



**ON-FARM FACTORS FOR *CAMPYLOBACTER*
INFECTION OF BROILERS:
SURVEY OF BROILER FARMS
IN NEW ZEALAND**

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IN NEW ZEALAND**

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SUMMARY

This report is part of a project investigating on-farm risk factors for *Campylobacter* infection of poultry flocks in New Zealand. The goal is to assist risk management of *Campylobacter* in poultry by identifying risk factors for on-farm contamination of poultry flocks that offer opportunities for risk management.

This report describes the results from a survey of broiler farms in New Zealand intended to capture detailed information relevant to biosecurity practices. A total of 60 of the approximately 160 broiler farms in New Zealand were visited. The farm visits were conducted by David Marks and Jutta Tebje-Kelly, poultry veterinarians with extensive experience in both regulatory and industry aspects of broiler farming. During the visits an extensive paper-based survey form was completed, and aspects of biosecurity were discussed with the farmer or farm worker. Photographs of relevant aspects of the farm were also taken.

The farm visit protocol and survey instrument were developed from February to March 2007. Farm visits were conducted during April to September 2007. Data were entered into a spreadsheet for analysis, and data cleaning, summary and analysis were conducted during September – December 2007.

The survey presents a detailed picture of poultry farming in New Zealand and biosecurity practices, largely in terms of structures and facilities. In general many aspects of biosecurity appear to be good.

- The majority of farm grounds are well maintained;
- Surface waters are rarely used as a drinking water source;
- Most farms chlorinate their broiler drinking water and monitor the treatment;
- Dead bird collection and disposal is generally frequent and controlled;
- Both sheds and annexes are usually cleaned, sanitised and dried between flocks;
- Regular biosecurity audits are conducted;
- Staff biosecurity facilities (boots, shed entry barriers, hand washing facilities) are provided in most sheds;
- Visitor cleanliness and vehicle decontamination facilities are standard on most farms; and,
- Pest control and exclusion (birds, rodents) is standard and apparently effective.

However, effective biosecurity to exclude *Campylobacter* requires consistent and universal coverage of the multitude of pathways by which the flock can become infected. The survey does highlight some areas where improvements could be made. Comparisons between the survey results and the recommendations in the recently developed poultry industry Biosecurity Manual suggest areas for possible improvement of on-farm biosecurity:

- More rigorous monitoring of chlorination of drinking water (also identified as a problem in some biosecurity audits);
- More frequent or rigorous cleaning of drinker lines;
- More stringent exclusion of pets from shed surroundings;
- Universal provision of hand washing or hand hygiene facilities for staff and visitors;
- Repairs or replacement of shed and annex structural features to improve cleanability;

- Upgrading or replacement of end pads and universal cleaning and sanitising between flocks;
- More universal availability of facilities for vehicle decontamination; and,
- Provision of dedicated clothing for each shed, in addition to the dedicated boots already available.

However, it is acknowledged that this survey was conducted prior to the release of the Poultry Industry Biosecurity Manual (August 2007). Anecdotal reports from the industry indicate that aspects of on-farm biosecurity have been addressed since the manual release, and the current situation may be quite different.

The best way to identify the on-farm risk factors that contribute to *Campylobacter* infection in New Zealand poultry flocks would be to assess farm practices against prevalence of infection. Such an analysis was not part of this project, and as already mentioned, the survey size would have limited statistical power. Instead, the survey data are considered in terms of risk factors that have been identified overseas.

It seems likely that New Zealand farms are modest in terms of size, number of sheds and birds, numbers of workers, and distance to processing plants. Almost all farms had more than one shed per farm, which has been identified as a risk factor (Wagenaar *et al.*, 2006) but is unlikely to be amenable to change.

The analysis shown in Table 3 indicates that there are improvements that could be made in the condition and cleanliness of sheds and annexes on approximately half the farms. This may influence carry-over of *Campylobacter* from one flock to the next. Although older sheds can be effectively cleaned and sanitised, newer sheds with smoother, non porous surfaces and fewer cavities/ledges/protrusions will be easier to clean. Repairs or replacement would be expensive, but this is a risk factor that could be managed.

Litter disposal was routinely done by removal from the farms, but spreading nearby was reported by approximately one third of farms. Without knowing the composting practices of the litter removal companies it is difficult to assess survival of *Campylobacter* and therefore potential for environmental contamination, but this risk factor could be managed.

Water supplies are predominantly bore/well, which will have lower risk of contamination than surface water. That chlorination may not be effectively implemented as a treatment has been reported by one New Zealand study (Boxall, *et al.*, 2003). There are also farms on which biofilm removal and drinker cleaning can be enhanced or implemented. The importance of such water source risk factors could only be assessed with further data, but management would be feasible if required. *Campylobacter* can survive in biofilms, and bacteria can move from drinkers into the drinker systems and pipes.

The presence of other animals on the farm or in the vicinity has also been identified as a risk factor (Wagenaar *et al.*, 2006). There is a high prevalence of animals (livestock and pets) both on farms and on surrounding farms, that might be contributing *Campylobacter* into the environment around sheds. The presence of animals on surrounding farms is unlikely to be able to be changed, but livestock on the poultry farm itself may be able to be managed.

Flies and wild birds were not reported within any of the sheds visited, but wild birds were observed in the surroundings of approximately half the sheds, and flies in the surroundings of approximately 17% of the sheds. One of the veterinarians commented that on the days when visits were conducted, environmental conditions were such that flies were unlikely to be seen around the sheds. Darkling beetles were only reported for North Island farms and it would be of interest to examine flock prevalence data from this perspective. Management of these pests, if indeed they are risk factors, is likely to be difficult.

Biosecurity facilities on the farms, for both farm staff and visitors, appeared to be generally available. It is worth noting that in several instances facilities were available but reported as not used. The single visits conducted for this survey will be able to examine facilities and structures, but not truly assess routine day-to-day implementation of biosecurity controls. It seems likely that adherence to good biosecurity practice is not universal; even single lapses may result in flock infection. While this cannot be assessed by the data from this survey, it seems reasonable that greater consistency in shed biosecurity practice is a risk factor that could be managed. Regardless of the adequacy of the facilities or the effectiveness of their use, it is likely that strict biosecurity procedures for visitors and vehicles would reinforce good practice by those people.

It is notable that on poultry breeder farms, more stringent biosecurity is practiced compared to broiler farms. Although breeder farms do experience occasional *Campylobacter* infection of flocks, the prevalence is lower than experienced by broiler farms. This points to the potential for enhanced biosecurity to reduce prevalence.

Thinning or depopulation is a well recognised risk factor, and is universally practiced on New Zealand farms. Protective clothing was reported as widely used by catching gangs. Farmers reported that cleaning of clothing between farms was performed by catching gangs although their ability to assess this issue is probably limited. Biosecurity by catching gangs between sheds appeared infrequently applied. While 58% and 44% of responses for transport crate condition and grower impressions of catching gang biosecurity respectively were “high”, there were a large number of lower gradings. The data collected by this survey (from farmers, not thinning contractors) on this aspect of biosecurity will be incomplete, and it does appear to be a risk factor worthy of further investigation and/or management.

In summary the risk factors that offer potential for management, based on the results of this survey, are:

- Condition of sheds and annexes;
- Livestock on the broiler farms themselves;
- Litter disposal on nearby farms;
- Biosecurity stringency in day-to-day operations; and,
- Biosecurity associated with thinning or depopulation.

1 INTRODUCTION

This report is part of a project investigating on-farm risk factors for *Campylobacter* infection of poultry flocks in New Zealand. The goal is to assist risk management of *Campylobacter* in poultry by identifying risk factors for on-farm contamination of poultry flocks that offer opportunities for risk management.

This is the second of two reports from this project. The first report covered the following:

1. Review of the scientific literature regarding on-farm risk factors for *Campylobacter* infection in broilers.
2. Overview of broiler farming in New Zealand, a national perspective collated from information supplied by major poultry producers.

1.1 Content of this report

This report describes the results from a survey of broiler farms in New Zealand intended to capture detailed information relevant to biosecurity practices. A total of 60 of the approximately 160 broiler farms in New Zealand were visited. The farm visits were conducted by David Marks and Jutta Tebje-Kelly, poultry veterinarians with extensive experience in both regulatory and industry aspects of broiler farming. During the visits an extensive paper-based survey form was completed, and aspects of biosecurity were discussed with the farmer or farm worker. Photographs of relevant aspects of the farm were also taken.

The farm visit protocol and survey instrument were developed from February to March 2007. Farm visits were conducted during April to September 2007. Data were entered into a spreadsheet for analysis, and data cleaning, summary and analysis were conducted during September – December 2007.

PROTOCOL AND SURVEY INSTRUMENT DESIGN

The project specification required that approximately 60 farms be visited. After discussions with Professor Nigel French, it was decided that due to the large number of variables related to risk factors of interest, compared to the number of farms involved, there would be insufficient power to analyse the data mathematically. Therefore the purpose of the survey was deemed to be descriptive epidemiology.

2.1 Risk factors for consideration

The previous report from this project summarised published information on risk factors for *Campylobacter* infection in broiler flocks. This was reviewed to assist in the design of the survey instrument.

Risk factors and sources identified and ranked for importance in a review from the United Kingdom (Adkin, *et al.*, 2006) are shown in Table 1. Contributing factors were defined as those associated with the occurrence of *Campylobacter* but not thought to be associated with the initial cause. To be deemed as a source, the variable had to be referenced in the study or defined as being the most probable cause of the broiler infection. A high positive relevancy score indicates a consistent positive association between the factor and *Campylobacter* colonization, considered to be relevant to the UK. A high negative score indicates a consistent lack of association.

Table 1: Risk factors for *Campylobacter* infection in broilers ranked according to a systematic review of literature (Adkin, *et al.*, 2006).

| Contributing Factor | Relevancy Score | Source | Relevancy Score |
|--------------------------------|-----------------|-----------------------|-----------------|
| Depopulation schedule | 14.17 | Depopulation event | 12.70 |
| Hygiene barrier | 10.13 | Cross-house transfer | 11.67 |
| Multiple houses | 9.80 | On-farm staff | 9.14 |
| Parent company/abattoir | 7.60 | Other livestock | 8.00 |
| Season of rearing | 7.44 | Wild birds | -0.71 |
| Disinfectant footbath | 6.71 | Small mammals | -4.10 |
| Outside access | 6.40 | Insect carriage | -5.00 |
| Number of staff | 6.00 | Dust/air | -5.25 |
| Water disinfection | 4.50 | Carry over | -5.43 |
| Presence of other animals | 2.38 | Vertical transmission | -5.84 |
| Age at sampling | 2.13 | Water supply | -8.41 |
| Flock stress | 1.50 | Litter | -9.00 |
| Down-time and routine cleaning | 0.30 | Feed | -11.44 |
| Insect presence | -1.00 | | |
| Litter characteristics | -1.64 | | |
| Age of housing/state of repair | -2.67 | | |
| Ventilation/heating | -3.86 | | |
| Clothing routine | -4.00 | | |
| Performance of farm | -5.33 | | |
| Locality | -6.50 | | |
| Staff hygiene: hands | -6.50 | | |
| Medication usage | -7.33 | | |
| Broiler line/sex | -8.40 | | |
| Disease occurrence | -10.00 | | |
| Flock size | -10.38 | | |

| Contributing Factor | Relevancy Score | Source | Relevancy Score |
|-----------------------|-----------------|--------|-----------------|
| Floor/yard material | -10.71 | | |
| Water equipment | -11.13 | | |
| Feed equipment | -11.50 | | |
| Rodent control | -14.67 | | |
| Stocking density | -14.67 | | |
| Manure routine | -15.25 | | |
| Removal of dead birds | -16.00 | | |

A review by the United Kingdom Advisory Committee on the Microbiological Safety of Food identified the following factors (ACMSF, 2005):

- Contaminated water.
- Vertical transmission from parent flocks.
- Contaminated feed.
- Carry-over from a previous flock.
- Domestic and/or wild animals and birds.
- Contaminated transport crates, vehicles and personnel at flock thinning and when birds are weighed or maintenance is carried out.
- Equipment at times other than thinning.
- Feed withdrawal.
- The external environment around the broiler house.
- Contaminated footwear and clothing of farm personnel and visitors.
- Transfer of contaminated equipment between houses.

A further review, conducted for the United Kingdom Food Standards Agency (Allen and Newell, 2005), reported that vertical transmission was considered sufficiently unlikely that the focus should remain on preventing horizontal transmission.

Although evidence for the effectiveness of biosecurity measures is sparse, the available evidence indicated that the following measures were important in the control of *Campylobacter*:

- Wearing protective clothing, house dedicated footwear, and/or dipping boots;
- Washing or sanitising hands;
- Cleaning and disinfecting the house and any equipment entering that house;
- Controlling visitors and their equipment and vehicles both to the house and the farm; and,
- Controlling pests and other animals on the farm.

Allen and Newell also commented that “although numerous on-farm sources of *Campylobacter* have been identified the relative importance of each of these in flock colonisation has yet to be established”. Consequently a programme including all feasible and practical biosecurity measures was recommended. Evidence for the value of biosecurity was derived from the almost 100% colonisation of free-range flocks (although these may be older birds and therefore at higher risk of infection), and unpublished UK company data indicated that levels of around 30% of flocks colonised were achievable, prior to any depopulation. Evidence from several countries suggested that although best practice biosecurity can delay

the onset of colonisation, prevention cannot be guaranteed. In addition, biosecurity may only be effective during the months outside the summer peak.

Based on these reports, risk factors were categorised. A recent publication (Wagenaar *et al.*, 2006) summarised risk factors and sources of infection for poultry:

- Age of animals;
- Number of broiler houses on farm;
- Presence of other animals on the farm or in the direct vicinity;
- Previous cycle positive;
- Thinning; and,
- Multiple broiler houses on farm.

