PRELIMINARY EPIDEMIOLOGY REPORT: AVIAN INFLUENZA OUTBREAK IN SUFFOLK, NOVEMBER 2007 AS AT 26 NOVEMBER 2007

EXECUTIVE SUMMARY

(I) Following a report of suspected avian notifiable disease in turkeys in Suffolk on 11 November 2007, highly pathogenic (HP) H5N1 avian influenza (AI) infection was confirmed on 12 November.

(ii) The infected premises (IP) comprised 5,000 growing turkeys, kept in 5 groups of 1,000, 1,118 ducks and 410 geese maintained under a free range system. Samples collected at slaughter for laboratory examination revealed that two groups of turkeys had a significant prevalence of infection (>50%), a further group had a maximum prevalence of 5%. No evidence of infection was found in the geese, but infection was detected in the ducks for which the maximum prevalence was 2%. The findings suggest that there had been an initial focal introduction of virus into one of the groups of turkeys, rather than a widespread exposure of all poultry on the site.

(iii) Epidemiological investigations of the IP resulted in the identification of five dangerous contact (DC) premises as a result of them being tended by the same stockmen who employed poor biosecurity measures. Only turkeys were kept on four of these DC premises, ducks, geese and turkeys were kept on the other DC premises. Samples were taken for laboratory examination from the birds culled at the DC premises. Infection was detected in one group of turkeys on one of these premises, which became designated as IP2. The maximum prevalence of infection in this group was 10%. This was consistent with infection having been transmitted from IP1.

(iv) Genetic analyses of the virus isolates from the turkeys on the two IPs and the ducks on IP1 indicated that the birds were infected from a single source. The current isolate has the closest genetic identity to an isolate from wild birds in the Czech Republic detected in mid-2007. The current isolate is phylogenetically distinct from the previous isolate of H5N1 in 2007 obtained from the Holton outbreak.

(v) The poultry on the premises which supplied the birds to IP1 and IP2 were sampled and tested with negative results. All of the birds were hatched in Great Britain.

(vi) The surveillance of poultry in the PZ and SZ has not revealed any further infected flocks indicating that infection has been confined to the two IPs.

(vii) The results of the epidemiological investigations to date provide no evidence that infection was introduced via imported poultry or poultry products or any activities associated with such importations.

(viii) IP1 was located in an area where wild birds were relatively common and was notably near to an ornamental lake which supports some 1000 waterfowl. H5N1 infection has not been detected in wild birds nor have any incidents of high mortality been observed in the area. An enhanced surveillance programme has been initiated. At the present time wild birds, most likely migratory species from central Europe, cannot be ruled out as the source of infection. Epidemiological investigations are continuing and the results will be provided in further reports

(ix). Two important and epidemiologically significant findings are evident from the investigations to date. These are:

- The poor biosecurity measures employed by the stockmen, which in this case were peripatetic and therefore cared for more than one unit of poultry which resulted in the transmission of infection in the area

- The siting of a free range poultry unit (IP1), which is likely to attract wild birds because of feed availability, in an area already unavoidably occupied by populations of wild bird species, notably migratory waterfowl, but also “bridge” species (such as gulls) which are capable of becoming infected by HP H5N1 and transmitting the virus from primarily infected wild birds to commercial poultry.

INTRODUCTION

1. This report describes the preliminary results of the epidemiological findings of the occurrence of highly pathogenic (HP) H5N1 avian influenza (AI) infection in free-range managed turkeys on a premises in the north of the county of Suffolk. The affected premises are part of a relatively complex business producing turkeys, ducks and geese by a range of production methods. These range from housed birds in environmentally controlled buildings to free-range birds reared organically. The epidemiological investigations are consequently complex and therefore will take some time to complete. The following preliminary report has the objective of providing our initial findings, but as indicated below any conclusions require the completion of the numerous epidemiological investigations.

THE FIRST INFECTED PREMISES (IP1)

2. Suspicion of an avian notifiable disease on this premises was reported to the local Animal Health Divisional Office, Bury St Edmunds on the afternoon of Sunday 11 November as a result of an increased mortality in the turkeys on a mixed species premises, comprising free-range, organically reared turkeys, geese and ducks, in the county of Suffolk near to the border with Norfolk (see Figure 1).

3. On 9 November, 5 turkeys had died in “hut 5” (of 5) comprising approximately 1,000 turkeys, the number of deaths previously had been a maximum 5 per week. On the morning of 10 November 23 dead birds were found. On the following morning (11 November) 63 birds were found dead.

4. As a result samples were taken from the turkeys in Hut 5 for laboratory examination at the European Union Community Reference Laboratory at the Veterinary Laboratories Agency (VLA), Weybridge, in the early evening of 11 November. These samples comprised 6 turkey carcases and 20 sets of blood samples, for serological examination, and oro-pharyngeal and cloacal swabs for virological examination

5. On the following day, 12 November, the preliminary results of the laboratory examinations revealed that a H5 virus was present in the samples submitted from the turkeys. This resulted in the establishment of a 3km radius Protection Zone and a 10km radius Surveillance Zone, together with a Restricted Zone as advised by the Ornithological Expert Panel. Then, on 13 November, the laboratory results confirmed that the turkeys were infected with highly pathogenic (HP) H5N1 AI virus.

6. In addition during the course of 13 November further molecular genetic analyses revealed that the virus isolated had a 99.8% identity to the isolates from wild birds in June and July 2007 in the Czech Republic. With respect to the isolates of HP H5N1 from incidents of infection in France and Germany in July and August 2007 there was a 99.3% identity with the current Suffolk isolate.

7. Culling commenced on this infected premises (IP) on 13 November. This progressed starting with the culling of the turkeys in Hut 5 followed by the 4,000 other turkeys in the other four huts, the 410 geese and the 1,118 ducks. Culling was completed on the afternoon of 15 November. In the course of the culling an increased mortality rate was observed in turkeys in Hut 4, 20 deaths were observed on 13 November. No evidence of clinical disease was observed in the turkeys in Huts 1, 2 and 3 or in the ducks and geese. The disposition of the birds on the site is shown in Figure 2

8. During culling a representative sample of birds from each of the 7 groups of birds was subject to sampling for laboratory testing. Blood samples and oro-pharyngeal and cloacal swabs were taken from 60 turkeys in each of the 1,000 strong groups. The same set of samples were taken from 152 geese and 151 ducks.

