Fly Management Guidance

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Contents

1. Introduction

This document is for Environment Agency (EA) officers to ensure environmental permits are complied with in respect of fly management. It was produced in discussions with Local Authority (LA) Environmental Health Officers (EHO) and should therefore also benefit EHOs in their work on flies.

The document is not prescriptive but it identifies ways in which you can gather information and offers solutions which may be applied in the right circumstances. There may be other options which aren't included, for example introduction of new techniques.

This guide will be helpful at any site where there have been reports of flies, or at sites where the proximity of sensitive receptors creates the risk of fly incidents.

The document does refer to other legislation that might also be relevant, such as Health and Safety at Work Act 1974 or the Food Hygiene Regulations 2006, where we are not the enforcing authority. Operators need to ensure they comply with all relevant legislation.

1.1. Regulation: working together

Defra guidance on the Environmental Permitting (England and Wales) Regulations 2010 (EPR) and the statutory nuisance provisions (Environmental Permitting Guidance – Statutory Nuisance) states that where a site is permitted and the permit conditions address nuisance by flies, it is our responsibility to investigate. Where a fly infestation is discovered at an off-site location (housing, offices) and traced back to a permitted facility which has a condition addressing the issue then we should investigate.

Where the permit does not contain such a provision the LA can exercise their statutory nuisance powers. The LAs are also responsible for investigating non-permitted and Part B permitted sites.

EHOs have wide experience in investigating nuisances and liaising with the local residents. Flies have been included in the list of defined Statutory Nuisances which they enforce. We should always work with the LAs to resolve the issue.

1.2. Permits and pollution

The way the management of flies is regulated under EPR has been reviewed for permitted waste operations. Our approach has changed.

The change in direction stems from the definition of “pollution” in the Regulations which relies on there being an 'emission as a result of human activity'. “Emission” for waste operations

means “the direct or indirect release of substances, vibrations, heat or noise from individual or diffuse sources related to the operation into air, waste or land”. The difficulty with this definition of emission is, to show that flies (or any other pests) amount to an emission, would require the pest to be treated as a substance. Without any specific definition of “substance” for waste operations, we have to rely on the terms normal meaning. It would be very difficult to argue that flies are a substance. Therefore, we have to conclude that there would be considerable risk in taking any action based on a fly infestation or the escape of flies from a site on the basis that the flies themselves amount to pollution. Depending on the pathogens flies will be carrying, it might be the case that flies could be a vector for the transmission of substances on their bodies which will pose a risk of pollution.

Given the definition of pollution, this could be the case where such substances may be harmful to human health. For substances transmitted by flies, a risk of pollution rather than actual pollution is likely to be the issue to focus on. However to be able to proceed on that basis clear evidence would be needed of the transmission of pathogens by the flies and the potential consequences of those pathogens.

Waste operations

This means that, for waste operation permits, we need to concentrate on the transmission of substances the flies may carry, rather than the flies themselves, and therefore, risk of pollution, rather than the actual pollution.

Permit conditions for waste operations

At permitted waste operations, the definitions above mean we are unable to use the emissions without limits or the management conditions to control pest issues. To explain this further:

- **General Management condition**

Modern permits may have a General Management condition which states:

> 1.1.1 The operator shall manage and operate the activities:
>
> *a) in accordance with a written management system that identifies and minimises risks of pollution, including those arising from operations, maintenance, accidents, incidents, non-conformances, closure and those drawn to the attention of the operator as a result of complaints; and so on.....*

This general management condition requires a management system that identifies and minimises pollution. Given the definition of pollution discussed above, we cannot require a management plan to prevent a fly infestation but we can require a plan that prevents flies from transmitting substances that would pose a risk of pollution. In practice, there may be little difference between the two, but any requests for management plans and approval of plans should take this distinction into account and needs to be clear that the focus is about transmitting substances. The same applies to any enforcement notice for a breach or likely breach of this condition.

- **Specific Pest condition**

We have the power to impose conditions at regulated facilities carrying out waste operations to prevent a nuisance due to flies as Article 13 of the Waste Framework Directive. This is wider in scope than the term “pollution” in EPR and is wide enough to cover a nuisance

caused by flies. Therefore, more recent waste operation permits and future permits may have a specific pest condition which requires the operator to produce and put in place a 'pest management plan' to ensure they satisfactorily manage the situation to regain compliance with the permit.

Typical permit condition or rule 3.6.1:

3.6.1 The activities shall not give rise to the presence of pests which are likely to cause pollution, hazard or annoyance outside the boundary of the site. The operator shall not be taken to have breached this condition if appropriate measures, including, but not limited to, those specified in any approved pest management plan, have been taken to prevent or where that is not practicable, to minimise the presence of pests on the site.

Typical permit condition or rule 3.6.2

3.6.2 The operator shall:

- *if notified by the Environment Agency, submit to the Environment Agency for approval within the period specified, a pests management plan which identifies and minimises risks of pollution from pests*
- *implement the pest management plan, from the date of approval, unless otherwise agreed in writing by the Environment Agency*

Installations

The situation for installations is different to that of waste operations. This is due to schedule 7A to the EPR applying to new installations and existing installations from 7 January 2014. The definition of "substance" for the purposes of Schedule 7A, (but not the main text of EPR) is amended to include "any biological entity or micro-organism". Although not further defined, it is wide enough to include flies and other pests.

Due to this different definition of substance we are able to use the emissions without limits condition and the management condition as they stand, for installations. In addition, the specific pest condition (condition 3.6.1) can also be used in an installation permit.

Measures to take

For all permitted activities, the operator should ensure that all appropriate preventative measures are taken to prevent fly dispersal from the site, or, if that is not possible, to prevent flies causing hazard, nuisance or annoyance beyond the site boundary. Operators will be expected to meet any standards of good practice along with any recommendations in our guidance. Having a pest management plan that sets out a number of measures operators will take does not necessarily mean they will comply with the condition. Operators may need to update this plan with further targeted measures to ensure they continue to meet the condition.

If there is a pest problem at a site and the operator has already implemented some measures, there may be a case to justify further measures. It may even call for restrictions on the activity, depending on the severity of the problem and the cost.

If the operator has a permit without a specific pest condition **and the regulatory control this condition brings is required**, a permit variation may be undertaken to add the specific pest condition**,** particularly if there is a fly infestation and the operator hasn't taken measures to control it.

2. Flies and fly problems

Just over 7000 species of true flies (Diptera) are known to occur in the UK. Of these, around ten species have the potential to cause regular and significant problems on and around waste management facilities and livestock sites.

2.1. Main fly species and identification

Correctly identifying the fly species at a site, or reported at receptors' premises, is critical to:

- clarify whether the reporter's flies are the same as those at the alleged source
- establish appropriate monitoring techniques
- establish appropriate prevention and control techniques

With appropriate training, the adults of most of the main fly pest species can be identified by eye, with the help of a x10 hand lens. Table 1, below, provides a brief overview of the common fly species which generate fly reports and can be associated with livestock or waste management facilities.

Table 1: Main fly pest species (More detail and illustrations in Appendix 1)

Fly species	**Typical pest status**	**Notes**
Common housefly (*Musca domestica*)	Can cause widespread and severe problems for receptors	Larvae found in poultry, pig, and calf manure and in refuse. Adult readily disperses and enters buildings.
Lesser housefly (*Fannia canicularis*)	Can cause widespread and severe problems for receptors	Larvae found in poultry manure and in refuse. Adult readily disperses and enters buildings.
Blow flies: Bluebottles / Greenbottles / Dump fly (*Calliphora / Lucilia*)	Localised problems only	Larvae found in carrion and faecal material, commonly associated with putrescible waste. Adults tend not to disperse far.
Stable flies (*Stomoxys calcitrans*)	Localised problems only	Larvae found in manure of large animals, e.g. cattle and pigs. Adult is blood-feeding, and tends not to disperse far.
Fruit flies (*Drosophila spp*.)	Localised problems only	A small (2mm) fly. Larvae found in rotting vegetation or vegetable waste, e.g. green-waste composting. Tends not to disperse far.
Cluster flies (*Pollenia rudis, Eudasyphora cyanella, Musca autumnalis)*	Localised problems only	The larvae of these flies are not found in livestock or waste facilities, but the adults do enter buildings in the autumn, and may be confused with houseflies.

2.2. Fly sources

In general, fly larvae occur in damp, decaying organic waste. However, each species will have its preferred niche in terms of temperature, moisture levels, and the nature of the organic material. In the UK, there are two main areas in which fly problems regularly occur:

Waste management industry

Common house flies and bluebottles have always been associated with putrescible waste (especially food waste) particularly during warmer weather. Infestation typically starts at the point of waste generation, when eggs are laid on waste in domestic or trade waste bins.

The longer the period of time before the waste reaches its final disposal point (landfill, composting, incineration) the greater the opportunity for fly problems to develop. In recent years the move towards fortnightly collection of domestic refuse, the introduction of a variety of waste processing techniques, and the reduction in the number of landfill sites and amounts of waste, have increased the potential for fly infestation.

Animal husbandry

Rearing poultry (particularly for egg production), pigs, cattle or other livestock inevitably creates quantities of manure, which is vulnerable to fly infestation. The potential for problems is greatest in husbandry regimes where the manure remains within the animal house for extended periods (such as some free-range poultry laying systems). In recent years, the rapid growth in large-scale free-range egg production has resulted in more frequent problems with lesser houseflies, which prefer the cooler environment in free-range houses.

2.3. Fly breeding and development

The life cycle of most flies has four main stages: egg, larva, pupa and adult, shown in the diagram below (which refers to the common housefly).

Figure 1: Common housefly life-cycle

The life cycle of most flies has four main stages - egg; larva; pupa and adult.

An example for a common housefly is shown opposite.

Eggs typically hatch within 1 - 2 days. Larvae take from 3 days in summer up to a month in winter to develop.

Adult flies emerge from pupae from 3 days up to a month later depending on conditions.

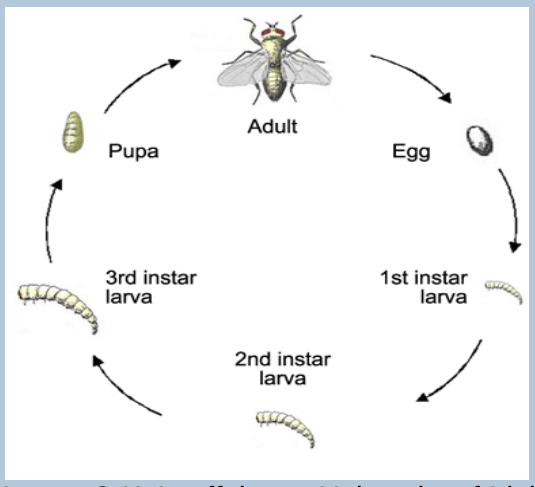

Image © K. Loeffelman, University of Idaho

In general, the adult female will lay eggs on a suitable surface for larval development; typically damp, decomposing organic materials. The larvae will hatch out and feed on the substrate, and when fully grown will search out a drier area in which to pupate. The adult fly will emerge from the pupa, mate, and continue the cycle.

The duration of the cycle is very dependent on the temperature of the larval environment, as shown in Table 2.

Table 2: The effect of temperature on the rate of common housefly development.

Species	Approximate duration of life-cycle (egg to adult) in days				
	16°C	18°C	20°C	25°C	30°C
Common housefly	45	27	20	16	10

The higher the temperature, the more quickly flies develop and increase in numbers, and so the greater likelihood of problems. Most other fly species will develop slightly more slowly than the common housefly.