Based on these publications, the following risk factors were included in the study:

- Physical aspects of sheds and farm: ventilation, pest control (screens), water supply and treatment, drinkers, numbers of sheds, other animals on farm, external environment (foliage etc.);
- Biosecurity measures to prevent introduction of *Campylobacter* on personnel into shed (other than depopulation) – clothing, footwear, physical barriers, handwashing;
- Biosecurity measures to prevent introduction of *Campylobacter* on vehicles and equipment into shed (other than depopulation);
- Biosecurity measures to control carryover of *Campylobacter* between sheds (personnel, equipment);
- Biosecurity measures to prevent carryover of *Campylobacter* from one flock to next (cleaning regimes between flocks);
- Biosecurity measures associated with depopulation (equipment, personnel);
- Farmer awareness and commitment to biosecurity with respect to *Campylobacter*; and,
- Assessment of biosecurity application based on farm visit and observation by researchers.

The following risk factors were excluded from the study

- Feed production (considered unlikely that *Campylobacter* will survive); and,
- Vertical transmission (not considered to be important by most scientists).

2.2 Protocol

2.2.1 Farms to be visited

The number of broiler farms in New Zealand supplying each processor at the time of designing the survey was reviewed and farms to be visited allocated on the basis of companies and regions to be representative.

The process for choosing farms within a region was random. Each farm was ordered alphabetically according to name of owner or contractor, numbered, and then chosen according to a random number generator in Excel.

During the development of the protocol, the survey was discussed with and gained the support of the Poultry Industry Association of New Zealand (PIANZ) and member companies. As individual farmers are contracted to specific companies, company staff responsible for broiler farming liaison facilitated visits to each chosen farm. An introductory letter was sent to each farm prior to the visit, or presented at the start (see Appendix 1). Each visit took approximately 4 hours, and involved observation of physical aspects of the farm and specific aspects of farm management related to biosecurity, as well as discussion with the farmer or farm worker about practices on the farm.

2.3 Survey instrument and pilot

The paper-based survey instrument was designed in collaboration by ESR scientists and the veterinarians, and reviewed by Dr Peter van der Logt at NZFSA as well as Professor Nigel French at Massey University. The final version was intended to gather information on a wide range of aspects of broiler farming. In order to make the information gathered as consistent as possible, sets of defined answer options were created wherever possible, while also allowing the opportunity for free text comments where an “other” answer was given.

The survey was piloted during joint visits by both veterinarians to three farms (four had been planned but a last minute cancellation prevented that visit). This process also served to calibrate the answers of each veterinarian, where a subjective judgment was called for.

Following the pilot visits, a number of changes were made to the questionnaire, largely adding questions on information that was considered useful. The finalised questionnaire is in Appendix 2. If a farm had more than three sheds, three were to be chosen randomly and detailed information (questions 61 – 92 replicated three times in the questionnaire) on these was collected.

Each returned survey was entered into a specially designed Excel spreadsheet, and text entered as embedded comments.

3 RESULTS

This section presents the data from the survey summarised to represent an overview from the 60 farms. In most cases the data set is complete; where information is assembled from fewer than all 60 farms this has been noted.

3.1 Farm details

Overall 60 of 158 broiler farms (38%) in New Zealand were visited. On a regional basis:

| | |
|---------------|-------------|
| Auckland: | 19/52 (37%) |
| Foxton: | 4/4 (100%) |
| New Plymouth: | 10/29 (34%) |
| Waikato: | 13/38 (34%) |
| Christchurch: | 14/35 (40%) |

The person interviewed during the visit was most often the farm owner:

| | |
|---------------|----|
| Farm owner: | 46 |
| Farm manager: | 14 |
| Other: | 0 |

Note: 6 surveys identified the person interviewed as both farm owner and farm manager – these were classed as farm owners.

3.2 Farm level variables

3.2.1 Size

Farm size in hectares:

| | |
|----------|-------|
| Average: | 15.7 |
| Median: | 6.6 |
| Maximum: | 154.0 |
| Minimum: | 1.89 |

Position of sheds on the farm relative to surrounding farms:

| | |
|--------------------|----|
| Central: | 20 |
| Close to one side: | 40 |

3.2.2 Surrounding farms

Number of farms with one or more adjacent livestock farms:

| | |
|--|--------------------------|
| Poultry farms with 1 adjacent livestock farm: | 2 (2 livestock farms) |
| Poultry farms with 2 adjacent livestock farms: | 8 (16 livestock farms) |
| Poultry farms with 3 adjacent livestock farms: | 18 (54 livestock farms) |
| Poultry farms with 4 adjacent livestock farms: | 26 (104 livestock farms) |

Number of adjacent farms with livestock: 176 (this represents 73% of 240 adjacent farms, assuming 4 farms adjacent to each poultry farm).

Types of livestock on those adjacent farms (may be more than one livestock type on each adjacent farm so total is greater than 176):

| | |
|---------------|------------------|
| Dairy cattle: | 72 farms |
| Beef cattle: | 71 farms |
| Pigs: | 2 farms |
| Sheep: | 30 farms |
| Horses: | 29 farms |
| Poultry: | 7 farms |
| Deer: | 1 farm |
| Goats: | 4 farms |
| Other: | 1 farm (peacock) |

3.2.3 Broiler variables:

Total number of birds per growing cycle on whole farm: (N.B. data from 59 farms only)

| | |
|----------|---------|
| Average: | 94,000 |
| Median: | 82,000 |
| Maximum: | 210,000 |
| Minimum: | 30,000 |

Distance to processing plant (km):

| | |
|----------------|------|
| As crow flies: | |
| Average: | 15.8 |
| Median: | 10 |
| Maximum: | 55 |
| Minimum: | 1 |

| | |
|---------------|------|
| By road (km): | |
| Average: | 24 |
| Median: | 18.5 |
| Maximum: | 110 |
| Minimum: | 1.5 |

Transport time to processing plant (mins):

| | |
|----------|------|
| Average: | 28.1 |
| Median: | 20 |
| Maximum: | 150 |
| Minimum: | 2 |

Cycles per year:

Number of days from birds out to placement of birds: (N.B. data from 59 of 60 farms)

| | |
|----------|------|
| Average: | 14.9 |
| Median: | 12.0 |
| Maximum: | 44 |
| Minimum: | 0 |

Number of days from litter out to placement of birds: (N.B. data from 58 of 60 farms)

| | |
|----------|------|
| Average: | 13.5 |
| Median: | 12 |
| Maximum: | 36.5 |
| Minimum: | 0 |

3.2.4 Farm workers

Routine day to day workers

| | |
|----------|------|
| Average: | 1.52 |
| Median: | 1.25 |
| Maximum: | 3 |
| Minimum: | 1 |

Temporary staff for cleanout: (N. B. data from 58 of 60 farms)

| | |
|----------|------|
| Average: | 2.3 |
| Median: | 2.25 |
| Maximum: | 6 |
| Minimum: | 0 |

Temporary staff for placing:

| | |
|----------|-----|
| Average: | 3.3 |
| Median: | 2.5 |
| Maximum: | 15 |
| Minimum: | 1 |

3.2.5 Farm conditions

General condition of the grounds (as assessed by visiting veterinarian):

| | |
|-------------------------|----|
| Frequent maintenance: | 44 |
| No maintenance: | 1 |
| Occasional maintenance: | 15 |

Source for boiler drinking water:

| | |
|--------------------|----|
| Bore/well on farm: | 48 |
| Town/mains supply: | 10 |
| River/creek: | 1 |
| Spring water: | 1 |

Broiler drinking water treatment:

| | |
|---------------|----|
| Chlorination: | 57 |
| None: | 3 |

N.B. Three farms used chlorination in combination with other methods as follows: chlorination and UV (1); chlorination and ozone (1); chlorination and H₂O aeration (1).

Of the 53 farms who indicated how the effectiveness of water treatment at drinker level was ascertained, 47 of these farms responded that testing was done, 3 farms did not test the water regularly and 3 farms did not test the water at all.

Of the 23 farms who recorded how often testing was done, 22 farms checked chlorine levels weekly and 1 farm tested annually. Other farms did not report how often testing was conducted.

The target concentrations of chlorine in the drinking water varied between farms from 1 to 3 ppm.

3.2.6 Other animals on farm

Livestock:

Of the 60 farms, 49 reported one or more livestock animal types present. Numbers of farms with each type of livestock and summary values for the number of livestock on a farm are:

| |
|--------------------------|
| Dairy cattle: 9/60 farms |
| Average 137 |
| Median 67 |
| Maximum 500 |
| Minimum 2 |

Beef cattle: 28/60 farms

Average 25

Median 11

Maximum 100

Minimum 1

Calves: 1/60 farms

Average 40

Median 40

Maximum 40

Minimum 40

Sheep: 15/60 farms

Average 13

Median 11

Maximum 30

Minimum 1

Horses: 8/60 farms

Average 6

Median 3

Maximum 21

Minimum 1

Deer: 1/60 (25 deer)

Goats: 1/60

No other livestock: 11/60

Pets: Of the 60 farms, 54 had pets of one or more types.

Dogs: 41/60 farms

Average 1.5

Median 1

Maximum 7

Minimum 1

Cats: 43/60 farms

Average 1.6

Median 2

Maximum 4

Minimum 1

Rabbits: 2/60 farms

Average 1

Median 1

Maximum 1

Minimum 1

20/57 farms reported that their pets went down to the sheds (5 farms reported being unsure of the answer to this question), and 22/54 farms reported not excluding them from shed surroundings (N.B: this question was not included in pilot thus fewer farms responded). Where pets were excluded from shed surroundings, the most common method of enforcement was by the use of fencing (35/56 farms).

3.2.7 Placement and litter

Containers used when placing chicks in sheds:

| | |
|------------|----|
| Plastic: | 58 |
| Cardboard: | 2 |

Litter type:

Wood shavings: 60

Disposal of litter: Almost all farms (59/60) removed the litter from the farm. Only one farm stockpiled some litter on site.

Removal of the litter was principally by a commercial company (53/60), with a few farmers (6/60) reporting removing the litter themselves. One farm reported that litter removal varied.

One third (20/60) of farms reported that litter would be spread on land nearby.

3.2.8 Bird disposal

Frequency of inspection of the flock and removal of dead birds (N.B. data from 57 of 60 farms)

| | |
|-----------------|----|
| Once per day: | 21 |
| Multiple daily: | 39 |

How dead birds were stored prior to removal:

| | |
|-------------------------------|----|
| Freezer: | 50 |
| Fridge: | 4 |
| Straight to burial/offal pit: | 5 |
| Bins: | 1 |

How dead birds are disposed of:

| | |
|--|----|
| Worm farm: | 10 |
| Rendered/composted (made into fertiliser): | 35 |
| Mortality/burial pit: | 8 |
| Unsure: | 7 |

Frequency of collection of dead birds for disposal:

| | |
|-----------------|----|
| Weekly: | 32 |
| Daily: | 4 |
| Every 1-3 days: | 9 |
| Other: | 15 |

The collection point for disposal of dead birds varies between farms and is sometimes within the bio-security area and sometimes outside the bio-security area. Collection points include:

- Farm boundary or entrance.
- Outside of sheds.
- From equipment, cow sheds or workrooms on the farm.

3.2.9 Shed cleanout

Who cleans the sheds?

| | |
|--|----|
| Permanent staff: | 19 |
| Contract industrial cleaners: | 35 |
| Permanent staff and contract cleaners: | 6 |

Is the shed cleanout audited or checked? (question not asked for pilot studies, and 1 non-response, so data from 56 farms)

| | |
|------|----|
| Yes: | 28 |
| No: | 28 |

Who cleans the annexe?

| | |
|--|----|
| Staff: | 37 |
| Contract industrial cleaners: | 18 |
| Permanent staff and contract cleaners: | 5 |

Are the annexes both cleaned and sanitised?

| | |
|--------|----|
| Yes: | 58 |
| No: | 1 |
| Other: | 1 |

When is annexe cleaned (in relation to the shed)?

| | |
|--------------------|----|
| Before: | 1 |
| During: | 51 |
| Before and during: | 1 |
| After: | 7 |

When is shed biosecurity put in place?

| | |
|-------------------|----|
| After cleaning: | 8 |
| After sanitising: | 50 |
| Other: | 2 |

Details of shed cleaning regime:

Most of the farms have similar clean out routines. These include removal of litter, dry blow out of dust, volume or high pressure wash of sheds and sanitizing. All the farms in the study used water to clean the sheds. It is unclear where this water drains to. A range of chemicals are used for sanitizing the sheds.

Are sheds dry prior to sanitising? (question not asked for pilot studies)

| | |
|--------|-------|
| Yes: | 44/57 |
| No: | 8/57 |
| Other: | 5/57 |

Are sheds dry prior to litter placement? (question not asked for pilot studies)

| | |
|-----------|-------|
| Yes: | 54/57 |
| No: | 2/57 |
| Not sure: | 1/57 |

Are brooding curtains used in sheds?

| | |
|----------------------------|-------|
| Yes: | 16/60 |
| Yes, but not in all sheds: | 3/60 |
| No: | 41/60 |

Are solid walls easy to clean? (as assessed by veterinarian)

| | |
|------|----|
| Yes: | 56 |
| No: | 4 |

Is cleaning of removable items performed inside or outside the shed?

| | |
|-----------------|----|
| Inside: | 29 |
| Outside: | 26 |
| Both: | 4 |
| Not applicable: | 2 |

Is sanitising of removable items performed inside or outside the shed?

| | |
|----------|----|
| Inside: | 40 |
| Outside: | 15 |
| Both: | 1 |

Unsure: 1
Not applicable: 3

3.2.10 Maintenance of drinking system, heaters and end pad

Frequency of cleaning and flushing during crop (question not asked in the same way for pilot studies so disregarded; data from 57 farms only).

Never: 40
Every run: 12
Between runs: 4
Every 2nd run: 1

Frequency of cleaning and flushing intercrop (question not asked in the same way for pilot studies so disregarded; data from 57 farms only).

Never: 2
Every 2nd/3rd run: 2
Between runs: 27
Prior to placement: 3
Once per year: 1
Externally every intercrop: 17
2/3 times per year: 3
Occasionally: 2

The answers provided for these two frequency of cleaning questions were very mixed and not completely internally consistent. It appears that cleaning and flushing is performed during the crop (i.e. during the grow out period of a flock = during a run) only on a minority (12/57) of farms. Cleaning and flushing intercrop (i.e. as part of the cleaning between flocks or runs) was performed on a higher proportion of farms: apparently between every flock on 47/57 farms, at least externally.