9. The serological tests, using the haemaglutination inhibition test, were negative in all groups.

10. The results of virological testing, using the real time PCR, are summarised in Table 1.

Epidemiological Group	Date sampled	RT-PCR result (No. +/ No. tested)	Prevalence (Upper 95% confidence limit)
Turkeys Hut 1	15 November	1/60	4.9
Turkeys Hut 2	14 November	0/60	-
Turkeys Hut 3	14 November	0/60	-
Turkeys Hut 4	15 November	25/60	53.8
Turkeys Hut 5	15 November	55/60	98.5
Ducks	15 November	1/151	1.9
Geese	15 November	0/152	-

Table 1: Results of virological examinations of the groups of poultry on IP1

11. These virological and serological results suggest that the virus was first introduced into the turkeys in Hut 5 and that the infection was detected in the early stages. Given the increased mortality rate on 9 November and assuming an incubation period of 3 – 21 days the virus was introduced during the period 16 October 2007 to 6 November 2007.

10. As is indicated in Figure 2, the poultry on IP1 were maintained on one field located approximately 40m from a large ornamental lake. Housing for each of the five groups of turkeys was provided by a polytunnel (“Hut”) with plywood sides. These were neither rodent nor bird proof. Feed was provided from a large central wooden bin and in suspended feeders. These feeders were replenished daily by the farm staff from buckets. The turkeys were bedded on straw and mains water was piped to the drinkers.

12. Each group of turkeys had access to a grass paddock, these paddocks were separated by temporary mesh fences. The turkeys in hut 3 had access up to the geese enclosure fencing which was some 300m from the turkeys.

13. The ducks had no direct access to the turkeys on site. The shared goose/duck shed is similar in construction to the turkey huts. Within the shed there is an open topped feed hopper and mains water is piped into open troughs within the shed.

14. Housing for the geese was provided by part of the duck shed which had been partitioned to keep the ducks and geese separated. The geese had access to enclosures in which there was a pond. They also had access to an outdoor covered hopper-style feeder.

15. All of the birds were hatched in Great Britain. Table 2 indicates the dates that the birds arrived on the IP and their ages. The premises had not been stocked since the Easter 2007 turkey production.

Species (Number of birds)	Date moved to the IP	Age when moved to the IP
Turkey (3990)	3 September 2007	18 weeks
Turkey (1008 – Hut 4)	7 September 2007	16 weeks
Geese	13. August 2007	4 weeks
Ducks	24 October 2007	4 weeks

Table 2: Dates of arrival of the poultry on IP1 and the ages

16. Questioning of the stockmen indicated that they had no set routine as to whether they attended to the turkeys or the ducks/geese first. They did have a routine for tending the turkey huts which was in the order: hut 1, hut 2, hut 3, hut 4, and hut 5.

RESULTS OF STANDARD EPIDEMIOLOGICAL INVESTIGATIONS OF IP1 TO DATE

Source of Infection Tracings

17. The usual tracings of potential sources of infection were enacted following the identification of infection at the premises. The following is a summary of the results of these investigations to date.

18. No evidence has been found to suggest that infection was introduced by the delivery of bulk turkey feed or the delivery of straw.

19. The turkeys and geese were obtained from a brooder farm within the parent company's network of farms. This premises was also the storage site for bagged feedstuffs which were used for the ducks and geese on IP1. It was within the Surveillance Zone and on investigation only 3,000 turkeys were

currently on the premises. There were three epidemiological groups on the premises each comprising some 1,000 turkeys. Even though these turkeys, if infected, were likely to have shown clinical signs they were sampled as a precautionary measure.

20. The sampling regime was to obtain blood samples, oro-pharyngeal and cloacal samples for laboratory examination from 60 turkeys from each of the three epidemiological groups. No evidence of infection was detected on these premises.

21. The ducks were also obtained from one of the company's farms situated just outside the 3km Protection Zone. This premises comprised some 47,000 ducks, 4,000 geese and 11,000 turkeys, all housed in environmentally controlled buildings.

22. The turkeys were examined clinically and found to be normal with no evidence of infection.

23. A random sample of the ducks and geese were selected for sampling for laboratory examination sufficient to detect a 2% prevalence of infection in each epidemiological group. As a result, a total of 540 ducks were sampled and 150 geese were sampled. The samples taken, for serological and virological examination, were as recorded above. No evidence of infection was found. However, during the course of our investigations this premises was also identified as an infection "spread" tracing (see below).

"Spread" Tracings from the IP to identify premises likely to have become infected

24. The initial investigations revealed that the stockmen for the poultry on IP1 were also responsible for the feeding and general management of a further four flocks of turkeys. One premises was within the PZ and three premises were in the SZ.

25. Our investigations revealed evidence, from the information supplied to our field epidemiologists, of poor biosecurity measures applied by these stockmen in terms of the disinfection procedures and other disease control measures employed by these staff. Simple measures to prevent the transmission of infection between premises were not followed. Such measures include changing clothing between premises, disinfection of Wellington boots, the disinfection between premises of buckets for the distribution of feed, and the carriage and handling of dead birds.

26. As a result of these investigations four further premises were identified as Dangerous Contacts (DC). That is that these premises were highly likely to have been exposed to infection with the HP H5N1 virus.

27. It was revealed, after the initial collection of information on tracings, that they had also had contact with the birds on the company's premises which

supplied the ducks on IP1. This premises was therefore designated a DC premises (DC5 – see below).

INVESTIGATIONS OF THE DANGEROUS CONTACT PREMISES

28. The location of the five DCs is shown in Figure 1.

DC1

29. This premises contained a free range organic turkey grower unit containing 4,000 birds. The birds were hatched in Great Britain and the growing poults were derived from the same brooder farm as for IP1.

