**Institution:** University of Edinburgh and SRUC, Scotland's Rural College

**Unit of Assessment:** 6

**Title of case study:** Whole-house gassing improves the welfare of birds requiring culling during a major disease outbreak and is now adopted by Defra.

**1. Summary of the impact** (indicative maximum 100 words)

**Impact:** Policy. Developed a humane culling method for large numbers of poultry in preparation for an outbreak of a notifiable disease such as avian flu (Highly Pathogenic Avian Influenza, HPAI), which was adopted by Defra.

**Significance:** In the event of a major disease outbreak, the large scale culling of infected birds would need to be accomplished in humane and cost-effective way.

**Beneficiaries:** Disease control authorities in all UK Government domains (England & Wales, Scotland, Northern Ireland) – more effective statutory controls; poultry production industries – reduced financial losses in case of outbreaks; the wider public – reduced welfare concerns.

**Attribution:** Prof. Sparks, Dr. Sandilands (SRUC).

**Reach:** All UK animal health related Government domains.

**2. Underpinning research** (indicative maximum 500 words)

Previous attempts (e.g. in the Netherlands in 2003) to control Highly Pathogenic Avian Influenza outbreaks using gas and other techniques to cull poultry on-farm led to welfare concerns. Birds' welfare could be severely compromised by the culling procedure itself and by ineffective culling (resulting in live birds being found amongst dead birds, days after the event) [3.1].

At the time our research was commissioned there was only one technique available to the UK Government for the large-scale emergency culling of poultry; the containerised gassing technique. This method requires live poultry to be caught by hand prior to killing, potentially exposing the catchers to the virus and posing logistical problems associated with capturing many birds.

Scottish Government policy makers identified the need for a more effective technique that would not unduly compromise bird welfare and funded the project, which began in 2006.

In summary:

- Before considering how gases could be used to cull poultry it was important to understand how the birds responded to the presence of a wide range of candidate gases. The project team (including Prof. Sparks (Team Leader, employed 1989-onwards) and Dr Sandilands (Behavioural Scientist, employed 2001-onwards)) selected gas mixtures (types and concentrations), and then commissioned innovative apparatus to be built in which birds could be exposed to the gases and their responses quantified. The outputs from these studies were important in enabling gas concentrations or mixtures that were overtly aversive to the birds to be identified and their testing discontinued [3.3].
- In the second phase, gases that had not been rejected in phase one were used to kill small numbers of birds. The key measurement was the time to unconsciousness and death. The team also studied the behavioural responses of the birds during this period. This phase involved a range of techniques including telemetry studies to monitor brain ECG activity.
- The gas mixture selected from phase two was then taken out of the laboratory and tested using purpose built test rigs in which the behaviour of the gas within an enclosed space – designed to represent a poultry building - could be studied. Following these tests, various methods of getting the gas into an empty building were assessed, as it was vital that the gas was introduced in a manner (time and concentration) consistent with welfare parameters determined previously. This included the testing of a number of injection techniques and ultimately the design of a novel portable injection lance. This design enabled the gas to be inserted into even poorly constructed/maintained buildings with the minimum of building preparation and protected the birds from the physical forces of the gas

plume. The lance was also designed to maximise the protection of human health, minimise the logistics associated with using the equipment, and so reduce the risk of inadvertent transmission of the disease [3.2, 3.4].

- Ultimately, the process was validated by testing it on a house of live birds, and thereafter, by a number of tests conducted by the UK Government to confirm the suitability of the equipment for use across a wide range of housing types [3.5, 3.6].