Drinker disassembly and cleaning:

< once per year: 5
1-3 times per year: 6
Never: 35
N/A: 8
Other: 6

The veterinarians commented that only some types of drinkers need to be disassembled and cleaned; hence the number of “never” and “N/A” answers to the question above.

Biofilm removal?

Yes: 27
No: 33

Growers from 11 of the farms believed the chlorine in the water removed biofilms.

How were biofilms removed from drinking systems other than chlorine? (N.B. data from 27 farms)

| | |
|--------------------|----|
| DL Flush: | 17 |
| Cider / Vinegar: | 3 |
| Super Chlorinates: | 3 |
| Just flushing: | 2 |

The amount of time DL flush was left in the pipes and tanks was between 2 hours and 3-4 days.

Frequency of biofilm removal (from pipes)?

| | |
|---------------------------------|----|
| Daily: | 8 |
| Two/three times per year: | 3 |
| At cleanout/intercrop only: | 22 |
| External at cleanout/intercrop: | 14 |
| Internal at cleanout/intercrop: | 1 |
| Never: | 10 |
| Other: | 2 |

Heater cleaning:

Who cleans?

| | |
|--|----|
| Permanent staff: | 52 |
| Contractor cleaners: | 3 |
| Permanent staff and contractor cleaners: | 4 |
| Never cleaned: | 1 |

How is it done? (N. B. data from 59 farms only)

| | |
|----------------------------|----|
| Wet cleaned: | 11 |
| Water blasted: | 15 |
| Blown out: | 36 |
| Blown out and wet cleaned: | 5 |
| Other: | 2 |

Is the end pad cleaned and sanitised before placing?

| | |
|---|----|
| Cleaned and sanitized at same time as the shed/annex: | 5 |
| Sprayed with sanitizer: | 28 |
| Cleaned if necessary and sanitized: | 16 |
| Cleaned and sanitized: | 2 |
| No cleaning or sanitizing of end pad: | 9 |

3.2.11 Biosecurity

How long ago was the last audit? (this question was not asked for the pilot studies so data from 57 farms only)

| | |
|---------------------------|----|
| Within the last 3 months: | 6 |
| Within the last 6 months: | 18 |
| Within the last year: | 14 |
| More than 1 year ago: | 10 |
| Don't know or never: | 9 |

Were any non-conformances identified? (this question was not asked for the pilot studies so data from 57 farms only)

| | |
|--|-----------------|
| Low CI levels or problems with testing: | 9 |
| None: | 33 |
| N/A: audit) | 6 (no relevant) |
| Unsure: | 2 |
| Other (e.g. rubbish, small structural repairs, bait station cleaning): | 7 |

How long ago was the last manual update? (this question was not asked for the pilot studies so data from 57 farms only)

| | |
|---------------------------|----|
| Within the last 3 months: | 12 |
| Within the last 6 months: | 5 |
| Within the last year: | 12 |
| More than 1 year ago: | 19 |
| Don't know or never: | 7 |
| Other: | 2 |

When are staff given biosecurity training? (this question was not asked for the pilot studies so data from 57 farms only)

| | |
|-------------------------------|---|
| Before they start work: | 5 |
| Through meetings and manuals: | 3 |
| On the job: | 19 |
| No training given: | 1 |
| Other (not specified): | 1 |
| N/A: | 28 (no recently employed or relevant staff) |

Most growers reported acquiring knowledge while “on the job” either from company technical advisors or through workshops organized by the companies. Several had also undertaken formal courses in biosecurity.

How are staff trained? (this question was not asked for the pilot studies so data from 57 farms only)

| | |
|---------------------------------------|----|
| One on one: | 3 |
| Formal company training: | 13 |
| Industry training: | 6 |
| A combination of the 3 above choices: | 29 |
| No training: | 4 |
| Other: | 2 |

3.2.12 Feed

How are feed spillages dealt with?

| | |
|--------------------------|----|
| Collected and discarded: | 54 |
| Collected and reused: | 3 |
| Never had a big spill: | 2 |
| Other: | 1 |

Policy on feed carryover:

| | | |
|---|----|---|
| Reused: | 40 | |
| Feed taken back to mill if over a certain weight: | 19 | |
| Normally nothing left: | | 1 |

3.2.13 Visitor biosecurity entering or leaving farm

Provision of protective gear for visitors

| | |
|---------|----|
| Yes: | 52 |
| No: | 7 |
| Unsure: | 1 |

Details of biosecurity amenities provided

| | |
|---|----|
| Boots, overalls, gloves, (hairnets, masks): | 8 |
| Boots only: | 21 |
| Boots and overalls: | 13 |
| Boot covers: | 6 |
| Boots and mask: | 1 |
| Boots and hand sanitiser: | 3 |
| Visitors supply own gear: | 1 |
| No protective gear provided: | 7 |

Handwashing facilities for visitors

| | |
|-----------------------|----|
| Yes: | 52 |
| No: | 3 |
| Yes, but not used: | 1 |
| Hand sanitising only: | 4 |

Details of handwashing amenities provided

| | |
|-----------------------------------|----|
| Hand sanitiser only: | 28 |
| Water, soap and towel: | 23 |
| Water, soap, towel and sanitiser: | 6 |
| No amenities: | 3 |

Access to visitor logbook: (1 question unanswered so data from 59 farms only)

| | |
|---------------------------|----|
| Yes: | 54 |
| No: | 4 |
| Had one, but it was lost: | 1 |

How are visitors informed about biosecurity? (question not asked for pilot study so data from 57 farms only)

| | |
|------------------------------------|----|
| Grower tells them + clear signage: | 4 |
| Grower tells them: | 31 |
| Visitor book and grower: | 18 |
| Visitor book provides information: | 3 |

Are procedures in place for vehicle decontamination?:

| | |
|------|----|
| Yes: | 44 |
| No: | 16 |

Amenities provided for vehicle decontamination:

| | |
|-----------------------|--|
| Handsprayer: | 24 |
| Knapsack sprayer: | 12 |
| High pressure hose: | 4 |
| Wheel wash/sanitiser: | 3 |
| No amenities: | 16 |
| Other: | 1 (concrete pad at end of unused shed) |

Are there signs to direct visitors appropriately?

| | |
|------------------------|----|
| Yes: | 50 |
| Yes, but not adequate: | 1 |
| No: | 8 |
| Other: | 1 |

Can sheds be locked?

| | |
|------------------|----|
| Yes: | 55 |
| Yes, but aren't: | 3 |

No: 2

Is biosecurity information provided on arrival?

Yes: 58
No: 2

Are the feed and litter trucks free to move around the farm? (question not asked for pilot studies so data from 57 farms only).

Yes: 2
No: 55

3.2.14 General biosecurity

General biosecurity (as assessed by veterinarian)

High: 43
(can proficiently answer questions relating to these issues and practices good biosecurity in the farm, can place or access the company manuals)

Medium: 14
(has a general understanding about biosecurity measures, but may not always put them into practice)

Low: 3
(has limited understanding about biosecurity measures and doesn't implement these, is not familiar with company manuals)

Ease of movement around farm to avoid contamination (as assessed by veterinarian):

Very easy: 45
Moderately easy: 13
Not easy: 2

Farmer understanding of manuals/biosecurity (as assessed by veterinarian)

High: 44
Medium: 13
Low: 3

3.3 Shed level variables:

There were 226 sheds on the 60 farms visited.

Number of sheds on farm:

| | |
|----------|-----|
| Average: | 3.8 |
| Median: | 4 |
| Maximum: | 8 |
| Minimum: | 1 |

Age of sheds on farm (years):

| | |
|----------|------|
| Average: | 18.2 |
| Median: | 14 |
| Maximum: | 46 |
| Minimum: | 0.3 |

Number of birds (per shed):

| | |
|----------|-------|
| Average: | 24886 |
| Median: | 24000 |
| Maximum: | 55000 |
| Minimum: | 6000 |

Biosecurity measures (information reported for 224 sheds only):

Clothing:

| | |
|------|-----|
| Yes: | 28 |
| No: | 196 |

Boots:

| | |
|------|-----|
| Yes: | 208 |
| No: | 16 |

Hand washing/ sanitising:

| | |
|------|-----|
| Yes: | 203 |
| No: | 21 |

Boot dips:

| | |
|------|-----|
| Yes: | 123 |
| No: | 101 |

3.4 Information on randomly selected sheds

Depending on how many sheds were on the farm, up to 3 sheds were randomly selected during the visit for the collection of more detailed information summarised below. Information was reported for up to 169 sheds.

3.4.1 Shed Design:

Shed size (square metres): (N. B. data from 164 sheds)

| | |
|----------|-------|
| Average: | 1883 |
| Median: | 1326 |
| Maximum: | 27300 |
| Minimum: | 315 |

Does the shed have an anteroom or annex?

Yes: 165/169 (no answer was provided for the other 4 sheds)

If yes, where is it located? (N. B. data from 165 sheds)

| | |
|------------------------|----|
| Side: | 75 |
| End: | 89 |
| Between sheds 1 and 2: | 1 |

Shed construction: (N. B. data from 164 sheds)

| | |
|---|-----|
| Nib wall: | 121 |
| Sandwich panel walls: | 29 |
| Sandwich panel or insulated skillion metal roof and side walls: | 47 |
| Internal posts: | 38 |
| Wood panel walls: | 43 |
| Plastic walls: | 3 |
| Other: | |
| Skillion walls and wood panel interior: | 5 |
| Hardboard walls: | 3 |
| Fibrelite: | 29 |
| Styrofoam roof: | 15 |
| Tin walls: | 10 |
| Concrete block walls: | 4 |

Is the end pad of a suitable size and condition (as assessed by veterinarian)? (N. B. data from 156 sheds)

| | |
|----------------------|-----|
| Yes: | 129 |
| No: | 16 |
| Unsure or only just: | 11 |

If not suitable or “unsure or only just”, the reasons given were “too small” (18/27) or “in poor condition” (2/27).

Type of electrics present in the annexe: (N. B. data from 164 sheds)

| | |
|---------------------|-----|
| Modular: | 100 |
| Wiring: | 56 |
| Modular and wiring: | 8 |

Type of electrics present in the shed: (N. B. data from 164 sheds)

| | |
|---------------------|-----|
| Modular: | 115 |
| Wiring: | 47 |
| Modular and wiring: | 2 |

Material of the pathway to the shed: (N. B. data from 162 sheds)

| | |
|------------------------|----|
| Concrete: | 11 |
| Metal hardpack: | 61 |
| Tar seal: | 3 |
| Concrete and hardpack: | 10 |
| Grass and dirt: | 6 |
| Metal and concrete: | 4 |
| Concrete and gravel: | 29 |
| Gravel: | 38 |

Condition of sheds (as assessed by the veterinarian): (N. B. data from 161 sheds)

High: 105
(well maintained, tidy, no or few areas that may represent biosecurity risk)

Medium: 53
(some areas that require repair or cleaning)

Low: 3
(requires maintenance work, or materials present that may represent a biosecurity risk)

Cleanability of the shed for between flock processes (as assessed by the veterinarian): (N. B. data from 161 sheds)

High: 99
(condition of surfaces and equipment look easy to clean)

Adequate: 56

(generally good, but some items would be difficult to clean)

Low: 6
(surfaces and equipment would be difficult to clean)

Ventilation systems: (N. B. data from 163 sheds)

| | |
|---------------------------------|-----|
| Tunnel with mini vents: | 24 |
| Tunnel and cross flow: | 20 |
| Cross flow: | 104 |
| Roof extraction: | 3 |
| Cross flow and roof extraction: | 12 |

Potential for contamination of air inlet source? (as assessed by the veterinarian) (N. B. data from 161 sheds)

Yes: 54
No: 107

Location of brooder heating system? (N. B. data from 150 sheds)

| | |
|----------|----|
| Inside: | 90 |
| Outside: | 47 |
| Annex: | 13 |

Type of brooder heating system? (N. B. data from 162 sheds)

| | |
|---------------------|-----|
| Hover brooders: | 8 |
| Gas blower heaters: | 112 |
| Diesel blowers: | 17 |
| Gas and electric: | 7 |
| Gas and diesel: | 1 |
| Coal: | 2 |
| Electric blowers: | 15 |

Drinker design: (N. B. data from 164 sheds)

| | |
|-------------------|----|
| Plasson: | 62 |
| Big Dutchman: | 5 |
| Cumberland: | 6 |
| Impex: | 34 |
| Ziggy: | 5 |
| Lubing: | 8 |
| Lubing and Val: | 4 |
| Strip drinkers: | 1 |
| Choretine button: | 3 |
| Roxell dry cup: | 12 |

| | |
|----------------|----|
| Roxell nipple: | 4 |
| Swish cups: | 13 |
| Corty: | 3 |
| Button nipple: | 1 |
| Bell: | 2 |
| Don't know: | 1 |

Drinker line material: (N. B. data from 164 sheds)

| | |
|-------------------------|-----|
| Plastic: | 159 |
| Galvanised: | 3 |
| Plastic and galvanised: | 3 |

Type of drinker system: (N. B. data from 164 sheds)

| | |
|---------|----|
| Cup: | 73 |
| Nipple: | 88 |
| N/A: | 3 |

The N/A answers refer to old style drinkers which are neither nipple or cup but trough style.