At temperatures below c.12°C, development will cease for most housefly species, while at temperatures above c. 45°C, houseflies and their immature stages will be killed.

As waste decays the microbial action generates heat, which can mean the in-waste temperature is warm enough for flies to breed even in winter months if waste turnaround isn't adequate.

2.4. Fly dispersal

Although most adult flies stay close to their breeding sites (manure or putrescent waste), a proportion will disperse away and may cause problems at receptors. Houseflies are capable of dispersing over distances of several kilometres, although problems seldom occur at distances greater than 2-3 km from the source. Significant problems likely to cause unacceptable nuisance levels tend to occur within 500m of the source. Regulators will look at the extent of fly breeding at the alleged source rather than how far flies have dispersed to ascertain the extent of the problem.

Dispersal factors can vary, but high levels of fly breeding at the source are what normally appears to result in high dispersal levels. Dispersal appears to be greater in calm, warm weather. A specific event, such as opening of poultry houses in preparation for removing manure, allows rapid dispersal which can cause a sudden increase in flies.

Dispersing flies are difficult to find. Even where there are a large number of flies at a source, and concurrent problems with flies in nearby premises, flies are seldom visible in numbers in the intervening areas.

2.5. Problems caused by flies

The persistent presence of flies gives rise to a range of issues:

Annoyance/Nuisance

People find the continued presence of numbers of flies in their home or workplace irritating and unpleasant. Where there are breeding sites nearby, residents or employees may experience tens or hundreds of flies in their homes or workplace. Where there are no breeding grounds nearby, one or two flies would be normal. The annoyance is often increased because houseflies are difficult to control with insecticides, and are particularly attracted to kitchens and humans.

Disease transmission

Adult flies are often active on putrescent and microbially contaminated substrates. As a result, their external surfaces and gut will become contaminated with a broad range of pathogens. If these contaminated flies subsequently come into contact with people, livestock or foodstuffs, there is the potential for disease transmission.

In the tropics a major source of infections in humans can be traced back to houseflies. Although fly numbers and the opportunities for contamination in the UK are typically much less, a small risk still remains.

Physical contamination

The physical presence of flies may lead to contamination issues. Flies may become incorporated into food products during manufacture, and have been found within the packaging of eggs being delivered for processing.

Fly spotting (fly faeces and vomit) on eggs can lead to their rejection or downgrading. The presence of large numbers of flies in an area might also interfere with the effective operation of other nearby businesses, such as vehicle repainting.

Biting

Of the flies regularly associated with waste or livestock sites, only the stable fly (*Stomoxys calcitrans*) feeds on blood. It normally feeds on large animals such as pigs, cattle or horses, but may also bite people.

Commercial impacts

Egg producers with persistent fly infestation resulting in poor quality eggs may find that their accreditation to various food quality schemes are suspended, or that customers such as supermarkets decide to terminate their commercial agreements.

3. Fly monitoring

The following techniques can be used as part of a one-off inspection to gain an idea of the level of infestation, or regularly as routine monitoring to build up a picture of trends in fly numbers. Operators should carry out routine assessments as part of their proactive fly control work, the Agency only tends to carry out monitoring in exceptional circumstances.

Appropriate measure:
Fly monitoring is an essential part of pest management providing a history of the problem on site and in addition, assisting in planning for the future. It is recommended that sites carry out or commission surveys of their sites to improve their understanding of where fly development and multiplication is taking place as this is likely to assist in the development of more targeted control measures.

- Trends in fly numbers at the alleged source can be compared with trends in numbers in reporters' premises, possibly providing evidence of a link.
- Monitoring data from different parts of the site, e.g. different poultry houses, or different areas on a large landfill, can be used to identify localised areas where fly breeding is occurring. This will allow specific causes to be identified so operators can use more focussed or intensive control efforts.
- Monitoring flies throughout a cycle will allow 'normal' levels to be established. Any rise in numbers will be noticeable, so early additional control measures or treatment can be put in place.
- Where records have been recorded over several seasons, they may help to predict impending fly peaks, so allowing pre-emptive fly control work.
- Comparing fly numbers before and after particular fly control measures have been used will help to indicate the effectiveness of the treatment. This is particularly useful if the officer suspects that the treatment is not being used correctly or that resistance to specific chemicals is becoming apparent.

Fly monitoring record forms for use by operators are in Appendix 2.

3.1. Monitoring adult flies at the source

Indoor resting counts for common house fly

This species readily rests in numbers on structural surfaces within buildings, such as poultry houses or waste transfer stations, so resting counts are often used to indicate relative population size. Typically 1 x 1m squares are outlined with white paint on internal wall surfaces, with the centre of the square at about head-height.

There may be 4 – 6 squares in a poultry house or waste transfer station. Squares should be located in areas where flies are seen to be resting, away from frequent people or vehicle movements, close to likely fly breeding areas, and where the square will not subsequently be obscured by manure, waste or other materials. The operator counts and records the number of flies resting within each square at regular intervals, for example up to twice-a-week from April to October and once–a-week at other times.

The squares should be brushed occasionally to remove dust and cobwebs, and should not be sprayed with insecticide. Rising numbers of flies indicates that investigation and intervention are required.

Indoor adhesive paper traps for houseflies

Adhesive fly papers (see Figure 2) are used to monitor lesser housefly numbers. In each building two to six 30cm wide rolls are hung up at about head height in areas where flies have been noted. At weekly intervals, a length of paper (approx 30cm) is pulled down from the roll, and at the end of the week, the flies stuck on the exposed paper are counted and recorded.

The paper should then be torn off the roll, covered with cling-film and retained so flies can be identified and counted. A fresh 30cm length is then pulled down ready for the coming week. The size of the roll used doesn't affect the monitoring method. Operators should carry out counts from April to October and at some sites may be required throughout the year.

Note: fly numbers will vary greatly between sites. Changes in numbers indicate changes in fly activity. Remember, there is no absolute number determined as a nuisance.

Figure 2: Adhesive fly paper used for fly monitoring in a poultry farm (Copyright C. Boase)

Open air Scudder grid counts for houseflies at waste sites

A Scudder grid is a standard 60cm square wooden slatted grid which is dropped onto the surface of the refuse. After a period of 10 seconds, the flies resting on the grid are quickly counted and recorded; these are likely to include common housefly and bluebottles, so an element of identification is necessary.

The count is repeated 10 – 15 times in areas with higher fly numbers, such as on and around the active tipping face. Counts should be carried out at times when flies are active, typically between 10.00 and 16.00 hrs.

Figure 3: Scudder Grid in use at a landfill site (Copyright C. Boase)

Avoid doing counts in cold, windy or wet conditions. Counts should typically be carried out 2-3 times per week from April to October. Regular monitoring can determine 'usual' numbers for that site and therefore any rise will be easily seen.

Open air adhesive paper catches for flies at waste sites

At open air sites, such as landfill sites and waste transfer station boundaries, operators can use adhesive papers to monitor fly numbers. Pieces of adhesive paper (~ 30 x 30 cm) can be attached to a post around the site for a week, and then removed, replaced and the catch counted.
The limitations are that the papers can't normally be positioned on the active tipping face as they will be damaged by vehicles. The papers also catch large numbers of non-pest species, which have to be separated from the pest species before obtaining a final count. Birds take the captive flies on papers, and adverse weather (wind and rain) will also affect the catch.

3.2. Monitoring larval flies at the source

Scrape-and-count, for common houseflies

Operators can monitor larvae by scraping the top 2 - 5cm layer from the surface of the manure or waste over an area of approximately 30 x 30cm. The number of exposed larvae is quickly estimated, and recorded.

This should be carried out at 4 – 10 locations within each building/vessel, depending on its size and the variability of the material. Larval stages are usually found where undisturbed damp manure or waste is present, rather than on surfaces that experience a lot of movement. Drainage channels that have waste residues within them can be very productive fly breeding sites.

Good monitoring locations are those where this material is present for extended periods, such as the manure pit in a poultry house or the tipping face of a landfill site, allowing a series of counts to be taken and trends to be established. In premises where there is a high turnover and removal of substrate (belt removal systems in poultry houses, or well-run transfer stations), then routine monitoring of larvae may be inappropriate, and monitoring will be based on adult counts.

Counts should be repeated up to twice-a-week from April to October. Consecutive counts should not be carried out on exactly the same area of manure or waste. One or two larvae or pupae may be considered normal, but if numbers are much higher than this is an indication that further investigation and intervention may be required.

Sample-and-count for lesser houseflies

The majority of severe problems with lesser houseflies occur almost entirely in free-range poultry layer units. Counting larvae in-situ is not appropriate for lesser houseflies because of limited access to the manure in free-range poultry houses, the difficulty in seeing the young stages within the manure, and the difficulty in separating larvae from pupae. Instead, operators can use a long-handled trowel or similar to scrape a sample of ~300g manure from the top 5-7cm of the pit surface, which is then put into a white bowl or tray. They should then check each sample and count and record the number of larvae and pupae present.

At best, the operator should obtain and check around four manure samples per week per poultry house. Samples should be taken from the manure pit wherever there's access. If possible, operators should try to get both drier (from edge) and wetter (from under drinkers) samples.

Again, very few larvae or pupae should normally be found. If the number is high, action is needed.

3.3. Monitoring adult flies at reporters' premises

Monitoring should be carried out in indoor locations where the flies regularly occur in numbers. This may be a porch, outbuilding, conservatory, kitchen etc. We don't recommend monitoring houseflies outdoors owing to the diversity of the catch, and the risk of catching birds or bats on adhesive papers

Figure 4: Adhesive fly papers in a resident's home (Copyright C. Boase)

Traditionally, long adhesive fly papers are used, available from DIY or farm supply stores. They're cheap, easy to use and catch flies well, although they can be difficult to handle and store after use. Single-sided adhesive fly papers should be transported in cardboard boxes and can then be stuck on white paper to identify (where possible) and count flies.

Officers should take photographs of papers as they may be required for evidence. Fly papers should be replaced weekly throughout the infestation, and continue to be used after numbers have dropped so that 'usual' numbers can be recorded. For enforcement cases it is essential to be able to state what is 'usual' in that area.

Alternatively, more specialised adhesive fly catching devices are available. Although these appear to catch fewer flies, the devices may be conveniently labelled and stored after use, and re-examined later as required. The size of the fly catching paper is not relevant as long as the methodology used is consistent and is in line with the flypaper manufacturer's recommendations. Adhesive devices should be labelled and changed weekly. The catch should be identified, counted and recorded by the investigating officer.

Liquid-baited fly traps are not suitable for fly monitoring as the traps can't be stored after use and the flies quickly decompose, making them difficult to identify.

3.4. Interpreting fly monitoring data

3.4.1. How many flies at the source constitute a problem?

There is not a fixed relationship between the number of flies at a 'source', and the risk of nuisance in neighbouring properties. The risk of nuisance occurring will depend not only on the number of flies at the 'source', but also on other factors, such as the distance from the 'source' to the neighbours, the sensitivity of receptors, the attractiveness of the neighbour's premises for the flies and the weather (see 2.4). For example, one poultry site may have very high fly numbers but not cause any problems because the neighbours are too distant, while a similar poultry site situated only 100m from neighbours will have to work very hard to prevent nuisance.

Through fly monitoring and feedback from the regulator, individual sites may develop an understanding of what fly levels on site correspond with reports from neighbours. This enables a threshold fly count to be set for that site, above which reports are likely to occur. Fly management measures at the site should then be timed to prevent fly numbers exceeding this threshold.