**3. References to the research** (indicative maximum of six references)


3.1) Raj, A. B. M., Sandilands, V. and Sparks, N. H. C. (2006). Review of gaseous methods of killing poultry on-farm for disease control purposes. Veterinary Record. 159 (8): 229-235. http://dx.doi.org/10.1136/vr.159.8.229

3.2) Defra (2009). Animal Health VO/ROD instructions on the preparations of a field report on the suitability of buildings for whole house gassing (WHG) or ventilation shut down (VSD) to kill poultry during an outbreak of highly pathogenic avian influenza (version 9). Defra October 2009. http://tinyurl.com/nolre7g

3.3) Sparks, N. H. C., Sandilands, V., Raj, A. B. M., Turney, E., Pennycott, T., and Voas, A. (2010). Use of liquid carbon dioxide for whole house gassing of poultry and welfare implications for the birds Veterinary Record. 167: 403-407. http://dx.doi.org/10.1136/vr.c3813

3.4) Sandilands, V., Raj, A. B. M., Baker, L. and Sparks, N. H. C. (2011). Aversion of chickens to various lethal gas mixtures. Animal Welfare. 20: 253-262. (Reference available on request.)

3.5) McKeegan, D. F., Sparks, N. H. C., Sandilands, V., Demmers, T. G. M., Boulcott, P. and Wathes, C. M. (2011). Physiological responses of laying hens during whole-house killing with carbon dioxide. British Poultry Science. 52 (6): 645-657. http://dx.doi.org/10.1080/00071668.2011.640307

3.6) Sparks, N. H. C (2011). Whole house gassing of poultry. Animal Welfare Science, Ethics and Law Veterinary Association Autumn Meeting, Edinburgh. (Reference available on request.)


**4. Details of the impact** (indicative maximum 750 words)

The major impact of this research is in animal health and welfare policy and improved welfare of birds subjected to a large-scale cull in the event of a disease outbreak. The method developed by SRUC has been adopted by all relevant government domains. Previous large-scale culling systems could harm both human health and bird welfare. Our research provided a humane method of killing large numbers of poultry *in situ*, significantly reducing the health risk to catchers and removing the need to handle live birds (the risk posed by dead birds infected with HPAI is significantly less than that posed by live birds). Following our work, the UK and other governments adopted a policy for whole house gassing using the technique developed in case large scale culling was required in the face of a disease outbreak.

At the time of writing Whole House Gassing offers the primary means in the UK and Ireland of culling large commercial poultry flocks in the event of a HPAI disease outbreak, and the project team has provided detailed information to a number of other potential users. Members of the project team were involved in providing input into standard operating procedures to be used by state veterinary staff as well as the contractor that would supply the gas and delivery equipment.

As evidenced by the Dutch experience, failure to contain an outbreak of HPAI is ruinously expensive, destroys commercial and breeding flocks that take years to replace, as well as damaging public confidence in a product. Also, the greater the spread, the greater the number of birds to be culled, and culling animals is increasingly a cause for public concern (as, for example, following the Foot and Mouth Disease outbreak in 2000/2001). Irrespective of the number of animals to be killed it must be done in a way that, as far as possible, minimises the impact on both animal and human welfare. The protocol developed under this project provides both Government and industry with a means of achieving these sometimes apparently conflicting needs, which has been adopted by policy makers.

**5. Sources to corroborate the impact** (indicative maximum of 10 references)
Suggested contacts:
5.1) Matthew Price, Defra's Head of Operational Capabilities Branch http://tinyurl.com/kmnhol5

5.2) Andrew Voas, The Scottish Government Veterinary Adviser (email letter of support available on request). http://tinyurl.com/lv4g6mx

Publications:
5.3) SEARS Scotland - Contingency plan for the outbreak of a notifiable disease. http://tinyurl.com/om784hz

5.4) FAWC - Report on the welfare of farmed animals at slaughter or killing (Part 2: White meat animals). http://tinyurl.com/qzwxdqh

5.5) Defra - Notifiable Avian Disease Control Strategy for Great Britain Revised July 2012. http://tinyurl.com/nvwllr9

5.6) Defra - Animal Health VO/ROD instructions on the preparations of a field report on the suitability of buildings for whole house gassing (WHG) or ventilation shut down (VSD) to kill poultry during an outbreak of highly pathogenic avian influenza. Defra October 2009 version 9. http://tinyurl.com/ogom86m

5.7) Defra - Invitation to tender issued for Whole House Gassing services (2012). http://tinyurl.com/q3zjvw3