Is a splash tray present?: (N. B. data from 164 sheds)

| | |
|------|--|
| Yes: | 77 |
| No: | 12 |
| N/A: | 75 (not required for some drinker types) |

3.4.2 Pest exclusion from sheds

Is the shed design adequate for pest exclusion? (as assessed by veterinarian) (N. B. data from 161 sheds)

| | |
|---------|-----|
| Yes: | 148 |
| No: | 10 |
| Unsure: | 3 |

Is there evidence of wild birds in sheds? (as observed by veterinarian) (N. B. data from 161 sheds)

| | |
|------|-----|
| Yes: | 0 |
| No: | 161 |

Are there wild birds around sheds? (as observed by veterinarian) (N. B. data from 161 sheds)

| | |
|------|----|
| Yes: | 78 |
| No: | 83 |

Does the grower discourage wild birds? (N. B. data from 156 sheds)

Yes: 91
No: 65

How are wild birds discouraged? (N. B. data from 91 sheds)

| | |
|---------------------------------------|----|
| Poison wheat: | 12 |
| Pulls hedges down: | 6 |
| Cleans up feed spillages immediately: | 3 |
| Discourages nesting: | 60 |
| Shoots birds: | 6 |
| Other: | 4 |

Is there evidence of flies in sheds? (as observed by veterinarian) (N. B. data from 161 sheds)

Yes: 0
No: 161

Is there evidence of flies around sheds? (as observed by veterinarian, question not asked for pilot studies) (N. B. data from 152 sheds)

Yes: 26
No: 126

Is a rodent control plan in place (as sighted by veterinarian) (N. B. data from 163 sheds)

Yes: 157
No: 6

Is there evidence of rodent baiting and clearing? (as observed by veterinarian) (N. B. data from 161 sheds)

Yes: 158
No: 3

Is there evidence of litter or darkling beetles? (as observed by veterinarian) (N. B. data from 155 sheds)

Yes: 44
No: 102

Occasionally: 9

Shed access barriers between annexe and shed: (N. B. data from 160 sheds except for the Line 159 sheds)

| | |
|---------------|-----|
| Bench: | |
| Yes: | 44 |
| No: | 116 |
| Line: | |
| Yes: | 7 |
| No: | 152 |
| Doorway: | |
| Yes: | 105 |
| No: | 55 |
| Boot dips: | |
| Yes: | 88 |
| No: | 69 |
| For visitors: | 3 |
| Over boots: | |
| Yes: | 27 |
| No: | 131 |
| N/A: | 2 |

Hand sanitising in annexe (location) (question not asked for pilot studies) (N. B. data from 151 sheds)

| | |
|-----------------------------------|------------------------------|
| Above barrier: | 3 |
| Close to biosecurity demarcation: | 5 |
| Annexe entrance: | 41 |
| Shed entrance: | 57 |
| Outside biosecurity barrier: | 3 |
| Within biosecurity area: | 19 |
| Other: | 3 |
| N/A: | 11 (i.e. none in the annexe) |
| None: | 9 |

Cleanability of annexe: (as assessed by the veterinarian) (N. B. data from 155 sheds)

High: 92
(well maintained, tidy, no or few areas that may represent biosecurity risk)

Medium: 55
(some areas that require repair or cleaning)

Low: 8
(requires maintenance work, or materials present that may represent a biosecurity risk)

Condition/cleanliness of barrier: (as assessed by the veterinarian) (N. B. data from 156 sheds)

High: 137
(boot dip fresh, boots tidy, fresh line etc)

Medium: 17
(old boot dip, overboots messy, peeling line etc)

Low: 1
(no evidence of boot dip, over boots, line etc)

No barrier: 1

Shed surroundings: is any vegetation/foilage present? (N. B. data from 157 sheds)

Yes: 46
No: 111

Distance to nearest adjacent shed (Metres)?

Average: 21.3
Maximum: 400
Minimum: 10
Median: 15

How close can animals get to the shed (Metres)?

Average: 27.4
Maximum: 500
Minimum: 0
Median: 15

3.5 Depopulation and Catching Gangs

Companies contract or employ their own catching gangs.

Company requirements for catching gangs in relation to biosecurity: A number of responses to this question indicated standard company procedures without giving further details. The requirements of each company will need to be obtained from their biosecurity manuals.

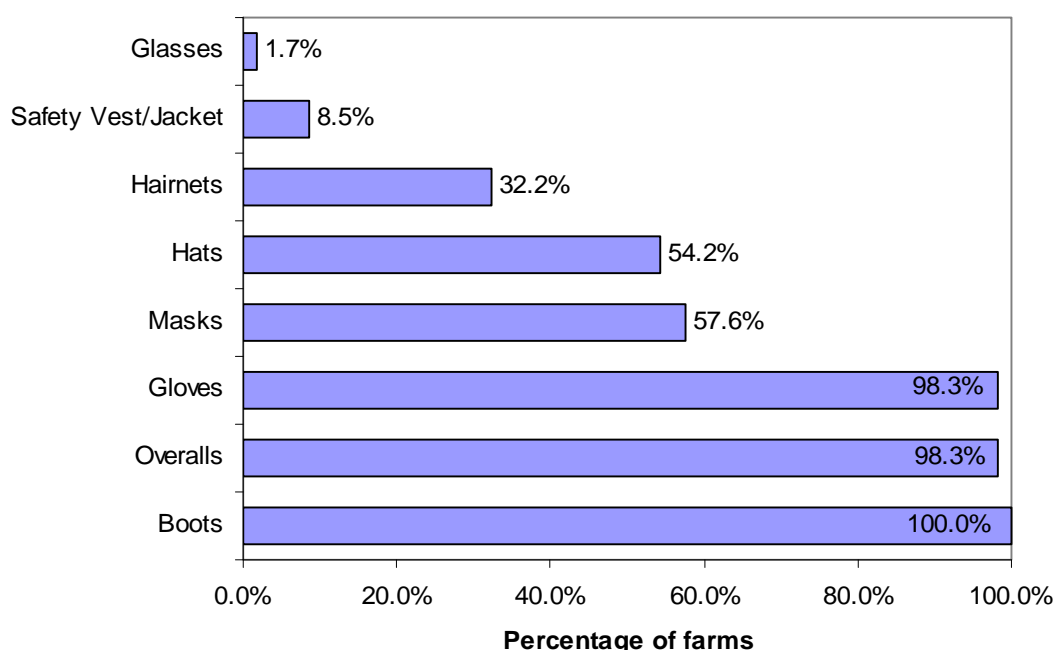
3.5.1 Protective clothing

Protective clothing is used by all catching gangs. A summary of clothing observed by the grower as being used by the catching gangs is summarised in Figure 1 . Fifty eight farms recorded that protective clothing was used by the catching gangs. Two farms did not reply to this question.

Specified protective clothing used.

| | |
|---------------------|----|
| Boots: | 58 |
| Overalls: | 57 |
| Gloves: | 57 |
| Glasses: | 1 |
| Masks: | 34 |
| Hairnets: | 19 |
| Safety vest/jacket: | 5 |
| Hats: | 31 |

Figure 1: Percentage of farms where catching gangs are observed to be using different types of protective clothing



On 56 farms out of 58 the growers believed that some cleaning or changing of clothing was done between farms. Most of these catching gangs were supposed to be entering farms with clean boots and clothing, however one grower noted that only gloves and masks were changed between farms. One grower suspected that clothing was not cleaned between farms and one grower did not know.

One of the vets conducting the survey made the following observation: “They are supposed to change, and evidence has been found by way of discarded masks & hairnets left on farms just serviced. They have steel capped leather boots that are supposed to be dipped, and one would expect that they have clean overalls for each farm. Whether or not this is always implemented is not clear - it's usually dark when they arrive on farms, and with the flurry of activity, the growers don't always specifically note the state of the catchers' gear.”

From 57 farms, only 5 growers were aware of any changing or cleaning of catching gang's clothing done between sheds on a farm. On one of the farms the distance between sheds required transporting the catchers and so clothing was cleaned or changed. Three of the

remaining farms reported cleaning or sanitizing of boots between sheds, with one of these also sanitizing hands and changing gloves. The fifth farm only reported the catchers changing clothing if sweaty or wet.

3.5.2 Equipment

Cleaning of equipment such as trucks and forklifts between farms by the catching gangs varied from “equipment is cleaned but not very well” to “all equipment is cleaned and sanitized between farms”. 56 out of 58 growers believed some cleaning of equipment between farms was performed. Of the 9 growers that specified forklifts in their answers, 6 growers stated that forklifts were not cleaned between farms, while 3 growers stated that forklifts were cleaned and sanitized before leaving the farm.

Only 4 out of 57 farms reported observed cleaning of some equipment between sheds on a farm:

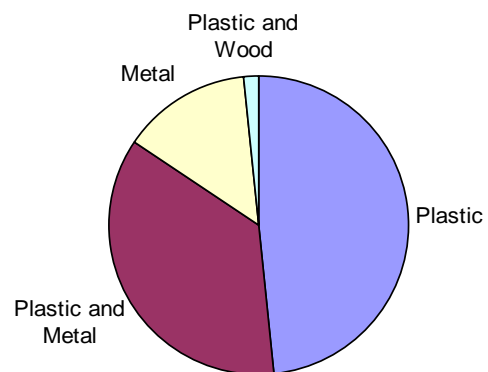
1. “All equipment washed between sheds.”
2. “Forklifts cleaned on end pads on farm.”
3. “If going from older to younger stock.”
4. Equipment cleaned between sheds on different sites on the farm.

One further farm answered NO to the question of inter shed cleaning of equipment, but said that forklifts were supposed to be sanitized / cleaned between sheds.

Catching crates are made from a combination of plastic, metal and or wood as shown Figure 2 for 58 of the farms.

Figure 2: Transport crate construction.

| Material | Number of farms | Percentage of farms (%) |
|-------------------|-----------------|-------------------------|
| Metal | 8 | 14 |
| Plastic | 28 | 48 |
| Metal and Plastic | 21 | 36 |
| Wood and Plastic | 1 | 2 |



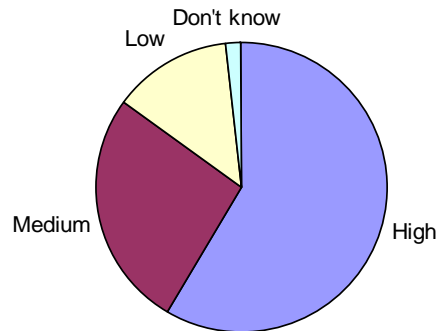
The condition and cleanliness of the crates was ranked (by the farmers and reported to the veterinarians) as:

- High – in good repair, few or no broken parts, clean
- Medium – reasonable condition, moderately clean
- Low – old crates, many broken or cracked parts, dirty

The condition of the crates was recorded as high at 35 of the 60 farms. One processing company provided 30 out of the 35 recorded high condition status. A summary of the condition of the crates used to transport the poultry is given in Figure 3.

Figure 3 Transport crate condition

| Crate condition and cleanliness | Number of farms | Percentage of farms (%) |
|---------------------------------|-----------------|-------------------------|
| High | 35 | 58 |
| Medium to Medium-High | 16 | 27 |
| Low to Medium-Low | 8 | 13 |
| Don't know | 1 | 2 |



3.5.3 Partial Depopulation

Some growers associate the occurrence of *Campylobacter* in the broiler sheds after a first cut of the flock with the contamination of the shed by the catching gangs or their equipment.

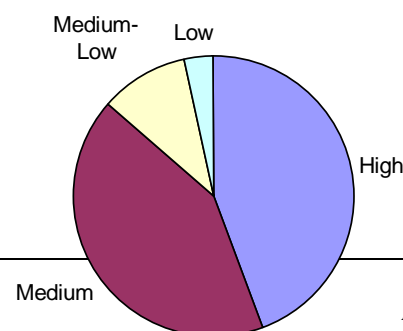
Out of the 60 farms surveyed, 49 (82%) always had partial depopulation of the sheds, while in the remaining farms; 2 farms regularly had full depopulation in one shed per run, 7 farms occasionally had 1 to 2 sheds fully depopulated per run and one farm sometimes had full depopulation occurring in 3 sheds. One farm did not give details of how many sheds were fully depopulated at first cut. Therefore, most sheds undergo partial depopulation at least once in a run.

3.5.4. Growers impression of catching biosecurity

When growers were asked about their overall impression of catching biosecurity, most growers (51 out of 59) thought the catching biosecurity was medium to high. A summary of the results is given in Figure 4. The low and medium low scores corresponded to two out of the four processing companies. Comments made by growers regarding problems with catching biosecurity included, “that generally the biosecurity was good, but occasionally when pushed cleaning was not done” and “the adherence to biosecurity procedures depended on who was supervising the catching gang”.

Figure 4 Growers impression of catching biosecurity.

| Impression of catching biosecurity | Number of farms | Percentage of farms (%) |
|------------------------------------|-----------------|-------------------------|
| High | 26 | 44.1 |



| | | |
|--------------|----|------|
| Medium | 25 | 42.3 |
| Medium – Low | 6 | 10.2 |
| Low | 2 | 3.4 |

3.6 Representativeness

These data provide a more detailed overview of the characteristics of a sample of broiler farms in New Zealand, and supplements the higher level overview provided in the previous report.

In order to assess how well the 60 farm sample represents farms in New Zealand, some comparisons can be made with the national overview provided in Section 4 of the previous report. These are shown in Table 2. Comparisons of the data on shed construction, and animals on or beside farms, were not able to be made due to differences in categories, and data gaps in the national overview respectively. The data that can be compared in Table 2 indicate that the 60 farm survey appears to be a representative sample.