30. On arrival at the premises the veterinary staff of Animal Health found 30 dead turkeys. As this appeared to be an unusually large number of deaths the designation of the premises was changed to Slaughter on Suspicion (SOS) of disease and 6 carcases were submitted for virological examination.

31. The culling of these birds was completed in the afternoon of 15 November. A sample of 60 birds was selected from each of the four 1,000 strong groups of turkeys for sampling for virological and serologicical testing as indicated above.

32. No virus was detected in the tissues from the six carcases. All 240 serum samples were negative and virus was not detected in any of the 480 swab samples.

33. On investigation, the increased mortality was associated with very cold weather.

34. Preliminary cleansing and disinfection was completed on 18 November.

DC2 (IP2)

35. This premises comprised a free range organic turkey grower unit comprising 9,000 turkeys. All had been hatched in Great Britain and the birds were derived from the same brooder farm as IP1 and DC1/SOS1. They were kept in 9 groups of equal size and the management and housing was identical to that used on IP1.

36 Samples from 60 birds from each of the nine groups were taken during and before the culling process on 15 and 16 November. The same set of samples as described previously was taken from each of the birds for serological and virological examination.

37. All samples from houses 1, 2, 3, 4, 5, 6, 8 and 9 were serologically and virologically negative. HP H5N1 virus was detected in 3 of the 60 oro-pharyngeal swabs taken birds in house 7 giving a 95% confidence for the

upper level of the prevalence of 10.4%. Full genome sequencing of the virus detected revealed a 100% identity to the viruses isolated from the turkeys and the duck on IP1. All other samples from the birds in this house were serologically and virologically negative. There was no evidence of clinical disease in this house or the other houses.

38. Questioning of the stockmen revealed that they always attended the houses in the following order: 1, 2, 3, 4, 5, 8, 6, 7, 9.

39. Preliminary cleansing and disinfection on this premises was completed on the morning of 19 November.

40. No further sampling or culling was required as a result of conducting the tracings investigation of this premises.

DC 3 and DC4

41. These two premises contained 3,000 and 6,000 turkeys, respectively. The group size was also 1,000 per epidemiological group.

42. The sampling regime was identical to that on IP2, with 60 birds sampled for serological and virological examination from each epidemiological group during the culling of the turkeys. On DC 3 the samples were taken on 16 November and those on DC 4 on 17 November. This resulted in a total of 540 birds being sampled and 1080 swabs and 540 blood samples being subject to laboratory examination.

43. All samples were negative on serological and virological examination.

44. Preliminary cleansing and disinfection was completed on both premises on 19 November.

DC5

45. As indicated above this premises was also identified as a potential "source" tracing. The premises comprises some 11,000 growing turkeys, approximately 4,000 growing geese and some 47,000 growing ducks. All species are maintained in environmentally controlled houses.

46. During the culling of the birds on the premises, which started on 22 November, 60 birds from each epidemiological group were sampled for serological (blood samples) and virological examination (oro-phyrngeal and cloacal swabs. No evidence of HP H5N1 infection was found in the turkeys, ducks and geese.

OUTBREAK SPECIFIC INVESTIGATIONS

The Parent Company

47. The parent company's main enterprise is the production of ducks for the table, but also has components producing turkeys and geese for seasonal consumption. Infection appears to have been confined to one relatively small "cell" of the company's production units which produce organic/ free range turkeys, geese and ducks. It has, however, been necessary to conduct epidemiological investigations of the company as a whole to assess all of the potential sources of infection for IP1.

48. The **duck production** component of the company's business comprises:

- Pedigree elite grandparent and parent units resulting in the production of ducklings at
- Two company owned hatcheries in East Anglia and a contract hatchery which supply day old ducklings to
- Seven breeding farms, one rearing unit and 76 commercial growing farms, 57 of which are contracted growing units
- Day old ducklings are imported weekly from a hatchery in The Netherlands to some of the 76 growing production farms. There was no epidemiological association with these imports and the current outbreak
- Day old ducklings are also imported from France into the multiplier and rearing units to enhance the genetic make-up of the originating stock. There was no epidemiological association with these imports and the current outbreak.
- Two slaughterhouses, in East Anglia, one of which is situated some 4km from IP1, but for which we have not found any epidemiological association to account for the source, as indicated below.

49. The seasonal, Easter and Christmas, **turkey production** component of the company comprises 18 grower units and one brooder/rearer unit. The latter is supplied with day old turkey poults from a hatchery in south-east England and a hatchery in Northern Ireland. Eight of the grower units and the brooder/rearer unit have been sampled as a result of our investigations, with negative results.

50. Day old goslings are placed from May to mid-August for seasonal **goose production**. Some 36% of the goslings are imported from Germany (9%) and Denmark (27%). There are 13 commercial goose farms. The majority of the geese are housed for 3 weeks and are then managed on grass paddocks. There are six houses in which the geese are housed from day old until the end of the growing period.

51. All epidemiological groups of geese have been sampled for serological and virological examination for HP H5N1 with negative results.

52. The company also has two slaughterhouse sites with associated cutting plants. One slaughterhouse, for the company's own ducks and the seasonally produced geese, is located in south-east Suffolk some 30km from IP1.

53. The other slaughterhouses are situated within the same complex of holdings as DC5. Ducks are routinely slaughtered together with the seasonal geese. The turkeys are slaughtered in a small slaughterhouse for the Christmas season. This was not in operation as it only operates for a few weeks before Christmas.

54. The initial investigations of the main slaughterhouse revealed a high level of biosecurity with respect to movements of staff between clean and dirty areas and the use of protective clothing. Lorries leaving the site have to pass through an automatic washing and disinfectant system. There is a separate entrance for lorries delivering birds for slaughter. This has a manually operated wheel wash and disinfection point. At the time of the visit the washing of crates and modules for transporting birds and of lorries was effective.

55. Animal by-products produced by the slaughter process and cutting plant were handled safely. They are transported through pipes from the slaughter hall and cutting plant directly into large skips contained in a purpose-built building.

