the gardens' should represent areas 'where relevant public exposure is likely, for example where there are seating or play areas. It is unlikely that relevant public exposure would occur at the extremities of the garden boundary, or in front gardens, although local judgement should always be applied'.

The PM_{10} objectives must be considered by local authorities under Local Air Quality Management (LAQM) and we are also required to 'have regard' to them in our regulatory activities. Our commitment is that no installation we regulate will cause or contribute significantly to a breach of a national objective. This is a duty placed on us by Local Air Quality Management – we believe that generally BAT will deliver this. It is more fully described in the Environmental Permitting Guidance, The IPPC Directive. Where these objectives are unlikely to be met, the local authority must declare an Air Quality Management Area (AQMA) under section 83(1) of the Environment Act 1995.

The likelihood of a poultry farm exceeding the PM_{10} AQS objective is influenced by a number of factors:

- The proximity of the closest sensitive receptor[1] to the poultry sheds, as the objective is only likely to apply in locations where members of the public are regularly present. Although particulate concentrations fall off rapidly with distance from the emitting source, if the sheds are located very close to a residential property, concentrations may be higher.
- The orientation of the sensitive receptor to the poultry sheds with respect to the prevailing wind direction. If the sensitive receptor is downwind of the poultry sheds then it is likely to experience a greater frequency of higher particulate concentrations than if the sensitive receptor was the same distance away but upwind of them.
- Background concentrations of PM_{10} in the local area. Poultry sheds located in rural areas where background levels are relatively low are less likely to exceed the AQS objective than poultry sheds located near urban areas and busy roads and motorways where levels of PM_{10} are already quite high.

These factors mean that poultry farms with similar set ups and bird capacities, may be required to undertake different levels of dust abatement.

Sources of dust

Dust from poultry houses mainly originates from feathers, skin particles and used litter, and to a lesser extent from feed, bedding, micro-organisms and fungi.

Dust abatement techniques

Defra financed a project (CTE0408 - Dust abatement techniques in the UK poultry industry June 2008 ADAS, by Walker O. and Emery. J) to look at such techniques in the UK poultry industry. Information from this project is summarised in the tables below.

The control of dust can be divided into two categories:
- control at source
- control at exhaust

Control of dust at source

Some of the dust control at source methods, i.e. those used inside a poultry building, are limited in the amount of dust they can remove. It is therefore debatable how practical or economical it is to use control at source abatement techniques as specific ‘stand-alone’ dust control methods in a poultry house.

Many techniques may well already make a contribution to dust control where they are part of normal flock management techniques. Most farmers already ensure that good quality feed pellets are fed to birds using modern feeders that do not break up the

[1] A sensitive receptor is a member of the public who is regularly present at locations which are situated outside of buildings or other natural or man-made structures, above or below ground. This applies to farm workers and their families who live on-site.

feed and are not over-filled. They also properly clean houses and equipment on a regular basis. Dust extracted bedding material is commonly used because it is better for the birds, more bio-secure and affordable. A summary of all the ‘at source’ control methods are given in Table 1.

Control of dust at exhaust

Dust particles that have not been trapped or eliminated at source may become airborne within the building and ultimately exhausted to atmosphere by the ventilation system. Since in many poultry houses air is exhausted via the fans, there is an opportunity to either vent exhaust air at high velocity or trap dust as this air leaves from these exhaust locations by using ‘end of pipe systems’. These typically consist of either passive air-cleaners or active systems, such as wet cleaning or air scrubbers. Exhaust cleaning systems have been proven to be an effective way of reducing not only dust, but also ammonia emissions from livestock housing, both in trials and in the commercial industry. However, they require a significant capital outlay on systems with high air change rates and may have high running costs. A summary of all control at exhaust methods are listed in Table 2.

How to use this guidance

Tables 1 and 2 below summarise the dust control methods at source and at exhaust. You may find that you are already using many of the techniques in Table 1 as part of your day to day management. If there are any breaches of air quality objectives or complaints about dust then we would expect you to consider further controls from Table 1 and Table 2.

After the tables, there are two checklists which can be used by the operator or the Environment Agency to assess and record which dust control methods are being used on the installation. Make sure you’ve read the comments in Tables 1 and 2 so you know what is feasible on your installation. If a method is not achievable record your reasons in the comments box of the checklist. From this assessment you can identify where improvements could be made.