Table 2 Comparison of broiler farm data from national overview and 60 farm survey

| Farm characteristic | National Overview (%) | 60 Farm Survey (%) |
|------------------------------|------------------------------|---|
| <i>Number of birds</i> | | |
| 25001-50000 | 16.2 | 10.2 |
| 50001-75000 | 23.85 | 27.1 |
| 75001-100000 | 23.85 | 28.8 |
| 100001-200000 | 32.3 | 32.2 |
| >2000001 | 3.8 | 1.7 |
| <i>Shed ventilation type</i> | | |
| Ridge | 1.8 | 1.8 (roof extraction) |
| Cross flow | 59.8 | 63.8 |
| Tunnel | 23.6 | 27 (mini vent 14.7 and cross vent 12.3) |
| Mixed | 14.6 | 7.4 |
| Other | 0.2 | - |
| <i>Shed numbers per farm</i> | | |
| 1 | 1.5 | 1.7 |
| 2 | 16.2 | 13.3 |
| 3 | 25.4 | 21.7 |
| 4 | 33.1 | 45 |
| 5 | 7.8 | 10 |
| 6 | 11.5 | 6.7 |
| 7 | 1.5 | 0 |
| 8 | 3.0 | 1.7 |
| <i>Water source</i> | | |
| Bore/well | 73.2 | 80 |
| Town mains/city | 18.3 | 16.7 |
| Spring water | 1.6 | 1.7 |
| River/creek | 6.1 | 1.7 |
| Dam | 0.8 | 0 |
| <i>Drinker design</i> | | |
| Nipple | 45.6 | 54.4 |
| Cup | 54.4 | 45.6 |

3.7 Assessments of shed cleanability and condition

The answers to four questions about the general cleanability and condition of the sheds were examined:

Q67. What condition is the shed in? (high, medium, low)

Q68. What is the cleanability for between flock processes? (high, adequate, low)

Q88. What is the cleanability of the annex? (high, medium, low)

Q89. What is the cleanliness/condition of the barrier? (high, medium, low)

These questions represent an assessment of the condition of the farm sheds by the vets. The farms were grouped according to the responses over all four questions as given in Table 3, where the farms are numbered according to the Excel spreadsheet line for their data. This representation allows assessment of relative numbers of farms.

The first column represents the farms which scored 'High' for all four questions. 'High' represents sheds/annex that are easy to clean and well maintained, with barrier controls clean and well maintained. These sheds present few or no cleanability or maintenance biosecurity risks.

The second column lists the farms which have the grading of one question with a 'medium' response, and the rest are all 'high'. Column three lists farms that have sheds with more than one question answered with a 'medium' or 'adequate' score.

The final column represents two farms with two and three questions answered as 'low'. The 'low' responses corresponded to:

- annexes with lots of stored equipment and wiring, with one annex not lined,
- shed constructed with tin walls and tin or poly roof which was hard to clean properly.

Both these farms also had 'Medium' responses to the condition of the barrier.

The farms grouped by the potential for contamination of the inlet air source are given in Table 4. There were 22 farms where there was at least two sheds that could cross contaminate via the air inlet, 5 farms where animals were grazing or moving close to the sheds and one farm with a drainage sump close to one shed. Two farms marked with bold type had two possible contamination sources for the air inlet.

Table 3. Grouping of farms based on condition and cleanliness of sheds and annexes as given by questions 67, 68, 88 and 89.

| Farms with all 'High' responses | Farms with three 'High' responses and one question given a 'Medium' response | Farms with more than one question given a 'Medium' response | Farms with more than one low response |
|---|--|--|---------------------------------------|
| 28 farms (1, 2, 3, 4, 7, 11, 12, 13, 14, 15, 18, 19, 21, 22, 26, 31, 32, 35, 38, 39, 42, 46, 50, 51, 52, 53, 58, 60) | 3 farms (20, 48, 49) | 27 farms (5, 6, 8, 9, 10, 16, 17, 23, 24, 25, 27, 28, 29, 30, 33, 36, 37, 40, 41, 43, 45, 47, 54, 55, 56, 57, 59) | 2 farms (34, 44) |

Table 4. Grouping of farms based on possible contamination sources for the air inlet to the broiler sheds.

| No potential for cross contamination | Air flow or dust from other sheds | Grazing or animals passing close to shed | Drainage sump |
|--|--|--|-----------------------|
| 34 farms (1, 2, 5, 8, 11, 12, 13, 14, 15, 16, 17, 18, 19, 21, 22, 29, 31, 33, 35, 37, 38, 42, 43, 46, 48, 51, 52, 53, 54, 55, 57, 58, 59, 60) | 22 farms (3, 4, 6, 7, 10, 20, 23, 24, 25, 26, 27, 28, 30, 32, 34, 36 , 39, 40, 41, 44, 45, 47) | 5 farms (9, 36 , 49, 50, 56) | 1 farm (34) |

4 ADDITIONAL LITERATURE REPORTS RELEVANT TO ON-FARM BIOSECURITY

In the period between this report and the previous one from this project additional information on risk factors has been obtained from a number of sources. The following section summarises this information.

4.1 MAF Biosecurity Survey

Rawdon T, Thornton R, McKenzie J, Gerber N. (2007) Biosecurity risk pathways in New Zealand's commercial poultry industry. Surveillance; 34 (3): 4-9.

This article reports the results of a June 2006 survey of poultry farms in New Zealand which was conducted alongside a survey for the presence of avian influenza antibodies. Farms visited included broilers (54 of 184), caged/barn layer (42 of 72) and free range layer (42 of 64). Broiler farm details were:

Total PIANZ registered farms: 184

Number of farms surveyed: 54 (29%)

Epidemiological units (sheds): 202

Broiler birds (total): 4.8 million

Birds per farm: 89,140 (median 80, 950; range 11,890 – 254,000)

Birds per shed: 23,930 (median 22,450; range 11,890 – 54,052)

Mean employees per farm: (excludes owner): 1.85 (median 2, range 0-3)

Mean employees in contact with commercial poultry (excludes owner): 1.12 (median 1, range 0-3)

Relevant biosecurity information:

No broiler farms reported any other domestic bird species present on the property (some were reported on layer farms)

Wild birds: 3 broiler farms had ponds or waterways on or forming a border to the farm, average distance to nearest waterfowl habitat was 333m; on 35 (65%) of the broiler farms wild birds were observed in the vicinity of poultry sheds or runs.

Implementation of biosecurity measures (stand down periods between personnel visits to other poultry farms, footwear disinfection before entering the farms, farm specific clothing worn, and “other” precautions) on broiler farms was high (close to 100%), both onto farms prior to contact with birds, and between sheds. However, the number of broiler farms using a footbath between sheds was about 70% indicating a possible biosecurity risk pathway. Vehicle/equipment disinfection between farms was also practiced on all broiler farms. Overall most risk pathways were identified on layer farms rather than broiler farms.

Broiler farm water sources:

Bore 35

Municipal 10
River/stream 1
Roof 0
Well 8
Other 0

Water treatment:
Chlorination 50
Filtered 0
UV 1
Other 1 (ozone)
None 2

Protection of bulk feed:
Bird proofed: 53/54
Vermin control programme: 54/54

Disposal of manure:
Only one broiler farm carried out on-site disposal of manure – using composting. Off-site disposal methods were: landfill (12), composting (15) pasture fertiliser (21), unspecified (4).

Dead birds disposal:
On site: Landfill (1), composting (1)
Off site: Composting (24), rendering (5), fed to pig/dog (7), unspecified (13)

This information is generally consistent with the results from the 60 farm survey.

4.2 Swedish risk factors

Hansson I, Vagsholm I, Svensson L, Olsson Engvall E. (2007) Correlations between Campylobacter spp. prevalence in the environment and broiler flocks. Journal of Applied Microbiology; 103: 640-649.

This paper examines the relationship between *Campylobacter* types found in broiler houses and their surroundings from 131 flocks on 31 farms in Sweden. Samples were collected from the ground outside (using special socks), from the floor of the broiler houses and anterooms, and from insects, water, feed and ventilation shafts. These were compared with those obtained from flocks sampled at the slaughterhouse (PFGE typing).

Surroundings:
Near entrance of shed 8%
Around whole shed 9%
Air ventilation in 2%
Air ventilation out 1%
Insects 1%
Water 0%
Feed 0%
Anteroom 4%

Broiler house (sock samples from floor): 8%

Slaughter:

Cloacal 23%

Neck skin 30%

Farms delivering positive flocks had a higher rate of *Campylobacter* isolation from within the broiler house, as expected. However, there were no differences between environmental prevalence and the likelihood that the farm would deliver *Campylobacter* positive flocks. This suggests that physical barriers are important for preventing *Campylobacter* spp. in the environment from being transferred into the broiler houses.

4.3 Supplementary “on-farm” material

The following material includes very brief summaries of relevant material presented during poster sessions at the *Campylobacter, Helicobacter* and Related Organisms (CHRO) conference in Rotterdam, September 2007. Copies of these posters are held by Rob Lake.

Guerin et al., Farm level risk factors for the occurrence of Campylobacter in broilers in Iceland

A variety of farm level categorical and continuous variables were analysed through logistic regression. The study used data from 792 flocks, 83 houses on 33 farms. 217 (27%) of the flocks were positive for *Campylobacter*. 95% of positive flocks occurred in summer so data was compressed.

Risk factors:

- Number of houses
- Median flock size
- Manure spread on pasture (on the farm itself)

Manure stored in piles, other domestic livestock, “official” and “official treated” water sources were protective. That other domestic livestock on the farm was protective was unexpected.

Guerin et al. House level risk factors for the occurrence of Campylobacter in broilers in Iceland

Same dataset as above.

Risk factors:

- Use of geothermal water for cleaning
- Changing and dipping boots before entering the house (unexpected)
- Horizontal and vertical ventilation

Vertical ventilation

(Note: Horizontal ventilation was the reference point)

Guerin et al. Temperature related risk factors for the occurrence of Campylobacter in boilers in Iceland

Same dataset as above. Temperature data was derived from closest weather station. Calculated CDD (cumulative degree days) (above an average temperature of 4.4°C), and also number of cool days (presence of at least one day below a maximum of 8.9°C – the temperature below which flies were assumed to be no longer active).

There was a statistically significant relationship between CDD and *Campylobacter* in broilers; cool days were protective. An association between fly activity and temperature was inferred.

Allen et al. Sources and spread of Campylobacter spp. during partial depopulation of broiler chicken flocks.

UK study of 51 farms, 7 companies, 2005-2006. *Campylobacter* status of flocks was monitored, and also vehicles, equipment, and workers from the catching crew were sampled. Isolates were typed by PFGE.

Approximately 20-30% of sites sampled were positive. A decline in positive samples was noted following increased biosecurity imposed to address avian influenza. The same PFGE types occurred in both birds and sampled sites, and in some cases across companies. This provides evidence for introduction of *Campylobacter* into flocks by the thinning operation.

Sowa et al. Identification of environmental reservoirs of Campylobacter on a poultry farm in Eastern England.

Isolates from flocks and the surrounding environment were compared using PFGE typing. Despite taking 1273 samples there was only one match with a strain in a flock, this was also isolated from wild birds.

O'Mahony et al., Distribution of Campylobacter in a subset of intensive poultry flocks on the island of Ireland: identification of possible factors affecting that distribution.

Tested both flocks and the environment on three separate farms. No *Campylobacter* were detected in the disinfected houses, the surrounding environment prior to chick placement, or one day old broiler chicks. During the study period *Campylobacter* were detected in all broiler flocks and some environmental samples (puddles, soil, air inside house, adjacent flocks).

Hansson et al., Reduced Campylobacter prevalence in Swedish broilers 2001-2006.

N.B. In Sweden there is a strict “all in all out” policy i.e. no thinning. Incidence of flock contamination from neck skin samples has declined from about 27% to about 17%. But

seasonal variation is considerable: <10% in winter, up to 50% in summer. About one third of farms seldom deliver *Campylobacter* positive flocks. Risk factors for high *Campylobacter* incidence were: insufficient general tidiness on the farm, slip slaughter, in-line position of doors between the outside and access into broiler houses, other livestock such as cattle, pigs and poultry, and being located in groves rather than in forest.

Heuer et al. Risk factors for the occurrence of Campylobacter in Danish broiler flocks.

Based on data from Danish surveillance programme in poultry, and questionnaires from 244 farms (543 houses). Variables significantly associated with *Campylobacter* status of broiler flocks were:

Age of house

Geographic location

Presence and employment of hygiene and biosecurity measures

Broiler age at introduction of whole wheat in broiler feed

Having more than one house on the farm

Number of chimneys on the broiler house (possibly related to the type of ventilation)

5 CONCLUSIONS AND RECOMMENDATIONS

This survey presents a detailed picture of poultry farming in New Zealand and biosecurity practices, largely in terms of structures and facilities. In general many aspects of biosecurity appear to be good.

- The majority of farm grounds are well maintained;
- Surface waters are rarely used as a drinking water source;
- Most farms chlorinate their broiler drinking water and monitor the treatment;
- Dead bird collection and disposal is generally frequent and controlled;
- Both sheds and annexes are usually cleaned, sanitised and dried between flocks;
- Regular biosecurity audits are conducted;
- Staff biosecurity facilities (boots, shed entry barriers, hand washing facilities) are provided in most sheds;
- Visitor cleanliness and vehicle decontamination facilities are standard on most farms; and,
- Pest control and exclusion (birds, rodents) is standard and apparently effective.

However, effective biosecurity to exclude *Campylobacter* requires consistent and universal coverage of the multitude of pathways by which the flock can become infected. The survey does highlight some areas where improvements could be made. These are discussed in the next section.

5.1 Comparison of survey results with Biosecurity Manual

In August 2007 the Poultry Industry of New Zealand published a “Broiler Growing Biosecurity Manual” that had been agreed with the New Zealand Food Safety Authority (http://www.pianz.org.nz/Documents/Version_1.pdf). This describes recommended minimum standards for many of the aspects of broiler farm operation covered by this survey. The following material considers the results of the survey against relevant aspects of the biosecurity manual.

Section 2.4.1: Grower restrictions

This includes bans on pet birds, other poultry or pigs, on site and in growers places of residence. The results of this survey indicate that this is the case in the farms visited.

Section 2.4.2: Restrictions on visitors

This concerns requirements for record keeping for visitors to the farm. Of the farms visited 5/59 did not have a visitor logbook.

Section 2.5.2: Exclusion of animals

This section requires a total ban on all livestock and pets on site, excluding places of residence, and requires a physical barrier between the poultry site and other animals. Substantial numbers of farms visited reported that pets went down to the sheds (20/57) or were not excluded from shed surroundings (22/54).

Section 2.5.4: Defined pathways

This requires foot pathways and traffic areas to be constructed of hard packed material. Of the sheds visited, only a small number (6/162) had grass and dirt pathways.