3.4.2. How many flies in a reporters' property constitute a nuisance?

As with other issues such as noise or odour, there is no rigid definition of how many flies represent a nuisance. Experience shows that some households will report incidents vigorously when there are about five flies in their home, while other households will quietly tolerate thirty flies. Defra's guidance on interpreting the Clean Neighbourhood and Environment Act 2005 says that:

'There are no objective levels at which a statutory nuisance exists or may be caused. In general, in domestic premises, it is likely that the threshold will be very low and control actions might be taken in cases of few house flies.

As a guideline, an occupier will normally experience some irritation if there are five or more 'flying' house flies present in any one room at any one time on three successive days. If house flies are monitored with baited traps, sticky ribbons, or spot cards, a collection of more than 25 in any 48-hour period may indicate grounds for distress.'

Defra's figure of >25 houseflies caught on fly papers in 48 hours identifies properties with a significant problem. However, for regular monitoring, weekly visits are more practical than 48hr visits, and in practice a catch of more than 50 houseflies per paper per week would indicate premises with a significant problem as outlined above.

Investigating officers should also look for opportunities to hang fly papers in premises where no fly problems are reported to get an idea of 'normal' background fly numbers.

In general, claims of fly nuisance relate to indoors. Claims about fly nuisance outdoors are much more challenging because of the numbers and diversity of other non-pest insect species. Reports about flies in gardens rarely identify the species involved.

4. Investigating and resolving fly reports

To demonstrate that a particular site is likely to be responsible for the flies at reporters' premises, officers need to show that:

- The alleged source is a breeding site for significant numbers of the same species of flies as those found at the reporters' premises. Simply showing that the adult flies at the alleged source are the same species as the flies at the reporter's premises isn't enough. The flies at the two locations could have come from another unknown site. Breeding has to be established at the source to make a clear link.
- There are no other significant sources of the same species of flies nearby, eliminating the possibility that the reporters' flies come from elsewhere. Not all houseflies come from mass breeding sites; small quantities of waste or manure may also generate some flies.
- Changes in fly numbers at the source (for example due to manure removal from poultry houses, or using an inert cover on landfill sites) are mirrored in the reporters' premises.

The following is an outline procedure to identify, investigate and resolve reported fly problems. This is neither a prescriptive approach, nor the only approach and the detail and the sequence may vary depending on the site.

Step 1: Fly incident details received

Discuss the issue with the reporter to ascertain the history of the problem, likely species, fly numbers, their habits and impact on the residents. If necessary, ask them to submit samples to the investigating officer for identification. Is the incident associated with or close to a permitted site?

If there are a number of residents affected or the issue is contentious, you may need to prepare an engagement plan – your local communications team can help with this.

Step 2: Visit and investigate

If the problem is persistent and appears to be related to a site we regulate, or involves several residents or businesses and concerns significant numbers of houseflies, consider visiting all of the premises to collect samples and take photos as evidence. Offer advice on control measures (section 5.2) they can use within their properties. Consider contacting the local environmental health department to see if they are aware of problems or can offer any advice.

Step 3: Structured fly monitoring

Ask the reporters to hang adhesive papers in agreed locations in the property (see Section 3) and change them every week until asked to stop. The investigating officer should take a photo of the fly paper in-situ before collecting the papers to identify and count the flies.

The sticky papers are then fixed to white paper and a label attached with details of location, dates, flies and numbers, and the officer takes another photo. See 3.4.2 for guidance on the numbers of flies in a receptor's property that may constitute a problem, but remember there is no absolute nuisance level.

If the number of flies caught is going to be used in evidence, the reporters will need to give a statement about whether they have moved or done anything to the papers during the monitoring period.

Step 4: Identify potential fly sources

If the incident concerns significant numbers of houseflies, identify potential fly breeding sites, initially within a 1 km radius of the premises. Contact the LA to discuss any issues they may be investigating in the area.

Step 5: Investigate potential fly sources

Contact the identified sites and ask about any recent fly issues. Visit the sites where the fly breeding may be occurring. Site visits should include:

- Discussion with the operator to understand the systems and processes on their site, such as age of stock on farm, manure storage and removal procedures, ventilation systems, incoming waste streams, waste processing procedures and times, good housekeeping including waste rotation, cleaning and washing down buildings etc. Establish if there have been any recent incidents (e.g. water leaks, or equipment breakdown), or changes in procedures (e.g. new incoming waste streams) that may have increased the risk of fly infestation.
- Checking the site for the presence of adult flies, fly breeding, and conditions conducive to fly breeding. Take dated photographs of key issues seen. On farms this investigation is

likely to involve examining manure from various locations within livestock sheds for moisture levels, and for the presence of fly larvae (see 3.2).

At waste sites this may involve examining waste for fly larvae. Additionally, any adhesive fly papers and electronic fly killers present should be checked for fly numbers and species. Are the fly species present the same as those at the reporters' premises? Is the farmer or operator already monitoring fly numbers? Are fly records available?

- Is the site already using fly control measures? Do they have a fly management plan? What has been identified in their management system? What techniques are used (both non-chemical and chemical), and for how long? Is there a fly control contract? Is the contract or contractor appropriate? Are records of pesticide use available?
- Repeat this process for each potential fly source. Beware of becoming fixated on one potential source at an early stage.
- Discuss with the operator what they need to tell the local community and what part they need to play in any engagement plan.

Step 6 Resolve fly problems

At sites where a clear fly problem has been identified it is likely that the operator has breached their permit.

You need to establish the root causes of the fly problem, such as wet manure, poor ventilation, over-flowing drinkers, insufficient use of cover, allowing unprocessed waste to remain on site for extended periods, inadequate composting process, inappropriate pesticide use etc.

Provide the operator with relevant advice on good practice for fly management, especially on fly prevention. Ask the operator to write or amend and implement a Fly Management Plan (see Section 6), which addresses the root causes to solve the issue and prevents recurrence. Advise the operator clearly of the level of nuisance being experienced in nearby residences.

An example of monitoring sheets which can be used by operators can be found in Appendix 2.

Step 7. Feedback to residents

Thank people for their assistance and discuss the action taken with the affected residents. Advise them that treatment is likely to take several weeks to be fully effective, and they should continue to monitor until otherwise advised or they are confident the problem has been resolved. Ask them to report future incidents to our pollution hotline.

Step 8. Follow up visits to site

For sites where action was required, revisit the site as soon as possible, preferably within a week to assess the implementation of agreed actions and their effectiveness.

If the action taken by the operator is inadequate or ineffective, continue to work to address the problems. Ask yourself the following questions:

- Are there issues that were missed at the initial visit?
- Are there fly breeding areas that were overlooked, for example, lesser housefly larvae can be very difficult to locate?
- Does there appear to be resistance to the insecticide products used?
- Are there other significant fly-breeding sites nearby which have not yet been investigated?

Step 9. Conclusion

Once the problem is resolved, advise all parties of the outcome of the investigation, action taken and proposals to avoid a recurrence. Advise reporters to contact us again if problems recur.

5. Fly management techniques

There are a range of measures potentially available for fly control at permitted sites. Some are preferred measures whilst others are a last resort. The Health and Safety Executive's document 'The Safe Use of Pesticides for Non-agricultural Purposes' (1995) sets out a hierarchy of approaches to dealing with pest problems.

The COSHH Regulations 2002 impose a requirement to consider using non-hazardous pest control techniques in preference to potentially harmful pesticides. Where suitable techniques exist, pro-actively preventing fly problems is a more effective and sustainable approach than trying to deal reactively with an established infestation of flies. Typical permit conditions require prevention of nuisance, where possible.

The following table adapts and summarises these approaches:

Rank	Issue	Detail
1	Competent fly control staff	There is a very wide range of techniques available for fly management on waste sites. Selecting and implementing the most appropriate strategy may require a detailed understanding of a range of technical issues. It is essential that waste company employees and pest control contractors alike, have a good knowledge and understanding of fly management as a whole, and not simply the application of a particular pesticide. See Section 4 below.
2	Identify and monitor the flies	Even within the waste industry, different species of flies will have different habitat requirements. Identifying the fly can help locate its source, and so trigger targeted measures to eliminate that source. Sites should carry out routine fly monitoring, and use the data to establish fly sources, and show trends over time. See Section 5 below.
3	Prevent flies and their problems by using non-insecticidal measures	There are important benefits of using non-chemical measures, for example: they prevent problems rather than trying to deal with them once they have arisen, they are long-lasting, and flies do not become resistant to these measures. Non-insecticidal techniques may include: avoiding waste stockpiles, stock rotation of baled recyclables, regular cleaning, proofing of buildings, etc. See Section 6 below.
4	Manage the flies with insecticidal means	At some sites, insecticides may be an appropriate part of fly management. However insecticides are not a routine stand-alone technique, but an intervention to be used when absolutely necessary, and in conjunction with non-insecticidal measures. Over-use of insecticides may select for resistance in the flies, such that the products cease to be effective. Insecticidal use also brings with it legal

		responsibilities in terms of training, compliance with the label, storage, usage, disposal and record keeping. See Section 7 below.

Further information is provided in sections 5.1.1 to 5.1.8, below which outline the main preventative techniques for reducing the risk of fly problems in a range of sectors and sections 5.2.1 to 5.2.3 which outline the main control techniques for existing fly problems.

5.1. Fly prevention measures

5.1.1. Fly prevention and appropriate measures for in poultry facilities

The key to avoiding fly infestations is managing water and moisture in the manure and frequent manure removal if appropriate. Premises which keep manure dry or regularly remove it rarely experience serious infestations, and almost never need to use insecticides. All installations should aim to achieve this situation.

High risk periods for fly infestation in poultry laying units are the first few months after a new flock has been introduced, where that period coincides with warm weather. For example, introducing a new flock into a house in April poses a risk of fly problems within a few weeks that may then persist for most of the summer. This is a result of the combination of rising temperatures, low initial predator numbers, and manure that tends to be wet in the initial period whilst the flock settles.

Operators should ensure they have a sufficient stock of insecticide products, and the resources to use them if required, over this high risk period.

Poultry laying units should adopt the following preventative steps where appropriate: Frequent monitoring of adult and larval flies using appropriate monitoring methods as described in Section 3;

- Where appropriate, manure should be frequently removed from the site.
- Manure remaining on site should be managed to keep water content below 50%, i.e. it is dry and friable. This may be achieved by monitoring water drinkers for leakage; preventing water ingress into the building; ensuring good ventilation of manure holding areas, and ensuring the livestock is healthy.
- Certain feeds result in wetter litter, and the producer should take action to deal with constantly wet faeces.
- Removal of manure/litter from the building and transport off site should comply with current Codes of Practice.
- Broken eggs and fallen stock should be removed daily.
- Cleaning up feed spillages daily, where possible. If this isn’t possible, the operator should monitor the spillage area more closely for flies.
- Incorporating fly screening into buildings if possible and where it won’t affect ventilation.
- Training staff in monitoring and treating fly infestations.

5.1.2. Fly prevention and appropriate measures for pig facilities

High risk times for fly infestation are prolonged periods of warm weather. Pig facilities should follow the steps below to help prevent fly problems:

- Twice-weekly monitoring of adult and larval flies during April to October using appropriate monitoring methods as described in Section 4.
- Manure should be removed frequently, ideally daily (or as frequently as possible) from high risk areas such as finisher units.
- Transport of manure/litter off site should comply with current local authority and Defra Codes of Practice.
- Fallen stock should be removed daily.
- Incorporating fly screening into buildings where possible and where it won't affect ventilation.
- Training staff in monitoring and treating fly infestations.
- Clean feed spillages daily, where possible. If this isn't possible, operators should monitor the spillage area more closely for flies.

