Statement of evidence

Respiratory hazards of poultry dust

Summary

Recent research into the incidence of ill health in agriculture in Great Britain reported a high prevalence of respiratory symptoms in poultry farm workers, who can be exposed to significant amounts of airborne dust (poultry dust) generated during poultry work activities. Both acute and chronic work-related symptoms have been reported in poultry workers and the range of symptoms suggests that poultry dust may cause harm by various mechanisms, including allergic reaction and direct irritancy. Strong evidence exists to support a risk of occupational asthma associated with exposure to certain components in the dust.

Poultry dust can be a complex mixture of organic and inorganic materials derived from soil, bedding, feed and feed components, chemical and therapeutic additives, faeces, feathers etc, as well as microbiological and invertebrate contaminants.

The evidence that the components of poultry dust are hazardous to health and the levels of dust exposure resulting from a range of poultry farming tasks, provide strong evidence for treating 'poultry dust' as a substance hazardous to health as defined in the Control of Substances Hazardous to Health Regulations 2002 (as amended) (COSHH).

Poultry dust contains a number of recognised asthmagens, including softwood dust and grain and storage mites. It is therefore essential that health surveillance is undertaken to enquire positively about any early symptoms of ill health. Employers will have a legal duty to carry out health surveillance under COSHH.

This statement summarises the evidence of respiratory health hazards associated with poultry dust and the various constituents that have been identified within it, to help dutyholders make an informed and valid judgement concerning the hazards of the dust and assess the risks to health in the workplace. A definition of poultry dust is included and the statement outlines the legal requirements under COSHH.

Background

1 Respiratory disease is a major occupational health risk for those working in agriculture, with an incidence of occupational asthma several times the national average[1]. Research suggests that working in poultry housings is associated with higher exposures to organic dusts than for cow or swine housing and prevalence of symptoms among poultry workers is also higher.[2] A review of published research by the Institute of Occupational Medicine reported a high prevalence of respiratory symptoms in poultry farm workers, including a 15% prevalence of chronic bronchitis.[3]

2 Poultry production methods have moved towards industrial large-scale confinement facilities and studies have demonstrated that poultry workers' exposure to organic dust can be substantial.[4] Given the complexity of the organic dust, a number of constituents could explain the high symptom prevalences observed in studies carried out on poultry workers. Exposure to dust, including softwood dust, and to ammonia may produce non-specific inflammation. Allergic airways response is likely to occur with exposure to dust containing grain, and to allergens from mites and poultry. Bacteria and endotoxins in the dust can also cause respiratory illness.

3 There is limited direct evidence in the scientific literature that poultry workers can develop work-related asthma, and the relative importance and prevalence of this within the industry remains to be established by epidemiological investigation.[5] But there is good evidence that some of the biological materials found in poultry dust can cause asthma and other respiratory diseases in other settings and it should be assumed that they present a risk in the poultry industry too.

4 The following statement has been drafted for industry stakeholders and summarises the evidence of respiratory health hazards associated with poultry dust and the various constituents that have been identified within it. This will help dutyholders to make an informed and valid judgement concerning the hazards of the dust and to assess the risks to health in the workplace.

Legal requirements

5 The Control of Substances Hazardous to Health Regulations 2002[6] (as amended) (COSHH) set out the legal requirements for protecting people in the workplace against health risks from hazardous substances, which include respiratory sensitisers. COSHH defines a substance hazardous to health as a '*substance (including a preparation)*:

(a) which is listed in Part 1 of the approved supply list as dangerous for supply within the meaning of the CHIP Regulations[7] and for which an indication of danger specified for the substance is toxic, very toxic, harmful, corrosive or irritant;

(b) for which the Health and Safety Commission has approved a workplace exposure limit (WEL);*

(c) which is a biological agent;

(d) which is a dust of any kind, except dust which is a substance within paragraph (a) or (b) above, when present at a concentration in air equal to or greater than –

> *(i) 10 mg/m^3, as a time-weighted average over an 8-hour period, of inhalable dust or*
> *(ii) 4 mg/m^3, as a time-weighted average over an 8-hour period, of respirable dust;*

(e) which not being a substance falling within sub-paragraphs (a) to (d), because of its chemical or toxicological properties and the way it is used or is present at the workplace creates a risk to health;'

6 Failure to comply with COSHH is an offence subject to penalties under the Health and Safety at Work etc Act 1974.[8]

* From 1 April 2008 the Health and Safety Commission (HSC) and Health and Safety Executive (HSE) merged to form a single national regulatory body, the Health and Safety Executive.

