Controlled air flow as a hygiene and biosecurity tool

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Hatcheries are an important crossroad in the multiplication and spreading of salmonella and other diseases and zoonoses. The warm, humid climate in hatcheries, together with the surplus of organic material creates perfect conditions for bacteria, viruses and fungi to grow. Hatching eggs are delivered from many farms and day old chicks are delivered to many farms. This means that a contaminated breeder flock can cause serious problems downstream if the level of biosecurity does not prevent cross contamination.

Eggs and materials from breeder farms are a risk factor since the time between infection and detection of a flock can be substantial. During this time the regular flow of eggs to the hatchery will continue. A good biosecurity program must start with good prevention and monitoring on the breeder farms. An incidental contamination cannot always be avoided. Between two consecutive monitoring periods, infection can occur and infected eggs will enter the hatchery.

At the hatchery, there is a constant risk of bacteria entering the facility, either by people or materials but in most cases with the eggs.

The technical area including the ventilation system.

High quality gas sealed doors prevent air leakage.

A rigid biosecurity program in a hatchery must be based on good hygiene management and the prevention of cross contamination. Bacteria such as salmonella spread and multiply very easily in a hatchery.

The basic requirements of temperature, humidity and the presence of organic material are ideal for them. Since salmonella can survive in the fluff for many months and even years, it is clear that not only prevention of infection is of key importance, but also prevention of cross contamination.

Controlling air flow

When the flow of air, eggs, egg handling equipment, such as trays and trolleys, and people is not controlled, cross contamination easily occurs. In an ideal situation, the flow of eggs, air, egg handling equipment and people is from the highest hygiene level (the setter rooms) towards the lower hygiene levels (egg transfer, hatchers, chick take off, chick movement and hatchery waste).

To create this, the layout of a hatchery must be designed carefully, and people instructed and trained well.

No matter how well designed and operated a hatchery is, care must be taken to avoid air movement from contaminated areas to clean areas.

One of the bigger risk factors is in the hatchers. Fluff, which carries bacteria, is produced during the hatching period. Exploders (eggs contaminated with gas forming bacteria) are a serious risk.

Research has shown that one salmonella positive exploding egg in a hatcher can infect every individual chick in that hatcher. If air flows from an area with a lower hygiene level (for instance a chick separation room) towards a higher hygiene level (for instance a setter room) serious cross contamination can occur. To prevent improper airflow, it is crucial to create pressure differences between various rooms in the hatchery.

Single stage incubation

A fundamental first step to prevent bacterial contamination is the change from multi-stage to single stage. With multi-stage incubation, it is difficult to keep risk levels under control since multi-stage machines are hardly ever emptied. Not only is cleaning

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and disinfection a difficult task, but the continuous movement of eggs in and out of the machines make cross contamination very probable if egg hygiene and condensation are not under control.

Contaminated and exploding eggs in the setter, either during incubation or during transfer activities, will increase the contamination pressure in the machines and corridor. As in multi-stage operations eggs are moved more or less continuously without cleaning and disinfection after transfer, the risk of cross contamination is substantial.

In single stage incubation, doors can be kept closed during the entire incubation process. Doors are not opened to introduce a new set of eggs into the setter.

The machines can be cleaned and disinfected between each set or hatch. The movement of trolleys is much more controlled. When a whole machine or set of machines is emptied at one time, the cleaning process is more controlled and does not cross contaminate eggs still in the setters.

The cleaning process is more effective since the entire machine is cleaned with no eggs in the machine.

Air leakage and pressure

However, air, fluff or other sources of contamination can escape from a closed machine as well. If doors are not air tight, when belt driven fans are used, or when inlets and outlets are not air tightly connected to the air ducts, cross contamination can occur.

Many single stage machines cannot connect the inlet directly to the air duct because pressure differences will create a short cut in ventilation.

In this situation, the risk of cross contamination through air leakage must be taken into consideration.

To equalise these air pressure differences a plenum is often used, especially to vent the hatchers. The plenum also functions as a fluff collecting device. When the pressure in a plenum is controlled correctly, this system works fairly well.

No 'dirty' air intake via the corridor prevents cross contamination.

A plenum requires a significant and expensive increase in building size.

The amount of fluff that escapes from the plenum, even a pressure controlled plenum, into the air is significant. The fluff creates a risk for cross contamination.

With HatchTech incubators cross contamination is less likely to occur because the incubators are gas sealed. Besides, the HatchTech machines do not need a plenum for air pressure differences.

HatchTech has introduced the HatchTech CyClean, which captures 95% of the fluff that would normally leave the hatchery via the plenum exhaust. As no plenums are needed the hatchery will save on space and building costs.

Use of return air

Many hatcheries still operate by re-using return air. The outlet of the setters is connected to a corridor, fresh air is mixed into this air to the desired level of oxygen and carbon dioxide, and it is then re-used in either setters or hatchers.

The advantage of this system is that the return air has a high temperature and relative humidity, which minimises spray and the creation of cold spots in the machines.

However, from a hygienic point of view, it is obvious that using return air is far from being ideal. Nowadays, one sees an increase in interest for systems that use fresh air only, coming from pressure controlled air ducts.

Leaking machines

To control the climate inside machines, it is important that the amount of air that is exchanged is controlled as well. We normally expect that the air is exchanged through the inlet and outlet of the machines. However, if we take a close look at machines in the field, we can see that quite a lot of leakage occurs through the doors, the holes where ventilator belts are going through, and through air inlets and outlets that are not connected directly to the air ducts. This not only creates problems in maintaining the exact climate in the machine, but uncontrolled intake and output of air creates cross contamination risks as well. If air from one machine cannot enter another machine, then the level of control of cross contamination is considered low.

Since most machines in the field are not air tight and controlled, most hatcheries consider a hatcher room with several hatchers as one unit.

This means that a salmonella problem or other disease problem can, at best, be limited to that hatcher room. Isolation of the problem to one hatcher in that room, without cross contaminating other hatchers, is difficult.

In HatchTech incubators only the inlet and outlet of the machines exchanges the air, because the machines are gas sealed. As a result a possible salmonella contamination can be limited to one hatcher if logistics are organised well.

Isolating bacteria

In an ideal situation, the flow of air, materials, people and eggs must move from the area with the highest hygiene level to the area with the lowest hygiene level. With air, this can only be practically and effectively controlled by means of pressure differences. To keep the machines isolated, a system with fresh air only is required.

Any system that uses recycled air by definition does not isolate machines from each other and therefore cannot prevent cross contamination. The machines must be air tight to avoid cross contamination between machines.

Only when these conditions are achieved can an incidental contamination, such as salmonella, be isolated in the hatchery without spreading to the breeder flock and creating major problems before it is detected. n