5.1.3. Manure removal and transportation

To minimise the impact of fly dispersal during manure transportation off-site, operators should comply with relevant local authority and Defra Codes of Practice, especially:

- Ensure adult fly numbers are minimised before houses are opened up for manure removal.
- Avoid overloading trailers to prevent manure spillages onto the highway.
- Cover trailers, if practical, when moving through residential areas.
- Ensure that the recipient of manure has selected an appropriate location for the heap (see below), and where possible can cover the manure heap at the end of each day.
- Wherever possible deliver infested manure to arable land where it can be immediately incorporated as it's spread.
- Infested manure is unlikely to be suitable for reprocessing (for example as poultry manure fertiliser).

5.1.4. Storage and spreading of manure and other biosolids

It may be necessary to store manure or other biosolids before land becomes available for spreading. Manure has the highest risk of infestation, but other biosolids such as anaerobic digester sludge can also become infested. Such storage should comply with relevant local authority and Defra Codes of Practice to minimise any potential fly nuisance during storage and spreading, as well as to prevent damage to land and watercourses.
Key points are:

- Only non-infested manure should be applied to grassland or growing crops. Infested manure spread to bare soils should be incorporated by deep inversion ploughing at the time it is applied, or in any case within 24 hours.
- Ideally, manure heaps should be located at least 500m distant from sensitive receptors where there is a known fly problem. Greater distances may be prudent where large quantities are being stored.
- If there is a risk of fly infestation, field-stored manure heaps should be tightly covered with polythene sheeting or similar impervious material. There should be no gaps between

overlapping sheets, and the edges of the sheeting should be buried in a 30cm deep trench around the entire heap and back-filled with soil.

- Sheeting should remain in place for at least 10 days to ensure the death of any flies within the manure, and ideally longer to prevent re-infestation.
- The integrity of the sheeting should be checked at least weekly, and repairs carried out as necessary.
- Spreading should not be carried out on Bank Holidays or Sundays.
- Manure should not be spread to land within three weeks of the last application of cyromazine larvicide. After spreading, the land should not be grazed or cropped for another 4 weeks.

Local authority Codes of Practice for manure removal, transport, storage and spreading emphasise that manure management is the joint responsibility of the producer, the transporter and the end user. There are steps that each can take to reduce and/or prevent fly infestations. These steps form an integrated approach involving good manure management, together with biological and/or chemical control methods.

5.1.5. Fly prevention and appropriate measures for waste transfer stations

High risk times for fly infestation at transfer stations are periods of warm weather. In general, putrescible household waste is at much greater risk of infestation than dry recyclables, although paper or plastics may also generate flies if contaminated with food waste. It is critical that proper fly control is used at the transfer sites with the flexibility to carry out additional treatments at peak times. This should prevent, or at least minimise, the potential for infestations of maggots/flies getting to landfill where it's often too late to implement adequate control measures. See appropriate measures below:

5.1.5 Guidance on fly management in transfer stations, MRFs and similar facilities		
During the warmer months, flies are brought into transfer stations within putrescible waste, and may emerge if the waste remains on site. Good fly management can be achieved by rigorous turn-around of waste and frequent, thorough cleaning. Use of insecticides should be a last resort. The key fly management measures are outlined below:		
Training	In-house	Ensure key site staff are trained in fly management, both in use of non-chemical and chemical options.
	Contractor	If an external pest contractor is used, ensure they are selected in line with the guidance in Appendix 2 below. Their work should be closely monitored.
Fly monitoring	Adult flies	Locate yellow adhesive fly cards within the building, close to waste, in areas preferred by flies. Replace cards weekly, identify and count flies, and keep records. Use counts to guide the treatment regime.
	Larval flies	If fly numbers are higher, conduct ad hoc survey(s) for fly larvae and pupae, and keep records. Adjust cleaning and treatment regime if necessary, to reduce breeding potential.
Non-chemical fly prevention	Process control	Ensure that designated waste turn-around time (48 hours is achieved. Use two alternating bays for incoming putrescible waste.

		Avoid backlogs and stockpiles of putrescible waste. Any obviously fly-infested waste should be removed from site immediately.
	Cleaning	Carry out daily cleaning to remove waste outside tipping bays. Each time each bay is emptied, remove accumulations of waste from corners etc. before re-filling. Carry out monthly deep clean, including under push walls.
	Containment	Containment of flies is difficult and good housekeeping and minimal storage times will be more effective. Keep vehicle access and personnel doors closed when not in use. Locate and seal unnecessary holes in fabric of main waste building, to prevent fly egress. Do not leave trucks of waste parked in open overnight.
Insecticide use	Insecticide space sprays	If necessary, apply non-residual pyrethroid space sprays over and around waste bays and flies aggregation areas, at end of working day, when building is closed. Comply with label conditions, including dose, frequency of use, and record-keeping.
	Insecticide residual sprays	If strictly necessary, apply to surfaces on which flies prefer to rest, including the waste itself. Use an insecticide from a different class to that used for space treatments, e.g. a carbamate. Comply with label conditions, and keep records.
	Insecticide fly baits	If required, apply to non-absorbent boards as vertical stripes, positioned in areas attractive to flies. Top up bait as often as required. Comply with label conditions, and keep records. Remove boards when not required, and in winter months.
	Larvicides	Some larvicides are not approved for use on waste sites. Even with approval, we do not consider their use appropriate.

Further appropriate measures are as follows:

- Monitoring adult fly numbers twice-a-week during April-Oct using an appropriate technique, such as resting counts in squares marked out on internal walls.
- Carrying out waste acceptance checks (monitoring at weighbridge where possible, monitoring fly numbers in each load, recording heavily infested loads in fly contaminated load log sheet, treating loads and priority removal off site, not accepting fly infested loads from other waste sites). Where it's not possible to monitor loads at the weighbridge, operators should monitor when it's unloaded.
- Consider a change in existing processes. For example, plastic recyclers baling intact post-consumer beverage containers experience problems with flies developing within the putrescent material remaining within the baled containers. A change in process to shredding and washing the containers results in a much cleaner end product and the fly problems are completely prevented.
- At sites producing and storing baled RDF or recyclables, bales should numbered, labelled or colour coded to show date of production, allowing older bales to be identified and removed preferentially.

- Fly breeding is accelerated at warmer temperatures. Premises in which waste is stored or processed should be designed to be as cool as possible, e.g. by avoiding sunlit areas.
- Rejecting infested/problematic waste (what procedure is in place to ensure repeat problematic loads/known problematic waste streams are not accepted).
- Ensure waste moves steadily through the process, proper waste handling and rotation (Alternate Bay (A/B) system of waste in one day and out the next, waste not stored for longer than 48 hours, waste treated). Avoid leaving household waste in the premises over the weekend. This is especially important during the warmer months.
- Ensuring that waste doesn't accumulate in inaccessible areas such as behind push walls, under plant or in corners. Any such waste should be removed daily, especially during the summer. Operators should also maintain good housekeeping, including cleaning down and disinfecting, regularly removing leachate and maintaining drainage systems.
- Smooth flooring is relatively easy to clean. Badly cracked or broken flooring should be repaired to avoid accumulation of organic debris within the cracks and potholes.
- Aiming to ensure contingencies are in place if the main nominated disposal point is unavailable e.g. technical problem at waste to energy site or high winds closing landfill. Contingencies should include identifying alternative outlets.
- Minimising the time external doors are left open during the warmer months, and where possible installing automatic doors. Screen other openings where possible to reduce fly dispersal.
- Training staff in using fly spray, identifying flies, toolbox talks and understanding the importance of monitoring/recording fly infested loads.

5.1.5 Guidance on fly management on sites producing baled RDF and recyclables		
Flies may develop within wetted RDF bales or within baled recyclables that contain organic contamination. Infestation risk is greater with lengthy storage. Good fly management can be achieved by ensuring RDF bales are well-wrapped, cleaning recyclables and good stock rotation. Use of insecticides should be a last resort. The key fly management measures are outlined below:		
Training	In-house	Ensure key site staff are trained in fly management, both in use of non-chemical and chemical options.
	Contractor	If an external pest contractor is used, ensure they are selected in line with the guidance in Appendix 2 below. Their work should be closely monitored.
Fly monitoring	Adult flies	Locate yellow adhesive fly cards within the building close to waste in areas preferred by flies. If bales are stacked outdoors, hang monitoring cards close to bale stacks. Replace cards weekly, identify and count flies and keep records. Use counts to guide the treatment regime.
	Larval flies	If fly numbers are higher, conduct ad hoc survey(s) for fly larvae and pupae and keep records. Adjust cleaning and treatment regime if necessary, to reduce breeding potential.
Non-chemical fly prevention	Process control	Ensure that baled RDF and recyclables are dated and good stock rotation is followed. Keep storage time to a minimum.

		Ensure that RDF bales are multi-wrapped preventing water ingress. Use plant specifically for handling wrapped bales to avoid tearing the wrapping and do not push bales along the ground. Where the wrapping of RDF bales becomes torn, either patch with tape or re-wrap. Stack bales so that access for insecticide treatment is possible.
	Cleaning	Where possible, wash and shred post-consumer recyclables to remove organic contamination. Frequently clean waste processing, bale wrapping and storage areas to remove any accumulations of waste. Deep clean regularly in warmer months.
	Containment	Containment of flies is difficult and good housekeeping and minimal storage times will be more effective. Keep doors to waste processing and storage buildings closed when not in use. Locate and seal unnecessary holes in fabric of main waste building to prevent fly egress.
Insecticide use	Insecticide space sprays	If flies are active, apply non-residual pyrethroid space sprays over and around indoor bale storage areas, at the end of the working day when building is closed and no unprotected staff are present. Comply with label conditions including dose, frequency of use and record keeping.
	Insecticide residual sprays	If strictly necessary, apply to surfaces on which flies prefer to rest, including the waste itself. Use an insecticide from a different class to that used for space treatments, e.g. a carbamate. Comply with label conditions and keep records.
	Insecticide fly baits	If required, apply to non-absorbent boards as vertical stripes, positioned in areas attractive to flies. Top up bait as often as required. Comply with label conditions and keep records. Remove boards when not required and in winter months.
	Larvicides	Some larvicides are not approved for use on waste sites. Even with approval, we do not consider their use appropriate.

5.1.6. Fly prevention and appropriate measures for landfill sites

High risk times for fly infestation at landfill sites are generally periods of warm and damp weather. Landfill operators should make sure they have sufficient stocks of appropriate daily cover, and the resources to apply it, over the summer period. Waste arriving on site should be thoroughly compacted immediately. In addition, the operator should ensure that an appropriate fly control contract is in place, and that it is sufficiently flexible to allow changes in treatment frequency if required.

Key fly prevention activities at landfill sites include:

- Monitoring adult fly numbers twice-a-week during April-Oct, using an appropriate technique such as a Scudder grid (see 3.1).
- When adult fly numbers are high, investigate potential fly breeding areas (see 3.2).
- Applying a daily cover thick enough to prevent fly infestation at the tipping area, and to associated flanks of lifts. This is especially important at the end of the working week. NOTE: Cover is applied for many reasons and these other requirements should also be considered.
- Sites should be operated with a small tipping face. This results in refuse acting as its own cover, so smaller quantities of appropriate daily cover are needed, and restricts the extent and need for insecticide treatment.
- When refuse is being brought in from areas operating a two-weekly domestic waste collection, ensure that waste is covered progressively over the course of the working day to reduce fly emergence.
- Immediately covering waste streams that are highly attractive to flies or which commonly experience infestations (e.g. food waste).
- Checking that any waste transfer stations used for intermediate storage have good fly management procedures in place, i.e. fast waste turnaround, and appropriate insecticide use. Doing this could prevent the landfill site becoming infested and being the subject of possible reports of fly problems.
- If necessary, investigate the use of alternative and more effective cover materials.
- Where space allows, relocate the active tipping area further away from residential areas, at least during warmer months.
- Ensure that site staff are adequately trained in fly monitoring, and aware of the importance of fly prevention.
- Putting in place methods to manage flies in storm / windy bay storage areas when tipping on working face not possible.

