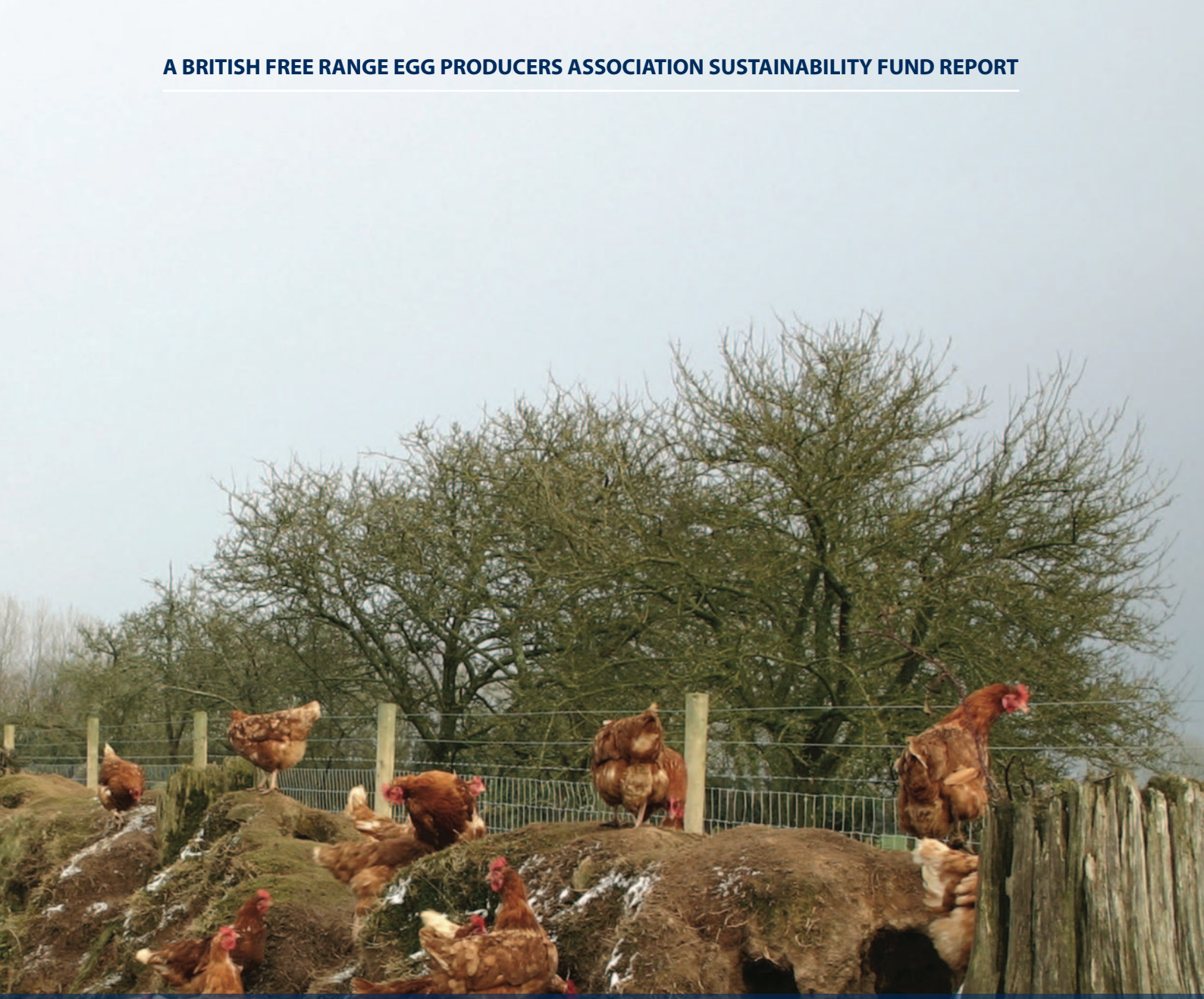
A BRITISH FREE RANGE EGG PRODUCERS ASSOCIATION SUSTAINABILITY FUND REPORT



IMPACTS OF AMMONIA EMISSIONS ON THE UK FREE RANGE EGG PRODUCTION SECTOR

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ADAS is an independent, private consultancy business which operates in a wide range of agricultural and environmental sectors mainly in the UK but also overseas. Key clients include trade organisations, corporate companies, farmers and government bodies. Within the poultry sector, ADAS consultancy work for farmers includes the preparation of environmental permit applications.