7 Poultry farm employers have a statutory duty under COSHH regulation 7(1) to ensure that exposure to a substance hazardous to health, is either prevented, or where this is not reasonably practicable, adequately controlled. Furthermore, regulation 7(7)(c)(ii) requires that exposure is reduced to as low a level as is reasonably practicable where a substance carries the risk phrase R42, R42/43 or is listed in section C of the HSE publication *Asthmagen? Critical assessments of the evidence for agents implicated in occupational asthma*,[9] as updated from time to time, or where the risk assessment for any use of a substance has shown it to be a potential cause of occupational asthma.

8 Employers should regard a substance as hazardous to health if it is hazardous in the form in which it may occur in the work activity. A substance hazardous to health need not be just a single chemical compound; it may also be a mixture of compounds, micro-organisms, allergens, process-related dusts etc. Where a work activity may expose employees to more than one substance hazardous to health, the employer needs to recognise the possible enhanced harmful effects of combined or sequential exposures.

9 Where employees are likely to be exposed to substances which may cause occupational asthma, health surveillance is required in accordance with the COSHH Approved Code of Practice Appendix 3, 'Control of substances that cause occupational asthma'.

Definition of poultry dust

10 'Poultry dust' is the term used to describe the dust, including any biological agents, arising from work activities on poultry farms (including hatcheries).

11 The work activities that give rise to the dust include:

- laying down of litter;
- populating poultry houses;
- handling and inspection of birds;
- vaccinating birds;
- the routine upkeep and cleaning of houses during the growing or production period;
- catching or depleting of birds;
- removing litter and/or manure; and
- cleaning houses at the end of the production period, and other related or similar activities.

12 Poultry dust may vary in composition from pure wood dust to a complex mixture of organic and inorganic particles, faecal material, feathers, dander (skin material), mites, bacteria, fungi and fungal spores and endotoxins depending on the type of birds, the work activity and the point in the growing or production cycle.

13 Some of the individual components, eg storage mites and softwood dust, are known asthmagens (substances that are capable of causing occupational asthma).

14 The following example demonstrates the changing composition of poultry dust during a typical commercial layer rearing cycle.

Example: Commercial layer rearing cycle

- **Laying down bedding/litter.** The dust initially derives mainly from bedding material (softwood shavings/shreds or straw), as the bedding material is transported from outside the rearing shed and distributed inside the cleaned

shed, using mechanical and manual means. At this stage, the bedding material is relatively clean though some biological contamination may be present.

- **Repopulation.** The rearing shed is then populated with day old chicks from a hatchery. Airborne dust, mainly 'fragments of down', is produced during the population process.
- **Rearing stage.** Typically during this stage, vaccination, crop inspection, crop thinning (see catching) and beak trimming activities take place. As the rearing cycle progresses, the bedding material becomes more contaminated with organic material derived from feed, faecal material, feathers, dander (skin material), mites and micro-organisms (bacteria, fungi and endotoxins).
- **Depopulation (catching).** At 14-16 weeks of age, point of lay birds are caught and moved to production units. The manual catching process generates airborne dust of mixed organic content accumulated over the rearing period. Much of the dust will come from the birds themselves.
- **Bedding/litter removal.** Following depopulation, the full depth of the bedding in the rearing shed is removed, using mechanical and manual means. The mixed organic material (partially composted) held within the matrix of the bedding accumulated over the rearing period may be released as airborne dust during this process.
- **Cleaning/disinfection.** The sheds are cleaned, disinfected and fumigated. Residual mixed organic material may be released as airborne dust/aerosol during cleaning activities, depending on the cleaning technique used.

Health effects of constituents of poultry dust

Characteristics of poultry dust

15 An individual's response to dust depends on many factors including the nature, duration, level and particle size distribution of airborne exposures.[10] The behaviour, deposition and fate of any particular constituent particle after entry into the respiratory system and the biological response that it elicits, depends on the nature and size of the particle. The Health and Safety Executive (HSE) distinguishes two particle size fractions for limit-setting purposes termed 'inhalable' and 'respirable'.*

16 Poultry dust contains particles of varying size in the range c 0.5-50 microns.[11,12] The presence of particles in the respirable range (<5-7 microns) means that poultry dust particles can penetrate into the gas exchange region of the lung. Larger particles can also cause disease by impacting in the upper and larger airways below the vocal cords.

