Report on the turkey house whole-house gassing exercise in Monaghan 25 – 28th February 2008

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1. Executive summary

On 25h February 2008 the Department of Agriculture Fisheries and Food (DAFF) conducted an exercise in sealing and gassing of turkey breeder houses. The exercise was held near Monaghan town on a site containing four empty houses. The method used was "whole house" gassing with carbon dioxide (CO_2), where the sides and doors of the house were sealed with plastic sheeting, followed by the high pressure (20 bar) infusion of liquid CO_2 until a concentration of CO_2 gas was reached, which would be sufficient to euthanase birds throughout the house. Two houses, Nos 2 & 3, were gassed. In house 2 the roof was sealed, while in house 3 the roof remained open. **5.5** tonnes of CO_2 were infused into house 2 (closed roof) for 13.5 minutes at full pressure, while **16.5** tonnes of CO_2 were infused into house 3 (open roof) for 37 minutes. An estimated 5 tonnes of CO_2 escaped through the open roof vents in house 3 before CO_2 gas levels reach comparative levels to house 2. The fire service opened both houses 24 hours later. The aim of the exercise was to develop a protocol for gassing turkey houses and to give cull teams practical experience in sealing turkey houses. This exercise also helped refine a protocol with the fire service for opening poultry houses after gassing.

Introduction

In an avian influenza outbreak it is essential that infected birds be killed as quickly as possible to prevent the spread of disease. Nevertheless, human health and safety must not be compromised while achieving this, and therefore it is of paramount importance to minimise the number of operatives exposed to live virus inside the house, in addition the method of slaughter chosen must strive to have minimal detrimental effect on the welfare of the birds. Previous exercises carried out by (DAFF in 2005[1] and 2006[2] demonstrated that "whole house" gassing with liquid CO_2 is an effective, and welfare-friendly method of euthanasing large

[1] DAFF internal document Ryan 2005
[2] DAFF internal document Ryan *et al.,* 2006

numbers of broilers and layers in Ireland. Gerritzen *et al.* [3] demonstrated that in a laboratory setting CO_2 is also an effective means of killing turkeys. Any period of compromised animal welfare experienced by the birds is likely to be shorter during gassing than during catching and handling (as necessitated by other methods of killing). The open structure of turkey fattening houses, presents a unique challenge for "whole house" gassing, as in theory these houses are more difficult to seal, and therefore the required concentrations of CO_2 necessary to achieve euthanasia of the birds may not be reached in these types of structures.

Objectives

The aim of this exercise was

- To develop a protocol for sealing turkey houses
- To provide practical experience to culling teams in assessing and sealing poultry houses, assess the equipment and logistics required for this
- To assess the health and safety and bio-security issues involved
- To test and refine the protocol with the fire service, (whose role is to open the houses following gassing, on the day after gassing, and to measure any residual CO_2 levels)
- To demonstrate the method to observers from the Fire service from different counties, as these personnel may be subsequently involved in a disease outbreak situation

3. Material and Methods

3.1 Exercise Design

The site selected was a turkey breeder/fattening site in County Monaghan comprising four empty houses i.e. no birds or litter were present (Figure 1-2). Two identical houses (Hse 2 & 3), 61.5 m in length and 18 m in width were selected for gassing (Figure 3). The houses had natural ventilation, with side vents and a series of open roof vents (Figure 4). There was an attached store and an external feed bin at one end. The

[3] Gerritzen *et al.,* (2006)

side vents and doors of both houses were sealed. The roof of House 2 was sealed, while the roof vents were left open in House 3.

The exercise was divided into three phases - pre-gassing, gassing and post-gassing. Four culling teams comprising 4 personnel in each team were involved in site preparation and the gassing of these two turkey houses. Two teams were allocated to each house. All four teams reported to the site co-ordinator. An engineer and a health and safety officer from the contract gas supplier advised on all aspects of the exercise. The fire service were involved in opening the houses and monitoring CO_2 and O2 levels inside, once the houses had been completely ventilated. Two DAFF health and safety officers attended, to assess the health and safety procedures.

3.2 Phase 1 Pre-gassing

3.2.1 Site assessment

Each cull team carried out a site assessment according to the protocol in the avian influenza (AI) manual (Chapter 7). From previous exercises it has been estimated that the amount of gas required to achieve a target concentration of 40% is 1kg liquid CO_2 / cm^3 (one tonne of per 500 m^3 of house space). The area of the house was 1080 m^2. The height of the house was estimated at 6 m. The highest point the birds could reach, while standing at the top of the feeders, was approximately 2 m. The house needed to be filled to a height of at least 2.5 m to ensure the birds were exposed to the gas. The minimum amount of liquid gas required for this exercise was estimated at approximately 8 tonnes. To include a safety margin that would allow for loss of gas through the fabric of the house, the sealed vents and any opened roof vents, an estimate of the amount of gas to fill the entire house i.e. 7000 m^3 was made, and a target delivery of 14 tonnes of liquid CO_2 was set.