Table 1. A summary of at source control methods for particulate reduction at poultry farms

Source of dust	Method	How is reduction achieved?	Comments
Poultry feed	Dust from silos	Covers put over feed silo pipes.	Bags or containers should be in place on silo exhausts to catch any excess feed and dust.
	Dust extraction in feed mill areas	Filters reduce dust emissions to the outside.	
	Storage of feed	Use of covers for feed containers.	Biosecurity issue as well.
	Feed spill control	Collection of any feed spill is undertaken to avoid dust being generated.	Good management practice and avoids possible pollution into a watercourse
	Form of feed	Mould feed into pellets so that dusty ingredients are bound together.	May affect flock performance in laying hens, additional cost of the feed, lack of pelleting equipment in UK mills, as well as increased feed consumption.
	Fat content	Increase fat content so that dusty ingredients are bound together.	Not economical or desirable for laying hens.
	Spraying oil or water mist onto feed	Mainly prevents particles on surfaces from becoming airborne again by making them too heavy.	Risk of deterioration in litter condition that could be detrimental to the welfare of the birds.
	Feed ingredients	Both wheat and barley have been found to be more dusty than maize.	Maize is not readily available compared to wheat in the UK for agronomic and economic reasons and is not commonly used in poultry diets.
	Feeding method	Hand feeding is preferable to screw auger systems and automatic feeders, which can produce increased dust levels.	Hand feeding is likely to be impractical on larger farms.
		Fit a material sock to the end of the auger pipe that delivers the feed directly into the bin.	Auger pipes tend to have downpipes that stop around 30–60cm short of the internal feed bin. Fitting a material sock to the end of the pipe that delivers the feed directly into the bin may reduce the feed dust that is created by ‘free-falling’ into the bin.
		Cover the internal feed bin, e.g. with a ply-wood constructed top, and fit the auger pipe through the cover.	The feed delivery into the bin is effectively sealed by the cover.
		Feed pans may be preferable to tracks.	Consider bird welfare issues.
	Over administration of feed to birds	Avoid spilled feed crushed on the floor into particles which become airborne.	

Source of dust	Method	How is reduction achieved?	Comments
Bedding material	Type of bedding	Sawdust and flax straw have been found to produce less dust than wheat, barley or rye straw.	Suitable litter materials for poultry must also consider availability and cost, ability to dispose of the used litter after the flock, and the risk of litter consumption by poultry. For example, turkey poults are more likely to consume wood shavings to the detriment of their health than straw.
	Treatment of bedding	Dust from straw can be reduced effectively if the straw is humidified prior to application.	Using dampened straw is not considered good practice in poultry production, as damp straw can cause pododermatitis and is contrary to welfare regulation.
	Amount of bedding	Deep bedding systems have been shown to contribute less dust to the environment than shallow bedding systems.	Suitable for ducks and turkeys but not broilers.
	Application of bedding	Bedding applied internally.	Bedding supplied in bales rather than in bulk. Bales opened in housing rather than blown in to reduce dust.
		Fit catching curtains when unloading and augering bulk bedding into housing.	Where bulked product is used, delivered by lorry and unloaded by a vehicle with a bucket that 'augers' (the auger is fitted in the bottom of the bucket) the bedding throughout the house to maintain an even depth, this is a source of dust. The amount of emitted dust could be reduced by fitting the catching curtains while spreading the bedding. Catching curtains are generally detachable and consist of thick black polythene strips which are used to keep light levels down when catching birds during the day.
	Age of bedding	As bedding materials break down to a dry friable litter dust production increases.	Even with "pre-packed, dust-extracted" bedding materials, dust levels will be low at first but will increase due to activity occurring in the litter.
Litter systems	Use of cage systems for layers	Dust emissions were much higher from houses using litter rather than cages with wire floors.	Producers in the UK and throughout Europe are moving towards littered systems for poultry on the grounds of animal welfare. Ban on the use of conventional egg production cages from 2012.
Relative humidity	Increasing humidity	Using misting systems to increase the humidity at low ventilation rates has been shown to reduce inhalable dust.	Increasing relative humidity in littered floor systems may result in pododermatitis resulting from damp litter and an increase in ammonia emissions.

