science summary

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PPC bioaerosols (dust and particulates) potentially emanating from intensive agriculture and potential effects on human health

Science summary SC040021/SR4

'Am I at risk of ill health from environmental exposure to bioaerosols from intensive agricultural activities?' Environment Agency researchers have tried to answer this question by conducting a comprehensive literature review of all the research undertaken into the release of bioaerosols from livestock farming, particularly of pigs and chicken. This review uncovered information that should prove useful for reducing bioaerosol concentrations both in and around livestock facilities and for controlling the spread of potentially serious diseases, such as avian flu.

The rise of intensive livestock farming since the 1960s has resulted in increasing emissions of bioaerosols, which comprise dust, microorganisms and endotoxins, as greater numbers of animals are housed in smaller spaces. This has led to concerns about the impact of rising bioaerosol concentrations on farm workers and those living nearby. As well as causing direct health effects, such as various respiratory problems, bioaerosols can help spread disease-causing bacteria and viruses.

The researchers reviewed around 240 studies investigating many different aspects of livestock-related bioaerosols. These included: the specific components making up these bioaerosols; the various methods that have been developed for measuring bioaerosol levels; the factors that can effect bioaerosol production, such as livestock density and activity, ventilation rates and housing conditions; the health effects on farm workers of being exposed to high concentrations of bioaerosols; the emission of bioaerosols from livestock buildings and their rate of transport in the open air; and mechanisms for reducing bioaerosol concentrations.

They found that the bioaerosols in poultry and swine buildings mainly consist of dust particles of various sizes, including particles derived from the surface of the animals (such as skin flakes), their feed and faecal

matter. This dust also contains numerous living microorganisms, including many different species of bacteria, fungi and viruses, as well as organic compounds derived from these microorganisms, such as spores, endotoxins and peptidoglycans. So it's not particularly surprising that those working in these environments report a wide variety of health complaints, with around 60 per cent of all workers experiencing symptoms of chronic bronchitis.

But the researchers also found that the bioaerosol concentrations in different livestock buildings can vary substantially, due to a variety of different factors. For instance, the level of animal activity has a big effect on bioaerosol concentrations, with more activity leading to a greater rate of bioaerosol release. The precise level of activity depends on the housing condition (caged or free-to-roam), whether it is day or night, the stage of animal growth and how the animals are handled.

Other factors influencing bioaerosol concentrations include: the rate of ventilation; the time of year (bioaerosol concentrations are generally lower in the summer due to open doors and windows); the type of feed (dry feed, consisting of feed pellets, generates more dust than wet feed, in which the foodstuff is mixed with a liquid such as water or whey); and the specific waste management practices.

The researchers also reviewed the effectiveness of the various mechanisms and equipment available for reducing bioaerosol concentrations in livestock facilities, such as vacuum cleaning, electrostatic scrubbers, spraying and biofilters. But they found that the most effective method for reducing the health risk of bioaerosols was to wear protective masks.

Bioaerosols don't just remain in livestock buildings, they also escape into the outdoor environment, especially from well-ventilated buildings. A number of studies have explored these bioaerosol emissions and found raised concentrations of bacteria, fungi and endotoxins hundreds of metres away from livestock buildings.

These findings have obvious implications for the spread of diseases from livestock, with avian flu the most important concern at the moment. As such, the researchers also reviewed studies on the spread of different strains of avian flu and found evidence that the avian flu virus can be transported within faecal matter attached to clothes and vehicles.

Despite this comprehensive review, the researchers were unable to provide a firm answer to the central question. This was because of a general lack of information on certain critical issues, such as which segments of the livestock production process produce the most bioaerosols and how their distribution in the outside environment is affected by the weather and physical obstructions.

Nevertheless, this report raises some important issues and should be of interest to anyone involved in air quality, disease control and livestock production.

This summary relates to information from Science Project SC040021/SR4 reported in detail in the following output(s):-

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