FOOD SAFETY
&
BIO SECURITY

for Small Poultry Flocks

Guidelines of the BCEGG Small Lot Permit Holder Program

BC egg MARKETING BOARD

Introduction

Food safety begins at the farm. Egg producers take their responsibility seriously for providing consumers with eggs of the highest possible quality. This desire for quality begins with responsible farm management as the key to healthy hens and safe, nutritious eggs for all operation types, and Provincial *Consolidated Orders* and the *Recommended Code of Practice* govern the hens' health, environment, and care during egg production, transportation, and humane fowl removal.

Biosecurity signs at farm entrances warn unauthorized people against entering property and buildings, thus protecting the hens from the accidental spread of bacterial pathogens. Field staff regularly test barns to ensure that the hens' environment and feed are free from *Salmonella enteritidis* (Se) contamination. As a result, only one in a million Canada Grade A eggs is estimated to be infected with Se, making Se contamination in Canada very rare in comparison to other countries. The BC Egg Marketing Board (BCEMB) works with the Egg Farmers of Canada (EFC) to administer the national HACCP*-based *Start Clean Stay Clean*™ Program. EFC field staff collaborates with producers to identify any biological, chemical or physical hazards in the egg production unit and then recommends controls and farm management practices to minimize or eliminate possible risks.

Acknowledgements

Content for this binder is an accumulation of information from various universities, government agencies, and companies around the world and have been included with their permission. The authors and their institutions are gratefully acknowledged.

The BC Egg Marketing Board would like to recognize Birgit Gagne and Randy Friesen for her involvement in this project. Her contributions and dedication to the completion of this project are greatly appreciated.

Liability Limits

The primary purpose of this binder is to assist owners of small poultry flocks in enhancing food safety and biosecurity on their farms.

Every effort has been made to ensure the accuracy and completeness of this binder but, this binder should not be considered the final word on areas of practice covered. You should seek the advice of appropriate professionals and experts as the facts of your situation may differ from those set out in this Guide.

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Table of Content

Food Safety and Poultry Management

Food safety remains a pressing issue, and not just in the eye of the public. From May to July 2010 alone about 2000 people fell seriously ill in the US. All were diagnosed with Salmonella enteritidis (SE). Thankfully no one died but in North America every year people become sick, and sometimes even die, due to food safety related issues. Canada alone has an estimated 6.000 to 12.000 cases of SE annually. Internationally, contaminated foods are often traced back to animal products but all foods, including fruits and vegetables, can become contaminated. Sadly, the 2010 SE outbreak in the US was traced back to egg consumption and in August 380 million eggs had to be recalled. While one might argue this is still a tiny fraction considering the amounts of food we consume, the impact for the people concerned, and the industries connected, can be devastating when these issues arise. It is therefore in everyone's best interest to minimize potential risk factors as much as possible.

Food safety in poultry flocks can be enhanced by *Best Management Practices* in five basic areas:

- directly related **food safety practices**, like storing eggs at an appropriate temperature and adequately controlling pests such as rodents and flies
- **flock management** that enhances the well-being of our birds and avoids 'high risk behaviours', like late mortality removal, dubious sourcing of birds, or no quarantine for new birds added to a flock
- **sanitation**, because overall cleanliness and adherence to accepted biosecurity practices are key to assuring sources of potential contaminants are minimized
- **flock health** maintenance, as healthy birds are better able to fight off pathogens
- and, last but not least, **record management**. Good records will not only facilitate seeing patterns in the flock's behaviour and health according to management adjustments, but it will also make life easier in case of emergencies. Certain information must be kept to facilitate traceability and to allow fast recall of eggs or meat, if the need should arise.

What are your present food safety and biosecurity provisions? Do you have a recall procedure in place? Do you change your footwear when entering the barn? When you get replacement birds, do you quarantine the new arrivals or do you practice 'all in/all out' with each new flock?

On the next page you will find a helpful self-assessment questionnaire. In Section V, on page 65, we also included Standard Operating Procedures (SOPs), adapted from the commercial BC on-farm food safety and biosecurity programs for poultry. Accompanied by a logbook (examples are starting on page 79), these SOPs describe important activities related to food safety and together they are the framework for our record keeping.

The assessment questionnaire and these SOPs were included here to give flock owners a better understanding of the standards and norms in today's *Best Management Practices* for poultry in BC. It explains what to look for in good food safety and biosecurity practices and facilitates making comparisons, and if necessary improvements, to practices on their own farm today.

For those questions that might have been answered with 'No' or '??' (which stands for 'not sure' or 'N/A: not applicable'), details of the reasons we strive for a 'Yes' can be found in the pages after the questions under the following five sections: Direct Food safety, Flock Management, Sanitation and Biosecurity, Flock Health, and Record Keeping.

Food Safety and Biosecurity Self-Assessment Guide

Look at this checklist, if your answering checkmarks are all in the YES boxes - CONGRATULATIONS!

#	Question	YES	??	NO
1	Do you have a pest control program?			
2	Do you change footwear and/or outer clothing when you enter the bird raising area?			
3	Do you wash your hands when you enter the bird raising area?			
4	Do you store collected eggs immediately between 10°C and 13°C?			
5	Do you collect eggs twice daily?			
6	Do you have recall procedures in place for eggs/meat shipped?			
7	Is feed and water provided clean and fresh on a daily basis?			
8	Do you store your feed in rodent-proof containers?			
9	Is your water tested annually for bacterial contamination?			
10	Do you, at least once a year or between flocks, do a clean-up where everything in the barn is cleaned, washed, dried and disinfected?			
11	Are your tools and equipment used only for this flock and nothing else?			
12	Do you dispose of dead birds immediately and securely?			
13	Do you keep daily records?			
14	Does your manure management prevent possible disease spread?			
15	Do you avoid visiting other farms that have birds?			
16	Does your barn have an entrance area where you can change your footwear and/or outer clothing when you enter the bird raising area?			
17	Does your farm have a gate or other barrier that can be closed in case of an infectious disease outbreak, on the farm or off-farm?			
18	Do you have signs, fences, or other means to discourage visitors from approaching your birds?			
19	Do you take opportunities to learn more about poultry food safety and biosecurity, as they come up?			
20	Are you aware of the nearest poultry flock in your neighbourhood?			

Congratulations on all the questions which you confidently answered with: yes, I do that!