3.2.2 Safety assessment and implementation

A site co-ordinator was responsible for health and safety measures on the site. A safe zone for observers was identified and cordoned off 10 m from the house. Owners of animals in nearby fields were notified of the exercise and were asked to remove animals from the fields for the duration of the exercise. There were

no dwelling houses nearby. All persons entering the site reported to the biosecurity officer who recorded the names and issued the appropriate personal protective equipment (PPE).

3.2.3 Biosecurity

Two biosecurity officers and a biosecurity coordinator controlled biosecurity on the site. A biosecurity control zone was set up at the DAFF cordon and a donning and doffing point and disinfection point identified (Figure 5). Cull team members wore Category 1 PPE (Ref Annex 2 - DAFF categorisation document) while all other personnel; including observers wore Category 2 PPE. Biosecurity officers were available to assist in correct donning and doffing. As per DAFF bio-security protocol, for health and safety (slip hazard) reasons, disposable overshoes were not provided, and personnel wore waterproof boots. Before doffing PPE, boots were washed and disinfected using an approved disinfectant. The fire officers and gas tanker driver donned PPE according to the standard protocol (AI Manual, Chapter 7). The gas tanker was disinfected according to a standard protocol. The fire-truck used on day 3 remained outside the DAFF cordon.

3.2.4. Site preparation

Site preparation commenced the day before the gassing and was finalised on the day of the cull and included:

a. **Liaising with the contract industrial gas supply company to:**

i. Supply of the gas

A contract industrial gas company supplied the liquid CO_2 in two 20 tonne tankers.

ii. Construct a lance assembly

Two different methods were used to deliver gas. In house 2 the lance assembly was mounted on a three-point linkage at the back of a tractor (Figure 6). The assembly was a modification of one designed by the contract industrial gas company. The lance was designed with a short stainless steel 1½" pipe with a BCGA (British Compressed Gases Association) industry standard coupling at one end for connecting to the tanker's hose. A hole was drilled through a wooden door at a height off 1.7 m using a circular saw, (Figure

7) and the lance was inserted through the hole. In house 3 the lance was bolted through the wall of the house at a height of 1.5 m, using a pair of steel plates placed either side of the wall (Figure 8).

b. Preparing and sealing the house

The houses had vents the full length of both sides. These were sealed with 1200 gauge radon heavy-duty builders' plastic sheeting (Figures 9-11) fixed in place by screwing 2" x 1" wooden batons using 40mm screws to the wall above and below the vents. Doors were sealed using radon heavy-duty builders' plastic sheeting, and fixed in place by nailing on batons (Figure 12). Any gaps surrounding the doors were sealed using expanding foam. The double doors of both houses remained unlocked, but and were held shut using a plank of wood. Two personnel using a scissors lift, sealed (95%) roof vents from inside house 2, using plastic sheets (foamex 4mm) screwed to wooden rafters (Figure 13).

The lances were introduced at the gable end of each house pointing directly up the house. Any loose objects or fittings such as hanging lights in the path of the plume were secured in place. Water tanks and drinkers were drained to prevent freezing damage.

c. Setting up of monitoring equipment

CO_2 monitors

CO_2 levels were monitored at 3 locations in each house (See Appendix 1a-b – Layout of House). Plastic tubes were placed at maximum bird height (2.5 m) and extended through the walls to three external CO_2 monitors. The sensors were monitored during the exercise and the gas levels recorded. CO_2 concentrations were recorded and reported to the cull team leader every 2 minutes during CO_2 infusion.

3.3 Phase 2 Gassing

3.3.1 Health and Safety implementation

I. All personnel moved to a designated safety zone and a roll call was carried out before culling team members moved to their designated sites to enable supervision of gas infusion and monitoring of CO2 levels.

II. All operatives were issued with walkie-talkies prior to the exercise commencing to enable coordination of the exercise.

III. Personal CO_2 monitors, measuring CO_2 levels up to 5% and that give audible alerts at 0.5% and 1.5% CO_2 (when safe levels are breached), were used by the 3 operatives measuring and recording the CO_2 concentrations inside the house. These operatives through necessity were positioned in close proximity to the house (5 m from the house). In addition 2 further operatives wearing personal CO_2 monitors were deployed by the cull team leader to monitor CO_2 concentration; one in the safety zone to ensure the safety of all observers, and a second at the gas tanker. A sixth observer monitoring the gas from an elevated position also carried a personal CO_2 monitor.

CO_2 concentrations recorded on the personal monitors were reported to the site co-ordinator every 3-5 minutes during the exercise. Operatives were advised to relocate to a safe location if CO_2 concentrations of 1.5% were recorded on the personal CO_2 monitors during the exercise.

3.3.2 Gas infusion

At 12:29 gas infusion commenced in house 3 (roof open). **16.5** tonnes of CO_2 were infused into the house for 37 minutes at full pressure until all three monitors were reading a CO_2 gas concentration of at least 40% for a period of 5 minutes. The tanker remained on site for approximately 2 hours.