Source of dust	Method	How is reduction achieved?	Comments
Ventilation	Increasing ventilation	An effective method is by significantly increased and controlled airflow velocities.	Increasing ventilation may reduce airborne dust within the house, but still exhausts dust to the outside. Consideration must also be made for the type of stock being ventilated For example, broilers require careful control of air flow over them as they are readily disturbed by draught and wind-chill. Fully feathered adult birds are much more tolerant of increased airflows at bird level than young birds. Increased ventilation is often used in summer months through the use of gable end fans.
House cleaning	Good management	Good house cleaning between flocks is essential to reduce the volume and potential for air contamination within the house and via exhaust systems.	Exhaust vent cleaning – take care to avoid dust accumulation around exhaust vents. Cleaning should take place in such a way that does not cause a release of dust to air or water, i.e. do not blow dust off site or wash it into surface water drains. Litter should be covered as soon as possible before leaving the site or moved to a store on site.
	Dust removal by vacuum cleaner	In-house dust removal by vacuum cleaner when the birds are in situ, reduces dust that could be disturbed by ventilation and emitted.	Only applicable for layers in cage systems.
Genotype	Animal activity	Birds that exhibit higher activity levels create elevated levels of dust in the air.	A genotype with lower activity levels may be difficult to initiate in a commercial setting and activity is recognised as having some positive benefits.
	Feather crunchiness	Greater feather crunchiness causes increased dust levels at moulting periods.	A genotype with less crunchy feathers may not be possible in a commercial setting.
Number of birds	Reduced flock numbers	Fewer birds, less feed, less litter means less activity to produce dust airborne.	Changing stocking density or moving from, for example, broilers to broiler breeders are options.
Crop cycle length	Lower final body weight	Birds grown to a shorter cycle length and lower weight produce less dust as most dust is emitted from day 20.	Depends on contract with the processing company.

Table 2. A summary of control at exhaust methods of particulate abatement at poultry farms

Dust control	Method	How is reduction achieved?	Comments
Screens and wind breaks	Natural and artificial	Both rely on exhaust air being directed towards them, typically from end-wall mounted systems, so that dust particles can be both intercepted and air lifted into the atmosphere for better dilution and dispersion. Vegetative screens have been seen to reduce dust levels by approximately 50%.	Natural screens also reduce odour, noise and visual impact on the local environment. However, you need the space to create them in a particular way and this makes them difficult to retro-fit.
Dry filters	Collecting dust onto filters on exhaust vents	Dry filters can be fitted to internal air recirculation units.	Can be used in poultry houses when air change rates are relatively low and where the system will not interfere with the air distribution within the house. However, to remove anything other than large particles would need both a large and impractical surface area of filter, or very frequent cleaning or changing, which may prove impractical.
Electrostatic precipitation devices (ESP)	Attraction and collection of dust particles	ESPs impart electric charges to dust particles. The electromagnetic force either pushes the particles out of the airstream into a collection tray, or attracts them to earthed surfaces.	However, although construction is simple, operating costs are relatively low and airborne dust removal is significant, electrostatic collectors still need development before they can be used to great effect within commercial poultry houses with large air change rates. An advantage is that no replacement filters are required.
Passive dry air cleaning units	Filter panels that collect dust across the width of the house	Fans are located in the end-wall of the house, in front of which is a plenum chamber fitted with linked filter panels making a filter wall. As air is drawn through to the fans the filter separates the dust into collection pockets that can be emptied. Commercial results suggest a 70% reduction in visible exhaust dust.	Can be retro-fitted to most existing houses. Several examples have recently been fitted to UK broiler farms at a cost of approximately £1 per $30m^3$ of air. Do not require water. Filters do present a resistance to air flow, so fans must be able to operate at higher pressure to prevent heat stress in broilers.