For those questions that you might have answered with 'No' or '??', this binder explains in detail the reasons we strive for a 'Yes' and assists you in making sense of necessary changes.

Section I - Direct Food Safety

The number one concern when it comes to food safety and poultry products is presently Salmonella enteritidis (SE). In Canada a regular swab test for these bacteria is done in all commercial poultry flocks because once a hen has contracted SE, generally through fecal-oral transmission, part of her fecal material is able to penetrate eggshells. As therefore SE could be present in raw or undercooked eggs, but also in meat birds, we test regularly for this pathogen to prevent any potential contamination problems. It should be noted here that this bacterial disease occurs most frequently in, and affects most severely, individuals that are stressed, be it bird or human. This is why we will not only talk about how to minimize possible disease transmission but also how to keep our birds as healthy and happy, meaning stress-free, as possible.

Concern for Salmonellosis is closely followed by outbreaks of Escherichia coli (E.coli), a bacterium that can likewise cause symptoms of nausea, vomiting, stomach cramps, fever, and (sometimes bloody) diarrhea. Both organisms can cause symptoms ranging from mild to fatal. Campylobacter, another bacterial source of potential food contamination is maybe not as common but, though rarely life-threatening, can also cause the symptoms mentioned.

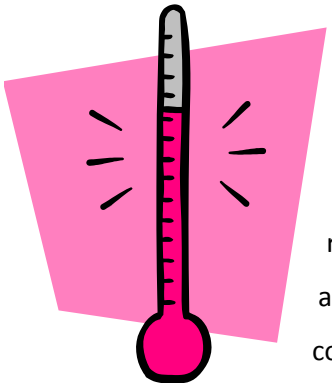
Disease outbreaks are always connected to three factors: pathogen reservoir (the initial amount of contaminant will greatly determine the severity and speed of which the bacteria will multiply), a susceptible host, and a favourable environment. Once one part of this equation is removed, the disease cycle is effectively interrupted. So how can we alter each one of these components?

Egg handling and cooling

Eggs have a natural barrier to prevent bacteria from entering through the egg shell. Little handling, to preserve this barrier, and cool storage assure the best possible shelf lifespan for eggs. As all three potential bacteria of concern thrive in a warm, humid environment, one of the most important steps to prevent illness is to store fresh eggs on-farm at temperatures between 10°C and 13°C until they are picked up.

Kept above these temperatures, bacteria will start to multiply and deterioration and quality loss will begin rapidly. Stored below 10°C, the barrier becomes compromised as the egg cools and the content contracts, potentially pulling disease causing organisms into the egg. Eggs found in wet areas, be it litter or manure, should be discarded during collection to prevent contaminated eggs entering the food chain. For eggs going to a commercial grading station, only the station will wash and dry the eggs.

Ideally only clean, dry eggs should be collected daily from the nests. (In later sections we will be talking about how to encourage hens to accomplish only dry and clean eggs.) Eggs must be in cool-storage within 24 hours of being laid. Eggs that haven't been put into cooling storage within those first 24 hours can be send to the 'breaker' where liquid egg is pasteurized. Maintaining air humidity as close to 70% as possible slows down moisture loss for the egg and will help further to maintain the best quality possible. Once the eggs have arrived at the end-consumer, they should be stored in a fridge below 10°C to prolong freshness and quality.



Again, appropriate refrigeration is crucial. On the farm, short term storage can be accomplished through fairly simple systems, as long as the correct temperature range of 10°C to 13°C is diligently maintained. The correct temperature must be verified through daily temperature recording. A good storage arrangement assures, besides proper cooling, a clean environment that is safe from potential contamination. As most cooling systems work on negative pressure, air - and potentially dust, debris, and pathogens, can be sucked in each time the cooler unit is opened. Keeping the area around the cool storage meticulously clean is therefore important. Consider investing in an actual cooler room, with a temperature regulating thermostat and maybe even an automatic alarm that lets you know if the temperatures approach the prescribed limits.

Try to avoid washing 'farm-gate' eggs sold directly to the consumer. If you must wash any eggs, assure the wash-water is warm, about 10°C warmer than the eggs, so the cold water doesn't create this above

mentioned ‘pulling’ effect from the inside. Be aware though that really hot water can cause fine cracks too. While eggs have that natural protection against contamination in form of a hard outer shell, once the shell has even fine cracks this natural barrier no longer works properly in protecting the content. Some studies have shown a 100 times higher bacterial count in eggs with cracked shells. Eggs, therefore, need to be ‘graded’ to assure only safe and sound ones reach the consumer.

When putting eggs into containers for farm-gate sales, on-farm grading can be as simple as visual inspection during the ‘candling’ of each egg, to find substandard ones. (See also the excellent University of Florida publication: *Concepts of Eggshell Quality* in the appendix on page 102.) By Canadian law, eggs not sold directly from the farm to the end-consumer must go through a commercial grading station. In certain situations, egg-producing flock owners may want to apply under the Shell Egg Grading Regulation (BC Reg 105/78) for a grading licence through the British Columbia Egg Marketing Board (BC Egg) and the Canadian Food Inspection Agency (CFIA).

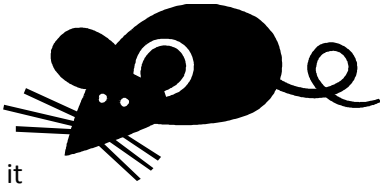
In a commercial egg grading station the eggs pass over a bright candling light on a conveyor belt that gently rolls the eggs during transport. This light makes the internal contents of the egg visible, allowing for internal defects to be seen (i.e. blood spots, meat spots, poor quality yolk, air cell size, etc). By rolling the eggs as they pass over the candling light, the grader can also see the entire outer surface of the egg. The light makes fine cracks in the shell visible, - some cracks are very difficult to see until candled, - and allows dirt, stains, or excessively rough shelled eggs to be noticed. The candler determines this way whether each egg meets the grade requirements for Canada A eggs. Defective eggs, leaking eggs, and other rejects are removed and the eggs that meet the A grade standard proceed to be weighed for the different size categories.

Candling allows us not only to see cracks. It also facilitates the detection of other abnormalities in table eggs, for example large airspaces and fertilized eggs. Candling

devices are therefore also handy for folks hatching their own replacement pullets because bright light will allow for differences, indicating 'dead' eggs, to be recognized more easily. No matter why you use one, the most important thing to remember for effective candling is: the brighter the light source used, the easier the candling! See the appendix for websites with ideas for a simple candling device on page 109.