17 Bacteria, fungi and their components (often referred to under the generic description of bioaerosols) are likely to be components of the dust. They may be present as single cells or spores, clumps of cells or chains of spores, or may be attached to other dust components and therefore be present in a range of particle sizes. There will be a combination of live and dead organisms, but both may trigger allergic response.

18 In addition to particulates, gases may build up as a result of the decomposition of biological material and these include ammonia and hydrogen sulphide. These substances have acute effects on the respiratory system and may compound the effects of the dust.[13]

* In occupational hygiene mixed dusts are often initially evaluated by determining personal and background (static) exposures to total inhalable dust. Inhalable dust is defined as the fraction of airborne material that enters the nose and mouth during breathing and is available for deposition in the respiratory tract. A sub-fraction of this total dust, the respirable fraction, denotes the airborne dust that penetrates into the gas exchange region of the lungs. Fuller definitions and explanatory material are given in MDHS14/3, *General methods for sampling and gravimetric analysis of respirable and inhalable dust*.[14]

19 Health effects have been identified both for poultry dust and its various constituents. These are separately discussed below.

Health effects and task-related factors

20 Most published health evidence about the effects of poultry dust comes from studies undertaken outside Great Britain where farming practices may differ in detail. Research suggests that work in poultry houses is associated with higher exposures to organic dusts than for cow or swine housing and the prevalence of symptoms among poultry workers is also higher.[15,16,17] The dust, as other agricultural dusts, contains a number of allergens that can cause respiratory illness. Multiple exposures are common and some exposures can give rise to more than one specific disease.[2] Acute and chronic work-related symptoms are very common in poultry workers: including cough, phlegm, eye irritation, dyspnea, chest tightness, fatigue nasal congestion,wheezing, sneezing, nasal discharge, headache, throat irritation and fever.[18,19] These symptoms are generally non-specific and may improve during periods away from work.

21 This range of symptoms suggests that poultry dust may cause harm by many mechanisms, including direct irritancy effects and those associated with allergy. In terms of interpreting the requirements of COSHH, the strongest evidence exists for a risk of occupational asthma associated with exposure to the asthmagens in the dust.*

22 Donham et al[18] have reported evidence of a dose-related decline in lung function in poultry workers. Dose-response trends were found for cross-shift declines in FEV_1 with total and respirable dust and with endotoxin concentrations. The data were considered to support an exposure threshold total dust concentration of 2.4 mg/m^3.

23 Some poultry farm jobs appear to be associated with a higher risk of exposure. Chicken catchers, turkey workers, broiler and layer workers have all been shown to exhibit significant decreases in lung function over a work shift.[16] In egg producers, the frequency of symptoms correlates with the hours per week inside laying facilities.

24 The length of time a worker has been exposed is correlated with the risk of respiratory disease.[16] Chronic respiratory symptoms have been reported in chicken catchers with five years or more of occupational exposure. Significantly higher prevalences of symptoms and decreased lung function are seen among poultry workers exposed for more than ten years when compared with those with fewer years of exposure. Workers who spend more than four hours in confinement at a time are at risk from rhinitis or eczema.[15]

25 Some risks are related to the design and operation of the facilities. Ventilation of the building has a major impact on the risk of respiratory disease.[20] The use of wood shavings for bedding, dry feeds, disinfectants and non-slatted floors increase the risk of organic toxic dust syndrome.[21] The type of production system, ie floor or cage housed, has an effect on the respiratory health of workers. Workers from cage-housed operations report more cough and wheeze and have decreased lung function when compared with workers from floor-housed facilities.[22] Other reported risk factors for bronchial responsiveness in poultry workers include gender, age, a positive family history of asthma and smoking.[17]

* It is possible that in some situations, eg clean out procedures, asthma-like symptoms may arise from the use of poultry disinfectants (biocides). Several disinfectant products contain active ingredients which can act as respiratory irritants (eg aldehydes, quaternary ammonium compounds, phenolics etc) under certain conditions of use. It is not known to what extent (if any) these biocides may be a contributory cause of respiratory ill health in the poultry farming industry and exposure to disinfectants was not included in HSE's Poultry Dust Respiratory Disease Project. An assessment under COSHH should consider the potential for exposure during typical activities as well as the risks to health.

Wood dust

26 The bedding used in hen rearing and broiler operations often comprises softwood shavings or shreds. Softwoods are mainly from coniferous trees such as Scots pine, yew and cedar. The following health problems are among the effects associated with exposure to softwood dust; skin disorders, rhinitis and occupational asthma.[9] Softwood dust has a *Sen* notation in EH40[23] and a WEL of 5mg/m^3 (eight-hour TWA). Therefore under COSHH, exposure by inhalation to softwood dust should be reduced so far as is reasonably practicable below the WEL.

Feed and vaccines

27 Poultry feeds provide nutrition for the birds at each stage of their development and are usually in the form of grain, pellets or meal. Cereals form the major part of all poultry feed, together with soybean and pulses. A vitamin and mineral supplement is also included. Fish meal is sometimes used as a source of essential amino acids, particularly in organically reared poultry. Poultry feeds are prone to fungal growth and mycotoxin production. In addition, the constituents of feed may contain protein allergens (wheat allergens) and microbial enzymes added to the feed (eg Phytase), and pollens from cereal grain. Mite species may be present in stored feed. A case of allergy to ethoxyquin (a preservative added to chicken feed to inhibit vitamin degradation) in a chicken farmer has been reported.[24]

28 Vaccines are the most commonly administered veterinary medicines in poultry production. Vaccination is used to increase the specific immunity to infections to which the vaccinated poultry are likely to be exposed. The various routes of administration are injection: wing web puncture, feather follicle, eye-drop, nasal-drop, drinking water, coarse spray, aerosol or on-feed spray. During the administration of vaccines, birds may need to be closely handled and those involved in this task may be exposed to aerosolised protein allergens derived from bird feathers, dander and serum.

29 There are therefore sensitising agents in the constituents of poultry feed and potential exposure to protein allergens during vaccine administration. These agents can act as allergens individually, but it is also possible that they have enhanced effects when combined with other allergens and endotoxin in an environment, for example, when aerosolised with the other constituents of poultry dust. Exposure to allergens may provoke sensitisation of the immune system triggering allergic responses such as asthma.[2]

Grain

30 Grain is the seed of cereal crops and comprises a cellulose-based seed coating and carbohydrate-based interior, and is used as a feed in the poultry industry. Grain may also be contaminated with many other materials. As a result, grain dust is a variable and changing mixture of the different constituents of the grain and contaminants. The type of contaminants present will depend on the origin of the grain. The contaminants may include:

bacteria; fungal spores; actinomycetes; microbial toxins such as endotoxins and mycotoxins; insects and insect parts; storage mites and their excreta; weevils and their excreta; animal hair; feathers from pigeon infestation; excreta from insects/animals; pollens; silica; soil particles; fungicide, pesticide and fertiliser residues; and/or plant debris other than grains.

31 Inhaling grain dust can cause ill health, for example asthma, bronchitis and grain fever.[9] Some people can become sensitised to the dust. This means that any subsequent exposure, even at low level, can result in nasal or eye irritation or

trigger an attack of asthma. Grain dust may contain mould spores that, if inhaled, can cause the potentially fatal disease, Farmer's Lung.

32 Grain dust is a hazardous substance as defined by COSHH.[6] It has a WEL of 10mg/m^3. The WEL is a maximum, not a target. All reasonably practicable measures must be taken to reduce exposure as far below the WEL as possible.

Mite allergens

33 Mite sensitivity is closely related to asthma and mite infestation is an important source of airborne allergens. Of the common allergens, sensitisation to mites seems to be the most prevalent in farming populations. The most important allergy-causing mites found in homes worldwide are the house dust mites, *Dermatophagoides farinae, D. pteronyssinus, Euroglyphus maynei* and the storage mite, *Blomia tropicalis*. One study has shown a high prevalence of sensitisation to house dust mites among farm students and house dust mites have been found in poultry dust. Among the storage mites, sensitisation to *Lepidoglyphus destructor* is the most prevalent and studies have shown that barn dust is predominantly infested with this species. Other species of storage mites such as *Glycyphagus domesticus*, *Acarus siro* and *Tyrophagus putrescentiae* are also found in this environment. A central science laboratory (CSL) study demonstrated that both house dust mites and storage mites were present, particularly in contaminated bedding/litter and feed, but they may also be present in stored feed.[25] The species identified in the CSL report were *Sancassania berlesei, Acarus siro, Acarus immobilis, Lepidoglyphus destructor, Cheyletus eruditus, Thyreophagus entomophagus, Tyrolichus casei, Cheyletus eruditis, Rhizoglyphus echinopus* and *Dermatophagoides pteronyssinus.* Occupational sensitisation to storage mites has been widely reported and they meet the revised EU criteria[26] for classification as a respiratory sensitiser (a cause of asthma). Storage mites are covered by Appendix 3, paragraph 4(a), of the COSHH Approved Code of Practice and are specifically listed in Section C of the HSE publication, *Asthmagen? Critical assessments of the evidence for agents implicated in occupational asthma*.[9]

34 Studies have shown the Northern fowl mite (*Ornithonyssus sylviarum*) to be a cause of occupational allergy in poultry workers[5] and *Aleuroglyphus ovatus* is a storage mite that has a worldwide distribution and has been found in stored bran, wheat, chicken meal, and dried fish products.[27] It is unclear from the published literature which parts of the mite are involved in its allergenicity, although it is likely to be mite parts and fragments as well as the excretory products, since these would form respirable particles.

Poultry feathers, dander, serum and faecal material

35 Allergen exposure may occur from contact with chicken feather, dander, serum or droppings. Chicken droppings may contain, similarly to pigeon droppings, excreted serum protein antigens.[2]

36 Inhalable feather dust has been shown to contain several allergenic components, which cross-react with serum allergens/antigens of the same as well as of other bird species.[27] Chicken serum albumin (alpha-livetin) has been implicated as the causative allergen of Bird-Egg Syndrome and Northern fowl mite (*O. sylviarum*), residing in chicken feathers, has been implicated as causing occupational allergy in poultry workers.[5]

37 Poultry workers may be exposed to aerosols of dried faecal material, particularly during the removal of accumulated waste from egg production units or when cleaning down broiler/rearing houses following depopulation. Inhalation,

ingestion and eye contamination by faecal material may occur in inadequately protected personnel undertaking these tasks. There are potential exposures to live bacterial and viral pathogens contained within the faeces but the actual risk to health depends on individual susceptibility and the quantity of live organisms present. The health effects of bacteria are outlined in the 'Bacteria' section and bacterial endotoxins, which may also be present in faecal material, are outlined in the 'Endotoxins' section.

38 Inhalation of dried faecal material may be associated with lung infections and lung symptoms caused by bacteria and endotoxins.[13]

Bacteria

39 Bacteria in poultry dust bioaerosols may be derived from soil and dust generally present in any agricultural environment, from feed and bedding, and from the birds themselves (faecal or skin microflora, zoonotic agents). Their presence may constitute a risk to human health of workers either through overt infection or through an immunological or toxic challenge to the respiratory system as a result of the biological burden.

40 Bacteria are classified according to their cell wall constituents and cell shape (rod shaped and cocci – round shaped), then into genera and species. Gram positive bacteria have a thicker cell wall and are generally more robust and therefore capable of surviving longer in bioaerosols. These include rod-shaped *Bacillus* species, common in dust and soil, and coccus-shaped *Micrococcus* and *Staphyloccus*, also found in dust but also associated with animal and human skin. Gram negative bacteria are mainly rod shaped, and are less robust but some are still capable of surviving for limited periods in bioaerosols and include faecally derived bacteria such as *Escherichia coli*, *Salmonella* and *Campylobacter* species. The presence of bacteria (and fungi, see below) in bioaerosols is usually measured according to the number of cells capable of growing to form a colony on agar media, expressed as colony-forming units (cfu)/m^3 air.