Dust control	Method	How is reduction achieved?	Comments
Active wet cleaning units	End-wall ventilated systems	Water air-cleaning units intercept dust as air passes through a water or chemical spray, often over a pad matrix.	Most easily incorporated into systems with end-wall ventilation fans or into systems with one dedicated ventilation exhaust outlet. Some systems can be retro-fitted to the outside of poultry houses as 'stand-alone' units, however, they usually require some alteration to the ventilation system control. They are expensive to install and operate, for example, simple stand-alone units can cost over £20,000 for about 100,000 m^3/hr of air change, or £1 per 5 m^3 of air.
	Roof ventilated systems	Water is sprayed over the exhaust air from exhaust chimneys, binding the dust. All units are connected together and used water falling on the roof goes to a central acidified treatment basin where odour and ammonia molecules are trapped. Requires the air pressure to be more than 30 Pa.	Currently not available at present but commercial trials show promising results.
Scrubbers	Bio-filters and acid-filters	Air passes through a water scrubber to remove the larger dust particles. Next, in the bio-filter system the air is passed over moistened beds of plant material, removing dust, odour, microbes and pathogens. In the sulphuric acid filter scrubber, 99% of ammonia molecules and other odorous compounds can be removed.	Due to the amount of filtration in the combination scrubbers, additional air pressure is needed to ensure the optimum flow rate of air. Some need a working pressure of 150 Pa to work correctly, increasing consumption of electricity and conflicts with CCLA requirements. This pressure can be five times greater than conventional poultry ventilation systems. Bio-filters are used in mainland Europe but are rare in the UK at present in commercial poultry production. They are typically fitted into new buildings where the ventilation system is specifically designed to guide air through the bio-filters. Acid-filter systems can cost approximately £1 per 3-4m^3 of air to install. There are concerns with regards to ensuring operators are sufficiently well trained to handle the very corrosive liquids and that all chemicals are safely stored and controlled.

Checklist 1 – Options for dust control at source

Source of dust	Method	How is reduction achieved?	Achieved Yes/No	Comments
Poultry feed	Dust from silos	Covers put over feed silo pipes.		
	Dust extraction in feed mill areas	Filters reduce dust emissions to the outside.		
	Storage of feed	Use of covers for feed containers.		
	Feed spill control	Collection of any feed spill is undertaken to avoid dust being generated.		
	Form of feed	Mould feed into pellets so that dusty ingredients are bound together.		
	Fat content	Increase fat content so that dusty ingredients are bound together.		
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	Feed ingredients	Both wheat and barley have been found to be more dusty than maize.		
	Feeding method	Hand feeding is preferable to screw auger systems and automatic feeders, which can produce increased dust levels.		
		Fit a material sock to the end of the auger pipe that delivers the feed directly into the bin.		
		Cover the internal feed bin, e.g. with a ply-wood constructed top, and fit the auger pipe through the cover.		
		Feed pans may be preferable to tracks.		
	Over administration of feed to birds	Avoid spilled feed crushed on the floor into particles which become airborne.		
Bedding material	Type of bedding	Sawdust and flax straw have been found to produce less dust than wheat, barley or rye straw.		
	Treatment of bedding	Dust from straw can be reduced effectively if the straw is humidified prior to application.		

Source of dust	Method	How is reduction achieved?	Achieved Yes/No	Comments
	Amount of bedding	Deep bedding systems have been shown to contribute less dust to the environment than shallow bedding systems.		
	Application of bedding	Bedding applied internally.		
		Fit catching curtains when unloading and augering bulk bedding into housing.		
	Age of bedding	As bedding materials break down to a dry friable litter dust production increases.		
Litter systems	Use of cage systems for layers	Dust emissions were much higher from houses using litter rather than cages with wire floors.		
Relative humidity	Increasing humidity	Using misting systems to increase the humidity at low ventilation rates has been shown to reduce inhalable dust.		
Ventilation	Increasing ventilation	An effective method is by significantly increased and controlled airflow velocities.		
House cleaning	Good management	Good house cleaning between flocks is essential to reduce the volume and potential for air contamination within the house and via exhaust systems.		
	Dust removal by vacuum cleaner	In-house dust removal by vacuum cleaner when the birds are in situ, reduces dust that could be disturbed by ventilation and emitted.		
Genotype	Animal activity	Birds that exhibit higher activity levels create elevated levels of dust in the air.		
	Feather crunchiness	Greater feather crunchiness causes increased dust levels at moulting periods.		
Number of birds	Reduced flock numbers	Less birds, less feed, less litter means less activity to produce dust airborne.		
Crop cycle length	Lower final body weight	Birds grown to a shorter cycle length and lower weight produce less dust as most dust is emitted from day 20.		

Checklist 2 – Options for dust control at exhaust

Dust control	Method	How is reduction achieved?	Achieved Yes/No	Comment
Screens and wind breaks	Natural and artificial	Rely on exhaust air directed towards them, typically from end-wall mounted systems, so that dust particles intercepted and air lifted into the atmosphere for better dilution and dispersion. Vegetative screens seen to reduce dust levels by approximately 50%.		
Dry filters	Collecting dust onto filters on exhaust vents	Dry filters can be fitted to internal air recirculation units.		
Electrostatic precipitation devices (ESP)	Attraction and collection of dust particles	ESPs impart electric charges to dust particles. Dust particles collected in a tray, or attracted to earthed surfaces.		
Passive dry air cleaning units	Filter panels that collect dust across the width of the house	Fans are located in the end-wall of the house, in front is a plenum chamber fitted with linked filter panels making a filter wall. As air is drawn through to the fans the filter separates the dust into collection pockets that can be emptied. Commercial results suggest a 70% reduction in visible exhaust dust.		
Active wet cleaning units	End-wall ventilated systems	Water air-cleaning units intercept dust as air passes through a water or chemical spray, often over a pad matrix.		
	Roof ventilated systems	Water is sprayed over the exhaust air from exhaust chimneys, binding the dust. All units are connected together and used water falling on the roof goes to central acidified treatment basin where odour and ammonia molecules are trapped. Requires the air pressure to be more than 30 Pa.		
Scrubbers	Bio-filters and acid-filters	Air passes through a water scrubber to remove the larger dust particles. Next, in the bio-filter system the air is passed over moistened beds of plant material, removing dust, odour, microbes and pathogens. In the sulphuric acid filter scrubber, 99% of ammonia molecules and other odorous compounds can be removed.		

Appendix F - Improvement options for the control / reduction in dust

Table 1. A summary of at source control methods for particulate reduction at poultry farms

Source of dust	Method	How is reduction achieved?	Achieved Yes/No	Comments
Poultry feed	Dust from Silos	Covers put over feed silo exhaust pipes		
	Feed spill control	Collection of any feed spill is undertaken to avoid dust being generated		
	Over administration of feed to birds	Avoid spilled feed crushed on the floor into particles which become airborne		
Bedding Material	Application of bedding	Bedding applied internally via bales rather than bulk	Yes	Already part of operating practice for all sites
Ventilation	Increase Ventilation	An effective method is to increase airflow velocity. However – this may increase other emissions		
House Cleaning	Good Management	Good house cleaning between flocks is essential to reduce the volume and potential for air contamination within the house and via exhaust systems. Particular note should be made to cleaning of the exhaust vents		Already part of site operating procedures
	Vehicle Movements	Control of vehicle speeds and damping down of roadways can reduce dust generated by traffic movements		Only really applicable during cleaning of site between flocks
	Covering of trailers of poultry litter leaving site	All loads should be covered to ensure no loss of load in either solid or dust form.	Yes	Already part of operating practice for all sites
Number of birds	Reduce flock numbers	Fewer birds, less feed, less litter means less activity to produce airborne dust.		Last resort if all other measures are not sufficient

Table 2. A summary of control at exhaust methods for particulate abatement at poultry farms

Source of dust	Method	How is reduction achieved?	Achieved Yes/No	Comments
Screens and wind breaks	Naturl and artificial	Planting of natural screens on the site perimeter, or artificial screens around point emission points		Natural hedgerow already exists along eastern boundary
Electrostatic precipitation devices (ESP)	Attraction and collection of dust particles	ESPs impart electric charges to dust particles. The electromagnetic force either pushes the particles out of the airstream into a collection tray, or attracts them to earthed surfaces.		Technology in developmental stage – further investigation would be required to demonstrate reliability of technology.
Filter panels on exhaust vents	Filter panels collect dust	Air is drawn through filter panels		Site has roof fans so filters would need to be fitted to fans within roof of houses. Checks would also be required to ensure fans could cope with increase air resistance
Active Wet Cleaning Units	Roof ventilation Units	Water is sprayed over the exhaust air from the exhaust chimneys, binding to the dust. “dirty water” then requires collection system allowing for treatment of contaminated water.		Expensive option which would require significant modification to existing surface water drainage system.
Scrubbers	Biofilters and acid filters	Air passes through a water scrubber to remove the larger dust particles. Next, in the bio-filter system the air is passed over moistened beds of plant material, removing dust, odour, microbes and pathogens. In the sulphuric acid filter scrubber, 99% of ammonia molecules and other odorous compounds can be removed.		Complex method involving corrosive chemicals. Expensive solution which would require many controls and staff training.