Section 2.5.5: Shed annex/service room

This section recommends that annex areas be kept as clean as possible, and disinfected weekly. Almost all farms (58/60) reported both cleaning and sanitising the annex, and most (51/60) performed such cleaning during the shed cleaning process. Of 155 sheds for which cleanability was reported, 55 were rated medium, and 8 as low (solid walls of sheds were reported as not being easy to clean for 4/60 farms). The condition of the barrier was reported as high (137/156) for the majority of sheds.

Section 2.5.6: End pads

Sealed end pads of sufficient size are recommended, with cleaning and sanitising immediately prior to litter and chick entry. Approximately 17% of end pads were considered by the veterinarians to be of unsuitable or marginal size and condition. On 9/60 farms (15%) no end pad cleaning or sanitising was conducted.

Section 2.6.3: Shed entry clothing requirements

This section requires that all visitors, including contractors, enter the shed with dedicated clothing and head cover. The survey found that while boots were provided in most sheds (208/224, 93%), clothing was only provided in a minority (28/224, 12%). Protective gear for visitors was provided by 52/60 farms, but only 8/60 provided the full complement of boots, overalls, gloves, hairnets and masks.

Section 2.6.4: Hand hygiene

This section concerns hand washing or sanitising immediately prior to entering the shed. Most sheds visited had hand washing or sanitising facilities in the annexe but 9/151 (6%) sheds did not. Four farms of 60 (7%) reported no handwashing facilities for visitors.

Section 2.6.5: Footwear requirements

Most sheds (208/224) had dedicated boots for each shed, and over half (123/224) used boot dips. Of the 16 sheds without dedicated boots, only three had boot dips instead. Dedicated boots for each shed are likely to be more effective than boot dips, which require more management to be effective.

Section 2.7: Vehicles and equipment

The requirements in this section concern control of vehicles entering the farm and/or sheds. Vehicle decontamination facilities were reported as unavailable on 16/60 farms.

Section 2.8: Water supply

This section recommends that all water is sanitised, and testing is conducted weekly. Almost all (57/60) farms reported chlorination of their water supply, and 22/23 farms who provided information tested weekly. However, low chlorine levels or problems with testing was reported as an audit non-conformance by 9/60 farms.

There appear to be some areas where maintenance of the drinker system could be improved: drinker disassembly and cleaning was reported as “never” by 35/60 farms, and drinker line biofilm removal was never conducted by 10/60 farms.

Section 2.9: Vermin and wild bird control

Almost all sheds visited showed evidence of a rodent control plan (157/163 sheds) and rodent baiting and clearing (158/161 sheds).

Section 2.11.2: Catching crew clothing requirements

Catching crews are required to change clothes prior to each site, or between sheds on multiage farms. The farmer comments in Section 3.5 suggest that between farm clothing changes are performed, but between shed changes are uncommon (only 5/57 farms reported this being done).

These comparisons between the survey results and the biosecurity manual suggest areas for possible improvement of on-farm biosecurity:

- More rigorous monitoring of chlorination of drinking water (also identified as a problem in some biosecurity audits);
- More frequent or rigorous cleaning of drinker lines;
- More stringent exclusion of pets from shed surroundings;
- Universal provision of hand washing or hand hygiene facilities for staff and visitors;
- Repairs or replacement of shed and annex structural features to improve cleanability;
- Upgrading or replacement of end pads and universal cleaning and sanitising between flocks;
- More universal availability of facilities for vehicle decontamination; and,
- Provision of dedicated clothing for each shed, in addition to the dedicated boots already available.

However, it is acknowledged that this survey was conducted prior to the release of the PIANZ Biosecurity Manual. Anecdotal reports from the industry indicate that aspects of on-farm biosecurity have been addressed since the manual release, and the current situation may be quite different.

5.2 Risk factors that offer opportunity for risk management

The best way to identify the on-farm risk factors that contribute to *Campylobacter* infection in New Zealand poultry flocks would be to assess farm practices against prevalence of

infection. Such an analysis was not part of this project, and as already mentioned, the survey size would have limited statistical power.

In this section we discuss the survey data in terms of risk factors that have been identified overseas, and summarised in Section 2.1.

It seems likely that New Zealand farms are modest in terms of size, number of sheds and birds, numbers of workers, and distance to processing plants. Almost all farms had more than one shed per farm, which has been identified as a risk factor (Wagenaar *et al.*, 2006) but is unlikely to be amenable to change.

The analysis shown in Table 3 indicates that there are improvements that could be made in the condition and cleanliness of sheds and annexes on approximately half the farms. This may influence carry-over of *Campylobacter* from one flock to the next. Although older sheds can be effectively cleaned and sanitised (and farmers may employ more rigorous procedures in less easily cleaned sheds), newer sheds with smoother, non porous surfaces and fewer cavities/ledges/protrusions will be easier to clean. Repairs or replacement would be expensive, but this is a risk factor that could be managed.

Litter disposal was routinely done by removal from the farms, but spreading nearby was reported by approximately one third of farms. Without knowing the composting practices of the litter removal companies it is difficult to assess survival of *Campylobacter* and therefore potential for environmental contamination, but this risk factor could be managed.

Water supplies are predominantly bore/well, which will have lower risk of contamination than surface water. That chlorination may not be effectively implemented as a treatment has been reported by one New Zealand study (Boxall, *et al.*, 2003). There are also farms on which biofilm removal and drinker cleaning can be enhanced or implemented. The importance of such water source risk factors could only be assessed with further data, but management would be feasible if required. *Campylobacter* can survive in biofilms, and bacteria can move from drinkers into the drinker systems and pipes.

The presence of other animals on the farm or in the vicinity has also been identified as a risk factor (Wagenaar *et al.*, 2006). There is a high prevalence of animals (livestock and pets) both on farms and on surrounding farms, that might be contributing *Campylobacter* into the environment around sheds. The presence of animals on surrounding farms is unlikely to be able to be changed, but livestock on the poultry farm itself may be able to be managed.

Flies and wild birds were not reported within any of the sheds visited, but wild birds were observed in the surroundings of approximately half the sheds, and flies in the surroundings of approximately 17% of the sheds. The veterinarians commented that on the days when visits were conducted, environmental conditions were such that flies were unlikely to be seen around the sheds. Farmers also reported that flies were more common around homesteads than around broiler sheds. Darkling beetles were only reported for North Island farms and it would be of interest to examine flock prevalence data from this perspective. Management of these pests, if indeed they are risk factors, is likely to be difficult.

Biosecurity facilities on the farms, for both farm staff and visitors, appeared to be generally available. It is worth noting that in several instances facilities were available but reported as not used. The single visits conducted for this survey will be able to examine facilities and structures, but not truly assess routine day-to-day implementation of biosecurity controls. It seems likely that adherence to good biosecurity practice is not universal; even single lapses may result in flock infection. While this cannot be assessed by the data from this survey, it seems reasonable that greater consistency in shed biosecurity practice is a risk factor that could be managed.

Vehicle decontamination facilities were unavailable on 16/60 farms, which is an aspect of farm practice that could be managed. The effectiveness of existing decontamination facilities on the farms that did have them cannot be assessed by this survey. Regardless of the adequacy of the facilities or the effectiveness of their use, it is likely that strict biosecurity procedures for visitors and vehicles would reinforce good practice during visits.

It is notable that on poultry breeder farms, more stringent biosecurity is practiced compared to broiler farms. This includes:

- Little equipment goes onto the farms;
- Equipment that goes onto the farms is sanitised in some way;
- Showering is compulsory on entry to the farm;
- Farm clothes are supplied (head to toe including boots)
- Farm clothes are laundered on site;
- Movement onto the farm is restricted;
- Less biomass is produced by the farm animals;
- Greater enclosure of farms facilities e.g. all walkways are totally enclosed;
- More rigorous changing of boots
- Greater attention and understanding for biosecurity;
- No thinning (occasional movements of birds are performed using dedicated crates which are thoroughly cleaned and dried between infrequent uses); and,
- Dedicated breeder farm staff.

Although breeder farms do experience occasional *Campylobacter* infection of flocks, the prevalence is lower than for broiler farms. Infection also occurs later in the bird's lifetime, which is approximately one year compared to 5 – 7 weeks for broilers. This points to the potential for enhanced biosecurity to reduce prevalence.

Thinning or depopulation is a well recognised risk factor, and is universally practiced on New Zealand farms. Protective clothing was reported as widely used by catching gangs. Farmers reported that cleaning of clothing between farms was performed by catching gangs although their ability to assess this issue is probably limited. Biosecurity by catching gangs between sheds appeared infrequently applied. While 58% and 44% of responses for transport crate condition and grower impressions of catching gang biosecurity respectively were “high”, there were a large number of lower gradings. The data collected by this survey (from farmers, not thinning contractors) on this aspect of biosecurity will be incomplete, and it does appear to be a risk factor worthy of further investigation and/or management.

In summary the risk factors that offer potential for management, based on the results of this survey, are:

- Condition of sheds and annexes;
- Livestock on the broiler farms themselves;
- Litter disposal on nearby farms;
- Biosecurity stringency in day-to-day operations; and,
- Biosecurity associated with thinning or depopulation.

5.3 Further research

A number of areas for further research are suggested.

- Litter: Although almost all farms removed litter following grow-out, approximately one third reported litter being spread nearby. Residual *Campylobacter* in litter may contaminate the land on which it is spread, and contribute to infection (via dust or insects) of further poultry flocks on the farms, or other livestock.
- Cleandown between flocks: The survey information suggests that cleandown and sanitising is rigorous and shed conditions are good in respect to their ability to be cleaned and sanitised. It could be useful to conduct some environmental testing of sheds (particularly from farms with a high flock prevalence) to confirm this. A second issue is disposal of the water used to wash out sheds following removal of litter. It is possible that this water, if not properly disposed of, may contribute significantly to environmental loading around the sheds. Testing of this water would assess this issue.
- Flies: No flies were observed in sheds (although their survival time is likely to be short), but for 17% of sheds, flies were seen in the immediate environment. This raises the issue of the introduction of *Campylobacter* on flies entering sheds. Given the apparent effectiveness of fly control in reducing flock prevalence in Denmark it may be useful to investigate this issue further.
- Crate cleanliness. It seems likely that cleaning of crates and modules following delivery of birds to the processing plant is insufficient to eliminate *Campylobacter*, and this may play a role in introducing *Campylobacter* into sheds visited later on the same day.

7 REFERENCES

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Allen V and Newell D (2005) Evidence for the effectiveness of biosecurity to exclude *Campylobacter* from poultry flocks

Boxall NS, Perkins NR, Marks D, Jones B, Fenwick SG and Davies PR. (2003) Free available chlorine in commercial broiler chicken drinking water in New Zealand. *Journal of Food Protection*; 66: 2164-2167.

APPENDIX 1: INTRODUCTORY LETTER FOR FARM VISITS

Dear

Re: On-farm risk factors for *Campylobacter* contamination of poultry

The New Zealand Food Safety Authority is currently conducting a number of projects to try and reduce the incidence of campylobacteriosis in New Zealand. Poultry has been identified as an important food source for these bacteria, and some of these projects aim to reduce the frequency with which poultry is contaminated. This particular project is aimed at lowering the frequency of infection of broiler flocks on farms before they go for processing. The project is being conducted for the NZFSA by ESR, with the assistance of David Marks and Jutta Tebje-Kelly, who are providing broiler veterinary expertise.

As part of this project we have organised visits to a number of broiler farms to collect information on how broilers are raised, in order to try and identify ways in which the prevalence of infection can be reduced. The most important areas to review are biosecurity and depopulation (thinning).

This programme of farm visits has been discussed with the Poultry Industry Association of New Zealand (PIANZ) Board, and their support was secured at an early stage. The specific protocol for the visits was also discussed in detail at a meeting with PIANZ in February 2007.

This is not an audit to assess compliance with a standard, but an information gathering exercise. Farms have been chosen to give a national overview, but selected at random within a particular region. We will be visiting around a third of the approximately 160 broiler farms in New Zealand. The information we gather will be used to:

- Compare with overseas studies of risk factors that are important for *Campylobacter* status of the flock;
- Compare with flock *Campylobacter* prevalence data collected as part of testing programmes;
- Identify whether there are opportunities to improve the biosecurity for broilers in conjunction with the current development, by PIANZ, of a basic biosecurity code of practice.

During this visit we would like to:

- Collect information about the farm structures, operation, and setup during a tour and discussions with the relevant person (manager, owner/operator);
- Discuss biosecurity practices on the farm;
- Examine management records such as the growers book, and pest control records;
- Discuss your knowledge of biosecurity related to *Campylobacter*; and,
- Take some photos of the farm.

The photos will be held by ESR, and no photos will be published without permission from the farmer. Any publications derived from the information gathered will not identify individual farms.

We will telephone you to check that you are willing for us to visit, and schedule a date. We expect that we will need to spend about 3-4 hours on the farm. During the phone call we will ask about whether to bring our own protective equipment, and vehicle cleaning requirements.

If you have questions about the project, or the farm visits, please contact me at ESR (03) 3516019 or rob.lake@esr.cri.nz

Thank you.

Rob Lake
Scientist, Food Group
ESR
Christchurch Science Centre
P O Box 29-181
Christchurch

APPENDIX 2: QUESTIONNAIRE



Broiler farm risk factors for infection of flocks with *Campylobacter*

Descriptive survey of farm practices and biosecurity

2007

Confidential farm management questionnaire

Contact: Rob Lake
Food Programme
ESR Christchurch Science Centre
P O Box 29-181
Christchurch
New Zealand
Ph: (03) 3516019
rob.lake@esr.cri.nz

Farm details:

1) Farm name/address (and any GIS information):

2) Farm telephone/mobile

Tel. Mobile.

3) Person(s) interviewed (please tick all that apply):

Farm owner Farm manager Other (please specify)

Name of person(s) interviewed:

4) Name of interviewer:

5) Date of visit and interview:

Note: We are collating information on current practices on broiler farms. Where practices might have changed recently, please find out what the practices are now.