If you do find cracked eggs or eggs otherwise unsuitable for human consumption, assure that they are disposed of in a manner that doesn't attract flies and other pests. Incidentally: you can test the age of an egg, or more accurately its freshness, by placing it into a bowl of water. The older the egg, the more air is in the air space and the further the egg will point up, towards the surface of the water. A fresh egg, ready to be packed, will stay sideways on the bottom of the bowl. An egg, tested like this at home for remaining freshness, should be discarded if it starts to float on the surface.

How to avoid pest infestations

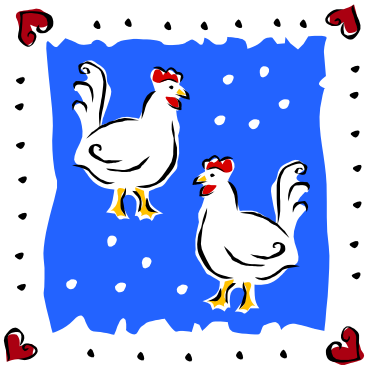


Pest control is of utmost importance for food safety and good flock management. Pests like rodents are one of the most pressing concerns when it comes to disease transmission on the farm, be it directly from bird to bird or indirectly from bird or egg to human. Mice and their parasites are implicated in the transmission of a number

of diseases including salmonellosis, rickettsial pox and hanta virus. Hantavirus pulmonary syndrome (HPS), which can cause severe illness and even death in humans, is transmitted by several mouse species. Rodents can also carry various types of tapeworms and roundworms, infectious to other animals and humans.

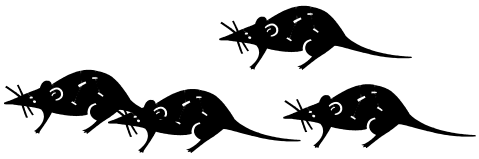
Rodents can also cause considerable financial damage through destructive burrowing and gnawing, preying on young bird and/or eggs, and large amounts of feed spoilage. It is estimated that every rodent spoils with hair, feces, and urine about ten times the amount of feed it consumes, and each mouse or rat consumes approximately five percent of their bodyweight each day. Doesn't sound like much? 100 rats consume about 1 tonne of feed each year and for each mouse on your farm you pay roughly 25 dollars a year in feed. It does add up!

But pests on a farm can come in many disguises. Disease transmitters on the farm beside rodents can include insects, like flies and darkling beetles, and wildlife like birds, skunks, and racoons. Beside contamination through droppings and urine, many pathogens can be found in saliva, hence are also carried onto the premises on fur, feathers and feet. Try to prevent entry into your poultry raising areas by wild animals or stray pets, such as dogs and cats. Your own pets (cats, dogs, pet birds, etc.) should not have access to your poultry raising areas either because, unfortunately, even our pets must be considered a potential source for pathogens. Cats, as well as dogs, can be carriers of pathogenic organisms, including roundworms, coliforms, and salmonella. Not to mention that many dogs can't resist the temptation of chasing the chickens around. And while a grown chicken is probably safe from being hunted by your average cat, the same can not be said necessarily for baby chicks.



Chickens Only!

Separating other birds from the flock is especially important with regards to biosecurity and avoiding disease transmission between bird species. A number of pathogens, for example certain strains of Avian Influenza, can live in some avian species without ill-effect on the original host species. Should the pathogen get transferred into domestic poultry flocks though, the resulting disease outbreak can be devastating and include very high mortality rates.



Minimizing primary entry onto your farm by pests and pathogens on equipment and supplies can be achieved through appropriate precautions such as inspection of shipping boxes, feed, and bedding sources, even if they are not directly poultry related. To assure these goods are also free from infectious agents, cleaning and disinfection of suspected material is highly recommended.

Rodents, because of their before mentioned habits and incredible fast reproduction - in the average lifespan of 3 years for a rat, a pair of them could produce through the exponential of following generations about 20 million more rats - are the number one concern for farms when it comes to pest control. As rodents adapt to so many different environments, they are found literally everywhere where there is food and shelter. Farms offer generally both, and our priority is therefore is to minimize access to food and shelter.

Kestrel

Sound construction, systems of exclusion like netting in front of windows, sanitation, as well as a sensible pest control program are the cornerstones in avoiding infestations. When setting up the premises for a new flock, or possibly during initial coop construction, thinking along these lines is can be very helpful in the long run. Consider perching poles around your poultry raising areas to encourage raptors, like barn owls and kestrels (a small type of falcon specialized in hunting for mice), to help with your pest control.

Rodents do not like open areas where they are exposed to predators and prefer to be out of sight, or within easy access to hiding places, while travelling and foraging. A clutter-free barn environment and gravel, pavement, or very short grass around the barns will go a long way to keep rodents away. Ensure doors, windows, air inlets, feed bin exhausts, etc. are either closing tight or are screened with appropriate material and check there frequently for holes, tears, and other damage. During cleaning and sanitation the simple presence of the person doing the job will disturb and discourage rodent activity. Checking for signs of rodent presence, like gnawing marks, droppings, foot prints, smell, etc. can be easily incorporated into the regular cleaning schedule. Pests, and germs, like a messy environment. The tidier the place, the less pest and disease problems you will likely encounter.

Nonetheless, even the best run farm can occasionally encounter problems with rodents. Once rodent activity is observed, - and seeing one likely means 20 or more are in hiding, maintaining a sufficient number of traps or bait stations is highly recommended. A well maintained bait-station is placed at close intervals in the right locations and checked and refilled, or replaced, frequently. The best location for placement depends on the type of pest to be controlled, rats and mice actually have differing preferences for their 'runs', pathways that are frequently used. Always make sure bait-stations are inaccessible to non-target species, as well as pets and children.

To prevent resistance build-up it is recommended to change the active ingredient in the rodenticide periodically. Starting in 2013, rodenticides containing *difethialone* (Hombre) or *brodifacoum* (Weatherblock, Ratak, Jaguar, Final) will be strictly for indoor use. Always check the label and follow the instructions for use provided on the bait product.