56. The cutting plant is used for the further processing of carcases slaughtered on site. In addition imported vacuum packaged meats are also handled in the plant. These products are re-marketed without removing the original packaging. There have been four suppliers of specialist poultry products, two in France and two in The Netherlands, since 11 September 2007. These include guinea fowl legs from France which are portioned into thighs and drumsticks with no waste being produced. A small number of guinea fowl, from France, are butchered which produces Category 3 waste which is disposed of via the system described above. A proportion of the whole ducks imported from The Netherlands are cut into fillet and leg portions which produces Category 3 waste which is disposed of in the same system.

Surveillance of Domestic Poultry

Within the Protection Zones

57. As required by the EU Directive 2005/94/EC a census was conducted of all poultry holdings in the PZ. The surveillance included the visiting of all premises on which birds were kept to conduct a clinical examination and an inspection of the production records. In addition geese, ducks and other waterfowl were sampled for laboratory examination. The sampling regime

was to sample a sufficient number of birds in each epidemiological group on each premises to detect a 5% prevalence with 95% confidence. A blood sample together with oro-phyryngeal and cloacal swabs were taken from each bird selected for serological and virological examination. All samples taken were negative for HP H5N1.

Within the Surveillance Zones

58. All commercial premises within the SZ, containing more than 50 poultry, were identified. All premises containing geese, ducks and other waterfowl were visited to inspect the birds and examine production records.

59. Sampling of domestic geese, ducks and other waterfowl was conducted on all premises except those where it was assessed that chickens and/or turkeys would have acted as sentinels for HP H5N1 infection because of their close contact with the waterfowl. The sampling regime was designed to detect a 5% prevalence of infection with a 95% confidence. An oro-pharyngeal and cloacal swab was taken from each bird for virological examination. All samples were negative for HP H5N1 infection.

60. An exception to this sampling strategy was applied to the unit comprising some 30,000 outdoor geese owned by the parent company. For this group of geese the strategy was to detect a 2% prevalence with a 95% confidence in each epidemiological group within the unit as a whole. No evidence of infection in these geese was found. This more rigorous sampling was applied as a result of the initial assessment by the OEP (see below) which indicated that a proportion of the wild bird populations on IP1 were likely to visit the outdoor goose unit which was just over 3km away.

Surveillance of Wild Birds

Background Surveillance

61. Since late October 2006 there has been a targeted surveillance programme for the detection of avian influenza including H5N1 in wild birds in GB. This has a number of components and is targeted to those species of birds considered to be at most risk of harbouring the H5N1 strain of the virus as determined by the European Food Safety Authority (EFSA):

(i) Requesting the public to notify dead birds belonging to the species of interest in the areas of GB which have been identified as most at risk in terms of the abundance of species of interest and the density of outdoor reared domestic poultry.

(ii) Identifying bird reserves which support the greatest populations of the species of interest and requesting the wardens at these sites to conduct weekly patrols to identify dead birds for laboratory examination. Some 400 sites in Great Britain, under the management of 33 organisations, are involved in this surveillance.

(iii) The sampling of live birds at wetland sites with the necessary catching and sampling facilities. Dead birds found at these sites are also submitted for laboratory examination

(iv) The submission of samples from birds shot at 17 locations in Great Britain in the normal course of wildfowl shooting.

62. H5N1 has not been isolated in wild birds during the course of this surveillance programme to date.

63. The distribution of the number of dead wild birds (collected under (i) to (iii) above) which were examined virologically for HP H5N1 during 2007, up to 20 November, by county and month found is provided in Appendix 1. A total of 2,682 carcases have been examined so far in 2007.

64. The distribution of the number of shot birds sampled in 2007 by county and month sampled is shown in Table 3

	Month						
County	**1**	**2**	**3**	**9**	**10**	**11**	**Total**
England							
Cheshire						2	2
Devonshire			7		27	11	45
East Riding & Northern Lincolnshire					16	1	17
Essex					4		4
Lincolnshire excl North					2		2
Norfolk	3	10		7	11	8	39
Northumberland	5			9	43	20	77
Suffolk		4					4
West Sussex				2	2	2	6
Wales							
North-East Wales	7	2		10	11	5	35
North-West Wales				5	10		15
Scotland							
East Central					16	13	29
Fife				6	5	12	23
Highland				2	34	11	47
Lothian	1	15			23	17	56
North-East Scotland	18	15					33
Scottish Borders	6	2			6		14
Tayside				4	6		10
Unknown	4	16			5		25
Grand Total	44	64	7	45	221	102	483

Table 3: Distribution of the shot wild birds during 2007 by county and month sampled

65. The distribution of the dead wild birds sampled in Norfolk and Suffolk during 2007 by species is shown in Table 4.

Bird type/species	Norfolk	Suffolk	Total
Bantam Chicken		2	2
Bewick Swan	1		1
Blackbird		2	2
Black-headed Gull	14	16	30
Brent Goose	6		6
Canada Goose	9	3	12
Chaffinch	1		1
Common Gull		1	1
Common Moorhen	1	2	3
Coot			0
Cormorant	1		1
Domestic Duck		3	3
Domestic Goose		1	1
Dunnock		1	1
Egyptian Goose	1		1
Eurasian Wigeon	1		1
Feral Pigeon		1	1
Fulmar	1		1
Gadwall	1		1
Gannet	3		3
Goldcrest		1	1
Goldfinch	1		1
Great Black-backed Gull		1	1
Greenfinch	1	1	2
Grey Heron	1		1
Greylag Goose	7	7	14
Guillemot	94		94
Herring Gull		7	7
House Sparrow		1	1
Little Auk		2	2
Mallard Duck	36	25	61
Muscovy Duck	1	1	2
Mute Swan	24	22	46
Northern Shoveler		1	1
Pheasant		2	2
Pink Footed Goose	3	1	4
Puffin	2	1	3
Razorbill	6		6
Redshank		1	1
Shelduck		3	3
Snipe	1		1
Song Thrush		2	2
Starling		1	1
Teal	1		1
Unlisted Dove species		3	3
Unlisted Gull species		1	1
Unlisted Swan species	1		1