Farm level variables:

6) Farm size (hectares)

7) General position of sheds with respect to surrounding farms

Central
 Close to one side (if so state type of adjacent farm)

8) What is the nature of all surrounding farms and livestock types?

| i) Farm number 1 | i) Farm number 2 | i) Farm number 3 | i) Farm number 4 |
|---|---|---|---|
| ii) Livestock | ii) Livestock | ii) Livestock | ii) Livestock |
| <input type="checkbox"/> present | <input type="checkbox"/> present | <input type="checkbox"/> present | <input type="checkbox"/> present |
| <input type="checkbox"/> absent | <input type="checkbox"/> absent | <input type="checkbox"/> absent | <input type="checkbox"/> absent |
| iii) If present, state type: | iii) If present, state type: | iii) If present, state type: | iii) If present, state type: |
| <input type="checkbox"/> Dairy cattle | <input type="checkbox"/> Dairy cattle | <input type="checkbox"/> Dairy cattle | <input type="checkbox"/> Dairy cattle |
| <input type="checkbox"/> Beef cattle | <input type="checkbox"/> Beef cattle | <input type="checkbox"/> Beef cattle | <input type="checkbox"/> Beef cattle |
| <input type="checkbox"/> Pigs | <input type="checkbox"/> Pigs | <input type="checkbox"/> Pigs | <input type="checkbox"/> Pigs |
| <input type="checkbox"/> Sheep | <input type="checkbox"/> Sheep | <input type="checkbox"/> Sheep | <input type="checkbox"/> Sheep |
| <input type="checkbox"/> Horses | <input type="checkbox"/> Horses | <input type="checkbox"/> Horses | <input type="checkbox"/> Horses |
| <input type="checkbox"/> Poultry | <input type="checkbox"/> Poultry | <input type="checkbox"/> Poultry | <input type="checkbox"/> Poultry |
| <input type="checkbox"/> Deer | <input type="checkbox"/> Deer | <input type="checkbox"/> Deer | <input type="checkbox"/> Deer |
| <input type="checkbox"/> Other (please specify) | <input type="checkbox"/> Other (please specify) | <input type="checkbox"/> Other (please specify) | <input type="checkbox"/> Other (please specify) |
| <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |

9) What is the approximate total number of birds per growing cycle on the whole farm?

10) To which processing plant are the birds sent?

11) What is the approximate distance to the processing plant?
as the crow flies (km) by road (km)

12) What is the approximate transport time between the farm and the processing plant (if known)?
 Hours Minutes

13) What is the usual number of cycles per year?
i) Number of days from the birds out to placement of birds? (includes litter removal and cleaning period)
Range across all sheds on the farm
ii) Number of days from the litter out to placement of birds?
Range across all sheds on the farm

14) How many people work on the farm?
Numbers for routine day-to-day operation
Specify staff titles
Numbers of temporary staff for cleanout
Numbers of temporary staff for placing

15) What is the general condition of the grounds surrounding the sheds? (PHOTOGRAPH)

- Frequent maintenance (is there evidence of regular grass mowing/weeding, is the concrete/gravel tidy and well maintained)
- Occasional maintenance (some mowing/weeding, gravel/concrete in reasonably good condition)
- No maintenance (e.g. surrounding area used for grazing)

16) What is the farm water supply source?

- Bore/well on farm
- Town/mains supply
- Spring water
- River/creek
- Dam
- Other (please specify)

17) What on farm water treatment is undertaken?

(ask to see evidence of effectiveness of treatment records, also conduct visual assessment)

i) Type of treatment:

Chlorination

Ultraviolet

Chlorine dioxide

Ozone

Other (please specify) _____

None

ii) How is effectiveness at drinker level ascertained? _____

18) What other animals are present on the farm? (small box after each option)

i) Livestock (indicate numbers)

Dairy cattle _____

Beef cattle _____

Pigs _____

Sheep _____

Horses _____

Other (please specify) _____

ii) Pets (indicate numbers)

Dogs (include working dogs) _____

Cats _____

Other (please specify) _____

19) Exclusion of animals from sheds:

i) Do the pets go down to the sheds?

Yes

No

ii) Are animals (including pets) excluded from shed surroundings?

Yes

How _____

No

Procedures for establishing new flocks (placing):

20) How are chickens placed in sheds?

In cardboard boxes

In plastic boxes

Other (please specify) _____

Bedding and cleaning down between flocks:

21) What litter type is used?

Wood shavings

Paper

Straw

Mixed

Other (please specify) _____

22) What is the normal disposal practice for used litter?

Removal from farm

Other (please specify) _____

23) Is there any stockpiling of litter on the farm between removal from shed and removal from farm?

Yes

No

24) Who removes the litter?

Commercial company (please specify)

Farm worker

Other (please specify) _____

25) Is there spread of (any) litter nearby (on adjacent land or farms)?

Yes

No

Dead bird checking and disposal:

26) What is the frequency of checking for, and collection of, dead birds in sheds?

Once per day

Multiple daily pick-ups

Other (please state frequency) _____

27) How are dead birds stored on the farm prior to collection or disposal?

Freezer

Fridge

Other (please specify) _____

28) What are the practices in place for disposal of dead birds?

Incineration on farm

Incineration off farm (see questions below)

Burial on farm

Other (please specify) _____

29) What is the frequency of collection of dead birds for disposal? (days/weeks) _____

30) Where is the collection point for dead birds in relation to the farm and sheds?

Shed cleanout between crops:

31) Who cleans the sheds?

- Staff (please specify whether contract/temporary/permanent)
- Contract industrial cleaners (specialist gangs)
- Name of cleaner/company
- Other (please specify)

32) Is shed cleanout audited or checked?

- Yes
- No

33) Who cleans the annexe? (PHOTOGRAPH)

- Staff (please specify whether contract/temporary/permanent)
- Contract industrial cleaners (specialist gangs)
- Name of cleaner/company
- Other (please specify)

34) Are the annexes both cleaned and sanitized?

- Yes
- No

35) When is the annexe cleaned (in relation to cleaning of the shed)?

- Before
- During
- After

36) When is shed biosecurity put into place?

- After cleaning
- After sanitizing

37) Please provide details of shed cleaning and sanitizing regimes - i.e. chemicals used, fumigation, time free prior to re-stocking etc.

38) Are sheds dry before sanitizing?

- Yes
- No
- Other (please specify)

39) Are sheds dry before litter placement?

- Yes
- No
- Other (please specify)

40) Are brooding curtains used in the sheds?

- Yes
- No

41) Are solid walls easy to clean?

- Yes
- No

42) Is cleaning of removable items performed inside or outside of the shed?

- Inside
- Outside

43) Is sanitizing of removable items performed inside or outside of the shed?

- Inside
- Outside

44) Drinking system cleaning and flushing:

i) How often is the drinking system flushed (during crop)?

- Daily
- Weekly
- Monthly
- Never
- Other (please specify) _____

ii) How often is the drinking system cleaned (intercrop)?

- Daily
- Weekly
- Monthly
- Never
- Other (please specify) _____

45) How often are drinkers disassembled and cleaned?

- Every batch (crop)
- Other (please specify) _____
- Never
- N/A

Comments: _____

46) Biofilm removal:

i) Are procedures in place to remove biofilms from drinking systems?

- Yes
- No

ii) If yes, please specify chemical and procedure for use.

iii) What is the frequency of cleaning?

- Daily
- Weekly
- Monthly
- Intercrop only
- Other (please specify)
- Never
- N/A

47) Heater cleaning:

i) Who cleans the heaters?

- Permanent staff
- Temporary staff
- Contract specialist cleaners
- Other (please specify)

ii) How is it done?

- Blown out
- Wet cleaned
- No cleaning
- Other (please specify)

48) End pad cleaning and sanitizing: (PHOTOGRAPH)

i) Is end pad cleaning and sanitizing performed before placing?

- Yes
- No

ii) Please give details as to how this is performed.

Biosecurity (general): (PHOTOGRAPHS OF RELEVANT MATERIAL)

49) Manuals/Audits:

i) When was the last time biosecurity was audited?

ii) Were any non-conformances identified?

50) When was the last update to the manual?

51) When are staff given biosecurity training? (small box after each option)

Before they start work on the farm

During the first week

Other (please specify)

52) How are staff trained on biosecurity?

One on one training

Initial induction

Industry training

Formal company training

Other (please specify)

53) How are feed spillages dealt with on site?

Feed is collected and discarded

Feed is collected and re-used

Other (please specify)

54) What is the policy on carryover of feed?

Feed is discarded

Feed is re-used

Other (please specify)

55) What health and safety/biosecurity procedures are in place for staff/visitors entering and leaving the farm?

i) Is protective gear provided for visitors?

Yes

No

If yes, please specify nature of protective clothing provided.

ii) Are hand washing facilities provided for visitors?

Yes

No

If yes, what are the facilities (ie hot/cold water, soap, towel) please specify

iii) Is a visitors log book accessible?

- Yes
- No

iv) How are visitors made aware of biosecurity requirements?

- Grower tells them

Specify what grower tells them

- Visitors book provides information

- Other (please specify)

v) How are visitors made aware of biosecurity requirements?

- Grower tells them

- Specify what grower tells them

- Visitors book provides information

- Other (please specify)

vi) Are procedures in place for vehicle decontamination?

- Yes

If yes, please specify

- No

vii) Are there signs in place to direct visitors appropriately?

- Yes

- No

viii) Can sheds be locked?

- Yes

- No

ix) Is biosecurity information clearly provided for visitors upon arrival - i.e. do they need to be accompanied by a farm worker?

- Yes

- No

x) Do the feed truck/litter removal driver(s) wander around the farm?

- Yes

Please give details

- No

56) What is the general biosecurity status of the farm? (assessment by interviewer)

- High (biosecurity practices specified and implemented in all sheds)

- Medium (some implementation of biosecurity measures)

- Low (little or no attempt to implement biosecurity measures)

57) How easy is it to move around the farm without getting contaminated?

- Very easy (presence of good biosecurity measures)
- Moderately easy (generally good biosecurity, but lacking consistency or use in all buildings)
- Not easy (poor or absence of biosecurity measures)

58) How good is the farmers understanding of company manuals and commitment to biosecurity measures?

- High (can proficiently answer questions relating to these issues and practices good biosecurity on the farm. Can place or access the company manuals)
- Medium (has a general understanding about biosecurity measures, but may not always put them into practice).
- Low (has limited understanding about biosecurity measures and doesn't implement these. Is not familiar with company manuals)

Shed level variables: (to be collected for all sheds)

59) Age and birds:

| Shed no | Age (years) | | Number of birds usually housed | |
|------------|-------------|--|--------------------------------|--|
| Shed no 1 | Age (years) | | Number of birds usually housed | |
| Shed no 2 | Age (years) | | Number of birds usually housed | |
| Shed no 3 | Age (years) | | Number of birds usually housed | |
| Shed no 4 | Age (years) | | Number of birds usually housed | |
| Shed no 5 | Age (years) | | Number of birds usually housed | |
| Shed no 6 | Age (years) | | Number of birds usually housed | |
| Shed no 7 | Age (years) | | Number of birds usually housed | |
| Shed no 8 | Age (years) | | Number of birds usually housed | |
| Shed no 9 | Age (years) | | Number of birds usually housed | |
| Shed no 10 | Age (years) | | Number of birds usually housed | |
| Shed no 11 | Age (years) | | Number of birds usually housed | |
| Shed no 12 | Age (years) | | Number of birds usually housed | |
| Shed no 13 | Age (years) | | Number of birds usually housed | |
| Shed no 14 | Age (years) | | Number of birds usually housed | |
| Shed no 15 | Age (years) | | Number of birds usually housed | |

60) Biosecurity measures (exit to and from sheds and between shed activity):

| | Protective gear | | | |
|-----------|-----------------|-------|-------------------------|-----------|
| | Clothing | Boots | Hand washing facilities | Boot dips |
| Shed no 1 | Y/N | Y/N | Y/N | Y/N |
| Shed no 2 | Y/N | Y/N | Y/N | Y/N |
| Shed no 3 | Y/N | Y/N | Y/N | Y/N |
| Shed no 4 | Y/N | Y/N | Y/N | Y/N |
| Shed no 5 | Y/N | Y/N | Y/N | Y/N |
| Shed no 6 | Y/N | Y/N | Y/N | Y/N |
| Shed no 7 | Y/N | Y/N | Y/N | Y/N |
| Shed no 8 | Y/N | Y/N | Y/N | Y/N |

| | | | | |
|------------|-----|-----|-----|-----|
| Shed no 9 | Y/N | Y/N | Y/N | Y/N |
| Shed no 10 | Y/N | Y/N | Y/N | Y/N |
| Shed no 11 | Y/N | Y/N | Y/N | Y/N |
| Shed no 12 | Y/N | Y/N | Y/N | Y/N |
| Shed no 13 | Y/N | Y/N | Y/N | Y/N |
| Shed no 14 | Y/N | Y/N | Y/N | Y/N |
| Shed no 15 | Y/N | Y/N | Y/N | Y/N |

NB: If there are more than 3 sheds on the property, please use a random number programme to choose 3 sheds for the fuller investigation below. Please indicate on the list above which sheds have been chosen.

For each of the 3 (or fewer) sheds chosen, please specify the following:

NB: Please use a different template for each shed.

Information on selected sheds:

SHED 1:

61) Approximate Size (Metres²)

62) Design:

i) Does the shed have an anteroom/annexe?

Yes

No

ii) If so, what is it's location relative to the bird housing?

Side

End

Other (please specify)

63) How is the shed constructed? (PHOTOGRAPH)

Nib wall

Sandwich panel walls

Sandwich panel or insulated skillion metal roof and side walls

Internal posts

Wood panel walls

Plastic walls

Other (please specify)

64) Is the end pad of a size and condition suitable for the purpose?

Yes

No

If no, please specify reasons

65) What type of electrics are present?

i) In the annexe:

Modular

Wiring

Other (please state) _____

ii) In the shed:

Modular

Wiring

Other (please state) _____

66) What is the material of the pathway to the shed?

Concrete

Other (please specify) _____

67) What condition is the shed in?

High (well maintained, tidy, no or few areas that may represent biosecurity risk)

Medium (some areas that require repair or cleaning)

Low (requires maintenance work, or materials present that may represent a biosecurity risk)

68) What is the cleanability for between flock processes?