At 16.07 gas infusion commenced in house 2 (roof closed). **5.5** tonnes of CO_2 were infused into the house for 13.5 minutes at full pressure until one monitor was reading a CO_2 gas concentration of 40% for 1 minute and other monitors were recording a concentration of a least 30%. Both houses remained shut until the following day.

3.4 Phase 3 24 hours Post-gassing

3.4.1 Ventilation of the house

Fire officers opened the houses. The fire officers on site consisted of 2 teams of two operatives wearing category 2 PPE (Figures 14) equipped with breathing apparatus (BA), plus one officer in command (OIC).

The Slaughter team leader briefed the fire service OIC, and fire officers on the layout and risk assessment of the houses. They then carried out a further Dynamic Risk Assessment, and in consultation with the slaughter team leader determined the most appropriate location for the establishment of Breathing Apparatus (B.A.) Entry Control (Figures 15).

The fire officers donned their PPE at the biosecurity control point (Figures 16) according to the protocol detailed in the AI manual (Chapter 7). One team opened each house by cutting the plastic covering the side vents and by opening the doors from the outside while the other team remained on standby. A radio link was maintained between the BA team and the OIC to monitor progress.

At 12.20 the fire officers put on their BA, CO_2/ O_2monitors and Hazmat suits. At 12.26 the first fire team crossed the BA entry control point and commenced opening house 3 at 12.27. The opening of house took longer than expected for a number of reasons: one side of house 3 was difficult to access (Figures 17); gaps in doors were sealed with foam and doors were locked. The fire officers monitored CO_2 levels in the work areas outside the house and relayed results to the OIC. After 19 mins at 12.39 the fire officers were down to their reserve air and withdrew to the BA entry control point. The second team put on their BA at 12.43 and crossed the BA entry control point at 12.46. It took the second team 15 mins to complete the opening of the doors and the side vents on house 3 (Figure 18), and 9 minutes to open the side vents, and doors on the upper side of house 2. The second team were down to their reserve air as they crossed the BA control barrier after 25 minutes at 13.11.

3.4.2 Safety checks and issuing of certificate of safe entry

The fire officers verified the clearance of CO_2 from both houses and associated sheds and feed bins (Figures 19). They entered the house in BA 20 minutes after each house was opened and assessed CO_2 concentrations at ground and head height every 6 metres along the length of the house. On entering the houses, no alarms reading at 0.5 % CO_2 were triggered during the verification process. The fire-brigade team took 8 minutes to walk through each house and measure the gas concentrations throughout the

house. Based on CO_2 levels below 0.5% and O_2 levels above or equal to 19.5%, the slaughter team leader issued a certificate of safe entry. Other personnel were then permitted to enter the house.

3.4.3 Decontamination of fire officers

The fire-officers Hazmat suits were disinfected at the BA entry control point (Figure 20) before they removed their BA. The fire officers doffed PPE (Figures 21-23) according to the standard protocol (AI Manual, Chapter 7). All staff were fogged wearing their normal clothing with a non-corrosive approved disinfectant on leaving the site (Figure 24).

4 Results

4.1 Gassing

a) House preparation

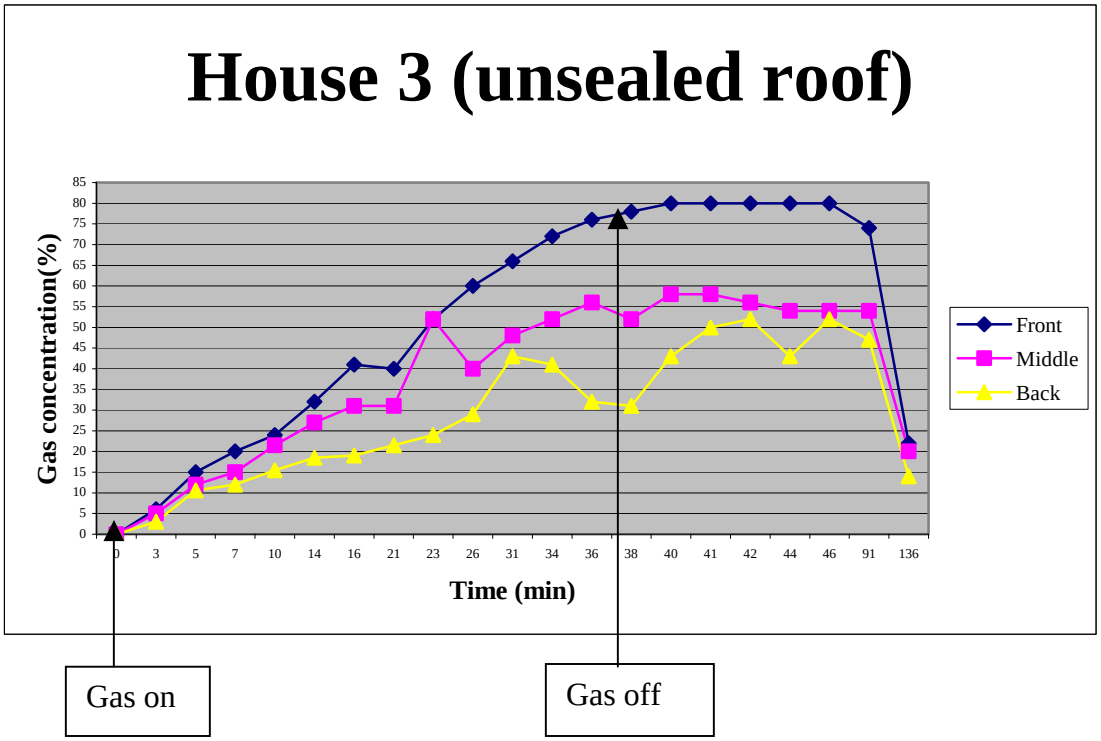
It took approximately 3.5 hours for two teams of four operatives to prepare and seal the side vents and doors and complete other preparations in houses 2 and 3. Setting up the lance mounted on a tractor at house 2, which as outlined involved drilling a hole in the door, took 2 operatives approximately 20 min. Setting up the lance at house 3, involving drilling a hole in the wall and attaching two metal plates took 2 operatives approximately 40 min. Sealing the roof in house 2 took 2 operatives approx. 1 hour.