1 INTRODUCTION

INTRODUCTION

This report has been commissioned by BFREPA for use by its members and officials. It begins with a brief overview of the environmental impacts of ammonia, concentrating on emissions from agriculture and poultry. It then sets out the key regulatory issues and controls for the poultry sector in relation to ammonia, based on European Union (EU) and national requirements. The national perspective is specifically in relation to England but the general principles are also likely to be relevant to other parts of the United Kingdom.

Controls on ammonia emissions which are likely to impact upon the future growth and nature of the free range egg production sector are then described. At present, these controls are most significant for farms which will expand above the threshold for environmental permitting (40,000 bird places) in future. However concerns over ammonia emissions may also have important implications for non-permitted farms e.g. in relation to gaining planning consent. The actions that producers can take in order to reduce ammonia emissions and the possible implications and costs of these are outlined.

2 AMMONIA EMISSIONS FROM AGRICULTURE

2.1 BACKGROUND

Ammonia is a soluble, nitrogen-containing gas. It is deposited onto the ground from the air, adding nitrogen to soils. The impacts of ammonia deposition to land can be significant. It can damage plants and ecosystems that thrive in low-nutrient conditions such as heathlands and certain types of forests. The additional nitrogen deposited from ammonia can result in existing plant species being replaced by others that grow more readily in such conditions. Ammonia can also cause eutrophication of other habitats including rivers and lakes.

By reacting with other atmospheric acids, ammonia can add to the damage caused by particulate matter (dust). In turn, it can impact upon human health, for example through cardiovascular and respiratory diseases; it can also contribute to smog in urban areas.

The agricultural sector was reported to account for 88% of all UK emissions of ammonia in 2016 and livestock production is known to be an important contributor. The poultry sector is responsible for around 15% of the total for agriculture, due to emissions from poultry houses, manure storage and applications of manure to land.

Because of its environmental importance, international agreements are in place to reduce ammonia emissions from all sources for the future. The targets set within these agreements underpin legislative and policy developments both at UK level and elsewhere. In relation to agriculture, the key elements are summarised below.

2.2 UK AMMONIA REDUCTION TARGETS

The UK is committed to reducing ammonia emissions as part of a global agreement[1]. In 2012, the ceiling target for ammonia from the UK was set at 279,000 tonnes by 2020. This represents an 8% reduction in ammonia emissions compared to the total emitted in 2005.

In May 2018, Defra published a Clean Air Strategy which covers a range of air pollution sources, including ammonia. It provides information about individual pollutants and how they interact, as well as setting out existing government policy and actions intended to ensure that targets are met. The strategy is subject to consultation at the time of writing and the final Clean Air Strategy and the National Air Pollution Control Programme are due to be published in March 2019.

The Clean Air Strategy[2] states that Defra will *'require and support farmers to make investments in the farm infrastructure and equipment that will reduce emissions'.* Details of the type of support envisaged within this are not available at present.

1: UNECE Gothenburg Protocol to the Convention on Long Range Transboundary Pollution
2: https://consult.defra.gov.uk/environmental-quality/clean-air-strategy-consultation/user_uploads/clean-air-strategy-2018-consultation.pdf

2.3 DEFRA CODE OF GOOD AGRICULTURAL PRACTICE FOR REDUCING AMMONIA EMISSIONS

Within the section headed 'Action to reduce emissions from farming', the Clean Air Strategy referred to above commits to providing a national Code of Good Agricultural Practice for Reducing Ammonia Emissions[3]. This was published by Defra in July 2018. Section 7 of the Code sets out poultry-specific measures which include guidance on housing systems, feed and diet formulation and the storage and spreading of manures. This applies to all farms irrespective of their scale of operation.

The Code sets out the principle of keeping poultry manure and litter as dry as possible in order to reduce ammonia emissions. Amongst the techniques proposed are the use of scrubbers and filters to remove ammonia from exhaust air and the use of a belt system to collect and remove manure. For belt systems, removal of manure from the house to covered storage is recommended with a clean-out frequency of two or three times per week.