5.1.7. Fly prevention and appropriate measures for Anaerobic Digestion (AD) and In-Vessel Composting (IVC) sites

The risk of fly infestation will be high during periods of hot weather, as the incoming waste is likely to be infested and fly development will be rapid. Parts of the site where the process generates elevated temperatures may be at risk of infestation throughout the year. Operators should:

5.1.7 Guidance on fly management in In-Vessel Composting and Anaerobic Digestion facilities		
During the warmer months, flies are brought onto site within waste and may emerge if the waste remains unprocessed. Good fly management can be achieved by rapid processing of incoming waste, together with frequent deep cleaning. Use of insecticides should be a last resort. The key fly management measures are outlined below:		
Training	In-house	Ensure key site staff are trained in fly management, both in use of non-chemical and chemical options.
	Contractor	If an external pest contractor is used, ensure they are selected in line with the guidance in Appendix 2 below. Their work should be closely monitored.

Fly monitoring	Adult flies	Locate yellow adhesive fly cards within the building, close to waste reception area, and in other areas preferred by flies. Replace cards weekly, identify and count flies, and keep records. Use data to inform fly management.
	Larval flies	If fly numbers are higher, conduct ad hoc survey(s) for fly larvae and pupae, and keep records. Adjust cleaning and treatment regime if necessary, to reduce breeding potential.
Non-chemical fly prevention	Process control	Ensure that all incoming waste is processed rapidly, and not stockpiled in reception overnight, or at weekends. Ensure that waste in vessels all reaches target temperatures.
	Cleaning	Carry out daily cleaning at end of working day to remove deposits of waste from reception and other areas. Carry out frequent deep cleans, to remove accumulations of waste from corners, dead spaces, within machinery, and under push walls.
	Containment	Ideally ensure that vehicles can enter the building completely, allowing external doors to close behind them whilst tipping. Keep external doors to waste reception and processing buildings closed, when not in use. Locate and seal unnecessary holes in fabric of main waste reception and processing buildings, to prevent fly egress. Do not leave trucks of waste parked in open overnight.
Insecticide use	Insecticide space sprays	If necessary, apply non-residual pyrethroid space sprays in waste reception and fly aggregation areas, at end of working day, when building is closed. If necessary, apply space spray over waste within vessels. Flies are unlikely to develop in compost on maturation slabs - any flies present are most likely to come from reception or vessels. Comply with insecticide label conditions, including dose, frequency of use, and record-keeping.
	Insecticide residual sprays	If strictly necessary, apply to surfaces on which flies prefer to rest. Use an insecticide from a different class to that used for space treatments, e.g. a carbamate. Comply with label conditions, and keep records.
	Insecticide fly baits	If required, apply to non-absorbent boards as vertical stripes, positioned in areas attractive to flies, e.g. in reception area. Top up bait as often as required. Comply with label conditions, and keep records. Remove boards when not required, and in winter months.
	Larvicides	Some larvicides are not approved for use on waste sites. Even with approval, we do not consider their use appropriate.

Further appropriate measures:

- Refuse the waste if it's likely to cause fly infestation - this would be dealt with as a waste acceptance issue under the conditions of the permit.

- Use sheeting or other containment when storing waste/waste products that are highly attractive to flies.
- Where applicable, ensure all waste is uniformly heated to above 45^{o}C to kill all fly stages.
- Ensure that waste doesn't accumulate in inaccessible areas such as behind push walls, pipe work or drains under plant or in corners. Any such waste should be removed daily, especially during the summer.
- At many MBT sites, incoming waste is tipped initially into a deep reception pit. This pit can't be emptied completely with the grab used to lift the waste out and it is not safe for staff to descend into the pit. This scenario provides ideal fly development opportunity in the bottom of the pit and therefore, insecticides are often applied routinely as a preventative measure. Changing the design of the reception area to allow waste to be tipped into a space allowing access and that could be fully and safely cleaned, would remove this fly source.
- There is no evidence to show that use water misters at vehicle entrances to prevent fly egress is effective. Investigation of work at one site indicates that these do not reduce fly egress.
- Usually, Electronic fly killers (EFKs) are used most appropriately as a means to reduce nuisance in offices and other similar settings as they can only kill small numbers. However, if EFKs are used as part of the design of the site, e.g. with a row of them along one side of the bio-hall, connected to an air-extraction system that sucks the flies into an external filter and this is successful then this would be considered an appropriate measure.
- Where possible, reduce fly movement out of the building e.g. use double or automatic doors for access to treatment halls and using fly-screening material. Maintaining negative air-pressure within waste treatment areas will also reduce fly egress.
- Within buildings, internal walls and partitions can be successful in preventing fly movement. In MBT facilities, ideally the bio-hall should be internally partitioned off from the waste reception area, to reduce fly egress whenever the reception doors are opened.
- Plastic strip curtains can be used reduce the internal movement of flies from one area to another.
- Consider changing the process on site. For example, at some MBT sites, the waste within the bio-hall is not disturbed at all until it is removed that typically results in significant fly breeding within the waste. However, at other sites the waste is turned regularly using a bucket wheel that results in a more uniform bio-degradation but also appears to result in better control of the flies because many of the larvae are killed by the process. It may not be feasible to install a waste-turning system to an existing MBT site but it should be considered on facilities being planned.
- When removing waste from the bio-hall, reuse the bottom layer of dry composted waste to form a cover over the recently arrived waste. This has been shown to reduce fly breeding, in the same way that a layer of inert cover reduces fly issues on landfill sites.

5.1.8. Fly prevention and appropriate measures for green waste composting sites

In general, houseflies do not breed within good quality green waste, although they may be attracted to it. However green waste contaminated with food waste may encourage infestation. Regular turning of waste windrows, especially the fresher waste, will ensure uniform heating of the waste and limit any fly breeding that does occur.

5.1.9. Fly prevention and appropriate measures for Mechanical Biological Treatment (MBT)

The risk of fly infestation will be high during periods of hot weather as the incoming waste is likely to be infested and fly development will be rapid. Parts of the site where the process generates elevated temperatures may be at risk of infestation throughout the year. Operators should:

5.1.9 Guidance on fly management in Mechanical Biological Treatment (MBT) facilities		
During the warmer months, flies are brought onto site within waste and may emerge if the waste remains unprocessed. Good fly management can be achieved by rapid processing of incoming waste, together with frequent deep cleaning. Use of insecticides should be a last resort. The key fly management measures are outlined below:		
Training	In-house	Ensure key site staff are trained in fly management, both in use of non-chemical and chemical options.
	Contractor	If an external pest contractor is used, ensure they are selected in line with the guidance in Appendix 2 below. Their work should be closely monitored.
Fly monitoring	Adult flies	Locate yellow adhesive fly cards within the building, close to waste reception area, and in other areas preferred by flies. Replace cards weekly, identify and count flies, and keep records. Use data to inform fly management.
	Larval flies	If fly numbers are higher, conduct ad hoc survey(s) for fly larvae and pupae, and keep records. Adjust cleaning and treatment regime if necessary, to reduce breeding potential.
Non-chemical fly prevention	Process control	Ensure that all incoming waste is processed rapidly, and not stockpiled in reception overnight, or at weekends. Ensure that waste in vessels all reaches target temperatures.
	Cleaning	Carry out daily cleaning at end of working day to remove deposits of waste from reception and other areas. Carry out frequent deep cleans, to remove accumulations of waste from corners, dead spaces, within machinery, and under push walls.
	Containment	Ideally ensure that vehicles can enter the building completely, allowing external doors to close behind them whilst tipping. Keep external doors to waste reception and processing buildings closed, when not in use. Locate and seal unnecessary holes in fabric of main waste reception and processing buildings, to prevent fly egress. Do not leave trucks of waste parked in open overnight.
Insecticide use	Insecticide space sprays	If necessary, apply non-residual pyrethroid space sprays in waste reception and fly aggregation areas, at end of working day, when building is closed.

		If necessary, apply space spray over waste within vessels. Flies are unlikely to develop in compost on maturation slabs - any flies present are most likely to come from reception or vessels. Comply with insecticide label conditions, including dose, frequency of use, and record-keeping.
	Insecticide residual sprays	If strictly necessary, apply to surfaces on which flies prefer to rest. Use an insecticide from a different class to that used for space treatments, e.g. a carbamate. Comply with label conditions, and keep records.
	Insecticide fly baits	If required, apply to non-absorbent boards as vertical stripes, positioned in areas attractive to flies, e.g. in reception area. Top up bait as often as required. Comply with label conditions, and keep records. Remove boards when not required, and in winter months.
	Larvicides	Some larvicides are not approved for use on waste sites. Even with approval, we do not consider their use appropriate.

5.2. Fly control measures

Even if proactive fly prevention measures are in place, it is likely that some flies will still occur and need to be controlled. The following sections outline the various measures available. Under the COSHH Regulations 2002 operators must consider non-chemical techniques first.

5.2.1. Biological control of houseflies

Appropriate measure:
Waste site operators should develop and implement appropriate non-chemical control measures; this should be the core of fly management as this avoids issues of pesticide resistance.

Within manure in poultry houses there are often a number of housefly predators present naturally. These include the small mite *Macrocheles muscaedomesticae* which preys on fly eggs, the beetle *Carcinops pumilio* which feeds on housefly eggs and larvae, and *Staphylinid* beetles.

These predators are typically slower developing than houseflies. Predator numbers therefore tend to be low in the early months of the flock, but increase towards the end of the flock. They are more common in drier manure.

Figure 5: *Carcinops pumilio* feeding on housefly eggs (Copyright: World Health Organisation)

Introduced predators or parasites

There are a number of commercial suppliers (often veterinary practices) of other predators and parasites. These insects are delivered to the site, and released into the premises. Several releases may be required over the season. The main kinds available are:

- Parasitic wasps (e.g. *Spalangia* and *Muscidifurax*) locate fly pupae, lay eggs into the case, and the developing wasp larvae eventually kill the fly.
- The predatory larvae of some flies (e.g. *Hydrotaea aenescens*) prey directly on housefly larvae.

	Suitable for:	Controls:	Limitations:
Natural predators:	Poultry layer units, where the manure is not regularly removed, and is relatively dry.	Common housefly, maybe others.	Predator population slow to build up after clean-out, so insufficient predators to control flies under new flocks. Vulnerable to insecticide treatment in poultry house.
Introduced parasites & predators:	Poultry layer units, where the manure is not regularly removed.	Common housefly, maybe others.	Usage pattern not well defined, so effectiveness uncertain. Vulnerable to insecticide treatment in poultry house.

5.2.2. Physical fly control techniques: Electronic fly killers and traps

Figure 6: Electronic fly killer (Copyright C. Boase)

Flies within buildings may be caught by mass trapping with adhesive papers, or with electronic fly control units. These can be effective at reducing the numbers of flies in small premises or enclosed areas in which no breeding is taking place, but are very unlikely to control established infestations.

Outdoors, liquid baited fly traps (Figure 7) are widely used in residents' gardens, for example.

Figure 7: Liquid baited fly trap (Copyright C. Boase)

Limitations:

This will not provide useful level of control in large structures such as poultry houses or transfer stations, or in the open air.

Bag traps cannot be used indoors owing to odour.