b) Gassing

House 3 (roof unsealed)

Five mins after gassing commenced gas was seen escaping from the unsealed roof at the gable end furthest from the inlet point. Gas rolled down either side of the house and along the ground and was visible for a distance of 8 m from the house. 20 mins after gassing commenced, gas was escaping from a third of the roof (distal to the gas inlet point). The biosecurity net (wire mesh) covering the roof vents at the distal end of the house started to freeze up 15 minutes after the gas started to escape. Once the biosecurity net froze the amount of gas seen escaping from the roof reduced sharply and very little was seen escaping from 20 mins onwards. Very little gas was seen escaping from the side vents.

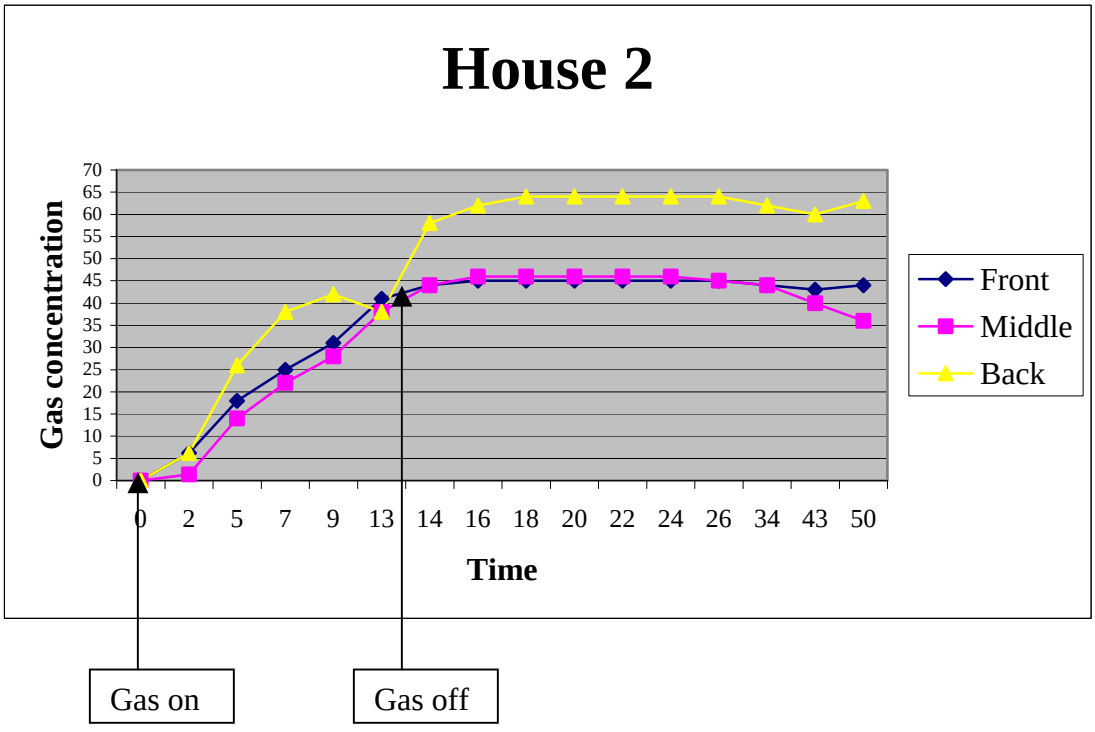
Gassing was effective. The CO_2 concentration reached at least 40% for 30 mins at all 3 locations, and all three monitors were registering CO_2 within 5 minutes of gassing commencing. Gas concentrations rose quickest at monitor 1 (Graph 1) positioned closest to the infusion point, and rose slowest at monitor 3, which was at the distal end of the house. CO_2 concentrations reached 20% 8 mins after gassing commenced at monitor 1, and by 16 mins had reached 40%. 31 mins after gassing commenced CO_2 concentrations were reading 40% at all monitors. CO_2 concentrations settled above 50% at all 3 monitoring points after the gas was turned off, and 30 m later CO_2 were reading at least 40%. 4 hours after the gas was switched off all 3 monitors were registering less than 10% CO_2. 24 hours after the house was gassed all monitors read 0%. The lance remained firmly fixed in place during the exercise and the metal showed no evidence of weakening or movement.