Table 4: Number and species of wild birds found dead, in Norfolk and Suffolk, in 2007

65. The distribution of the live birds by species which were sampled during 2007 up to 20 November is shown in Table 5.

Species	Number
Aylesbury Duck	1
Barnacle Goose	76
Bewick Swan	18
Black-headed Gull	8
Canada Goose	39
Common Moorhen	3
Coot	64
Domestic Duck	2
Eurasian Wigeon	8
Gadwall	11
Grey Heron	2
Greylag Goose	49
Mallard Duck	691
Mute Swan	284
Northern Shoveler	2
Pink Footed Goose	1
Pintail	161
Pochard Duck	110
Shelduck Duck	336
Teal	157
Tufted Duck	11
Unlisted Duck species	1
Unlisted Goose species	1
Whooper Swan	333
Total	2369

Table 5: Distribution of live birds sampled during 2007 by species

66. As a result of the occurrence of HP H5N1 infection in domestic poultry the number of visits to find dead birds at the reserves identified to target the national surveillance (see (ii) above) has been increased from weekly to twice weekly. In addition specific surveillance to detect dead wild birds and collect droppings from identified species, for virological examination, in the locality of IP1 has been initiated (see below).

Specific Ornithological Investigations

67. A teleconference comprising senior members of the National Emergency Epidemiology Group (NEEG) and its Ornithological Expert Panel (OEP) was

held on 12 November. This was held while one of the locally based (at the British Trust for Ornithology) expert ornithologists was conducting an initial Expert Ornithological Field Assessment (EOFA). As indicated above an initial objective was to provide advice on the extent of the EU required Restricted Zone (RZ). Local knowledge and observations from the initial EOFA provided a basis for this advice and this Zone was established as indicated above. This was based on the likely movements of gulls and corvids from the area around IP1. (A second specific EOFA on 13 November was conducted to determine the direction and distance of roosts from the area around the IP. The conclusion from this field assessment was that there was no evidence of gulls moving from the PZ and SZ to roosts beyond the RZ.)

68. For the EOFA on 12 November it was not possible to gain access to IP1 because of the health and safety aspects. Observations of the IP were therefore limited. Two corvids were noted in the area occupied by the ducks and geese and a pheasant was observed in the turkey enclosures. At least 400 corvids were seen pre-roosting in the trees around IP1.

69. Counts were made of the various species on the large lake adjacent to IP1. Table 6 provides the details of these observations which were estimated to cover 75% of the lake.

Species	Number
Mute swan	54
Canada Goose	240
Greylag Goose	24
Wigeon	111
Shoveler	3
Gadwall	8
Tufted Duck	8
Coot	34
Moorhen	12
Cormorant	9
Black-headed Gull	150
Lesser Black-backed Gull	4
Grey Heron	1

Table 6: Counts of the various species of wild birds on the lake adjacent to IP1 on 12 November

70. In addition 7 Egyptian Geese were seen in the fields around the lake. There were known flocks of 3,000 Golden Plovers and 600 Lapwing in the area and these were seen spread around the fields in the area.

71. Wood pigeons were common throughout the area and there was a flock of 6 Moorhen and 22 Mallard on the village pond a few kilometres from IP1.

72. Further observations centred on the large free range flock of geese in the same complex as DC5 referred to above. Some 600 corvids and 2,500

Starlings were observed among the geese together with at least 5 Lesser Black-backed Gulls, 40 Black-headed gulls and one Lapwing.

73. In summary from these observations there were normal species and numbers that would be expected for this landscape and at this time of year.

74. Further visits were made to IP1 and the area around the adjacent lake. The objectives of these visits were as follows:

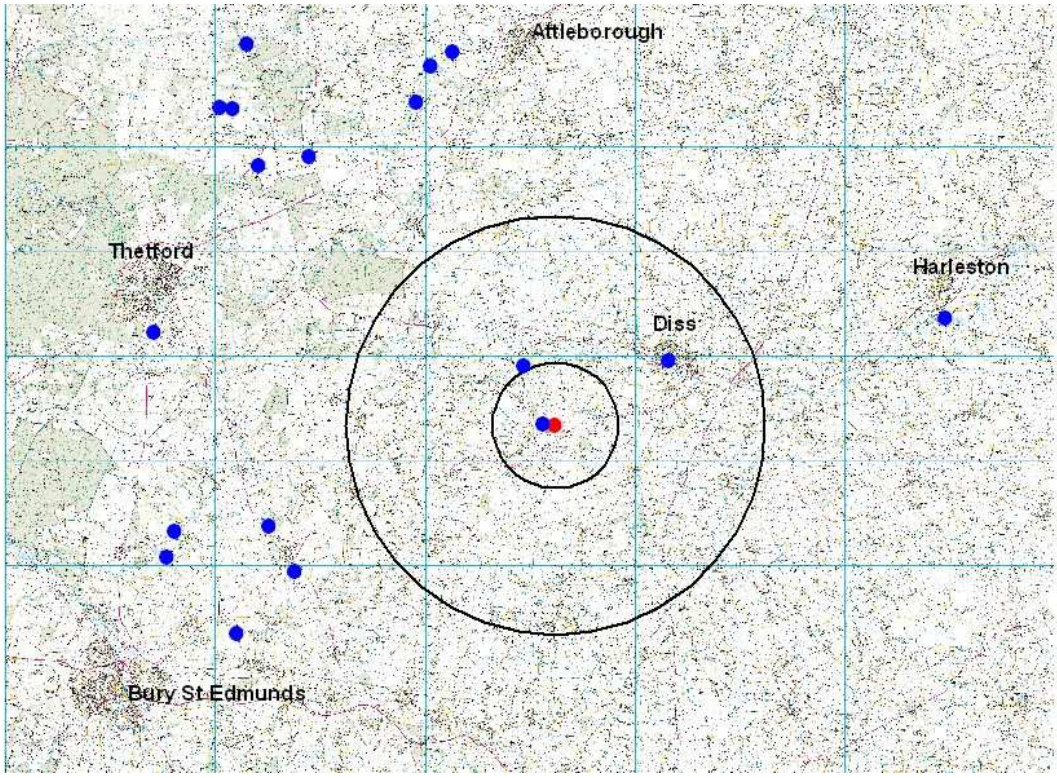
- to obtain droppings from known species on IP1 and the lakeside for virological examination
- observe the wild birds in the area for any clinical signs of disease and collect any carcases of wild birds for virological examination
- conduct counts of wild birds on the lake and surrounding fields, and on IP1

75. The results of the virological examination of faeces samples from wild birds on IP1 collected at the time of writing are summarised in Table 7. No evidence of HP H5N1 infection was found in these initial samples. No signs of clinical disease were observed in the wild birds in the area.