Factsheets on bait-station placement are available online, from your bait supplier, or the BC Ministry of Agriculture (BCMA). Keep also in mind that bait is most likely to be accepted by the target pest when there is little access to other food, therefore assure feed spills are cleaned up promptly. Occurring poultry mortalities or spoiled eggs should be also removed as soon as possible, but at least daily, and disposed of or stored in an appropriate manner. (See also *Mortality Management* on page 25.)

Darkling Beetle (*Alphatobius diaperinus*)

Darkling Beetles, and their larvae stage known as 'Lesser Mealworms', are small insects found often in the bedding of poultry houses. They eat almost anything, including dead poultry, and have proven to carry many pathogens. Eaten by the chickens, they can transmit bacterial diseases like E. coli, coccidiosis and salmonellosis, and also viruses that cause Marek's Disease, Infectious Bursal Disease, Fowl Pox, Newcastle Disease, and Avian Influenza. Any of these conditions will likely cause either a drop in egg production, or in the number of eggs that are fit for your customers, making Darkling Beetles not only a potential food safety issue but also a financial burden to chicken owners for this reason alone. Furthermore, Darkling Beetles will actively consume chicken feed and in addition, the beetles can actually cause substantial damage to the coop

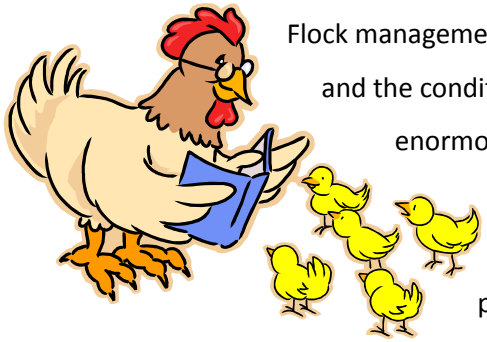
construction itself. Damage of the building insulation due to heavy beetle infestation leads to higher energy costs for cooling and heating, and can acerbate condensation problems. Last not least, material softened by the insects will allow easier access for rodents like mice.

The concept of integrated pest management (IPM) calls for intervention at a certain level of a given pest problem, depending on pest species, economic threshold, and other circumstances. To estimate how many beetles are in a certain area, home-made monitoring traps can be easily placed to estimate pest numbers. Depending on the amount of beetles found, an insecticide may be sprayed once the flock is removed. Generally it is not recommended to take chemical action against Darkling Beetles while the birds are present. (See also the North Carolina University fact sheet on management of Lesser Mealworm (aka Darkling Beetles) in the appendix on page 119.) Frequent litter change and keeping your poultry housing facility dry is the best way to alleviate potential darkling beetle problems.

Other insects of concern are flies and mosquitoes. Not only are they disease transmitters but their small size and their ability to fly allows them access to virtually any place. They too are often attracted to humid conditions. Assure proper management of manure, compost piles, and feed to prevent fly breeding and remove any stagnant water as it provides breeding ground for mosquitoes. Infestations can be prevented by proper management of the surroundings, and use of beneficial insects purchased from agricultural retailers and released directly into manure piles can be a valuable aid. Insecticide sprays, baits and strips, like all other pesticides, should be used judiciously and in mind with possible impact on food safety, bird health and/or the environment. For more information check out the factsheet *Poultry Area Fly Control* from Virginia Tech, in the appendix on page 122.

Pest control companies are readily available to deal with pests of many sorts but for most small farms the running costs to hire such services become quickly prohibitive. For more information and tips on how to deal with pests the internet can be of valuable service. Look up reputable sites such as commercial poultry organizations or government extension services, often paired with universities, for advice on effective pest management methods and new research in pest control.

Section II - Flock Management

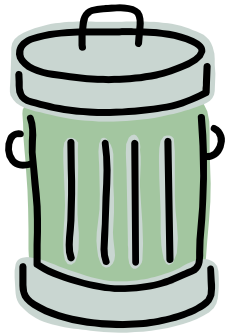


Flock management, meaning the environment the birds spend their lives in and the condition and circumstances they are raised under, has an enormous influence on food safety. As pointed out earlier, environmental stressors will affect the immune system of your bird and stressed birds will fall victim much easier to potential disease causing agents than a bird that is healthy and stress-free. Feed and water access, housing facilities, as well as range management, if applicable, all influence the direct well-being of the flock. Indirectly, mortality management falls also under good flock management as inadequate removal frequency and disposal will raise the exposure to pathogens and attract stressors in the form of predatory or scavenging wildlife. All support systems, be they heating, ventilation, feed and watering equipment, alarms you might have, or the back-up generator, should be tested intermittently to ensure proper functioning. The appendix, starting on page 93, has more information on causes and factors of low egg production and poor egg shell quality.

Feed and water

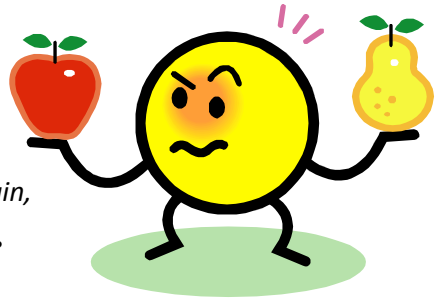
Feed and water are, obviously, of utmost importance. Access to fresh, clean feed and water in regular, appropriate frequency and sufficient amounts is crucial. Both have to be offered in easily accessible locations and big enough number of stations to avoid stress for the birds through hunger, thirst or competition. Try to avoid spilled feed as it attracts free-loaders, be they wild birds or rodents. Cleaning up food attractants, maybe from a leaking auger underneath the feed bin, is a task that should never be postponed. Assure the spilled feed is completely removed. Sweeping the spill from underneath the feedbin into the surrounding area will give a clean impression, but it doesn't achieve the goal of removing the pest attractant.

Poultry rations are available already conveniently formulated for the different ages and types of birds. When stored and handled properly, these premixed feeds are convenient for you and they assure healthy poultry as they assist in a complete and balanced nutrition program for your birds.



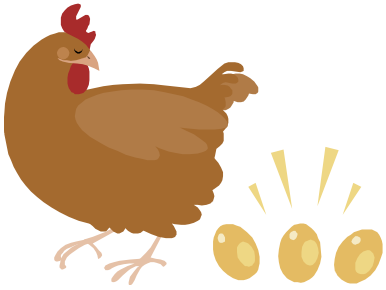
Feed should be stored cool, dry, and dark, and once opened the content should be consumed by the birds within about 2 weeks. Never leave bags of feed, open or closed, out in the open. Invest in a sturdy container, preferably metal, to keep rodents from eating and spoiling the feed. All feed should be periodically inspected for smell, color, and texture to assure freshness and quality.