Graph 1: Gas concentration in House 3 (roof unsealed)

House 2 (roof sealed)

Gassing was effective. The CO_2 concentration reached at least 40% at all 3 locations. Gas concentrations rose quickly, and all three monitors were registering CO_2 two mins after gassing commenced (Graph 2). Gas concentrations rose quickest at monitor 3 which was furthest from the infusion point, registered 20% CO_2 at 5 mins, and by 9 mins all three monitors were recording a CO_2 concentration of at least 20%. Monitor 1 recorded 40% CO_2 at 13 mins at which time the gas was turned off (the other two CO_2 monitors were recording concentrations of 38%). After the gas was turned off CO_2 concentrations continued to rise as the gas settled in the house. 30 mins after the gas was turned off CO_2 concentration in the house was still recorded over 40% on all 3 monitors. 24 hours after the house was gassed, low levels of CO_2 (< 10%) were still been detected in the house.



Graph 2: Gas concentration in House 2 (roof sealed)

5. Discussion

The exercise was successful and confirms that "whole house" gassing can be used for the emergency slaughter of turkeys. The lance assembly adapted for mounting on a tractor was easy to assemble and use. It avoided the need to enter the house and thus helps reduce the number of people exposed to infected birds. It also has the advantage of avoiding the need for drilling into a concrete apron (which is necessary for stabilising the third lance structure available to DAFF). This has the inherent risk of exposing operatives to the risk of electric shock from contact with underground cabling. It is estimated that one team of 4 people can assess and seal one large house in approximately 7 hours.

Gerritzen *et al.,* [4] demonstrated that turkeys die within 13 mins in an environment of 45% CO_2 in inhaled air. In this exercise the degree of sealing carried out in both houses was sufficient to achieve concentrations of 45% CO_2 for at least 13 minutes. 40% CO_2 for 30 m is recommended to kill broilers and hens [5]. Nevertheless, the 40% for 30 min may be critical for turkeys [6] and it is recommended that a minimal concentration of 45% CO_2 in inhalation air be maintained for 30 min to kill turkeys in whole-house gassing. Although the CO_2 concentrations in house 2 dropped below 45% after 20 m, it remained at 40% for at least 30 m. In an exercise with live birds or in an outbreak situation the CO_2 concentration would be monitored for 30 m and if levels dropped below 45% before 30 mins had lapsed, more gas would be pumped into the house.

During a disease outbreak DAFF culling teams would aim to achieve the CO_2 concentration in "whole-house gassing" to go from 0.05% to 20% in 4-5 m (but not less than 3 m). This minimises the inductive period, i.e. the time from when birds first demonstrates physiological effects due to CO2 and becoming unconscious. **Gerritzen *et al.,*** [7] demonstrated behavioural signs in turkeys indicative of physiological effects at 4.1% CO_2, and loss of consciousness at 20-25% CO_2. A 5 min. induction time was achieved in house 2 but not in house 3. Gas rise in house 3 was slow initially and as a result in a live situation the

[4] **Gerritzen *et al.,* 2006**
[5] **Gerritzen *et al.,* 2004**
[6] **Gerritzen *et al.,* 2006**
[7] **Gerritzen *et al.,* 2006**

inductive period would have been prolonged for 2-3 minutes. This period of compromised animal welfare however, is likely to be shorter than when animals are caught and handled for other methods of killing [8].

An aim of any "whole house" gassing would be to ensure that birds lose consciousness before they inhale the higher, more unpleasant, concentrations (>40-50% CO_2) of CO_2 [9] [10] [11]. The CO_2 concentrations recorded in both houses would have permitted induction of analgesia and unconsciousness prior to exposure to high CO_2 concentrations.

Previous experiences of whole house gassing demonstrated that gas is first seen escaping from the roof at the end of a house furthest from the gas inlet point; this was also seen in this exercise. The difference in the pattern of CO_2 concentration rise between house 2 (roof sealed) and 3 (roof unsealed) is most likely a consequence of the open roof vents in house 3, which allowed large amount of gas to escape and hence CO_2 levels at the far end of house 3 were slower to rise than in other areas of the house. CO_2 levels continued to rise in both houses after the infusion stopped as the gas settled. An adequate level of CO_2 should be achieved if gas is switch off when one monitor reads a CO_2 gas concentration of 40% for 1 minute and the second monitor reads a concentration of a least 30%.