High (condition of surfaces and equipment look easy to clean)

Adequate (generally good, but some items that would be difficult to clean)

Low (surfaces and equipment would be difficult to clean)

69) What type of ventilation system is used?

Tunnel with mini-vents (small, near roof so that incoming cool air mixes with internal hot air)

Tunnel and cross flow (fans at end and walls, vents in walls)

Cross flow

Roof extraction

Other (please specify) _____

70) Is there potential for contamination of the air inlet source? (e.g. manure pile, outlet of adjacent shed, dairy pasture)

Yes (please specify) _____

No

71) What is the location and type of brooder heating system?

i) Location: _____

ii) Type:

Hover brooders

Gas blower heaters

Diesel blowers

Other (please specify)

Drinker design:

72) What is the name of the drinker system used? (PHOTOGRAPH)

- Plasson
- Big Dutchman
- Cumberland
- Impex
- Val
- Ziggy
- Lubing
- Roxell dry cup
- Roxell nipple
- Swish cups
- Other (please specify) _____

73) Are the drinker lines:

- Plastic
- Galvanised

74) What type of drinker system is used?

- Nipple
- Cup

75) Is a splash tray present?

- Yes
- No
- N/A

Pest exclusion:

76) Is the shed design adequate for pest exclusion?

- Yes
- No

If no, specify problem _____

Examine bird proof screens, particularly over the air inlets:

77) Is there any evidence of birds in sheds and/or signs of bird activity in sheds?

- Yes (please specify) _____
- No

78) Is there any evidence of wild birds in sheds and/or signs of wild bird activity in sheds?

- Yes
If yes, please specify _____
- No

79) Is there any evidence of wild birds around the sheds (ie nesting under roofline or in vents etc)?

Yes

If yes, please specify

No

80) Does the grower discourage wild birds?

Yes

If yes, please specify how

No

81) Is there evidence of flies present in the shed (ie flies seen in the shed during visit)?

Yes

No

82) Is there evidence of flies present around the shed (ie flies seen around the shed during visit)?

Yes

Please note weather conditions during farm visit:

No

83) Is a rodent control plan in place? (ask to see a rodent control plan)

Yes

No

If a rodent control plan is in place, examine the traps:

84) Is there any evidence of baiting/clearing?

Yes

No

85) Have Litter or Darkling beetles been seen in the shed?

Yes

No

Shed access for personnel:

86) What type of barrier/biosecurity measure between annex and shed is there?

Bench

Line

Doorway

Boot dips

If applicable state chemical used, and frequency of changing:

Describe the condition of the boot dip:

Over boots

Other (please specify)

87) If a hand sanitizer is used prior to shed entry, where is this located in relation to the shed entrance (ie would it be in a place where it was the last thing to be done before entering the shed)?

88) What is the cleanability of the annex?

- High (well maintained, tidy, no or few areas that may represent biosecurity risk)
 Medium (some areas that require repair or cleaning)
 Low (requires maintenance work, or materials present that may represent a biosecurity risk)

Please specify problems identified:

89) What is the cleanliness/condition of the barrier? (PHOTOGRAPH)

- High (boot dip fresh, boots tidy, fresh line etc)
 Medium (old boot dip, over boots messy, peeling line etc)
 Low (no evidence of boot dip, over boots, line etc)

90) Shed surroundings:

i) Is any vegetation/foliage present?

- Yes
 No

ii) If yes, what type of vegetation/foliage is present?

91) How far is this shed from the nearest other shed (metres)?

92) How close can other animals get to the shed? (state type of animals and distance in metres)

Additional comments:

SHED 2:

61) Approximate Size (Metres²)

62) Design:

i) Does the shed have an anteroom/annexe?

- Yes
 No

ii) If so, what is it's location relative to the bird housing?

- Side
 End

Other (please specify)

63) How is the shed constructed? (PHOTOGRAPH)

- Nib wall
- Sandwich panel walls
- Sandwich panel or insulated skillion metal roof and side walls
- Internal posts
- Wood panel walls
- Plastic walls
- Other (please specify)

64) Is the end pad of a size and condition suitable for the purpose?

- Yes
- No

If no, please specify reasons

65) What type of electrics are present?

i) In the annexe:

- Modular
- Wiring
- Other (please state)

ii) In the shed:

- Modular
- Wiring
- Other (please state)

66) What is the material of the pathway to the shed?

- Concrete
- Other (please specify)

67) What condition is the shed in?

- High (well maintained, tidy, no or few areas that may represent biosecurity risk)
- Medium (some areas that require repair or cleaning)
- Low (requires maintenance work, or materials present that may represent a biosecurity risk)

68) What is the cleanability for between flock processes?

- High (condition of surfaces and equipment look easy to clean)
- Adequate (generally good, but some items that would be difficult to clean)
- Low (surfaces and equipment would be difficult to clean)

69) What type of ventilation system is used?

- Tunnel with mini-vents (small, near roof so that incoming cool air mixes with internal hot air)
- Tunnel and cross flow (fans at end and walls, vents in walls)
- Cross flow
- Roof extraction
- Other (please specify) _____

70) Is there potential for contamination of the air inlet source? (e.g. manure pile, outlet of adjacent shed, dairy pasture)

- Yes (please specify) _____
- No

71) What is the location and type of brooder heating system?

i) Location: _____

ii) Type:

- Hover brooders
- Gas blower heaters
- Diesel blowers
- Other (please specify) _____

Drinker design:

72) What is the name of the drinker system used? (PHOTOGRAPH) (Specify all if more than one)

- Plasson
- Big Dutchman
- Cumberland
- Impex
- Val
- Ziggy
- Lubing
- Roxell dry cup
- Roxell nipple
- Swish cups
- Other (please specify) _____

73) Are the drinker lines:

- Plastic
- Galvanised

74) What type of drinker system is used? (Specify if more than one)

- Nipple
- Cup

75) Is a splash tray present?

- Yes
- No
- N/A

Pest exclusion:

76) Is the shed design adequate for pest exclusion?

- Yes
- No
- If no, specify problem

Examine bird proof screens, particularly over the air inlets:

77) Is there any evidence of birds in sheds and/or signs of bird activity in sheds?

- Yes (please specify)
- No

78) Is there any evidence of wild birds in sheds and/or signs of wild bird activity in sheds?

- Yes
- If yes, please specify
- No

79) Is there any evidence of wild birds around the sheds (ie nesting under roofline or in vents etc)?

- Yes
- If yes, please specify
- No

80) Does the grower discourage wild birds?

- Yes
- If yes, please specify how
- No

81) Is there evidence of flies present in the shed (ie flies seen in the shed during visit)?

- Yes
- No

82) Is there evidence of flies present around the shed (ie flies seen around the shed during visit)?

- Yes
- No

83) Is a rodent control plan in place? (ask to see a rodent control plan)

- Yes
- No

If a rodent control plan is in place, examine the traps:

84) Is there any evidence of baiting/clearing?

- Yes
- No

85) Have Litter or Darkling beetles been seen in the shed?

- Yes
- No

Shed access for personnel:

86) What type of barrier/biosecurity measure between annex and shed is there?

- Bench
- Line
- Doorway
- Boot dips
- If applicable state chemical used, and frequency of changing:

Describe the condition of the boot dip:

Over boots

Other (please specify)

87) If a hand sanitizer is used prior to shed entry, where is this located in relation to the shed entrance (ie would it be in a place where it was the last thing to be done before entering the shed)?

88) What is the cleanability of the annex?

- High (well maintained, tidy, no or few areas that may represent biosecurity risk)
- Medium (some areas that require repair or cleaning)
- Low (requires maintenance work, or materials present that may represent a biosecurity risk)

Please specify problems identified:

89) What is the cleanliness/condition of the barrier? (PHOTOGRAPH)

- High (boot dip fresh, boots tidy, fresh line etc)
- Medium (old boot dip, over boots messy, peeling line etc)
- Low (no evidence of boot dip, over boots, line etc)

90) Shed surroundings:

i) Is any vegetation/foliage present?

- Yes
- No

ii) If yes, what type of vegetation/foliage is present?

91) How far is this shed from the nearest other shed (metres)?

92) How close can other animals get to the shed? (state type of animals and distance in metres)

Additional comments:

SHED 3:

61) Approximate Size (Metres²)

62) Design:

i) Does the shed have an anteroom/annexe?

- Yes
- No

ii) If so, what is it's location relative to the bird housing?

- Side
- End
- Other (please specify)

63) How is the shed constructed? (PHOTOGRAPH)

- Nib wall
- Sandwich panel walls
- Sandwich panel or insulated skillion metal roof and side walls
- Internal posts
- Wood panel walls
- Plastic walls
- Other (please specify)

64) Is the end pad of a size and condition suitable for the purpose?

- Yes
- No
- If no, please specify reasons

65) What type of electrics are present?

i) In the annexe:

Modular

Wiring

Other (please state) _____

ii) In the shed:

Modular

Wiring

Other (please state) _____

66) What is the material of the pathway to the shed?

Concrete

Other (please specify) _____

67) What condition is the shed in?

High (well maintained, tidy, no or few areas that may represent biosecurity risk)

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Low (surfaces and equipment would be difficult to clean)

69) What type of ventilation system is used?

Tunnel with mini-vents (small, near roof so that incoming cool air mixes with internal hot air)

Tunnel and cross flow (fans at end and walls, vents in walls)

Cross flow

Roof extraction

Other (please specify) _____

70) Is there potential for contamination of the air inlet source? (e.g. manure pile, outlet of adjacent shed, dairy pasture)

Yes (please specify) _____

No

71) What is the location and type of brooder heating system?

i) Location: _____

ii) Type:

Hover brooders

Gas blower heaters

Diesel blowers

Other (please specify) _____

Drinker design:

72) What is the name of the drinker system used? (PHOTOGRAPH) (Specify all if more than one)

- Plasson
- Big Dutchman
- Cumberland
- Impex
- Val
- Ziggy
- Lubing
- Roxell dry cup
- Roxell nipple
- Swish cups
- Other (please specify)

73) Are the drinker lines:

- Plastic
- Galvanised

74) What type of drinker system is used? (Specify if more than one)

- Nipple
- Cup

75) Is a splash tray present?

- Yes
- No
- N/A

Pest exclusion:

76) Is the shed design adequate for pest exclusion?

- Yes
 - No
 - If no, specify problem
-

Examine bird proof screens, particularly over the air inlets:

77) Is there any evidence of birds in sheds and/or signs of bird activity in sheds?

- Yes (please specify)
- No

78) Is there any evidence of wild birds in sheds and/or signs of wild bird activity in sheds?

- Yes
- If yes, please specify
- No

79) Is there any evidence of wild birds around the sheds (ie nesting under roofline or in vents etc)?

Yes

If yes, please specify

No

80) Does the grower discourage wild birds?

Yes

If yes, please specify how

No

81) Is there evidence of flies present in the shed (ie flies seen in the shed during visit)?

Yes

No

82) Is there evidence of flies present around the shed (ie flies seen around the shed during visit)?

Yes

No

83) Is a rodent control plan in place? (ask to see a rodent control plan)

Yes

No

If a rodent control plan is in place, examine the traps:

84) Is there any evidence of baiting/clearing?

Yes

No

85) Have Litter or Darkling beetles been seen in the shed?

Yes

No

Shed access for personnel:

86) What type of barrier/biosecurity measure between annex and shed is there?

Bench

Line

Doorway

Boot dips

If applicable state chemical used, and frequency of changing:

Describe the condition of the boot dip:

Over boots

Other (please specify)

87) If a hand sanitizer is used prior to shed entry, where is this located in relation to the shed entrance (ie would it be in a place where it was the last thing to be done before entering the shed)?

88) What is the cleanability of the annex?

- High (well maintained, tidy, no or few areas that may represent biosecurity risk)
 Medium (some areas that require repair or cleaning)
 Low (requires maintenance work, or materials present that may represent a biosecurity risk)

Please specify problems identified:

89) What is the cleanliness/condition of the barrier? (PHOTOGRAPH)

- High (boot dip fresh, boots tidy, fresh line etc)
 Medium (old boot dip, over boots messy, peeling line etc)
 Low (no evidence of boot dip, over boots, line etc)

90) Shed surroundings:

i) Is any vegetation/foliage present?

- Yes
 No

ii) If yes, what type of vegetation/foliage is present?

91) How far is this shed from the nearest other shed (metres)?

92) How close can other animals get to the shed? (state type of animals and distance in metres)

Additional comments:

Depopulation:

(Information to be obtained by interviewing farmer, unless de-population is witnessed during tour):

1) Who is the catching gang?

2) What are the company requirements for catching gangs? (please ask to see the company biosecurity manuals)

3) Is protective clothing used by the crew?

- Yes, please specify _____
- Boots
- Overalls
- Gloves
- Other (please specify) _____
- No
- Don't know

4) Is there any cleaning or changing of protective clothing, done by the catching gangs, between farms?

- Yes (please specify) _____
- No
- Don't know

5) Is there any cleaning or changing of protective clothing, done by the catching gangs, between sheds?

- Yes (please specify) _____
- No
- Don't know

6) Is there any cleaning of equipment (eg tractors, trucks, fork lifts) done by the catching gangs between farms?

- Yes (please specify) _____
- No
- Don't know

7) Is there any cleaning of equipment (eg tractors, trucks, fork lifts) done by the catching gangs between sheds?

- Yes (please specify) _____
- No
- Don't know

8) What material are the catching crates made from?

- Plastic
- Wood
- Other (please specify) _____
- Don't know

9) What is the condition and cleanliness of the catching crates?

- High (in good repair, few or no broken or cracked pieces, clean)
- Medium (reasonable condition, moderately clean)
- Low (old crates, many broken or cracked parts, dirty)
- Don't know

10) What is the growers overall impression of catching biosecurity?

- High (suitable measures in place to maintain good level of biosecurity)
- Medium (some measures in place, but these could be improved)
- Low (little attempt to maintain biosecurity)

11) Are there any sheds where partial depopulation doesn't occur? (i.e. all birds removed at once)

- Yes (if so please state how many)
- No

Additional comments:

