H7 AVIAN INFLUENZA VIRUS OUTBREAK IN NORFOLK: EPIDEMIOLOGY REPORT, 30 APRIL, 12.00h

INTRODUCTION

1. Evidence of H7 avian influenza (AI) virus infection was found, on 26 April 2006, following laboratory examinations on carcases and samples from a broiler breeder flock in Dereham, Norfolk (Ref: LPAI 2006/01) which had been reported as having clinical signs of an avian notifiable disease on the evening of the 25th April. On 28 April laboratory examinations revealed evidence of infection with Low Pathogenicity AI H7N3 virus strain.

2. Evidence of H7 AI virus infection was found on two additional poultry farms (LPAI 2006/02 & LPAI 2006/03), under the same ownership, whose owner's private veterinary surgeon reported suspect avian notifiable disease retrospectively on the evening of 27 April. These two farms are located approximately 3km from the first detected farm.

3. This epidemiology report provides relevant epidemiological information on these incidents and a summary of the results of surveillance to date .

THE FIRST DETECTED FARM (LPAI 2006/01)

4. The first detected affected farm comprised some 34,500 broiler breeders owned by a partly integrated company based in Norfolk. The birds are housed in four sheds which have to be regarded in one sense as a single epidemiological unit as they are linked by a common feeding passage. The affected birds were 32 weeks old, and were imported as day old chicks from France in September 2005.

THE PARENT COMPANY

5. Analysis of available data indicates that the company owns 34 poultry premises, all of which are in Norfolk except for one located in Wisbech, Cambridgeshire. These are comprised of one hatchery which has a total incubator capacity of 2,073,600 with a daily output of 170,000 chicks, eight active broiler breeder sites, four rearing sites and 21 broiler sites. A risk assessment of the hatchery revealed that very good biosecurity and hygiene measures are in operation, and the eggs from the IP are identifiable and were being stored as "rejects".

6. The number of birds on the broiler breeder and rearing sites range from 7,250 to 34,700 birds and the number on the broiler sites range from 25,500 to 416,000.

ASSOCIATED SLAUGHTERHOUSES AND CATCHING COMPANIES

7. The company own a slaughterhouse in Attleborough, Norfolk for their broiler meat birds. An overview of the activities of this slaughterhouse is given at **Appendix 1**. The company employs its own catchers for birds on the broiler sites. Spent hens from the broiler breeder sites are slaughtered at another non-company slaughterhouse in Norfolk which uses its own sub-contracted catching teams.

TIMELINE OF EVENTS ON THE FARM AND HATCHERY

8. The timeline of events on the farm and hatchery are shown in **Figure 1**. The details of the clinical disease and laboratory findings are described in the following paragraphs.

SUMMARY OF CLINICAL DISEASE

9. Clinical signs were first noted on 20 April 2006 in Shed 2, on the 21 April in Shed 3, on the 22/23 April in Shed 1, and on 24/25 April in Shed 4. The clinical signs included marked anorexia, reduction in egg production and quality, and a fourfold increase in the mortality rate.

SUMMARY OF LABORATORY FINDINGS

10. Initial evidence of viral infection with the H7 strain was found in tissue samples from carcasses and cloacal swabs from birds in Sheds 1 and 4 taken on 26 April. At this time birds in these sheds were serologically negative for H5 and H7, and three serum samples from 20 birds in Shed 2 were positive for H7 antibodies.

11. Further laboratory examinations revealed the presence of LPAI virus H7N3. The pathotype was assessed as LP on the basis of genetic sequencing. This is an interim result as intravenous (IV) pathogenicity tests are in progress, on 6 week old poults, to determine any evidence of highly pathogenic (HP) strains within the virus population, which may have emerged as a result of the passage and mutation within the birds on the farm. These tests commenced on 27 April and final results will not be available until 7 days after the IV inoculation, that is on 4 May. However, if HP strains are present there could be evidence 3 – 5 days after inoculation (30 April – 2 May).

12. At the time of culling, on 27 April, ten carcases and blood samples from 100 birds from each Shed were taken for laboratory examinations.

13. Virus isolation is being undertaken from carcase tissues to determine if there is any evidence of mutation of the virus during the course of infection on the farm. These results are awaited.

14. The results of the serological (HI) examinations are summarised in **Figure 1** and **Figure 2**. In summary, the prevalence of seropositives in the first two Sheds (2 & 3) affected was 100%, whereas in Sheds 1 & 4, which were most likely infected some 3 to 5 days after the initial infection of birds in Shed 2, the sero-prevalences were 25.3% and 19.4%, respectively. **Figure 2** provides details of the distribution of the HI titres in the samples taken from the four Sheds and indicates that the high (100%) prevalences were associated with a greater proportion of birds with greatest titres. These results provide strong evidence for the observed clinical signs being associated with LPAI infection. Further analyses of these results are in progress to assist in providing an understanding of the dynamics of infection within the poultry population on this farm.

ESTIMATED DATE OF INFECTION

15. Assuming that clinical signs are associated with infection and the incubation period ranges from 2 – 5 days then the likely date of infection is between 15 and 18 April (see **Figure 1**).

POSSIBLE SOURCES OF INFECTION

16. The results of investigations on the second and third detected affected farms (LPAI 2006/02 and LPAI 2006/03, see below) indicate that this is not the index case.

Movement of Birds.

17. There is no evidence that infection could have been introduced by domestic poultry as no birds have been moved onto the premises since it was stocked in February 2006.

Infection from wild birds.

18. Professional ornithologists at the British Trust for Ornithology (BTO) based in Thetford, Norfolk have been consulted. The advice is that the area immediately around the farm is not highly populated by water birds. Further discussions are in progress on wild birds in the area in general and around the other sites owned by the company. At present a source of infection from wild birds cannot be ruled out.

Infection from fomites and visitors.

19. The site is theoretically biosecure with shower-in facilities and secure boundary fences. During the last four weeks there have been 111 movements onto the premises. A proportion of these are related to company relief staff

visiting the site to collect eggs. These and the other movements are the subject of current field epidemiological investigations.

Infection from feed and/or water.

20. Feed is an unlikely source of infection as all four sheds receive feed from the same supplier and a common, mains water supply. There has been a clear temporal transmission of infection amongst the four sheds providing no evidence for a common source.

SURVEILLANCE WITHIN THE PARENT COMPANY

21. Initial clinical and serological surveillance within the Company has been concentrated on the other broiler breeders.

22. Clinical inspections and examinations of egg production, feed and water intake and mortality records have revealed evidence of an egg drop syndrome, similar to that experienced on the IP, on one broiler breeder farm, which is contracted by the company to produce eggs for hatching. However, attendant veterinary surgeons found evidence of infection with Infectious Bronchitis virus and the initial serological examinations (on the first 20 birds sampled on this farm) for AIV were negative.

23. Serological results, from at least 20 birds per farm, are now available from eight of the company owned or associated broiler breeder farms. All are negative. The remaining two broiler breeder farms were sampled on 28 and 30 April. Results are awaited.

SECOND AND THIRD DETECTED AFFECTED FARMS (LPAI 2006/02 & LPAI 2006/03

24. These two farms are privately owned, and each comprised ~ 8,000 free range laying chickens which at the time of investigation were 45 - 47 weeks of age. No other livestock are present and the remainder of the farmland is under arable production. The poultry on the two premises are cared for by the same personnel, the owner and two other people. It was reported, retrospectively, as having a suspected avian notifiable disease on 27 April.

25. The timeline for the events on these two premises are shown in **Figure 3.** The clinical histories and results of laboratory examinations to date are described below.

CLINICAL DISEASE

26. Clinical signs of disease were first observed on LPAI 2006/02 on or around 25 March. Clinical signs included a drop in egg production and a two-fold increase in mortality. There was also evidence of cannibalism.

27. The owner's private veterinary surgeon was consulted on 29 March and carcases of affected birds on LPAI 2006/02 were submitted for autopsy at the practice's laboratory. (The birds at the other farm under the same ownership (LPAI 2006/03) were unaffected at this time). The post mortem examination revealed evidence of egg peritonitis and the clinical signs were attributed to a power failure in the preceding week.

28. Similar clinical signs were observed in the flock on LPAI 2006/03, but with a three-fold increase in mortality, on or around 7 April, but no laboratory examinations were conducted and suspect avian notifiable disease was not reported to Defra.

29. Suspect avian notifiable disease was reported on both farms, retrospectively, on 27 April. As a result both farms were visited by a VO on 28 April. There was some evidence of continuing clinical disease (reduced egg production) on LPAI 2006/03, but cannibalism was the only clinical abnormality observed in the poultry at LPAI 2006/02. Twenty blood samples, for serology, were obtained from both flocks together with cloacal swabs and four carcases were obtained from LPAI 2006/03.

30. The M-gene PCR, conducted on 29 April, revealed evidence of AI infection in samples from the four carcases from LPAI 2006/03, but cloacal samples from both farms were negative.

31. Serological testing revealed a prevalence of 75% (15 positives out of 20) in the samples from birds on LPAI 2006/02 and of 45% (9 positives out of 20) in the samples obtained from LPAI 2006/03.

32. Further samples were obtained on 30 April when the culling of these flocks commenced. Ten carcases and 100 blood samples are being collected from each flock. The results of these are awaited.

ESTIMATED DATES OF INFECTION

33. Assuming that clinical signs are associated with infection and the incubation period ranges from 2 – 5 days then the likely dates of infection are between 20 and 23 March for LPAI 2006/02 and between 2 and 5 April for LPAI 2006/03 (see **Figure 3**)

POSSIBLE SOURCES OF INFECTION

34. It is currently uncertain whether LPAI 2006/02 is the index case.

35. Professional ornithologists have not been consulted on the wild bird populations around these two premises, but the veterinary staff have reported that there are more wild birds around these farms than around the first detected affected farm LPAI 2006/01. Further investigations are in hand.

36. There are, as yet, no links identified between the three affected farms except that they are relatively close to each other.

37. No other sources of infection have been identified. Field investigations are in progress.

EVIDENCE OF HUMAN INFECTION

38. There is evidence of a single mild case of human infection, resulting in conjunctivitis, with H7N3 AIV on LPAI 2006/01. As a result a collaborative effort between the National Emergency Epidemiology Group and colleagues in the HPA has been initiated. This is to ensure that epidemiological information of human infection is available to assist in investigating infection in poultry, especially the likely date(s) of the introduction of infection.

Information concerning the circumstances in which this infection was acquired (consistent with the requirements of patient confidentiality) has been made available concerning this case to Defra.

Appendix 2 lists the information that would normally be requested from colleagues in the HPA concerning any future such incidents.

SUMMARY AND DISCUSSION OF THE EPIDEMIOLOGICAL FINDINGS ON THE THREE PREMISES

39. The earliest date of infection, on LPAI 2006/02, is likely to be on 20 March or a few days later. Some 11 days later the birds in the LPAI 2006/03 flock were infected and evidence of active infection was still evident on 29 April. LPAI 2006/01 is most likely to have become infected some 15 days after infection entered LPAI 2006/03.

40. It is impossible to determine whether or not these three flocks were infected by a common source, such as infected wild birds.

41. There is some evidence that the virus may have increased in virulence from the first known affected flock to the third affected flock which was under separate

ownership. This is based on the mortality rates which doubled on the first farm, trebled on the second farm and increased fourfold on the third infected farm. Also the prevalence of serologically positive animals on the second farm was only 45% after a period of 28 days, with evidence of infected and virus excreting (based on the results of the M5 gene PCR) birds at this time. This is in comparison to a prevalence of 100% after 12 days of infection in the third flock. It is unlikely that the prevalence of 45% represents a decline in HI titres as the first flock had a sero-prevalence of 75% some six weeks after the introduction of infection. The different husbandry methods between the LPAI 2006/02 & LPAI 2006/03 farms and LPAI 2006/01 may have resulted in a slower transmission of infection in the free range flocks (LPAI 2006/02 & LPAI 2006/03) which were only housed at night. Further epidemiological analyses of the extensive serology on the three flocks may help to provide a better understanding of the dynamics of infection in each.

42. With respect to background surveillance of possible outbreaks of disease due to AIV, the relatively undramatic presentation of the clinical disease in all three flocks is notable. It seems possible that clinical cases of LPAI infection may have gone unnoticed and AI infection does not seem to have been considered as a prime reason for the clinical signs in LPAI 2006/01. Previously infected flocks could therefore have been missed and may indeed no longer be in existence as their productive life has already ended. There therefore has to be some uncertainty as to whether the true start of the epidemic will be identified.

43. On a more optimistic note, the results of clinical and serological surveillance to date do not provide evidence of infection within the company which owned LPAI 2006/01.

44. There is still a great deal of work involved in the field investigations to be completed to determine the possible source of infection and the reason for transmission between flocks, should this have occurred.

Acknowledgements

We are grateful for the considerable efforts of colleagues working in the Avian Virology Unit, VLA, at the LDCC, Bury St Edmunds and for the MHS which have provided data and information for this report. Any errors in this report are, however, the responsibility of the NEEG.

National Emergency Epidemiology Group
30 April 2006.

Figure 1

LPA1 2006/01 - TimeLine

As at 30/04/06

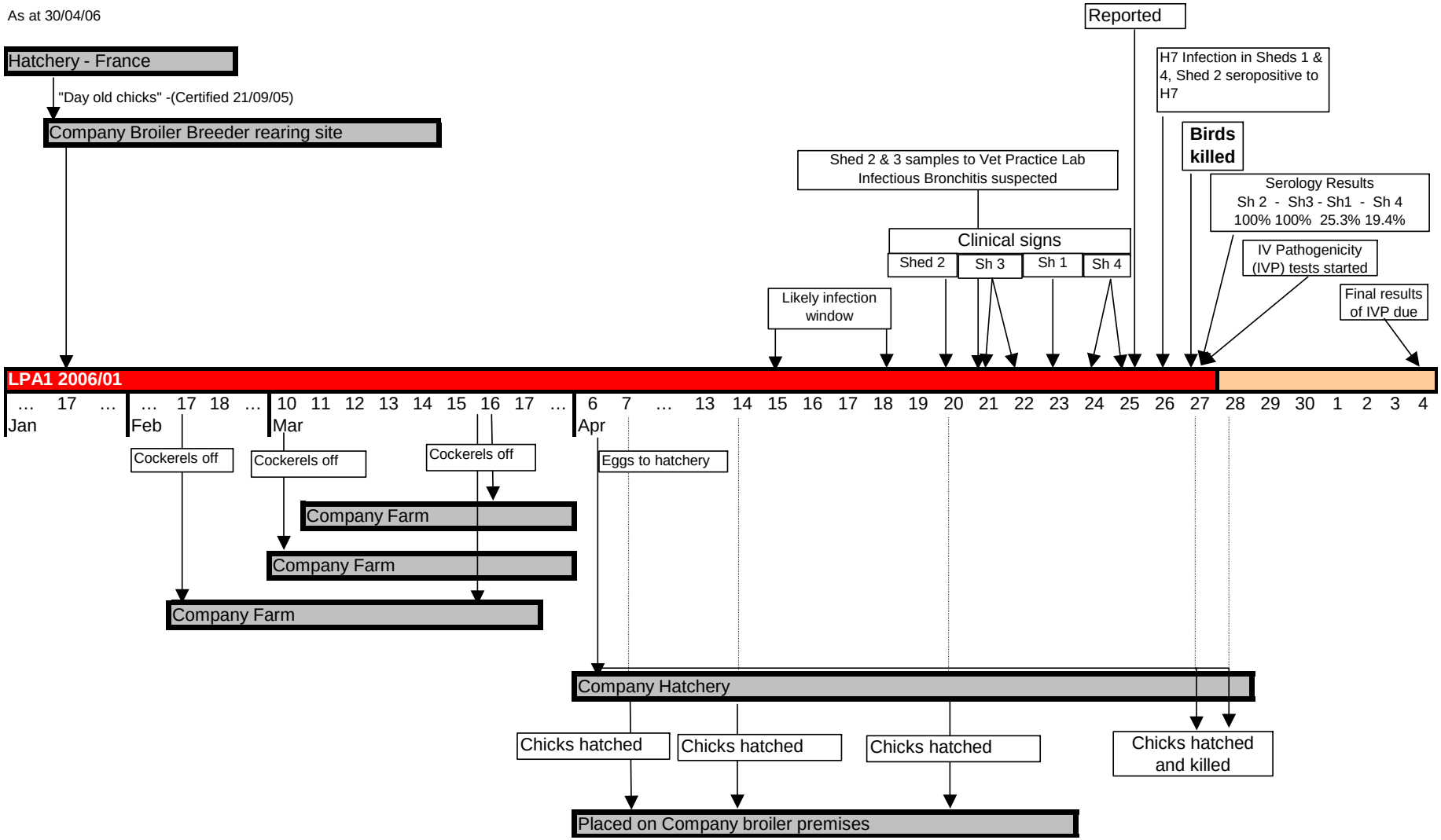


Figure 2. Number of birds by titre by shed

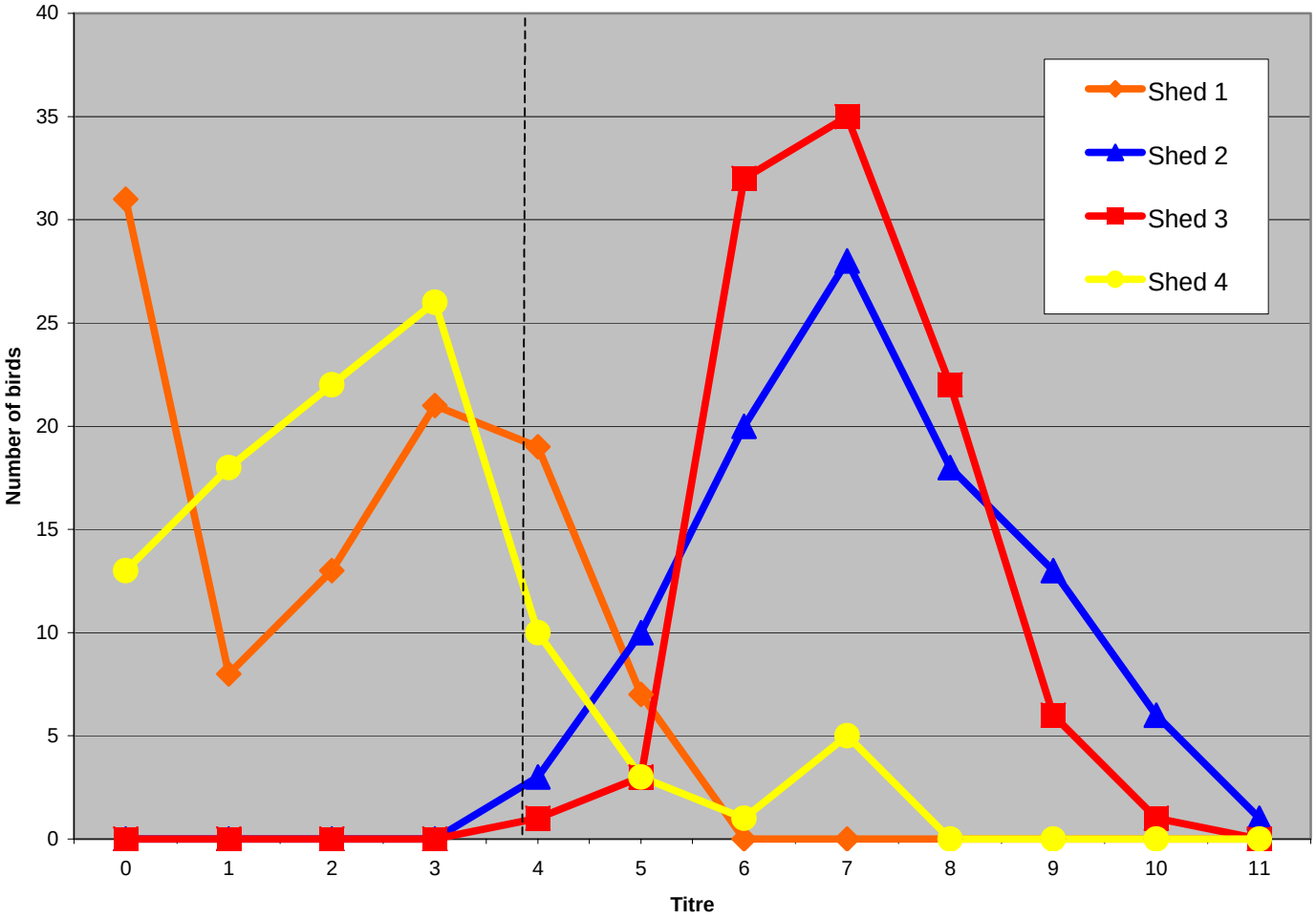
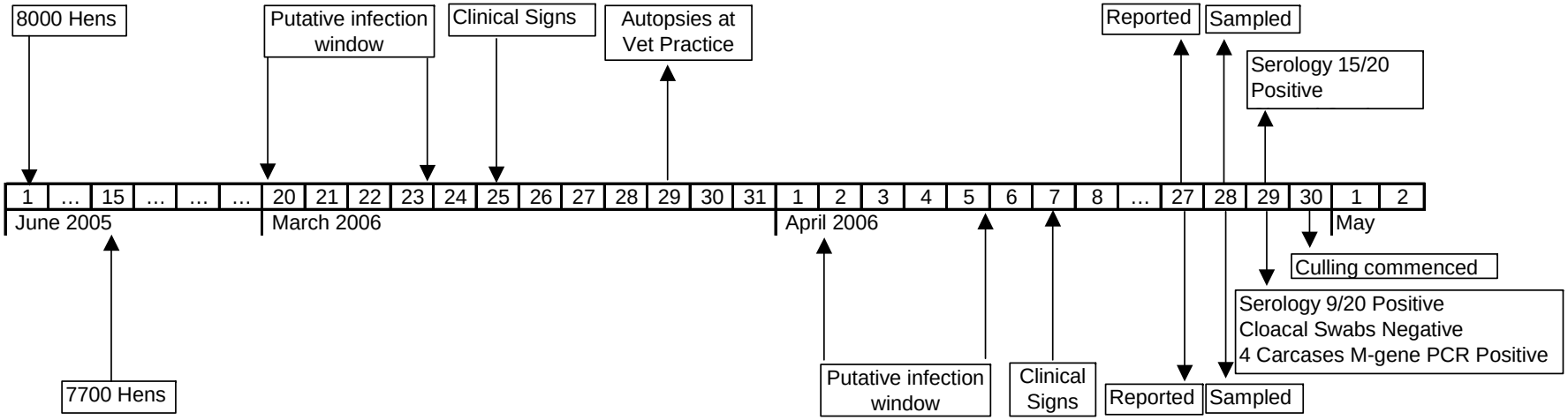


Figure 3

TIMELINES FOR LPA1 2006/02 & LPA1 2006/03

As at 30 April 2006

LPA1 2006/02



LPA1 2006/03

APPENDIX 1

OVERVIEW OF WORK CARRIED OUT IN A WHITE MEAT (POULTRY) SLAUGHTER HOUSE (to aid identification of risk/route of exposure of abattoir workers to pathogens carried by poultry)

1. The following is a descriptive overview of work at abattoir which owns LPAI 2006/01at Attleborough, the vet responsible to the MHS for the provision of Official Inspection at the abattoir.

Summary

2. Live birds arrive at the slaughterhouse in crates on a lorry. Birds are hung on a line, stunned, throats cut, bled, scalded, plucked, eviscerated, trussed and chilled. The birds are caught and hung on the line by hand, however the majority of the rest of the process is automated and carried out by machine. Apart from the initial catching, most human intervention is either as back-up where there is machine failure, or as inspectors.