House 3 (unsealed roof) was gassed for 20 minutes longer than house 2 (roof sealed), and over 10 tonnes more gas was used. After 23 m, the CO_2 concentrations at 2 monitors in house 3 were above 50%. The rise in CO_2 concentration (graph 1 in Annex 1) after the gas was turned off in both houses suggests that if the gas in house 3 had been turned off after 23 min it is probable that the CO_2 concentration would have been maintained at least 45% for 30 minutes. At 23 mins 11 tonnes of gas had been used in house 3, where as in house 2 only 6.5 tonnes of gas had being use to achieve a similar concentration of CO_2. At 23 min the netting covering the roof vents was frozen and very little gas was escaping from the roof. Thus approximately 5 tonnes of CO_2 escaped through the open roof vents in house 3.

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[8] Raj *et al.,* 2006
[9] Raj *et al.,* 2006;
[10] Gerritzen *et al.,* 2006
[11] McKeegan *et al.* 2006

The nettings covering the vents in house 3 were congested with dust and debris and the holes in the netting were quite small. It is surmised that the dust/debris formed a lattice on which the gas froze. Perhaps if the netting was new or the holes were larger the gas would have continued to escape from the roof for a longer period of time and the gas loss would have been greater.

The houses were empty at the time of the exercise and the temperature was ambient. If turkey breeders/ fatteners had been present in the house the temperature would have been between 5-7^{0}C higher. In addition the exercise was carried out in February when ambient temperatures were low (around 9^{o}C). The temperature in a full turkey house in the summer months would be higher and it is possible that this may affect the movement of the CO_2 gas in the house.

The wind was gusting at roof top level during the exercise, and much of the gas emerging from the roof dissipated quickly. However pockets of gas were visible at ground level adjacent to the house and posed a potential risk to operatives. Operatives were recording up to 1.5% CO_2 on their personal monitors (at which time they withdrew to a safe area). The effects of different weather conditions are unpredictable, but if the wind had been calmer it is likely that the CO_2 gas emerging from the open roof vents would not have dispersed as quickly. This could continue to pose a risk to operatives once gassing had ceased.

Sealing the roof in house 2 using the method described above was easily achievable as the house was devoid of birds or litter. If birds and litter had been present it would have been considerably more difficult or even untenable. Ladders and scaffolding are unsafe on litter. A diesel-powered four-wheel drive with a hose leading from the exhaust would probably be the only suitable and safe vehicle; however the noise from such a machine machinery maybe a potential welfare problem for the birds. In addition it would be inadvisable for operators to spend an extended period of time in a diseased house. Sealing the roof of turkey houses from outside is not usually an option due to health and safety concerns. Nevertheless technical experts are being consulted with a view to exploring potential methods for sealing roofs from outside the house using a mobile elevated platform, which would allow the operator to work from inside a cage. In a disease outbreak situation involving turkey houses, an assessment will need to be made as to

whether the house can be adequately gassed with the roof vents opened, taking into account the weather conditions at the time.

The houses were sealed and gassed effectively, and the equipment supplied worked well. The exercise highlighted a few minor modifications needed to existing protocols

- Cordless screw drivers were safe easy to use and operatives did not require ear protectors; screws were subsequently easy to remove. Using an automatic feeder to feed the screws into the power tool would be more efficient than placing each screw manually. Powered nail guns were considered unsuitable for use in a field situation, as they pose a significant safety risk.
- Using scissors was more effective and safer than using a knife for cutting plastic, especially if the plastic was in a roll
- To seal side-vents, fix the batons horizontally (rather than vertically), at the upper and lower edge of each side vents. This allows the plastic to be subsequently easily cut between the batons when the house is being opened

Greater than 6% CO_2 concentration was detected in house 3 (unsealed) 5 hours post gassing. Due to time constraints it was only possible to monitor CO_2 concentrations in house 2 (sealed) for 1 hour post gassing, at which time the CO_2 concentration was over 35% at all 3 monitoring points. It is not possible to extrapolate data from this exercise to estimate the levels of CO_2 which might still be present in a sealed house 5-6 hours post-gassing. 18 hrs post gassing, the CO_2 concentration in house 2 was >6%, which was similar to the level detected 5 hours after gassing in house 3. A CO_2 level of 6-9% would be sufficient to cause rapid impairment of judgement, and unconsciousness after 30 min and at >10% CO_2 exposure, death will result within a few minutes. Due to safety concerns, even if the CO_2 concentration read <10% on all 3 monitors, the risk to staff opening doors without wearing BA would be unacceptable. The monitors only sample in 2-3 places, and are positioned at the points reached last by the gas, which may well also be the areas where the gas clears first, and the levels of gas in other parts of the house may be much higher; once the doors are opened (thus inducing a draft), it may be possible to get pockets of high concentrations of gas blowing out. These pockets of CO_2 may still be present in the vicinity of a sealed house up to 24 hrs post-gassing. Gas disperses rapidly from a house once the front and back doors are opened, even if the side

vents remain sealed (gas engineer per. observation), and within 30 minutes of the houses in this exercise been opened, CO_2 levels in all areas had dropped rapidly to zero. Nevertheless, on the basis of this exercise alone, it cannot be assumed that in an outbreak situation CO_2 levels in a house would be zero 30 minutes after every house is opened.