May even actually attract flies to the immediate area.

5.2.3. Insecticides

Appropriate measure:
Pesticide legislation requires that people who use pesticides as part of their work must be "trained and competent" in their use - see Appendix 3.

Specific conditions of use are specified on the product label which constitutes the terms of approval and therefore must be followed. These conditions cover dosages, application techniques, treatment frequencies, premises, target pests, and other issues. Where insecticides are being used at a site, the officer should check that products are being used in accordance with statutory label conditions.

Anyone using pesticides professionally should have adequate instruction, training and guidance in their correct use. Although pest control can be carried out by appropriately trained in-house staff, in general such staff lack broader experience of pest control issues.

Pest control companies that are members of a recognised trade association, such as the British Pest Control Association, will typically have a broader experience, and meet minimum requirements in terms of training, insurance, pesticide handling etc.

Individual pest control technicians should have the RSPH/BPCA Level 2 Pest Control qualification as a minimum. In terms of the company's experience of fly management, there are no specific qualifications on this, and the operator will need to ascertain their experience.

The COSHH Regulations 2002 require that all activities surrounding the use of pesticides (storage, use and disposal) should be documented, and records kept for at least three years.

Insecticides for fly control are available for various types of usage, as outlined below:

Insecticide space treatment ('Knock-down' sprays)

Figure 8: Thermal fogging at a green waste composting site (Copyright C. Boase)

Some insecticides are approved for use as space sprays, where the liquid insecticide is atomised into very fine droplets that drift in the air and contact flying insects directly.

Space treatment is typically achieved by:

- Using a thermal fogging machine, which produces a dense white fog.
- Using an Ultra Low Volume (ULV) sprayer, which uses an air-blast to produce the fine spray. The spray is less visible than that from a fogger. Such machines may be hand-held, or permanently installed, for example within a waste transfer station. ULV treatments are typically more effective than thermal fogging.

Space treatment insecticide products typically contain non-residual pyrethroids, which have a short-lived effect. See product labels for specific usage details, but typically treated premises should remain closed for at least 30 minutes after treatment, and should not be re-entered by unprotected personnel for 2 – 3 hours after treatment. Treatments are normally applied at the end of the working day. These systems are most effective when they are applied direct to insects.

Note: Composters in the PAS 100 / Compost Certification Schemes who wish to use fly control products, disinfectants and additives need to first complete an application form for approval.

Sector	Controls:	Limitations:
Waste sector, contained areas i.e. indoors.	Most species of adult flies, if susceptible.	Very short-lived effect. Less effective outdoors as spray rapidly disperses.
Empty livestock buildings.	Most species of adult flies, if susceptible.	Cannot be used in buildings where livestock are present.

Residual insecticide sprays

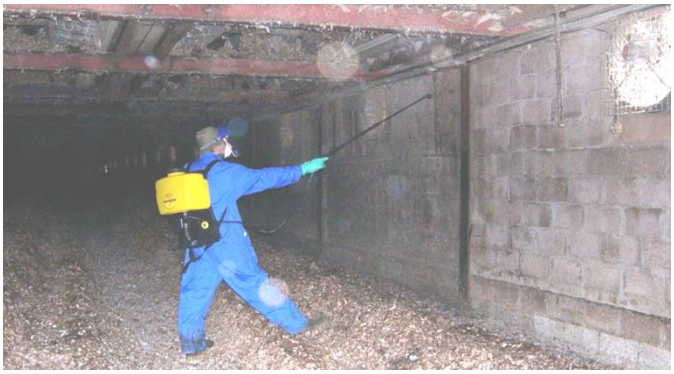

Figure 9: Applying residual insecticide for fly control (Copyright C. Boase)

Some insecticides are intended for use as a residual spray and are applied to surfaces using a hand-held compression or pneumatic or motorised sprayer. They leave a deposit that remains active for some days or weeks. Flies that subsequently alight on the treated surface pick up a lethal dose of the insecticide and are killed. They typically contain residual pyrethroids or a carbamate. Residual insecticides are seldom applied to manure, as they will kill the beneficial (insects and mites). However they may be applied to waste in transfer stations or landfill sites. Waste that has been turned may need to be re-treated. In animal husbandry the structural surfaces should be sprayed but not the manure. In waste facilities however, spray can be applied to surfaces and to the waste itself.

Appropriate measure:
Residual sprays are considered to be likely to select for resistance. Therefore, where space sprays are used (usually pyrethrins or pyrethroids) then it is preferable to use a residual spray (if required) from a different chemical class e.g. carbamate.

Sectors	Controls:	Limitations:
Waste sector, both indoors and on landfill.	Most species of adult flies if susceptible.	
Agriculture	Most species of adult flies if susceptible.	The HSE discourage using pyrethroid products in intensive livestock units as they may rapidly select for resistance. Less effective on lesser houseflies, as they do not rest readily on surfaces. Must not be used on substrate.

Insecticide baits

Insecticide baits typically consist of a mixture of insecticide, sugar and pheromone attractants. They are most commonly mixed to a paste and painted onto sheets of cardboard which are nailed up within the premises, or painted directly onto structural surfaces such as push walls in a waste transfer station or supporting posts where flies commonly rest.

Once applied, the bait will normally last some weeks or longer, but may need re-applying where large numbers of flies are present or if the bait becomes covered in dust or dirt.

Figure 10: Preparing insecticide fly bait cards (Copyright C. Boase)

Although originally developed for fly control in livestock units, some products are also now labelled for use in waste sites.

Sectors:	Controls:	Limitations:
Pig and poultry and waste sites.	Adult common houseflies, if susceptible.	Less effective on lesser houseflies and stable flies, as they do not feed on baits.

Larvicides

Larvicides are intended to control only the fly larvae, and have no useful effect on the pupal or adult stages. They are applied directly to the larval habitat, i.e. manure, or where the label permits, to waste. They are normally applied as a spray, but one product may also be applied from dry granules to a very wet slurry.

They are more effective on the younger larvae than older larvae, so treatment should be carefully timed on the basis of monitoring data. They typically contain the active ingredient Cyromazine that is more active on common houseflies than on lesser houseflies. Larvicides are relatively slow in action, with effects not becoming apparent until a week or two after treatment. Cyromazine is selective in action, controlling the fly larvae while leaving beneficial non-dipteran insects (beetles, mites, wasps) unharmed.

Larvicides are widely and effectively used in livestock units. They are typically applied either as a blanket spray to all manure within a poultry shed, or as a spot treatment to wet areas or to other localised breeding areas identified through monitoring. The approval for one such product, Neporex 2SG, permits a minimum individual dose of 25g product diluted with 1 - 10 litres of water and applied to 10 square metres and maximum individual dose of 250g product diluted with 1 - 10 litres of water and applied to 10 square metres. The label also

defines the maximum frequency of application as calf manures/slurry – 6 per year; pig manure/slurry – 3 per year; poultry manure slurry - a maximum total dose of 50 g of product per square metre of manure/slurry per year.

Larvicides are not typically approved for waste sites other than landfill. On landfill sites, larvicides are typically applied at a rate of 250g per 10 square metres. The recommended treatment interval depends on factors such as management and climatic conditions. An application rate of approximately every 4–6 weeks might be sufficient but it can vary from 2 weeks in hot weather up to several months in the cold season. Alternatively an application rate of 25 gm per 10 square metres every 2nd working day for a total of 10 treatments in a treatment cycle of approx. 3 weeks can be chosen.

Neporex 2SG is a larvicide that has recently been approved for use at waste sites. The label has been updated and requires the use of Neporex 2SG as part of an integrated pest management approach, including appropriate non-chemical control measures. Fly populations should be monitored and product applications appropriately targeted. It should not be used continuously against houseflies in intensive applications. If sustained treatment using an insecticide is required this should be alternated with products with different active ingredients and different control methods (such as space sprays or baits) as part of a treatment cycle to reduce the risk of resistance developing. The restrictions on the maximum number of treatments or overall maximum dose are not applicable to use on waste treatment sites. These restrictions are not related to resistance management but are applied to animal/slurry/manure use as a result of a safety specific risk assessment on the use of treated animal waste i.e. when it is used as a fertiliser on crops.

The slow action of these products means their impact at most waste sites other than landfill will be limited and their use is not an appropriate measure. For example, at a transfer station, any treated refuse has normally left the premises before the product has a chance to work. Similarly for MBT plants, if waste contains flies these tend to be at many different stages of the breeding cycle. A larvicide in itself will prove ineffective because it will not have sufficient time to work and in addition will not treat adult flies nor pupae. Recently however, Cyromazine based larvicides have been applied routinely and automatically to incoming waste at some MBT sites. This is a continuous use of large quantities of larvicide that is a breach of the terms of approval for products that are approved, many larvicides are not approved for this use. The impact on fly resistance and the impact on the environment from subsequent use of MBT outputs remains unclear.

Sectors	Controls:	Limitations:
Pig and poultry sites. Some products approved for use on waste, but see 'Limitations'.	Common houseflies. Control larval stage only. Cyromazine has no impact on beneficial fly predators.	Relatively slow action against houseflies. Limited number of treatments per year on manure. Restrictions on spreading of treated manure on farmland - see label. Lesser housefly is less susceptible to cyromazine. Less effective against older larvae, so need good monitoring to detect young larvae early. In sites where waste is turned around quickly, such as transfer stations, larvicides are not appropriate.

5.2.4. Insecticide resistance

Through the gradual process of mutation and then natural selection of advantageous genes, many insect pests have become resistant to insecticides.

Houseflies in particular, because they have a relatively short generation time, and because they are often the target of insecticide treatment, have become resistant to many of the insecticides used against them.

Resistance to a particular insecticide does not necessarily mean the insecticide is completely ineffective. Resistant flies can be managed by:

- Prioritising the use of non-chemical control measures, e.g. manure drying, encouraging predators, swift waste removal, daily use of inert cover, etc.
- Complying with all insecticide product label conditions, particularly those intended to delay the onset of resistance.
- Alternating the use of insecticide products containing active substances with different modes of action.
- Minimising treatment practices (e.g. regular residual treatments) that are known to accentuate resistance problems.

There are a number of ways of reducing the pressure for insecticide resistance:

- Using non-chemical measures, e.g. good housekeeping, or good bale wrapping, instead of using insecticides.
- Not using insecticides when fly numbers are low.
- Using short-lived space-spray insecticides instead of residual insecticides.
- Alternating between insecticides with different modes of action.

6. Pest Management Plan (PMP)

Although flies may not be completely eliminated, their numbers can be minimised by implementing a structured PMP. The PMP should have the following six steps:

1. Ensure that staff are trained in key areas, for example the significance of flies, using control techniques and waste rejection procedures.
2. Monitor fly numbers and the extent of breeding sites.
3. Select and implement the most appropriate long-term fly prevention methods, such as drying or removing manure, confining or covering waste materials, and using predators.
4. Select appropriate insecticidal fly control techniques, bearing in mind the need to minimise the impact of resistance, and the impact on beneficial organisms.
5. Decide the trigger level in fly populations for pesticide treatments, based on the results of (2) above.
6. Regularly review effectiveness of the fly control methods.

Note: For proposed new intensive farming facilities the best available technique is to install manure removal systems. Where such systems operate properly, fly problems are rare.

The template checklists in Tables 3 and 4, below, identify the range of fly management techniques that that may be used on pig and poultry farms and waste sites respectively, and enable practices at any particular site to be identified.

Table 3. On site and Pest Management Plan (PMP) assessment (options not mandatory) – Template check list for Pig and Poultry farms

Source	Method	On-site check	PMP check	Comment
PMP	Manage site activities in accordance to the PMP			
Fly Monitoring	Follow routine monitoring for flies using either: resting counts, adhesive paper fly catches, fly larval counts, or other.			Specify which monitoring method(s) were used.
	Fly species identified.			
	Trigger levels followed for the relevant monitoring method/s to initiate insecticidal control.			Specify the trigger level for each monitoring method used, if applicable.
Manure management	Daily check of water lines and drinkers for defects and/or spillages.			
	Buildings are watertight with no water ingress from outside.			
	Manure holding areas well ventilated.			
	Manure moisture is kept below 50% in poultry units.			
	Ensure liquid feed stores are appropriately sealed and that external sources and surrounding areas are kept as clean as far as practically possible. Try to organise vents so that flies cannot pass through these.			
	Manure and slurry removed frequently, if appropriate.			
	Belts and scrapers are cleaned regularly, if used.			
Infrastructure	Buildings are in good condition and kept well maintained			
	Windows and doors are fitted with fly-screens, if appropriate.			

Carcasses	Fallen stock are removed and/or incinerated frequently			
Housekeeping	Spillages are cleaned up as soon as possible			
	Rubbish bins are emptied regularly			
Biological control options	Use of fly parasites / predators to control flies.			Describe the species used
	Insecticide drift onto manure avoided when using adulticides.			
Insecticide control options	Insecticide labels are complied with, and records kept of all treatments.			Must be complied with.
	If on-site staff are using insecticides, they should be trained and competent.			Must be complied with
	Fly baits used.			
	Space treatments used.			
	Residual insecticides used.			
	Larvicides used.			
	Larvicide applications are targeted to known infested areas			
	Insecticide products are rotated to reduce risk of insecticide resistance			
Transporting manure	Check and comply with Defra's Code of Good Agricultural Practice: "Protecting our Water, Soil and Air", and any relevant Local Authority codes of practice.			Must be complied with.
	Adult fly numbers minimised before house opened for manure removal.			
	Manure is checked on-site for fly maggots before transporting it off-site.			
	If possible treat the infestation and leave on farm for a suitable period of time for the treatment to have been effective.			
	If the manure is infested and flies could be released during transport, cover the trailer before leaving the site.			

Manure storage	Check and comply with Defra's Code of Good Agricultural Practice: "Protecting our Water, Soil and Air", and any relevant Local Authority codes of practice.			Must be complied with
	Do not place field heaps where they could cause problems for nearby residents.			
	Manure field heaps are inspected regularly for flies			
	If manure heap is found infested with flies/maggots, it is covered with sheeting.			
	If sheet covers are used, they are left for at least 10 days			
	If sheet covers are used, they are inspected to check for any damage.			
Manure spreading	Check and comply with Defra's Code of Good Agricultural Practice: "Protecting our Water, Soil and Air", and any relevant Local Authority codes of practice.			Must be complied with
	Three weeks must elapse after the last application of cyromazine, before the treated manure can be spread on land. Thereafter, another four weeks must elapse before grazing or cropping (See statutory condition on cyromazine label.).			Must be complied with
	Manure is spread to land as soon as possible, after it is received.			
	Manure is fully incorporated into the ground immediately after spreading (within 24 hrs)			

Table 4. On site and Pest Management Plan (PMP) assessment – Template check list for Waste Sites

Source	Method	On site check	PMP Check	Comment
PMP	Manage site activities in accordance to the PMP			
Infrastructure	Buildings are in good condition and kept well maintained			
	Windows and doors are proofed as much as possible to prevent escape of flies. Minimise the time doors and windows are open. Install fly screening where appropriate.			
	Containers used are covered, locked, and leak proof.			
Waste management	Pre Acceptance Check - including checks with previous waste holders that fly management techniques are in place there.			To include waste stream assessment
	Waste rejection (what procedure is in place to ensure repeat problematic loads/known problematic waste streams are not accepted).			
	Check waste types, if of a nature more likely to attract flies (fish waste) ensure it is deposited and covered immediately.			
	Small tipping face. Ensure waste covered down at the end of the working day and waste that can attract flies does not protrude through the cover (landfill sites).			
	Vehicles carrying wastes to and from the site can be carrying fly infestation with them. Clean vehicles inside and out periodically as required.			
	Waste should not be stored for long periods of time. Quick turn-over recommended. Where waste is to be sorted on site it should be done on a first in first out basis. Permit may stipulate the length of time waste is allowed on site.			
	Waste is checked on-site for fly larvae before transporting it off-site.			
	If waste is infested ensure it is treated and checked on-site for fly larvae before transporting it off-site			

	Vehicles bringing waste to and from the site are covered.			
Housekeeping	Spillages and accumulations of waste are cleaned up as soon as possible, including in hard-to-reach areas. Records kept - (action taken, site diary, fly contaminated load log sheet, treatments applied)			
	Rubbish bins are emptied regularly.			
Fly Monitoring	Follow routine monitoring for flies using: monitoring squares and resting counts; adhesive paper fly catches grid counts larvae counts			Specify which monitoring method was used, if applicable.
	Fly species identified			
	Trigger levels established and followed for the relevant monitoring method/s to initiate insecticide control.			Specify the trigger level for each monitoring method used, if applicable.
Chemical control options	Insecticide labels are complied with, and records kept of all treatments.			Must be complied with.
	If on-site staff are using insecticides, they should be trained and competent.			Must be complied with.
	Insecticide baits are used.			
	Insecticide space treatments are used.			
	Residual insecticide surface treatments are used.			
	Larvicides are applied to waste where appropriate.			
	Insecticide products are rotated to reduce risk of resistance.			
Contingencies	Relocation of tipping face further away from receptors if other control measures do not satisfactorily manage problem (landfill sites).			
Incident response	What procedures are in place to deal with fly reports from the public, local authorities, or the EA?			Do they notify EA of fly infestation on site? Are they proactive?

Appendix 1 Flies commonly associated with waste sites and pig and poultry farms

Stage	Feature	Common housefly (*Musca domestica*)	Lesser housefly (*Fannia canicularis*)
Adult			
	Size:	Typically 6-7mm long, but does vary.	Typically 4-6 mm long, but does vary.
	Pattern on dorsal surface of thorax:	Four distinct longitudinal dark lines.	Three indistinct longitudinal dark lines.
	Abdomen colour:	Yellow-ish at basal end.	Often yellow-ish along sides.
	Wing venation:	Fourth longitudinal vein bends forwards (see below).	Fourth longitudinal vein straight (see below).
	Position of wings when at rest:	Projecting out from the sides of the abdomen, giving a delta-shaped outline.	Folded one over the other, directly over the abdomen, giving a more parallel sided outline.
	Adult resting behaviour	Typically resting in numbers on a range of surfaces within the building, e.g. walls, posts, ceiling etc. Sometimes in large clusters in preferred places.	Even when abundant, tends not to rest in numbers on walls or ceilings. More often resting on the manure, or on surfaces very close to the manure.

	Flight behaviour at source:	Flies very readily and in numbers. Often alighting on or colliding with people within the building.	Even within poultry sheds, the numbers of flies on the wing is low. Males' flight is typically jerky circling high up within the building. Very seldom alighting on people.
	Flight behaviour at reporter premises:	CHF will continually alight on work surfaces, food, walls, cupboards and people.	LHF normally flies in jerky circles within the room, often high up and around hanging objects occasionally alighting on light shades or pelmets etc. It seldom alights on people or food.
House fly Larva	Appearance:	CHF lava - white-ish, smooth, maggot appearance. Active wriggling behaviour, often in clumps, just beneath manure surface. Normally in wetter manure. Easy to see when manure disturbed.	LHF - dull grey-brown, spiky exterior. Inactive, and seldom clumped. Normally in wetter manure. Needs careful and close examination of the manure to find them.
		 Larvae of common housefly in wet manure (larvae of blowflies appear similar) (Copyright C. Boase)	
House fly Pupa	Appearance:	CHF - smooth, barrel shaped, from tan, through chestnut-brown to almost black in colour, depending on maturity. Normally in drier manure. Easy to find. Pupae of common housefly in dry manure (pupae of blowflies appear similar) (Copyright C. Boase)	Pupae of lesser housefly (larvae appear similar) (Copyright C. Boase)

			

Issue	Common housefly (CHF) (*Musca domestica*)	Lesser housefly (LHF) (*Fannia canicularis*)
Overwintering behaviour	This species cannot hibernate. It can only overwinter in warm locations, e.g. in pig farrowing units, or intensive poultry layer sites, where it continues breeding. Flies at cooler sites, e.g. free-range poultry units, will die out each winter, and so have to be re-colonised each spring, hence CHF problems in such sites, if they occur, are often later in the summer.	At the onset of winter, LHF will hibernate at the pupal stage, within the manure. These pupae will hatch the following spring, with the onset of warmer weather. Manure removal in the winter will take out most of the infestation.
Dispersal behaviour	Some adult flies will leave the source, and may cause nuisance in buildings up to two or more km away. Dispersing flies are not obvious in intervening areas.	Some adult flies will leave the source, and may cause nuisance in buildings up to two or more km away. Dispersing flies are not obvious in intervening areas.
Typical breeding sites	- Intensive poultry layer units. - Free-range poultry layer units (less commonly). - Pig units. - Waste bins. - Waste transfer stations. - Landfill sites.	- Free-range poultry layer units. - Waste bins. - Waste transfer stations. - Landfill sites.

Stage	Feature	Blue Bottle (Blow Flies) (Calliphora vomitoria)	Green Bottle (Blow Flies) (Lucilia sericata)
Adult			
	Size:	They are larger than houseflies, growing to 10 - 12mm long.	
	Colour of thorax and abdomen:	Metallic blue.	Bright metallic green.
	Wing venation:	The 4th long vein is bent sharply forwards; more so than the common housefly.	
	Flight behaviour at source:	Typically crawling over the surface of putrescent, malodorous waste.	
	Flight behaviour at reporter premises:	Blowflies do not disperse or enter buildings to the same extent as houseflies.	
Larva	Appearance:	The larva is similar to the housefly: white-ish, smooth, maggot appearance. Active wriggling behaviour, often in clumps, just beneath the surface. They take 7 - 12 days to mature.	
Pupa	Appearance:	Similar to common housefly: smooth, barrel shaped, and chestnut-brown in colour.	

Stage	Feature	Stable fly (*Stomoxys calcitrans*)	Black dump fly (*Hydrotaea aenescens*)
Adult			
	Size:	Typically 5 - 8 mm long.	Typically 5 - 6 mm long.
	Pattern on dorsal surface of thorax:	They are grey in colour with four indistinct longitudinal dark lines on the thorax.	Uniform glossy black.
	Abdomen colour:	They have several dark spots on top of the abdomen.	Uniform glossy black.
	Location:	Largely confined to pig and cattle rearing facilities.	Commonly found on putrescent waste, e.g. in composting sites, and on animal manure.
	Features:	Long slender piercing proboscis as they feed on blood.	
	Adult resting behaviour	Resting in numbers on livestock, and often basking on sun-lit external walls of animal houses.	Attracted to faeces, carrion and putrescent waste. Often rests on vegetation around breeding sites.
Larva	Appearance:	Eggs are laid in moist decaying organic material that contains large amounts of rotting vegetation, such as manure mixed with bedding, fermenting feed, silage, and rotting hay. Larvae are yellowish white maggots about 5 - 12 mm long.	The larvae are found in decomposing putrescent waste, manure, and carrion. Larvae of the black dump fly are beneficial in some situations, because they prey on house fly larvae
Pupa	Appearance:	Pupa are reddish to dark brown and 4 - 7 mm long. Development is complete within 1-2 weeks when they then emerge as adults. NB: Stable flies overwinter in breeding sites as pupa and emerge the next spring as adults.	Pupa are reddish to dark brown and 4 - 7 mm long. Development is complete within 1-2 weeks when they then emerge as adults.

Stage	Feature	Common cluster fly (*Pollenia rudis)*
Adult		
	Size:	Typically 7-9 mm long.
	Thorax:	Golden wavy hairs.
	Abdomen colour:	Chequered dark/light grey.
	Wings:	The 4th longitudinal vein bends sharply forward, similar to the blowflies. At rest, the veins are held directly over the body, not projecting out sideways as with the common housefly.
	Behaviour at reporter premises:	In the summer, this fly lives outdoors and is not an issue. However in the autumn, it comes into buildings, often domestic premises, in order to hibernate. There may be hundreds in preferred places in attics etc. They may easily be confused with common houseflies, but in are not associated with waste sites or animal rearing.
Larva		Common cluster fly larvae are parasitic on earthworms, and so are rarely seen. They are not associated with waste or animal rearing sites.

Appendix 2 Examples of monitoring sheets

The following are examples of fly monitoring sheets for operators to use at farms or waste sites:

Farm Fly Monitoring Record

Site name: Name of Poultry / Pig House:
Date animals in: Number of animals:
Main fly species assessed: Name of person doing monitoring:

Date	Adult fly counts (see below)							Larval fly counts (see below)							Notes (e.g. water leaks, manure removal)
	1	2	3	4	5	6	av	1	2	3	4	5	6	av	

State chosen monitoring methods:

Location of monitoring points:

Adults

1.....
2.....
3.....
4.....
5.....
6.....

Larvae

1.....
2.....
3.....
4.....
5.....
6.....

Waste Transfer Station or MBT Plant Fly Monitoring Record

Site name: Name of person responsible for monitoring:
Main fly species assessed:

Date	Adult fly counts (see below)							Larval fly counts (see below)							Notes (e.g. fresh waste stockpiled, incoming infested waste, etc)
	1	2	3	4	5	6	av	1	2	3	4	5	6	av	

Adult flies monitored either by:
- Counting fly numbers resting within 1 x 1m squares marked on internal walls, one to three times per week.
- Fly counts on 30 x 30cm adhesive fly papers, changed weekly
- Fly counts using a Scudder Grid on waste, one to three times per week

Larval flies monitored by counting the larvae exposed by scraping the surface from an area of 30 x 30cm of waste.

State chosen monitoring methods for adults and larvae:

Location of monitoring points:

Adults
1.....
2.....
3.....
4.....
5.....
6.....

Larvae
1.....
2.....
3.....
4.....
5.....
6.....

Landfill Site Fly Monitoring Record

Site name:
Name of person responsible for fly monitoring:
Main fly species assessed:

Date	Adult fly counts (see below)										Larvae counts (see below)			Notes (e.g. infested incoming waste, issues with cover, any larval counts)
	1	2	3	4	5	6	7	8	9	10	1	2	3	

Monitoring details:

Adult flies monitored either by

- counting flies with a Scudder Grid on and around the active tipping face, one to three times per week
- using adhesive fly papers in fixed locations, changed weekly.

Larval flies monitored by counting the larvae exposed by scraping the surface from areas of 30 x 30cm of waste. Typically only done to determine why adult fly numbers are high. There are no fixed monitoring points.

State chosen monitoring methods:

Appendix 3 - Selecting a pest control contractor

There are a wide range of pest control companies, with widely varying experience of fly management on waste sites. If possible, contact colleagues at other waste sites for suggestions for potential contractors. It is good practice to approach three potential companies, and then compare their experience, capabilities and bids, before entering into a contract.

The ideal fly management contractor would:

- Be a current member of a pest control trade association.

- The main trade association is the British Pest Control Association, but there is also the National Pest Technicians' Association. Membership requires they meet a minimum standard in terms of training, insurance, pesticide storage etc.

- Have appropriate site safety qualification or certification.

  BS EN16636:2015 is a professional standard for pest management. It is certified by the European Pest Control Association (CEPA) and the British Pest Control Association is encouraging its members to obtain certification. You can check the CEPA directory at: http://www.cepa-europe.org/ Other bodies such as CHAS, NEBOSH are also applicable.

- Have public/product liability insurance.

Not a legal requirement, but it is required for membership of trade associations.

- Have experience of fly control on other waste sites. Ask for references.

This is important. Most pest controllers will not have dealt with fly control on waste sites, and will not have a clear idea of appropriate measures.

- Be able to carry out fly identification, monitoring and surveying, if required.

A competent contractor should be able to identify the main fly types.

- Have the application equipment to treat a large site.

As with 4 above, you need to know that they have the resources to deal with a large building or site.

- Be able to provide cover outside normal working hours, e.g. evenings, weekends and holidays, if required.

You may require out-of-hours work, especially during any fly outbreaks.

- Be located within a reasonable distance of your site(s).

Ideally you would have a pest controller who already covers your area, so they can call in to look at an issue, without a time-consuming detour.

- Be able to propose a sensible fly management plan for your site, including both non-chemical and chemical measures.

This should give a clear indication of their experience and knowledge. You should be looking for a company that is able to provide advice on pro-active preventative measures, not just apply routine insecticide treatments.

- Be able to carry out other pest management activities if required, e.g. rodent or bird control.

It makes sense to have all your pest control requirements carried out by one contractor, if possible.

Avoid buying into routine scheduled insecticide treatments from the start of the contract. Advice and inspection can be just as important as treatments.

Appendix 4 - Management strategies for fly problems at abandoned sites

Introduction

Dealing with fly infestations at abandoned sites or sites where waste is likely to be present for prolonged periods with little management controls is likely to require a site specific management plan. Ideally the waste should be removed as soon as possible but it is acknowledged that this may not be an option. In these circumstances there are a number of considerations that can be to be taken into account.

Establish whether flies are an issue

The first step is to determine whether there is a fly problem. Generally it is unlikely to be a problem from early November to the end of March, but is possible during warmer months.

- Are there reports from nearby receptors?
- Are large numbers of adult flies visible on the waste?

Fly management strategies

When a problem is established, a professional pest controller will be required to assess the situation and apply appropriate treatments. Advice on selecting a suitable consultant is given in Appendix 3. It is worth discussing the issue with several potential contractors to ascertain what their proposals would be before making a decision. Many pest control companies will not have the experience or the resources to deal effectively with a large quantity of abandoned waste.

Example treatment options

- Surface spray treatment

Surface spray treatments may contain either residual pyrethroids, or bendiocarb. They are intended to kill adult flies, but may also have a limited effect on larvae. The treatments should be applied as a coarse spray to the surface of the waste, using either a manual knapsack sprayer, or a motorised mist blower at a setting that will give the coarsest possible droplets (in order to minimise drift). The treatment will remain effective for a few days at least, but residual action may be reduced if the treatment is followed by rain.

All label conditions and precautions should be followed. In particular, surface treatments should not be used in windy conditions, or if there is a risk of the spray run-off contaminating nearby non-target areas, such as watercourses.

- Larvicides

Larvicide treatments (eg diflubenzuron – labelled for ‘refuse heaps’) would be applied as a coarse spray to the surface of the waste. They can take 2 – 3 weeks to have an effect on the numbers of adult flies. They are therefore unlikely to be useful in dealing with flies at sites where the abandoned waste will be removed within that time.

However if the expectation is that the abandoned waste will continue to remain in place for an extended period, then they should be used in conjunction with a faster-acting adulticide treatment. All label conditions and precautions should be followed.

Appendix 5 - How Insecticides Work

Modes of action

Most modern insecticides work on contact with the target organism. The insects have either to be exposed to the pesticide in the air or as a deposit on the substrate. Some insecticides, often those used as baits, need to be ingested by the insect.

Insecticides can be classified by their mode of action. Most insecticides affect one of five biological systems in insects as follows.

1. The Nervous System

Most traditional insecticides, such as organochlorines, organophosphates, pyrethroids and carbamates fit into this category. However, of these groups only pyrethroid and carbamate insecticides are typically used.

Insecticides that affect the nervous system can be divided into two groups; axonal poisons, which adversely affect the nerve fibre and synaptic poisons that disrupt the synapse, which is the junction between two nerve connection points.
Pyrethroids are synthetic chemicals whose structures mimic the natural insecticide pyrethrin. Pyrethrins are found in the flower heads of plants belonging to the family Compositae (for example: chrysanthemums). These insecticides have a unique ability to knock down insects quickly.

Synthetic pyrethrins (also known as pyrethroids) have been chemically altered to make them more stable. Examples of pyrethroids are alpha-cypermethrin, bifenthrin, cypermethrin, deltamethrin, d-phenothrin, lambda-cyhalothrin, permethrin, and tetramethrin. Pyrethroids are axonal poisons. Carbamate insecticides also affect the nervous system. They are moderately residual and relatively more effective at higher temperatures. They are also readily broken down especially in situations of high alkalinity. The most common of this group is bendiocarb. Carbamates are synaptic poisons.

Avermectins belong to a group of chemicals called macrolactones and are typically used for crop protection. These chemicals are derived from a fungus and act on insects by interfering with neural and neuromuscular transmission. Abamectin is an example of one of the Avermectins. Avermectins are axonal poisons.

Imidacloprid belongs to the chloronicotinyl chemical class of insecticides used to control sucking and soil insects and are also used as a flea treatment for domestic pets. Imidaclorprid is also a synaptic poison but is more specific for insect nervous tissue than mammalian nervous tissue.

2. Insecticides that inhibit energy production

The most well known energy inhibiting insecticide is hydramethylnon, typically used in baits to control ants and cockroaches in both indoor and outdoor applications. Insects that ingest this compound literally run out of the energy needed to maintain life.

3. Insecticides that affect the endocrine system

These chemicals are typically referred to as insect growth regulators or IGRs. IGRs act on the endocrine or hormone system of insects. These insecticides are specific for insects, have very low mammalian toxicity, are nonpersistent in the environment and cause death slowly.

Most of the currently registered IGRs mimic the juvenile hormone produced in the insect brain. Juvenile hormone tells the insect to remain in the immature state. When sufficient growth has occurred, the juvenile hormone production ceases triggering the moult to the adult stage.

IGR chemicals, such as S-methoprene and pyriproxyfen, mimic the action of juvenile hormone and keep the insect in the immature state. Insects treated with these chemicals are unable to moult successfully to the adult stage and cannot reproduce normally.

4. Insecticides that inhibit cuticle production

These chemicals are known as chitin synthesis inhibitors or CSIs. They are often grouped with the IGRs. The most notable chemical being used as a CSI is benzoylureas. This class of insecticides includes flufenoxuron and cyromazine based larvicides. These chemicals inhibit the production of chitin. Chitin is a major component of the insect exoskeleton. Insects poisoned with CSIs are unable to synthesize new cuticle, thereby preventing them from moulting successfully to the next stage.

5. Insecticides that affect water balance

Insecticides with this mode of action include diatomaceous earth and certain aromatic oils. Insects have a thin covering of wax on their body that helps to prevent water loss from the cuticular surface. Diatomaceous earth is very effective at absorbing oils. Therefore, when an insect contacts one of these chemicals, it absorbs the protective waxy covering on the insect, resulting in rapid water loss from the cuticle and eventually death from dessication.

Unfortunately, insects that live in environments with high relative humidity or that have ready access to a water source show an increased tolerance to diatomaceous earth. This is because water loss can be minimised by either of these conditions and the insect may survive despite the absence of a wax layer.

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