The Code itself is referred to as a 'guidance document' but the Clean Air Strategy states that Defra *'will explore whether the code could form the basis of a clean air standard within a wider gold standard for farmers'.*

It is possible therefore that there will be incentives for farmers who can achieve the necessary standards. Conversely those who cannot may be placed at some kind of disadvantage.

3: https://www.gov.uk/government/publications/code-of-good-agricultural-practice-for-reducing-ammonia-emissions

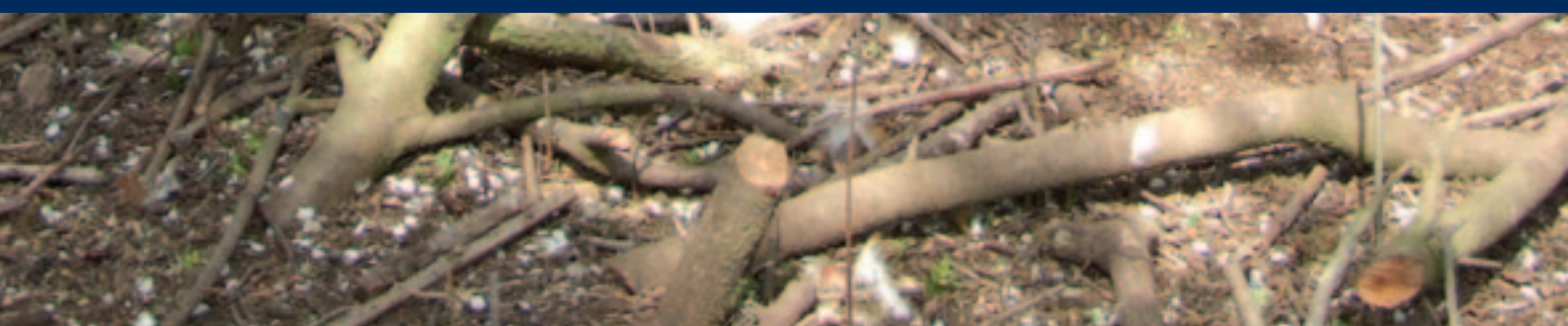
2.4 ENVIRONMENTAL PERMITTING

Environmental permitting regulations in the UK implement EU legislation[4] which requires all poultry units with over 40,000 bird places to obtain and comply with permit conditions set by the Environment Agency (in England). These aim to avoid or minimise all types of emissions.

Farms must use 'best available techniques' (BAT) in order to meet these permit conditions and the document 'How to comply'[5] sets out the requirements that must be met in England. It lists ammonia as a 'key issue' (along with others) and it describes appropriate management and operational points. Methods for controlling emissions and requirements for monitoring and record-keeping are also covered.

4: EU Directive 2010/75 EU on industrial emissions (integrated pollution prevention and control)
5: https://www.gov.uk/government/publications/intensive-farming-introduction-and-chapters

3 RELEVANCE TO THE UK FREE RANGE EGG SECTOR



RELEVANCE TO THE UK FREE RANGE EGG SECTOR

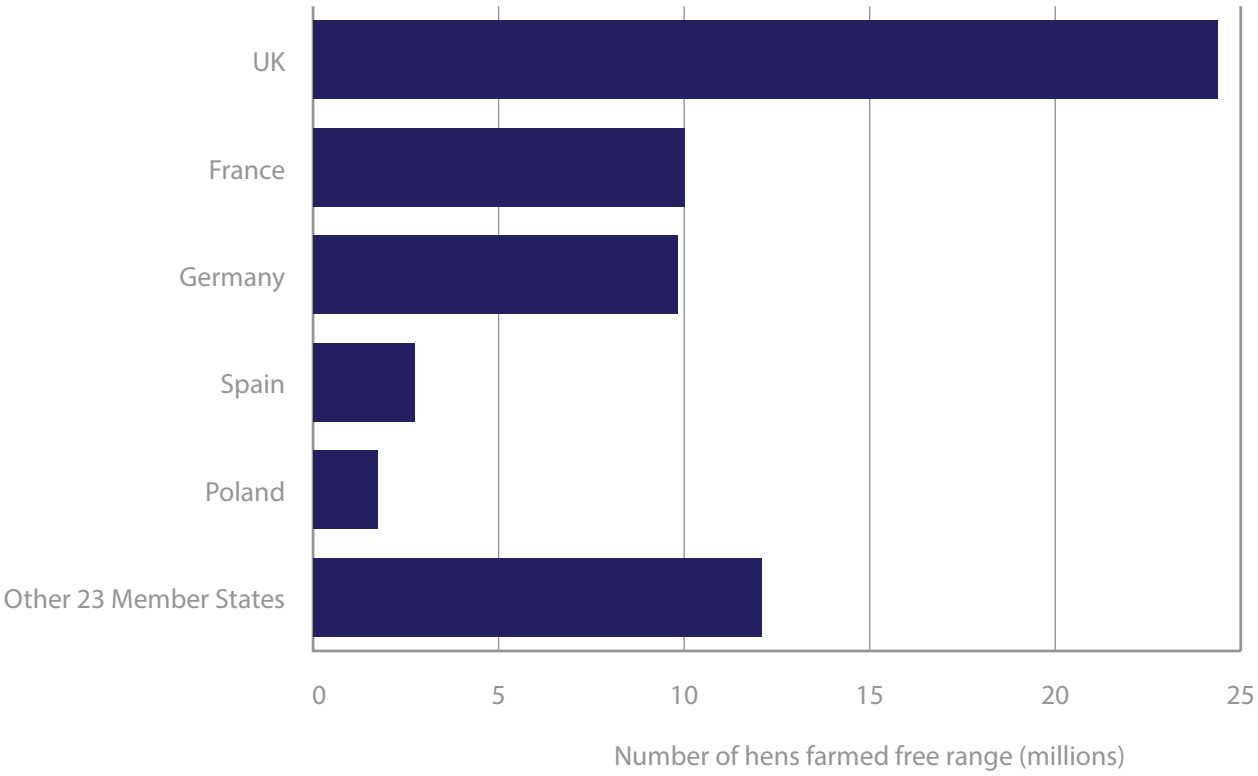
In the UK, free range production accounts for a substantial share of the egg market. Because of this – and the trend towards farms having larger numbers of birds, the impacts of ammonia from free range production are particularly pertinent in policy terms.

The free range egg production sector is significantly larger in the UK than in any other EU Member State (see Figure 1 below). According to the latest figures from the European Commission[6], five countries – namely Germany, France, Spain, Poland and the UK, account for 60% of all the laying hens in the EU (2017). Whilst the Commission reports that free range in the UK represents 55% of the national flock, comparative figures for Germany and France are 18.5% and 20.1% respectively although both also have significant organic sectors (11.6% and 8.7%). For Spain and Poland, conventional free range represents just 5.4% and 3.2% respectively and organic production in both countries is insignificant.

Based on the same European Commission source - which places the UK laying hen flock size at 44 million birds (higher than current national figure would suggest), the UK free range flock was considerably larger (24.5 million birds) than that of the other four large, egg-producing countries combined (23.6 million birds) in 2017. In total, around 60 million laying hens out of an EU total of 397 million were reported to be in free range systems in 2017. Just over 40% of these were in the UK.

6: European Commission (DG ESTAT, DG AGRI), MSs notifications (CIR) (EU) 2017/1185 and Regulation (EC) 617/2008), GTA: https://ec.europa.eu/agriculture/sites/agriculture/files/dashboards/eggs-dashboard_en.pdf

Figure 1.
Number of conventional free range laying hens in the UK and other EU Member States[7]



7: Figures taken from the European Commission's egg market report, accessed 13.08.2018: https://ec.europa.eu/agriculture/sites/agriculture/files/dashboards/eggs-dashboard_en.pdf.

Due to the present scale of free range egg production in the UK it is likely that individual free range farms are on average larger than free range farms in other EU countries. In countries where organic production is significant in size (e.g. Germany) it is likely that unit sizes are also small. Environmental permitting requirements are therefore likely to have more impact on the free range sector in the UK than in other EU Member States.

No comprehensive data are available on the number of UK free range egg production farms which have an environmental permit in place at present. The Environment Agency reports a small increase in the number of egg production farms with permits in England in recent years. Whilst it is unable to provide a breakdown of these farms according to production system, it seems likely that most, if not all farms with laying hens which are now being permitted for the first time will be using free range production systems.

If there is further expansion of the UK free range sector, it is likely that more existing and new units will require an environmental permit in future, as a result of farms exceeding the 40,000 bird place threshold.

4 REGULATORY CONTROL OF AMMONIA FROM EGG PRODUCTION

REGULATORY CONTROL OF AMMONIA FROM EGG PRODUCTION

Whilst the new Defra Code of Good Agricultural Practice for Reducing Ammonia Emissions (see section 2.3) sets out general requirements which apply to all farms, specific ammonia emission factors are relevant to permitted farms (over 40,000 bird places). This section sets out the basis for these and what they mean in practice.

4.1 EUROPEAN BEST AVAILABLE TECHNIQUES

In February 2017, a European Commission document[8] set out Best Available Technique (BAT) Conclusions for the intensive rearing of poultry or pigs. Since these are aimed at farms that have an environmental permit, the requirements are directly relevant only to those with over 40,000 bird places.

The Conclusions are based on a detailed and comprehensive BAT reference document, normally referred to as the 'BREF'[9]. They provide a reference for the environmental permit conditions that apply to farms and they set emission levels (on a 'per bird place' basis) that must not be exceeded.

The BAT Conclusions set out the need for production systems and practices to comply with BAT associated emission levels for ammonia (BAT-AELs). These are expressed in terms of 'kg of ammonia per bird place per year'. The actual BAT-AEL value varies according to poultry species (e.g. there are different values for laying hens and broilers) and the housing system in use but the same figures apply throughout the European Union. In effect, the values set a benchmark for determining whether a system or activity can be regarded as a Best Available Technique (BAT) or not. All new facilities must meet BAT requirements when a permit is first issued.

In the BAT Conclusions, the BAT-AEL for laying hens in non-cage systems is given as a range, from 0.02 and 0.13 kg of ammonia per animal place per year. However there is a separate note in the document for 'existing plants'. For these, the upper limit for single-tier systems is higher, at 0.25 kg NH3 /animal place /year. In this context, 'existing plants' are those which were

8: Commission Implementing Decision (EU) 2017/302
9: http://eippcb.jrc.ec.europa.eu/reference/BREF/IRPP/JRC107189_IRPP_Bref_2017_published.pdf

already covered by an environmental permit on 15 February 2017. Existing poultry houses on farms which did not operate with a permit on this same date (because the farm was below the 40,000 bird place threshold at the time) are not classed as 'existing plants'.

If a farm expands in future such that it requires an environmental permit for the first time, all of the poultry houses (including houses already in use) will be treated as 'new' and therefore the term 'existing plant' and the ammonia emission factor of 0.25 is not applicable.

In effect, this means that all houses on all newly-permitted farms with non-cage laying hens must achieve a BAT-AEL no greater than 0.13 kg of ammonia per place per year i.e. the maximum figure given above.

4.2 IMPLICATIONS FOR FARMS WITH OVER 40,000 BIRD PLACES IN ENGLAND

Independent of the European BAT-AELs for ammonia described above, the Environment Agency sets ammonia emission factors for different poultry species and production systems in England. These are also expressed in terms of 'kg of ammonia per bird place per year'. As long as the Environment Agency's emission factor is lower than the equivalent European BAT-AEL, the system will be regarded in England as a Best Available Technique.

For all non-cage systems, the EU maximum emission factor is 0.13 kg NH3 / animal place / year as previously noted (i.e. the upper limit of the range set out in section 4.1). Multi-tier non-cage systems in England easily meet this standard. Referred to as 'aviaries', the Environment Agency's ammonia emission factor for these is 0.08.

For single-tier, non-cage systems, the situation is different. The European BAT-AEL maximum for these as new plants would again be 0.13 but the Environment Agency's emission factor is substantially higher than this, currently given as between 0.21 and 0.29. On this basis, a house with a single-tier system would not be regarded as a BAT for a newly-permitted farm even if that house has already been in use for several years on a non-permitted farm.

The ammonia emission factors used in England at present are recognised as being some years old and the Environment Agency has recently requested a review of emission factors for poultry and pigs. Current figures are derived from the UK Inventory of Ammonia Emissions[10] and the report dated October 2016 notes (page 23) that 'no studies of emissions from outdoor poultry have been reported'.

10: https://uk-air.defra.gov.uk/library/reports?report_id=928

Farms with single-tier houses which were already 'permitted' at the time when the BAT Conclusions were published (15 February 2017) will be able to continue to operate as they currently are without time limits, unless additional new regulatory controls are introduced. However, they would not be able to add any new single-tier systems to those already in place.

As a result of this, any farm with free range egg production in England which now expands such that it requires an environmental permit for the first time will almost certainly have to be fully multi-tier. If the farm includes an existing single-tier system, this could not be included within the permit unless it underwent some form of change or conversion such that ammonia emissions are reduced.

The next three sections (5, 6 and 7) consider ways of achieving ammonia reductions from existing single-tier houses, based on management and stocking changes (Section 5), conversion to multi-tier (Section 6) and the use of new technologies (section 7). These sections are specifically aimed at producers with single-tier systems who require a new environmental permit in future.

References

5 AMMONIA REDUCTIONS BY CHANGING MANAGEMENT AND STOCKING POLICIES

AMMONIA REDUCTIONS BY CHANGING MANAGEMENT AND STOCKING POLICIES

The ammonia emission factor used for a single-tier system could be reduced by increasing the turnaround time between successive flocks, since no ammonia is emitted from a clean, empty house. In effect, this could reduce overall ammonia emissions 'per bird place per year'. Given the scale of the difference between the EA and BAT-AEL figures though, the empty period would need to be substantially prolonged in order to comply with the BAT-AEL figure for non-cage systems. This will therefore not be a viable option.

An alternative approach that could be explored with the Environment Agency if expansion to over 40,000 places is being considered is the possibility of renting or even selling any existing single-tier housing to another farmer. For this to be beneficial, the single-tier system would have to be on a separate installation which does not require a permit.

For this approach to be considered, a range of criteria would need to be met. It is likely that the two units would have to be under separate management with separate financial accounts in place. Purchases of inputs (feed, pullets etc.) would need to be completely separate for the two units as would sales of eggs and end-of-lay hens.

Any producers considering this approach would need to successfully demonstrate the separation of different houses and should get agreement from the Environment Agency (or equivalent bodies in Wales, Scotland and Northern Ireland) in relation to their specific proposals.

6 CONVERTING SINGLE-TIER SYSTEMS TO MULTI-TIER

CONVERTING SINGLE-TIER SYSTEMS TO MULTI-TIER

Converting existing single-tier houses to multi-tier is an option available to farmers wishing to expand above the 40,000 bird place threshold, but the process can be both difficult and expensive.

6.1
HOUSE CONVERSION CHALLENGES

A number of factors influence how feasible and cost-effective it is to retrofit a multi-tier system and UK poultry equipment suppliers identify a number of common issues. The three main barriers to conversion are:-

- **Structural-support posts in the house.** These do not necessarily prohibit conversion because a number of different multi-tier systems are available, but the range of options may be reduced. In some cases it may be impossible to fit certain equipment. Clear-span buildings are much easier to convert but these are less common in older houses.

- **The height and width of the house.** The height both to the eaves and at the ridge is important because low roofs can restrict the type of multi-tier that can be installed. Again, this can be a particular problem for older houses. The optimal width for a multi-tier unit is often wider than most existing single-tier houses. Whilst not prohibitive, narrow buildings restrict the choice and typically increase the conversion cost on a 'per bird' basis.

- **The electricity mains supply available.** The ventilation system normally needs to be changed when converting to multi-tier. Single-tier houses typically use natural ventilation but this is not sufficient for multi-tier because of the higher stocking rate (based on floor area) and different air flow properties of the system. Mechanical ventilation systems need to be installed instead, which increases electricity requirements. Additional electricity is needed for equipment such as manure belts and possibly also for an egg packing machine (if not already in use). One poultry equipment supplier said that in their experience, 10% more power is required for multi-tier.

Upgrading the power supply to the farm can be expensive, especially if an existing single phase system has to be replaced with three-phase. Other factors include the distance to the local grid. Because of the number of different variables, costs of electricity provision vary substantially from farm to farm and we were advised that farmers consult with a local electrician to find out what extra electrical supply may be required.

The size of the range area available for laying hens can be a limiting factor for optimal house conversion. A multi-tier house will typically accommodate more birds than a single-tier system of the same size. The range area needs to be large enough to comply with legislation and assurance scheme standards for increased numbers of birds. Extra popholes will also be required when bird numbers are increased in the house. This is relatively inexpensive to address but it is more difficult if access to the range is only from one side of the building.

Consideration also needs to be given to how the extra manure which is regularly removed (typically twice weekly) will be managed. If the manure cannot be spread all-year-round in the local area, then it will need to be stored. If existing storage is not sufficient, a new manure store may need to be constructed at additional cost.

The size of the egg room or store may also need to be increased to cope with extra birds and increased egg numbers. The egg packing machinery may need to be upgraded or replaced which can in turn also increase electricity demand.

6.2 EXPECTED IMPACTS ON BIRD NUMBERS

When planning to convert a single-tier house, it is important to know how many extra birds the new multi-tier system will hold, as this will have a significant influence on the cost-effectiveness of the conversion. Numbers will be dependent on several variables, including the type of multi-tier system used.

In general (if issues such as range area do not limit the number of birds) an 8,000 bird capacity single-tier house will convert to approximately a 12,000 bird capacity multi-tier; a 12,000 will convert to between 18,000 and 20,000 and a 16,000 bird capacity single-tier house will convert to around 26,000 – 27,000 birds. In some cases, it will be possible to extend the length of an existing single-tier house so that additional birds can be stocked. This can reduce costs on a 'per bird place' basis.

When converting to a capacity of over 16,000 birds, the house will almost certainly need to be split into separate flocks to comply with assurance scheme limits. Each flock will need separate feed, water, lighting and ventilation. This can reduce the cost effectiveness of increasing bird numbers above 16,000. For example it may be preferable to convert a 12,000 bird capacity single-tier house to a 16,000 capacity multi-tier rather than going to 18,000.

References

6.3 TYPICAL CONVERSION COSTS

The cost of retrofitting a multi-tier system can vary considerably depending on the issues discussed above. Typical costs are currently around £15 – £20 per bird, based on the new higher number of birds rather than the current single-tier capacity. This is comparable to the price of equipping a new building, but it can vary depending on the size of the house and other factors. It is typically more cost-effective to retrofit large single-tier units than smaller ones, because of economies of scale.

On the whole, one equipment supplier believed that it would be possible and cost-effective to convert approximately 75% of the existing single-tier laying hen houses in the country to multi-tier systems.

References

7 USE OF NEW TECHNOLOGIES TO REDUCE EMISSIONS

USE OF NEW TECHNOLOGIES TO REDUCE EMISSIONS

BAT Conclusions (section 4.1) set out a range of BAT-AELs for ammonia emissions for each system (section 4.2). The same document also sets out what are considered to be 'best available techniques' when used alone or in combination. These include manure belts for non-cage systems (hence multi-tier systems are considered a BAT but single-tier systems are not) and also the 'use of an air cleaning system'. Examples given of these include i) wet acid scrubbers; ii) a two or three stage air cleaning system and iii) bio-scrubbers. An accompanying note in the BAT Conclusions states however that these 'may not be generally applicable due to the high implementation cost'.

The BREF document describes in more detail a number of different approaches within the category of 'air cleaning systems'. It also sets out expected reductions in ammonia levels from these in percentage terms, where data are available from suitable scientific studies. For example, liquid scrubbing systems are recognised (Table 4.129 of the BREF) and the accompanying text states that ammonia emission reductions for such systems can be over 70%. The Environment Agency may accept this as evidence of a BAT and could agree a reduced ammonia emission factor for a single-tier house with such a system in place. If this reduction results in an ammonia emission factor of less than 0.13 (see Section 4.2), then the system is likely to be accepted by the Environment Agency as compliant with environmental permitting requirements.

Several different equipment companies now have such systems commercially available in the UK. These can either be fitted to new buildings or alternatively they could be retro-fitted to existing ones and the costs of some

may be comparable or even lower than the costs of system conversion to multi-tier.

To date, such systems have typically been used on farms where additional control is required over ammonia and / or odour for permitting, planning or nuisance reasons and the uptake has largely been within the broiler sector. There is little track-record of use in free range systems. Questions have been raised over the effectiveness of air cleaning in free range systems because untreated air would be able to escape from the building through the popholes, when they are open.

If considering the use of such technologies, it is important to ensure that benefits claimed can be substantiated for free range systems to the satisfaction of the Environment Agency. Unless there are comprehensive data already in place, this can be a lengthy and expensive process.

8 SUMMARY

SUMMARY

Agriculture is a significant source of ammonia and it is clear that reducing emissions is an important issue for UK government and enforcement bodies at present. The Clean Air Strategy 2018 sets the direction for future air quality policy, whilst the Code of Good Agricultural Practice for Reducing Ammonia Emissions provides more specific guidance for farmers. These developments will have implications for many free range egg producers in future, regardless of their scale of operation. Within this final section, we summarise the main issues arising.

8.1 ENVIRONMENTAL PERMITTING

Environmental permitting legislation sets specific requirements on ammonia for poultry farms with over 40,000 bird places. A new permit cannot now be issued for any farm with a traditional single-tier system, no matter the size or the likely remaining lifespan of the house in question. In contrast, any farm that held a permit with single-tier systems prior to 15 February 2017 is currently able to continue indefinitely.

At present, we understand that substantial numbers of free range producers have between 32,000 and 40,000 bird places. Any expansion of these farms is likely to take them above the permitting threshold for the first time and under current regulations it would not be possible for them to obtain a permit if they currently have any single-tier systems.

The basis for this situation lies in European legislation (Commission Implementing Decision 2017/302) and specifically the BAT-AEL for non-cage systems. Given the scale of the free range sector in other EU Member States, this requirement will be largely (and maybe even wholly) specific to the UK, due to its scale compared to that of other Member States.

Ammonia emission factors used by the Environment Agency at present are generally recognised as being outdated and not representative of current management practices. No studies of emissions from outdoor poultry have been included in the current UK Inventory of Ammonia Emissions. The lack of up-to-date information on ammonia emissions has been acknowledged both by the Agency and by industry.

8.2 HOUSE CONVERSION TO MULTI-TIER

At present, both single-tier and multi-tier systems are in widespread use in the free range sector. Older houses are generally single-tier whereas recent developments have been almost exclusively in multi-tier. There are no reliable data on the percentage share for each system but it has been suggested that around 30% of all free range houses currently use multi-tier systems. However, these houses are likely to be larger than average and so the percentage of birds in multi-tier systems is likely to exceed 30%. Nevertheless, there remains a lot of single-tier housing in place.

For producers wishing to exceed 40,000 bird places for the first time on a farm, conversion to multi-tier is likely to be feasible in most cases but it is inevitably expensive. Farm-specific issues such as the size and design of the existing house, the electricity supply and the availability of additional range land (so that house capacity can be increased) are all important factors.

The broader merits of single-tier and multi-tier systems have been considered in other contexts. There has been prolonged discussion on the subject but (probably) a consensus that there is a role for both, in order to meet varying customer requirements and farm circumstances. The need to reduce ammonia emissions will inevitably favour multi-tier systems at the expense of single-tier on permitted farms.

8.3 ALTERNATIVES TO HOUSE CONVERSION

Farmers with existing single-tier housing wishing to expand to over 40,000 bird places on a site could potentially seek to rent or even sell their existing single-tier units to others. This may enable them to either obtain a new permit (for multi-tier housing only) or to remain below the threshold for requiring one.

Retro-fitting air cleaning or scrubbing systems to reduce emissions in single-tier houses may be feasible in theory, when combined with powered ventilation but it is inevitable that such systems will be less effective at times when the popholes are open.

Farmers considering such approaches would require further engagement and discussion with the Environment Agency (or equivalent bodies in Wales, Scotland and Northern Ireland).

8.4 FUTURE GOVERNMENT STRATEGY

The Clean Air Strategy 2018 states that Defra will 'require and support farmers to make investments in the farm infrastructure and equipment that will reduce emissions'. The nature of this 'support' will be important to the sector but the details are currently not available.

Whilst uncertainty continues about what support will be given, producers may be unwilling to invest in new facilities which could reduce ammonia emissions (e.g. the construction of covered manure stores) in case they fail to qualify for available assistance at a later date.

An additional important consideration is whether the support given will be the same throughout the United Kingdom or whether separate devolved approaches will be taken in different countries within the UK.

Finally, the Clean Air Strategy states that Defra will explore whether the Code of Good Agricultural Practice for Reducing Ammonia Emissions could form the basis of a 'clean air standard within a wider gold standard for farmers'. At present, further details are not available on what is intended here but farmers and others may be able to play an active and constructive role in ensuring that this objective is appropriate and can be achieved.

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