41 The concentrations of bacteria in poultry dust bioaerosols have been cited in a previous published study[29] to range from 100 000 to 6 million cfu/m^3, with a mean value of 289 000 cfu/m^3. Approximately 85% of these were Gram positive *Bacillus* species. In the current HSL study,[4] the highest recorded bacterial levels for task-specific activities ranged from 2.5 million cfu/m^3 during depopulating (catching) chickens to 200 million cfu/m^3 for a worker removing bedding/litter in a chicken house. Gram negative species recorded in poultry dust bioaerosols include *E. coli, Enterobacter agglomerans*, and *Pseudomonas*, *Acinetobacter* and *Salmonella* species. *E. coli* and *Salmonella* species are potentially capable of causing gastrointestinal infection, chiefly through hand-mouth transfer, and all Gram negative bacteria yield endotoxin (see below). Zoonotic agents, ie animal infections capable of causing human infection, associated with poultry may include *Chlamydophila psittaci* (bacteria causing psittacosis). Although examples of such workplace infection have been reported in the poultry industry, this is mostly in association with slaughtering and evisceration.[30,31]

Fungi

42 As with bacteria, fungi present in poultry dust bioaerosols may be derived from soil and dust generally present in any agricultural environment and from feed and bedding/litter, but to a lesser extent from the birds themselves. Their presence may constitute a limited risk to human health of workers through overt infection, but may represent a significant immunological challenge to the respiratory system as a result of the biological burden. Long-term or repeated exposure to high concentrations of airborne fungal spores in a range of agricultural environments is recognised as

contributing to decline in lung function and allergic disease such as asthma and allergic alveolitis, eg Farmer's Lung disease.

43 The main source of fungi in poultry houses is likely to be from feed and bedding/litter. Fungi naturally present, for example, in bedding material such as straw will multiply in the moist conditions. There may also be a progression of development of thermophilic (heat-loving) fungi as the predominant species if conditions in, for example, deep litter become similar to those in composting organic materials. Some of these thermophilic species such as *Aspergillus fumigatus* are recognised respiratory allergens as well as being potential pathogens, causing lung infections in humans, albeit usually in immunocompromised individuals, and also can cause economic losses through lung disease in birds.

44 Species previously reported to be prevalent in poultry dust are *Cladosporium, Aspergillus* including *Asp. fumigatus* and *Eurotium (Asp. glaucus group), Penicillium, Scopulariopsis, Fusarium, Epicoccum, Mucor, Alternaria, Ulocladium, Basidiospores, Acremonium, Aurobasidium, Drechslera, Pithomyces, Crysosporium, Geomyces* and *Rhizomucor*.[32] Many of these are recognised allergens. The keratinophylic fungus, *Trichophyton mentagrophytes*, has also been isolated, using feathers as a nutrient source.[33] This species poses a minor risk of causing human skin and nail fungal infection.

45 Published data on poultry workers' exposure to fungi is limited, although one study gave a median exposure of 440 000 cfu/m^3 ranging from 14 000 to 110 million cfu/m^3 air.[21] In the recent HSL study,[4] the highest recorded fungal levels for task-specific activities ranged from 1120 cfu/m^3 for depopulating (catching) in a battery farm to 4 million cfu/m^3 during laying of bedding/litter at a duck farm. The latter was associated with handling mould-damaged straw and *Asp. fumigatus* formed a major proportion of the fungal spores present.

Endotoxins

46 Endotoxins are present in poultry dust samples collected at all stages of the production cycle. Endotoxins are a lipopolysaccharide component, released after breakdown of the cell wall of Gram negative bacteria (see the 'Bacteria' section) and are potent stimulators of the body's immune system. They are present in a wide range of occupational environments including livestock farming, animal feed industry and the processing of waste and compost[34] and have both acute and chronic effects on the respiratory system.[35] Where surveys have differentiated inhalable and respirable fractions of the dust sampled, a greater proportion of endotoxin has been found in the inhalable fraction.[10,18]

47 Acute respiratory symptoms associated with exposure to endotoxins include dry cough, shortness of breath, fever and shivering (organic dust toxic syndrome) as well as lung function impairment (dose-dependent). People with pre-existing respiratory disease may be more susceptible to these effects.[35]

48 Epidemiological and animal studies suggest that chronic endotoxin exposure may lead to chronic bronchitis and reduced lung function.[36]

49 There are no regulatory limits for endotoxins in place in Great Britain but some guidance values have been proposed in other countries.