Fire service protocol

One aim of the exercise was to test and refine the protocol with the fire service, and to demonstrate the method to observers from the Fire service from different counties, as these personnel may be subsequently involved in a disease outbreak situation. The fire-service protocol worked well, all operatives were clear in their role in the exercise, and the houses were safely opened and declare clear of carbon dioxide. Several improvements for inclusion in the existing protocol were identified including:

- Locating the BA entry control point as close as possible to the poultry houses
- Identifying the priority locations to be opened on the site plan
- Facilitating the opening of the houses by ensuring that doors are unlocked prior to fire service donning BA, sealing doors from the outside rather than the inside, and by not using expandable foam
- Prioritising the opening of the end doors (with side vents only opened if time is available)
- Highlighting the need to use disinfectant that does not stain the HAZMAT suits
- Using HAZMAT suits with integrated radios.

Health and safety conclusions

A number of recommendations were made by the Health and Safety Section, including:

- Factoring in rest breaks (one hour will include time to doff PPE, have a 20 minute break and don fresh PP)
- Ensuring all personnel in the vicinity of gassed houses wear personal CO2 monitors
- Training of all team members in Safe Pass procedures
- Training of selected team members in the use of forklifts (and if used, the use of mobile elevated platforms)

- Ensuring sufficient personnel are present to allow for ladders to be footed whilst in use
- Having a work bench available for use when cutting timber

PPE

The biosecurity team members made the following observations in relation to the use of PPE:

- A method needs to be developed to allow personnel to drink liquids while wearing the PPE
- The positive pressure respirators were preferred to the negative pressure respirators for prolonged manual work, as they were more comfortable to wear
- Using two pairs of disposable nitrile gloves was more suitable than using Marigold-type outer gloves for work requiring manual dexterity (e.g. attaching small screws to the screw-drivers)
- Minor PPE problems e.g. small tears to outer gloves and suits should be solved without necessitating full doffing and donning fresh PPE
- A disinfectant fogger should be included in the equipment list for infected premises.

Overall conclusions

The exercise allowed us to develop a protocol for gassing turkey houses, and gave cull teams practical experience in sealing a turkey house. It was essential in demonstrating that it is possible to adequately gas a turkey house with the roof vents open. Previous research had established that exposure to CO_2 is a suitable method for killing turkeys. Therefore in this exercise it was decided that having live birds in the house was unnecessary.

Acknowledgements

The Department would like to thank the following people for their invaluable assistance in preparing and executing the gassing exercise carried out on 25-28th February 2008:

- The poultry company and poultry farmer
- The Fire Service
- The various companies who supplied services to the exercise
- The veterinary and technical staff of Monaghan DVO
- Members of DAFF culling and biosecurity teams

References

Gerritzen, M.A., Lambooij, E., Stegeman, J.A., Spruijt, B.M. (2004) On Farm Euthanasia of Broiler Chickens. Effects of Different Gas Mixtures On Behaviour and Brain Activity. *Poultry Science* **83:** 1294-1301

Gerritzen, M.A., Lambooij, E., Stegeman, J.A., Spruijt, B.M. (2006) Slaughter of poultry during the epidemic of avian influenza in the Netherlands in 2003 *Veterinary Record* **159:**39-42

McKeegan, D.E.F., McIntyre, J., Demmers, T.G.M., Wathes, M., Jones, R.B, (2006). Behavioural responses of broiler chickens during acute exposure to gaseous stimulation. *Applied Animal Behaviour Science* **99**: 271-286.

Raj, A.B.M., Sandilands, V., Sparks, N.H.C. (2006) Review of gaseous methods of killing poultry on-farm for disease control purposes. *Veterinary Record* **159:** 229-235

DAFF internal document Ryan, J. (2005)

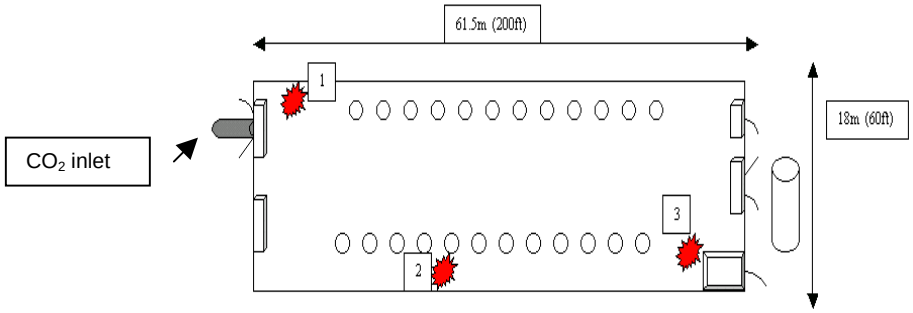
DAFF internal document Ryan J., Sheehan, M., Wrigley, K., Gaynor, S. (2006).

www.agriculture.ie/animal_health/avian_influenza/contingency/Gassingreport29thsept06.pdf

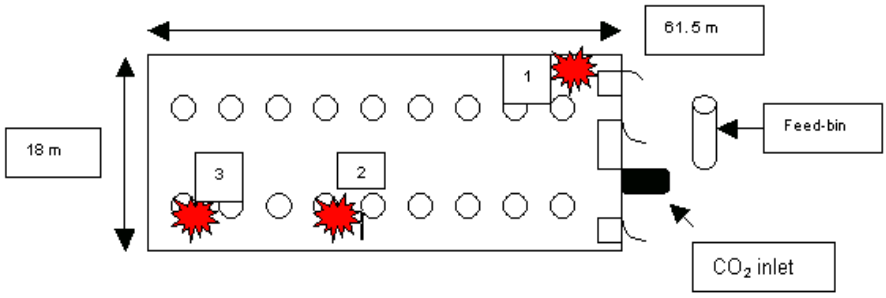
Annex 1

Diagram of houses

House 2



House 3



CO_2 Monitoring points

Annex 2

DAFF categorisation document

Table 1

Exposure category, protection and training required

Worker Category	Exposure	Protection	Training on PPE, respirator fit & SOPs
1	• Exposure to infected, or highly suspect (HS), live birds in confined space for prolonged period	Flu vac (in season) Tamiflu PPE Positive Pressure Respirator (P3)	Yes
2	• Exposure to infected, or HS, live birds in confined space for brief period • Exposure to infected, or HS, live birds in open space • Exposure to infected, or HS, dead birds in confined or open space • Exposure to contaminated or potentially contaminated material (specimens, litter, faeces, feed, equipment, environment)	Flu vac (in season) Tamiflu PPE Disposable P3 negative pressure respirator* goggles	Yes
3	• Engaged in active surveillance in contiguous flocks & contact flocks	Flu vac (in season) PPE Disposable P3 negative pressure respirator*	Yes

		Goggles Tamiflu if birds test positive	
4	a) Exposure to injured, sick or dead wild birds in restricted zone when H5N1 on Island of Ireland b) Exposure in investigation large die off in wild birds	Flu vac (in season) Tamiflu PPE Disposable P3 negative pressure respirator* Goggles	Yes
5	a) Exposure to isolated injured, sick or dead wild birds outside restricted zone when H5N1 on Island of Ireland b) Exposure to isolated injured, sick or dead wild birds when H5N1 not on Island of Ireland	Disposable gloves Tamiflu if birds test positive	Information
6	• Assisting in outbreak control not exposed to hazardous material		Information

* Staff with beards, or moustaches, should shave or use a positive pressure respirator. There are several models of disposable P3 negative pressure respirator and those staff whose face shape doesn't allow a good fit with the standard model will be offered an alternative.

Post exposure health monitoring and serology will be required for all staff according to the Guidelines of the Avian Influenza Subcommittee of Pandemic Influenza Expert Group (Annex 1)

Table 2

Individuals assisting in the control of an outbreak in a poultry flock*

INFECTED PREMISES	
Individuals Potentially Exposed	**Category**
Farm staff, manager, owner	1 or 2
DAF veterinary Inspector/TAO on site	2
Sealing crew: (1 vet, 2 AOs)	
o Inside house	1
o Outside house	2
Gas delivery driver	2
Fire brigade staff :	
o 2 to go inside,	2
o 2 outside	2
o 1 supervisor on periphery/outside house	6 or 2
(If not gassing) Catching and slaughter crew	1
Collection team (s) for dead birds	2
Driver of waste transport vehicle	2
Staff in intake area of Rendering Plant receiving waste	2
Dealing with litter, feed and water	2

Staff involved in erecting and operating: • Porto cabins for office, rest rooms etc • Canteen on site • Porto loos on site	 6 6 6
Personnel removing PPEs (already bagged & binned)	6
Engineers/environmental technicians assessing burial composting sites	6
TAO/Garda security at periphery of infected premises	6
STAFF WORKING OFF SITE:	
Active surveillance in contiguous flocks	3
Operating road checks	6

*Individuals may be moved into a higher risk category if need arises but if so must receive the appropriate protection

Figure 1. Front of Houses 1-4

Figure 2. Back of Houses 1 - 4

Figure 3. Inside of house 3

Figure 4 House 2: side vents and roof vents are open

Figure 5 Biosecurity control zone

Figure 6. Mobile lance attached to tractor

Figure 7. Lance bolted to the wall of house 3

Figure 8. Sealing side vents

Figure 9. Sealing side vents in a confined space

Figure 10. Sealed side vents

Figure 10. Doors covered in plastic and proped shut

Figure 12. Sealed side vents

Figure 13. Vents sealed with lightweight plastic

Figure 14. Fire service in PPE leaving donning area

Figure 15. Observers a BA entry point

Figure 16. Fire officers at BA entry point

Figure 17. Working in difficult conditions

Figure 18. Fire service opening side vents

Figure 19. Checking CO_2 levels in feed bin

Figure 20. Disinfection of hazmat suits at BA entry point, prior to removing BA

Figure 21. Disinfection at biosecurity control point

Figure 22. Removal of PPE

Figure 23. Hazmat suits hanging up to dry

Figure 24. Fogging with non-corrosive disinfectant