Species	Sample collection date	Sample type	Number of Samples
Canada Goose	14 November	Faeces	36
Greylag Goose	15 November	Faeces	38
Canada Goose	15 November	Faeces	10
Eurasian Widgeon	15 November	Faeces	3
Unspecified gull *spp*	15 November	Faeces	4
Mute Swan	15 November	Faeces	6
Unspecified Swan *spp*	15 November	Feather	1
Unspecified Goose *spp*	15 November	Feather	1
Unspecified bird *spp*	15 November	Feather	2
Mute Swans	16 November	Faeces	9
Unspecified Goose *spp*	16 November	Faeces	95
Unspecified Duck *spp*	16 November	Faeces	3

Table 7: Number of samples from wild birds obtained from IP1, by date sampling, type of sampling and species

76. On 15 November expert ornithologists from the British Trust for Ornithology visited 18 water bodies in south Norfolk and north Suffolk within a 24 km radius of IP1 (Figure 3). The objective of these visits were to look for dead or sick birds that could have potentially contracted the H5N1 virus. The were was no evidence of widespread disease or multiple deaths at the locations. No carcases were found which were suitable for laboratory testing.



Key: red dot = IP1, blue dots = sites visited, circles are the 3km Protection Zone and the 10km Surveillance Zone

Figure 3: Location of waterbodies visited on 15 November to look for dead or sick birds

77. The counts of the wild birds on the lake adjacent to IP1 and the surrounding fields made on 15 and 23 November are summarised in Table 8. The conclusion from these observations is that there were no significant changes in the bird populations between these two visits. Three pheasants were observed on the IP, one in the duck/goose pen and two in the area previously occupied by the turkeys in hut 5.

Species	15 November	23 November
Mute Swan	54	65
Greylag Goose	378	400
Canada Goose	96	95
Egyptian Goose	6	18
Wigeon	99	81
Gadwall	144	166
Teal	5	4
Mallard	67	90
Shoveler	9	7
Pochard	5	14
Tufted Duck	8	16
Heron	1	0
Moorhen	38	42
Coot	118	123
Golden Plover	1200	1500
Lapwing	450	80
Snipe	11	1
Lesser Black-backed Gull	656	50
Black-headed Gull	1	2

Table 8: Counts of waterfowl at the lake adjacent to IP1 and surrounding fields on 15 and 23 November

78. Following the confirmation of infection on IP2 an EOFA was conducted on and around these premises. The conclusions from this assessment was that the area that these turkeys were maintained in presented a low risk of infection from or to wild birds. There was clearly a marked difference in this risk compared with that for IP1. Some concern was expressed as a result of the presence of pheasants around the turkey enclosures on IP2.

79. The OEP have also advised on bird scaring activities on IP1, a ban on shooting and the prioritisation of active surveillance of domestic poultry flocks in the SZs (which have been included in the SZ sampling strategy described above).

80. A plan has been produced for the surveillance of wild birds for HP H5N1 infection on and around IP1 and in the general locality. This includes the further observation of wild birds for any evidence of clinical signs of disease, the collection of droppings from identified species and any dead birds found.

81. Further epidemiological reports of the outbreak will include an assessment of the wild bird population in the area around IP1 relative to other areas supporting more dense populations of susceptible wild bird species. Updated findings of national and local wild bird surveillance for the detection of HP H5N1 infection will also be provided in these reports.

DISCUSSION OF EPIDEMIOLOGICAL FINDINGS TO DATE

82. At the time of writing this outbreak is confined to the index case which is also the first case of infection and a secondary case as a result of fomite transmission by the stockmen. The first case was identified sufficiently early such that infection had not become widespread on the premises.

The results of the genetic analyses to date on the HA1 portion of the haemaglutinin gene of the virus indicates that the infected poultry on the two IPs were infected from a single source.

83. The potential hypotheses for the introduction of HP H5N1 virus into the commercial poultry unit are two fold:

- Introduction via poultry or poultry products infected with HP H5N1 virus, and/or via associated vehicles and personnel, from countries which have undisclosed infection in their domestic turkey, geese and duck population

- Introduction via wild birds infected with HP H5N1 virus

84. There is no evidence for the introduction of infection as a result of the importation of day old turkeys (from Northern Ireland), day old goslings (from Germany and Denmark) and day old ducklings from France and The Netherlands. The infection of turkeys on IP1 was not associated with any of these imports. This represents an unlikely means of transmission.

85. A number of poultry products are imported into the company's slaughterhouse. These present a negligible risk as the animal by-products disposal system in place is sufficiently secure and there is no identifiable means of transmission of infection from the slaughterhouse and cutting plant to IP1.

86. The molecular genetic analysis of the isolate from the outbreak indicate that there is a very close identity (98.8%) with the isolate obtained from a Mute Swan in mid-2007 in the Czech Republic in June and July. There are nucleotide similarities between the current Suffolk isolate and isolates from Kuwait which range between 99.4 – 99.6% and isolates from Germany which range from 99.2 – 99.4% all of which were identified in mid-2007. The current isolate is phylogenetically distinct from the previous isolate of H5N1 in 2007 obtained from the Holton outbreak.

87. As there are no epidemiological links with domestic poultry in central Europe, the molecular genetic results suggest that wild birds may have introduced the virus into Suffolk from Europe.