50 A health-based exposure limit of 50 EU/m^3 (EU = Endotoxin Units – a measure of biologically active endotoxin) was proposed in the Netherlands in 1998.[37] This limit was derived mainly from an experimental study of human exposures to organic dust (cotton dust) with varying endotoxin content.[38] Observed reductions in lung function (FEV_1) were correlated with endotoxin concentration, there being no

observable effect around a level of 90 EU/m^3. A safety factor of two was applied to take account of potential chronic pulmonary effects at lower levels of exposure.[37]

51 Field observations suggested that this health-based limit was very difficult to achieve in practice[35,36] and a temporary legal limit of 200 EU/m^3 was subsequently adopted by the Dutch government.[34] Published measurements need to be interpreted with caution as in the absence of a standardised method large inter-laboratory variations in results have been reported.[40]

52 In the HSE poultry farm study,[4] recorded endotoxin levels for task-specific activities ranged from less than 30 EU/m^3 up to 38 000 EU/m^3.

Conclusions

53 Poultry dust is a complex mixture of organic and inorganic materials derived from soil, bedding, feed and feed components, chemical and therapeutic additives, faeces, feathers etc as well as microbiological and invertebrate contaminants. There is evidence, as summarised in this document, that inhalation exposure to these materials at the levels likely to be encountered in commercial poultry production could trigger allergic respiratory disease and exacerbate existing respiratory allergy.

54 The evidence for health hazards from the components listed above and the levels of dust exposure resulting from a range of poultry farming tasks, provide strong evidence for treating 'poultry dust' as a substance hazardous to health and therefore subject to statutory duties under COSHH.

55 The observed high levels of total inhalable and respirable dust for a wide range of tasks in the poultry industry require that steps are taken to ensure that workers' exposures are adequately controlled as defined by regulation 7(7) of COSHH. Furthermore, the presence of recognised allergens in dusts collected at various stages of the process, imply that potential causes of occupational asthma are present and that exposures should be reduced to as low a level as is reasonably practicable. The specific asthmagens identified include: softwood dust, grain dust (*Sen* notation, EH40) and storage mites.

56 In addition, general environmental allergens such as fungal spores may be present, depending on the process type and stage, at levels that considerably exceed background levels. Under these circumstances, the requirements of the COSHH Approved Code of Practice, Appendix 3, 'Control of substances that cause occupational asthma' apply. This includes health surveillance where employees are likely to be exposed to substances which may cause asthma (see paragraph 14 in Appendix 3).

57 Employers' risk assessments and control strategies should therefore consider the composition of the dust throughout the range of farming processes in use as well as the likely levels of dust exposure in farming tasks. Assessment of control measures and good working practices for substances that cause asthma should take into account the seriousness of the health effects that could result from a failure of control. Particular attention should be given to identifying and assessing the controls for any short-term exposures which involve markedly higher concentrations than the long-term average.

58 Poultry dust contains a number of recognised asthmagens including softwood dust, grain and storage mites. It is therefore essential that health surveillance is undertaken to enquire positively about any early symptoms of ill health.[41] Employers have a legal duty to carry out health surveillance under COSHH (see regulation 11 and Appendix 3).

The objectives of health surveillance are to:

- protect the health of individual workers by detecting, as early as possible, symptoms that may be caused by exposure to substances hazardous to health;
- help evaluate the effectiveness of measures taken to control exposure;
- collect information to update knowledge of health hazards in the workplace.

As a **minimum**, health surveillance should include:

- Pre-employment screening that includes a questionnaire about present or past asthma or chest illness.
- Informing new starters about what symptoms they should look out for and report.
- Completion of a questionnaire for all workers after employment at 6 weeks, 12 weeks (or similar intervals) and at least annually thereafter to enquire about any developing symptoms.

The questionnaire should be administered by a responsible trained person who understands the purpose of the questionnaire and knows how to interpret the answers and what action to take if any adverse effects are found.

- Keeping an individual health record for each worker. This should not include any personal clinical or medical data. Any such information should be treated in confidence and kept separately and securely.

Lung function testing may also help with assessing a worker's respiratory health.

Each employer should also identify a named occupational health professional (doctor or nurse) who can:

- help to develop the scheme;
- train the responsible person;
- advise on any adverse findings from the questionnaire and, in particular, fitness to continue in the work;
- make arrangements for further investigations where necessary.

Each employee should be given information about the health risks associated with exposure to poultry dust, the relevant symptoms to look out for and the need to report any symptoms to the nominated responsible person.

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