Operating Hours

3. The abattoir operates for 16-18 hours each week day, operating with two shifts of workers, starting from 5.30am. It does not normally operate at weekends. Recently work has started at 4,30am to catch up time lost through recent Bank Holidays. It also operated on Saturday 29 April, and had completed operations by mid-afternoon. No work is planned for Sunday 30 April or Monday 1 May, and normal working will recommence on Tuesday 2 May

Detail

4. Birds are held in crates in the lairage area; these are moved into position for unloading in the hanging area by fork lift truck. Birds are hung individually and manually on a moving line. There are two daily shifts of workers, with about 6-8 people per shift. In this area other jobs include washing and stacking empty crates and disinfecting delivery lorries; there are supervisors and inspectors visiting the area regularly. At any time up to 15 people may be working there. The people catching the birds and hanging them on the slaughter line have the greatest exposure to the poultry.

5. The birds are then stunned and their throats are cut, both by machine. A worker is in position after the cutting machine to cut any that the machine has missed. Approximately 4 people are on each shift for this job, working for about an hour at a time each.

6. The line carrying the bird carcases then passes over the long bleeding tanks until the birds are fully bled out. Thereafter the carcases pass through a scalding tank to loosen the feathers and then are plucked by automatic machines. About 4-5 people serve as back up to this, to complete plucking on any birds that are not fully plucked by the machine. The birds then pass in front of a manned inspection point.

7. The plucking machines are cleaned regularly by staff.

8. Carcases are then rearranged with feet being cut, and rehung on a different line, where there is a person providing back-up in case of machine error.

9. Carcases are eviscerated by machine, and a person checks this has been done effectively by examining the body cavities. The carcases then pass an inspection point manned by 2-3 inspectors at a time (due to the speed of the line).

10. The guts are separated from the livers and gall-bladders, with 4-5 people involved in ensuring this is effective, followed by further automatic operations such as neck removal.

11. A final quality inspection of the carcases involving 2-3 people plus supervisors is carried out before the carcases go the grading area where they are graded by weight.

12. The final stage is in a separate room where carcases are trussed, placed in trays and put in the chiller; about 30 people work here.

National Emergency Epidemiology Group, Defra
29 April 2006

APPENDIX 2

DETAILS FOR ALL SUSPECT AND CONFIRMED HUMAN CASES REQUESTED FROM COLLEAGUES IN THE HPA

1. An identification number or code
2. Status - suspect or confirmed
3. Strain type if confirmed
4. Date confirmed
5. Range of dates during which infection is believed to have occurred - i.e. earliest and latest estimated dates of infection
6. Date of first clinical signs
7. Date of clinical examination
8. Date of sampling
9. Addresses including post code, for all locations where patient worked with, or has exposure to poultry or other animals, during the exposure period
10. For each location:

a. Dates on which patient worked there during estimated exposure period
b. Detailed description of animal related tasks at location, including (i) type of animal or animal product handled (eg carcases, viscera, feathers etc) (ii) activity eg cutting up products, washing products, cleaning equipment (?pressure hose used?) etc
c. How often the patient changes jobs (people can rotate between different jobs within a slaughterhouse)? If more than one job done during estimated exposure period, please obtain a description as described in 10.b above for each of them
c. List of animal species present at the location

Note: This information is to be provided with due observance of the guidance set out to medical practitioners concerning confidentiality. This will normally require the consent of the person affected. Detailed guidance in respect of confidentiality and the duties of doctors working within the HPA are set out in the General Medical Council's publications 'Good medical practice', 'The duties of a doctor (1995)' and 'Confidentiality: Protecting and Providing Information (April 2004)' available at :

http://www.gmc-uk.org/guidance/good_medical_practice/index.asp
http://www.gmc-uk.org/guidance/library/duties_of_a_doctor.asp
http://www.gmcuk.org/guidance/library/confidentiality.asp

Similar guidance exists for all clinical staff employed by the HPA