88. To date we have no evidence of HPAI H5N1 infection in the local wild bird population, or in Great Britain as a whole. The continued surveillance may

help clarify the infection status of the wild bird population, but we have no evidence of high levels mortality in the local wild bird populations which would suggest a high prevalence of H5N1 infection in these populations.

89. The location of IP1 with respect to wild bird species potentially susceptible to infection with H5N1 is a significant finding. Infected wild birds as source of infection cannot therefore be ruled out, but we have no evidence of widespread infection or of a high prevalence of H5N1 infection of the wild bird population.

90. Two important and epidemiologically significant findings are evident from the investigations to date. These are:

- The poor biosecurity measures employed by the stockmen, which in this case were also peripatetic and therefore cared for more than one unit of poultry which resulted in the spread of infection in the area

- The siting of a free range poultry unit (IP1), which is likely to attract wild birds because of feed availability, in an area already unavoidably occupied by populations of wild bird species, notably migratory waterfowl, but also "bridge" species (such as gulls) which are capable of becoming infected by HP H5N1 AI virus and transmitting this virus from primarily infected wild birds to commercial poultry.

ACKNOWLEDGEMENTS

We would like to thank the staff of the parent company for their help in the epidemiological investigation, members of the NEEG's Ornithological Expert Panel, expert ornithologists of the British Trust for Ornithology, colleagues in the Avian Virology Unit, VLA Weybridge, the GIS team in the Food and Farming Group, Defra, and staff in Animal Health for sample collection and the clinical inspection of poultry.

NATIONAL EMERGENCY EPIDEMIOLOGY GROUP
Food and Farming Group
Defra

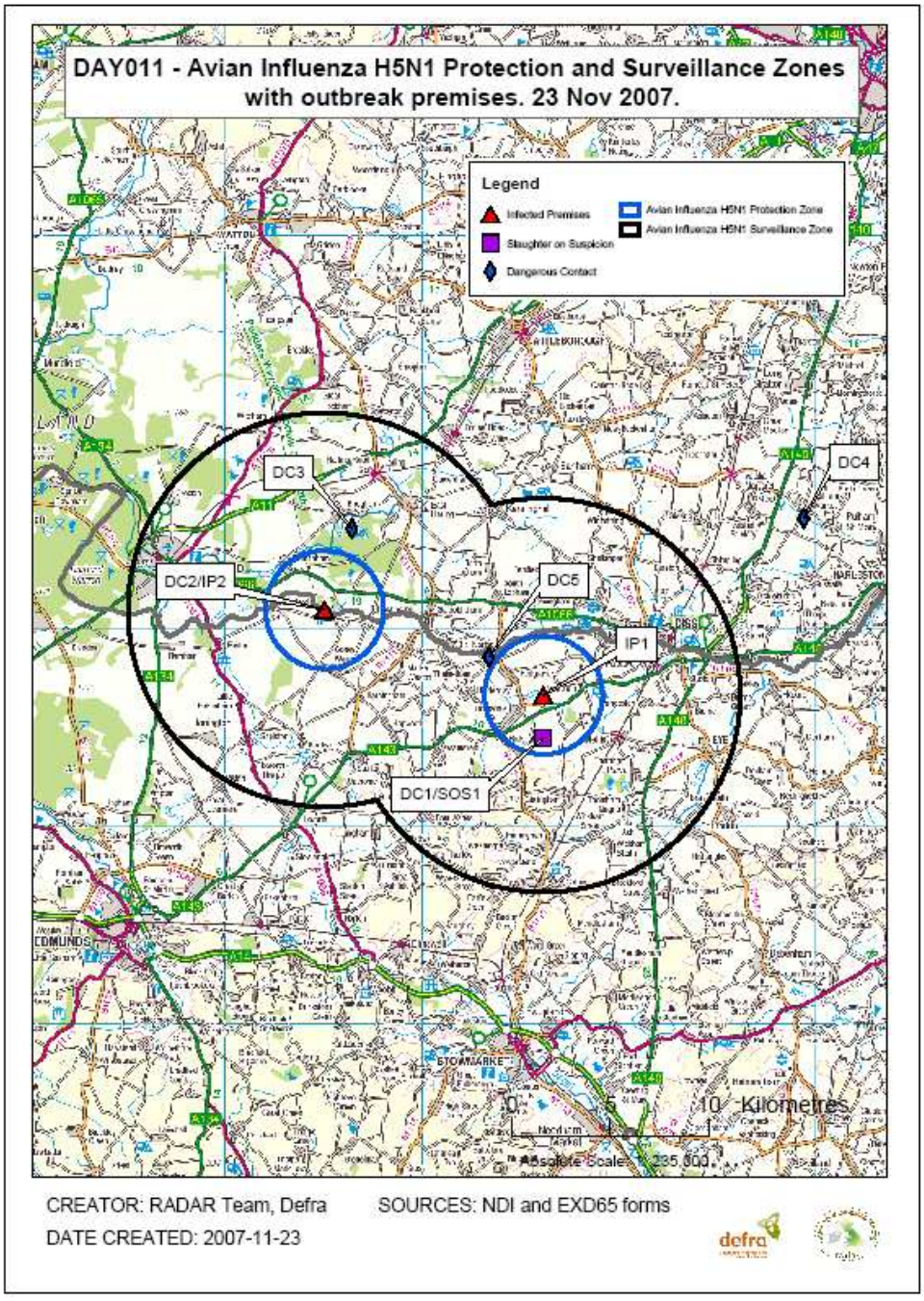

DAY011 - Avian Influenza H5N1 Protection and Surveillance Zones with outbreak premises. 23 Nov 2007.
Legend
Infected Premises
Slaughter on Suspicion
Dangerous Contact
Avian Influenza H5N1 Protection Zone
Avian Influenza H5N1 Surveillance Zone
DC3
DC4
DC2/IP2
DC5
IP1
DC1/SOS1
10 Kilometres
Absolute Scale 1:35,000
CREATOR: RADAR Team, Defra
SOURCES: NDI and EXD65 forms
DATE CREATED: 2007-11-23
defra

FIGURE 1

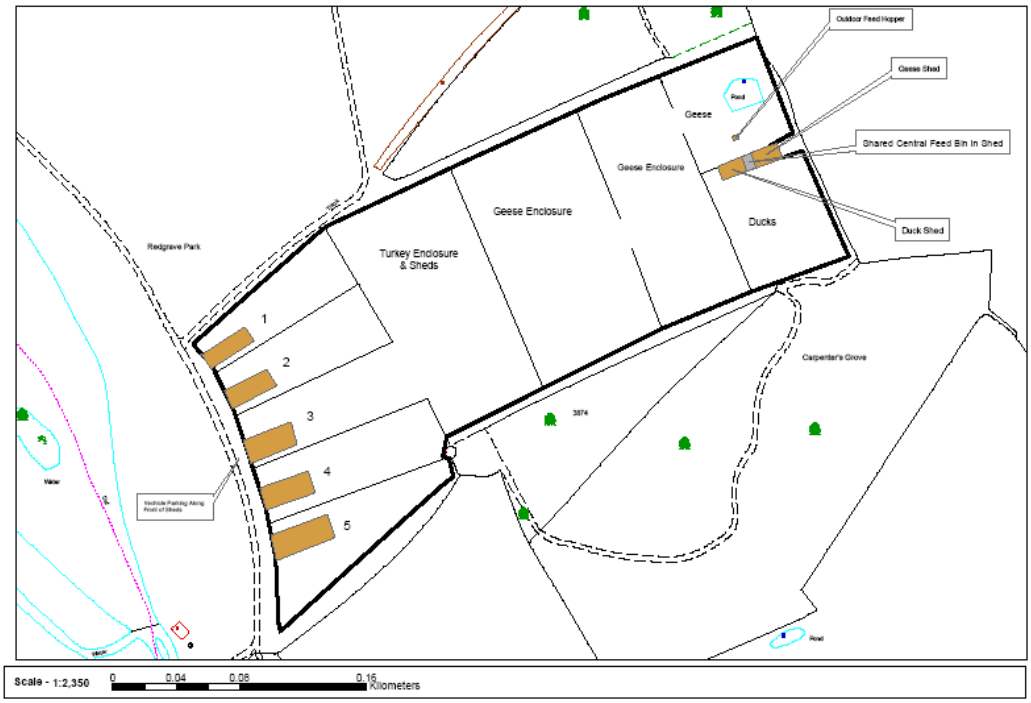


Figure 2: Disposition of the turkeys, ducks and geese on IP1

APPENDIX 1

Distribution of wild birds examined in Great Britain in 2007 up to 20 November, by month and county

	Month											
County	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**Total**
England												
Bedfordshire	5	18	4	4	6			3	1	7	1	49
Berkshire		3	4								3	10
Buckinghamshire	1	3	1	3	12					1		21
Cambridgeshire	7	2	9	1		1	3					23
Carmarthenshire									1			1
Channel Islands or Isle of Man								1				1
Cheshire	3	11	9	7	3	5	6	1	1	7	1	54
Cleveland & Darlington				1								1
Cornwall & Isles of Scilly								1	1			2
Cumbria	2	2		1	1			3	2			11
Derbyshire	2	9	6	7	6	6	4	1		3	2	46
Devon										1		1
Devonshire	3	14	10	11	3	2	13	2	1	4		63
Dorset	26	13	19	13	17	7	9	12	4	3	4	127
Dumfries and Galloway		1		2	1		4	6		1	2	17
Durham		1										1
East Riding & Northern Lincolnshire						706	1					707
East Sussex	8	2	9	5		3	1	2	4	1	2	37
Essex	4	22	12	7	5	1	7	20		13	4	95
Gloucestershire excluding South Gloucestershire										1		1
Greater London		5		3							1	9
Greater Manchester	1											1
Hampshire	5	7	2	6	18	13	5	1	1	2	2	62
Herefordshire	1	2	2	3	1	2		2	1		1	15
Hertfordshire											1	1
Lancashire	13	35	29	7	7	11	7	9	7	7	8	140
Leicestershire & Rutland	1	7	3	2	1						1	15
Lincolnshire excl North	4	9	16	3	12	3	5		2	2	4	60
Lothian	3	7	1	2	2	1	2	1	3	2	1	25
Merseyside		6										6
Norfolk	8	41	9	20	3	5	13	1	5	116	13	234
North Somerset & South Gloucestershire	11	3	5	14	7	1	2	1	2	4		50
North Yorkshire		5	21	15	4		1	14	1	1	2	64
Northamptonshire	1	1										2
Northumberland							32	9		4		45
Nottinghamshire	17	22	9	4	1	25	3		4		5	90
Shropshire	1	1	5		5	2	3			1	2	20
Somerset	8	9	4	1		2			4	3	12	43

County	Month											
	1	2	3	4	5	6	7	8	9	10	11	
South Yorkshire	3											3
Staffordshire	4	9	4	5	2		2	2	3	1		32
Suffolk	3	64	23	3	6	4	2	4	2	12	6	129
Surrey	4										1	5
Warwickshire	1	4	3	10	1	5	2	6	3	3		38
West Midlands	5	2	5	6	4	4	4	5	2			37
West Sussex	7	8	4	1	2	4	2	2		2	1	33
West Yorkshire	1	3	2	2		2		2			1	13
Worcestershire		5	3	3	2	4			11	2		30
Wales												
Ceredigion				2						2		4
North-East Wales	1		1	1	1							4
North-West Wales	2					2						4
South Wales						1	1		1		6	9
Scotland												
Argyll & Bute							3					3
Ayrshire		4			3		1	5	1	1		15
Fife		8	7	4	1		1				1	22
Highland							4					4
North-East Scotland			6				4		3			13
Scottish Borders				2		1		1			1	5
Tayside									3	1		4
Tyne and Wear			1									1
Unknown	23	36	12	6	17	9	8		3	10		124
Grand Total	189	404*	260	187	154	832**	155	117	77	218	89	2682

** 404 birds in February due to increased surveillance following the outbreak of HP H5N1 in Holton.*
*** 832 birds in June includes a mass die off of 706 starlings in The East Riding and North Lincolnshire.*