Grain, supplements (like salt, trace elements, vitamins), and oyster shell or limestone can also be purchased separately. Trials have shown that chickens are good at eating what they need, provided not more than three choices are given. This is explained in the following excerpt by Carlyle Bennett, Business Development Specialist from Manitoba Agriculture Food, & Rural Initiatives, titled *Choice-Feeding of Small Laying Hen Flocks*:



1. Do not give the hens too many choices. Hens can handle up to three choices quite well (grain, supplement and limestone or oystershell). If you want to use more than one grain, such as wheat and barley, you should mix them together in the same feeder.

2. Give the hens choices that are nutritionally distinct. For example, grain is high in starch and energy, supplement is high in protein and vitamins and limestone is high in calcium. When provided such clear choices, the hens learn which feeders to go to and how much to eat to meet their basic nutritional needs. Some choices may not be clear enough for the hens. For example, wheat and peas both are high in starch and have moderate levels of protein; having separate feeders of wheat and peas may not provide a distinct enough nutritional difference for the birds.



3. Introduce the whole grain and choice-feeding a month before the start of egg production (about 15 weeks of age). This adjustment period will allow the birds time to learn how to choice-feed themselves before they are exposed to the nutritional demands of egg production. It will also allow the pullets the opportunity to increase

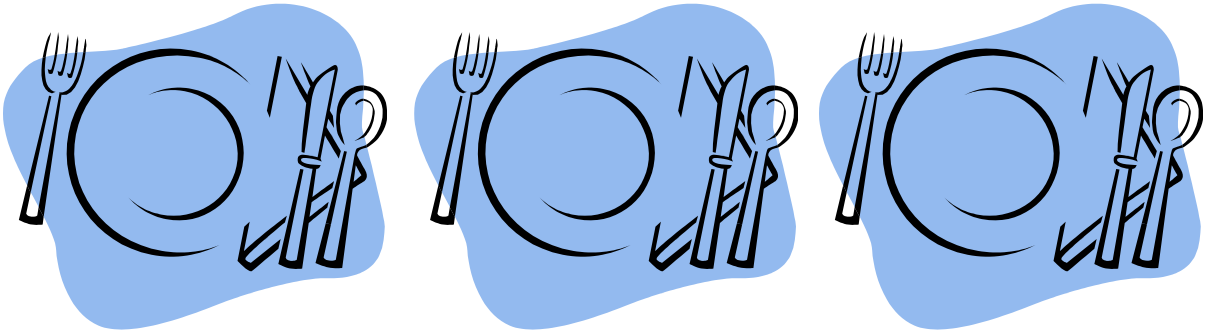
their calcium consumption and build up the calcium reserves in their bones before they start to lay eggs. Finally, it takes the gizzard three weeks to build muscle mass and you want the hens to be able to efficiently grind the grain once egg production begins.

4. Do not feed vitamins or micro-minerals (e.g. copper, zinc etc.) in a separate feeder. Use your supplement as a source of these ingredients. If vitamins or micro-minerals are placed in a separate feeder, some birds may not eat them because they do not like the taste while other birds may over consume them and suffer toxic side effects.

5. Give the birds adequate feeder space. If you have a large backyard flock, you may need several feeders for each ingredient. For a one hundred hen barn, two hanging feeders each of grain, supplement and limestone are suggested.

6. Purchase a supplement designed to be mixed with grain or grain and limestone to provide a complete laying hen diet. A supplement formulated in this manner will contain in the range of 25% to 40% protein. A grower supplement may be used prior to the start of egg production but use a laying hen supplement once the birds begin egg production.

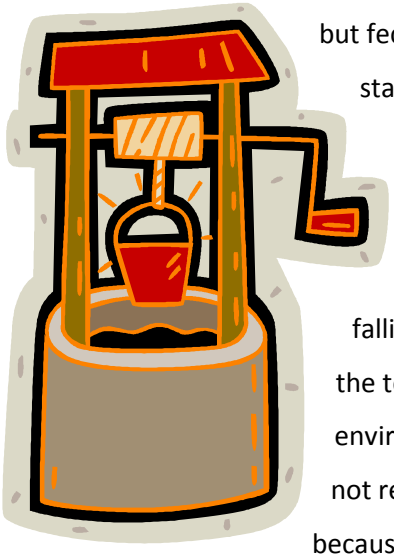
As mentioned in the free choice tips, another important factor in feeding is 'space-per-bird'. Besides quality of feed, the distance to access and the available space each bird has will determine to a large extent the feed intake. Presently the recommended distance of feeders is a maximum of 16 m apart, as birds shouldn't have to walk much further than 8 meters to reach feed. To assure the more timid, lower-ranking birds get enough feed, each adult hen should have 2 to 3 running inches of feeder space available.



This translates to 20 to 30 chickens at the standard round feeder. Open trough feeders will double the space available as the birds can reach from both sides into the feed.

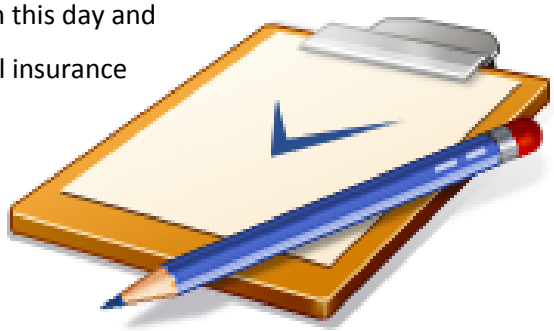
For sufficient access to water, the space requirements can be halved for standard round waterers, meaning about 50 chickens will share one water station. If the birds drink from a nipple system, calculate 1 unit for 6 to 10 birds. If you do use a nipple system, all units have to be checked daily to make sure they work properly as nipple drinkers get plugged very easily.

Where does your water come from? The water supply should be clean, fresh, and must be free of contaminants like bacteria or heavy metal residues; at least above certain limits. For commercial poultry operations in BC the critical maximum is 10 per mg/l for total coliforms (TC), but fecal coliforms (E. coli) must be completely absent. To assure this standard, well water must be tested annually for bacteriological contaminants.

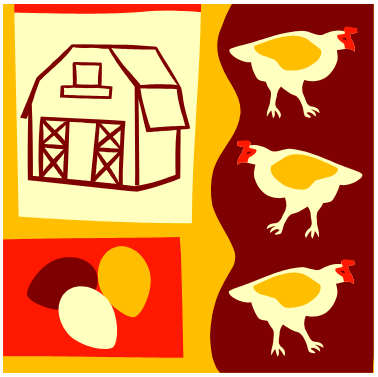


Water samples should be gathered in a way that assures no cross contamination can occur, for example dust from the tap falling into the sample container. Improper shipping, too, can distort the test result, as extended periods of the sample in a warm environment will allow present bacteria to multiply. Even farms that do not rely on well water should consider testing their water periodically, because of the potential for pipe contamination.

Should you have a checklist for daily tasks? Having records, in particular for the daily feeding and watering chores isn't a bad idea. It can be especially helpful when more than one person takes care of the birds, as you will avoid 'Peter' saying to 'Bob': "I thought it was YOUR turn!" - while the chickens go hungry or thirsty. Secondly, in this day and age of due diligence and record keeping, a potential insurance claim for compensation or similar legal matters are much quicker solved when written logs and records are there to support the producer's claim of due diligence.



Housing



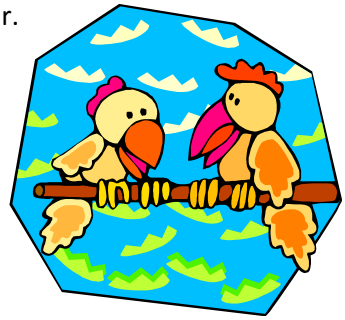
The way poultry is housed can contribute to a large extent to successful food safety and biosecurity. Beside lay-out and space, one of the most important aspects contributing to a flocks well being is how easily the housing unit can be cleaned. Whichever material and type of chicken housing you prefer, or maybe have 'inherited', assure it can be easily cleaned.

If you have the chance to build your own poultry raising facility there will be many opportunities to incorporate food safety and flock health enhancing features. Ideally the land used is well drained already and maybe large enough to allow for future expansion. If the barns were already present when you moved onto the property, you might have to adapt certain features of the previous configuration. In both cases the housing facility has to meet municipal and provincial siting guidelines, including appropriate distances of barns to neighbouring lands, as well as for manure management provisions. If the barns are being newly built, the needed permits should be in place before construction starts. For more tips on barn locations see also the factsheet titled *Siting and Management of Poultry Barns* from the BC Ministry of Agriculture at http://www.agf.gov.bc.ca/resmgmt/publist/300Series/305104-1.pdf. To obtain a copy of fact-sheets like *Poultry Housing and Handling*, please contact the Canada Plan Service at www.cps.gov.on.ca.

In poultry raising good housing arrangements have multiple benefits to the birds. It will keep them safe from predators and inclement weather, be it winds, snow, blazing sun, or pounding rain. It gives hens a quiet place to lay their eggs, as well as a sheltered place to consume feed and water. The birds' well-being is greatly influenced by stress or the absence of it. As aggressive interaction amongst birds will rise with flock density, meaning the more birds have to share a given area, the more likely aggressive behaviour amongst the birds will be observed, sufficient space-per-bird is crucial in housing.

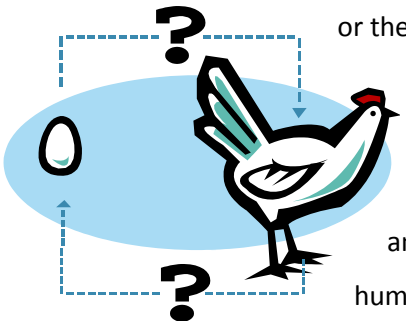
Minimum floor space per bird has often been discussed and regulatory requirements are periodically changing. Most

smaller flocks are housed these days free-run or free-range, but as of 2010 the minimum floor space requirements for layers kept in cages are 67 square inches for white hens. At least 75 square inches are required for brown layers, as they tend to be bigger. Minimum free-run (birds run loose inside their housing) space allotment is now at 264 square inches for white layers and 295 square inches per brown hen. This presumes an all litter floor. If the floor consists of all slats or wire, the space requirement can be halved. For free-range housing it is assumed the birds have plenty of floor space. As chickens generally prefer to roost elevated, the space per bird should also be considered when it comes to perches.



Additional information on space requirements can be found in the Consolidated Order of the BC Egg Marketing Board, under *Schedule 2 - Operational Standards*, or at the National Farm Animal Care Council website, under *Current Code: Poultry - Layers (2003),* respectively.

Where is the egg? Here the question is not so much the old one as who was here first, the hen or the egg, but - while you see the hen - where has she laid her eggs today? Eggs laid into clean nests are less likely to become contaminated then 'floor eggs'. Hence nestboxes, clean, of sufficient space and numbers, and in the right location are another important step in assuring the safest eggs possible for human consumption.

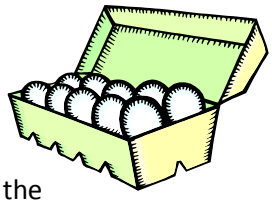


Nestboxes should be placed in locations that are easy to clean but that also appeal to hens as suitable egg-laying sites. Your hens are looking for a sheltered spot of sufficient size in a quiet, secluded area. Nestboxes provided therefore should be of sufficient size for the hen to get in and out easily, some place away from the 'hustle and bustle' of the daily center of flock activity, and preferable not in bright light.

Cleaning nest boxes might be a daily task or a periodical one, 'as needed'. It all depends on the condition of the nestbox interior. Broken eggs, or chicken manure, will require immediate clean-up to prevent eggs from being soiled and also to prevent attracting flies. Well managed nests can generally be cleaned thoroughly, and have fresh bedding replaced, as regular clean-up proceeds.

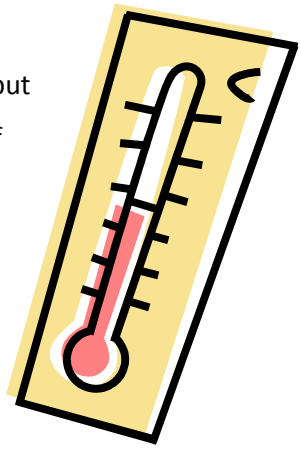
The number of nests needed to avoid floor-eggs varies with breed, flock habits and, of course, the number of hens in your barn. A maximum of five hens should have to share one nest but observing the flock closely will allow you to judge if additional nests are needed. Egg collection should be done ideally two times a day.

Eggs must be in cool-storage within 24 hours of being laid but collecting twice a day instead of once has several other advantages. As most eggs are laid between 7AM and 11AM, collecting the first time in the morning will lessen the danger of eggs cracking as additional hens lay their eggs into the same nest. Collecting a second time around midday removes remaining eggs out of reach of 'predators', even other hens picking at eggs in search of a calcium source, and at the same time lessens the risk of contamination by organic material.

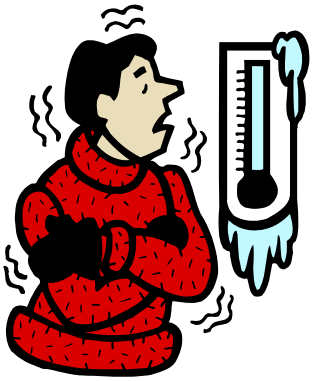


Though written originally for breeder flocks, background information on many details that apply to layer bird preferences, too, can be found in the excellent excerpt titled *Encouraging Hens to Lay in Nests and Minimizing Floor and Slat Egg Problems* in the appendix on page 110.

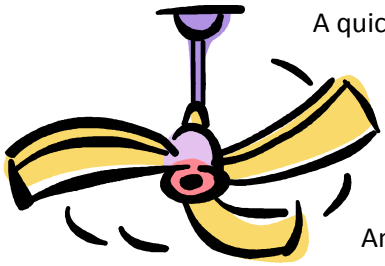
Temperature control



Cold and excessive heat will affect the well-being, as well as the egg-laying capabilities, of your flock. Adult chickens are normally housed around 20°C but heating or cooling requirements vary with age, weather, and also number of birds in a flock. Especially baby chicks are very cold-sensitive and need temperatures around 30°C for the first few weeks. Before newly purchased chicks or pullets arrive, the heating should be turned on for several hours in advance to stabilize room temperature and warm the floor areas.
Mature birds are much less sensitive. As long as they have shelter to keep them dry and out of the prevailing winds, they can cope with cool temperatures just as long as they are above freezing. Nonetheless, an additional heat source in form of a heat-lamp, or other forms of heating to raise the temperature to a comfortable 20°C, will be gladly accepted.

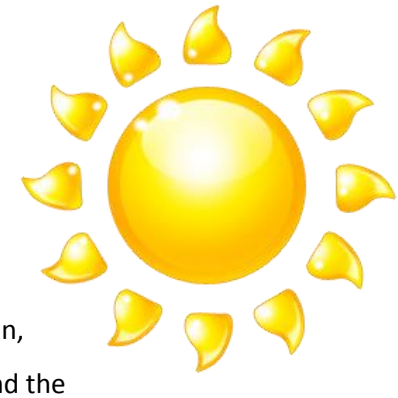


Birds avoiding the center of the heating zone usually indicate too high a temperature setting and, conversely, chickens gathering in close proximity to the heat source usually indicate the room temperature is too low. Other signs that alert us to heat stress are panting, as well as frequent spreading and flapping of the wings. Birds suffering from low temperatures and cold stress will shiver and huddle together. They will appear lethargic and ruffle their feathers frequently trying to keep warm. If you encounter these conditions frequently, the insulation and/or the ventilation of the building should likely be upgraded.



A quick word with regards to ventilation: good ventilation allows for air exchange without chilling the birds or loosing excessive heat in the building. Good airflow reduces vapour condensation on walls and ceiling, lowers the dust level, and prevents ammonia build-up. Ammonia build-up, easily recognized by its strong smell, indicates the need for cleaning up manure and improving ventilation. If you find the air inside the coop unpleasant so will your birds.

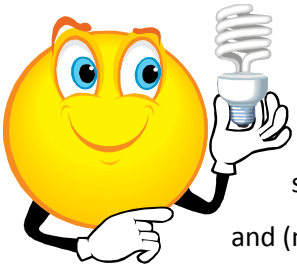
Good ventilation assures the humidity in the building is lower than the recommended maximum of 80%. This is especially important as summer temperatures rise above 26°C. Ideally, the higher the ambient temperature the lower is the humidity. You can find more tips on ventilation for poultry houses on the Canada Plan Services website under http://www.agf.gov.bc.ca/resmgmt/fppa/refguide/activity/870218-57_Ventilation.pdf.



Light

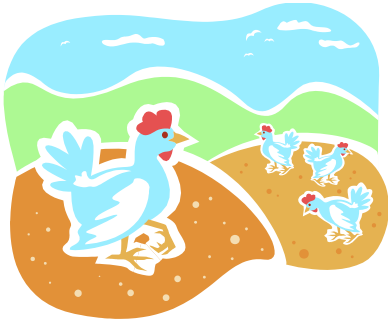
Anybody who ever had a bout of 'cabin fever', suffers from Seasonal Affective Disorder (SAD), or on the contrary has seen their animals laying happily in the grass soaking up every ray of sun, knows the importance of sunlight. Light, its intensity, spectrum and the amount of hours we get, influences everyone's well being, and our chickens are no exception. Light affects birds in two ways. It enhances their general well-being but it also stimulates egg

production. All bird species start egg production with the lengthening daylight hours of spring and summer and, to assure continuing fall and winter egg production, this natural process can also be initiated through artificial light. For young birds starting to lay, lighting duration can be increased around 17 or 18 weeks of age and increased gradually over 1 to 2 weeks until they are exposed to 14 to 16 hours of light daily. For birds already laying, the season can be prolonged by supplying additional light for a total of up to 16 hours a day, giving them 8 hours rest per night.



Light is also very important in the first weeks, as getting all birds on feed and water within the first 24 hours is crucial. Good lighting will help with feed and water intake as chicks will instinctively peck at shining surfaces. If properly illuminated, this includes the water surface and (metal) feed bowls. Water and feeders that are highlighted by good lighting will attract chicks very quickly. For more details on the subject of light see in the appendix on page 126 *Lighting for Poultry* by Dr. Bill Cox, poultry veterinarian from the Animal Health Centre of the BC Ministry of Agriculture in Abbotsford.

Range management



Free-range systems where the chickens have daily access to the outside, short of really miserable weather, are common for small flocks. Like free-run systems, free-range housing allows for expression of more of the typical chicken behaviours, like dust bathing and scratching, than for birds in cages. In addition, free-range systems provide birds with access to sunlight, lessening the need for vitamin D supplements.

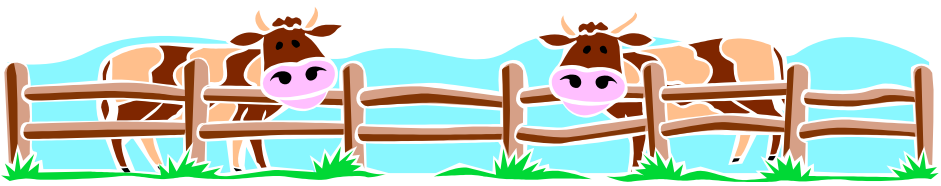
In order to keep your birds save from predators, the daily access area should be fenced all around and might even be netted from the top to avoid predation by air, as well as intermingling with other bird species. Wildlife in general but especially birds and their droppings should be excluded from accessing your poultry raising areas as much as possible. At

the very least feeders and waterers should be made inaccessible for wild birds. This can be generally accomplished through netting or by offering feed and water only indoors.

Some people build, in addition to the barn, coop, or chicken house, outside shelter from the sun and adverse weather. For flocks were the pen is not covered by netting, the additional shelters can also provide access to safe places from sudden prey-bird attacks. Desirable habitat for rodents like tall grass, shrubs and bushes, that can offer the rodents shelter should be eliminated next to the chicken barn. This will also discourage predators attracted to your birds, and/or their eggs, from approaching the barn area.

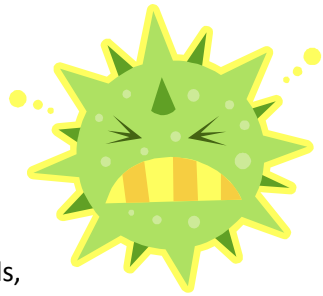
Consider investing in a system to 'parcel off' your pasture. Frequent rotation of grazed areas prevents overgrazing and ingestion of feces and pathogens because manure build-up is prevented. Rotation also allows the flock manager to avoid muddy areas where drainage is impaired or too much water is collecting, for example by improperly installed or clogged eave troughs. To facilitate good pasture management, many small flock owners are now using 'chicken tractors', coops on rolls that can be moved as the pasture is grazed down. This system prevents manure build-up, lessens soil disturbance and demolished grass roots, while at the same time allowing the birds' safe access to the outside. For bigger flocks portable coops might not be easily feasible but it pays nonetheless to protect the pasture, from overuse by any livestock, by developing a system that allows only limited amounts of time in a given part of the range.

Occasionally your range area should be checked for potential contaminants, like pesticides and certain weeds. Keep an eye out for poisonous plants like Jimsonweed or common vetch. While birds are generally pretty good in avoiding harmful plants, if the pasture is grazed down to stubbles they will consume plants they would normally avoid.



Mortality management

Sooner or later, one or several birds will die, be it from a disease, accident, culling or natural causes. Such mortalities have to be then somehow disposed of, while still keeping in mind good housekeeping and biosecurity principles.

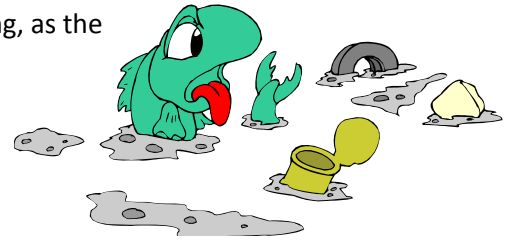


The first principle is to remove dead birds as soon as possible. As mortalities occur, carcasses have to be removed at least on a daily basis from the rest of the flock. Not only are mortalities a perfect breeding ground for all kind of pathogens like bacteria, viruses, moulds, and protozoa, but carcasses may harbour these disease causing organisms that can spread to other birds, or to people, by direct contact. Therefore, the longer the carcass is present in the poultry raising area, the higher the likelihood of contact with remaining birds. The more time has passed, the higher will be the number of potentially present pathogens. As bacteria multiply exponentially, a relatively small number will explode into disease causing proportions in just a few hours under the right circumstances. Bacteria that cause botulism, for example, thrive in disposing dead birds, endangering the remaining flock. As maggots or darkling beetles cleaning the carcass accumulate the toxin produced by the bacteria in their bodies, hens feeding on the insects will then ingest the toxin by eating the insects. Removing mortalities as soon as possible is crucial to food safety and biosecurity.

The next issue to consider is the reason for the mortality occurrence. If you suspect a contagious disease contact your veterinarian and the **Animal Health Centre of the BC Ministry of Agriculture at 604-556-3003**.

Thirdly, because of the disease transmission potential, consider the distance of the disposal site from the flock. In a nutshell it is safe to say: the further the better. While speedy, appropriate mortality management is crucial to avoid the spread of pathogens, part of appropriate management is the disposal distance. Especially if a rendering service is chosen or the birds are incinerated on another farm, consider the disease transmission potential of the method employed to your farm, but also from your farm.

Regardless of the final method chosen, protect yourself from body fluids, etc. when removing dead birds. If you don't dispose of the carcass immediately, store dead birds properly in a sealable container, like a bucket with a lid or a sturdy, maybe doubled, plastic bag. Many farms collect mortalities up to a certain number in a separate freezer unit until final disposal takes place. This is not recommended for burying or row composting, as the system can digest smaller quantities easier than larger ones. Improper disposal of mortalities, especially in large numbers, can also result in contamination of the ground water supply.



The four most common disposal options are carcass off-farm removal by a rendering company, burial, incineration, and composting. Each of them has pros and cons that need to be considered by each farm manager under his or her specific circumstances. These four options are explained here in a more detailed factsheet from the BC Ministry of Agriculture:

Mortality Management for Poultry Flocks

by Dr. Bill Cox, Animal Health Centre, BC Ministry of Agriculture

One unfortunate consequence of owning poultry has to deal with dead birds. Not all mortalities will be the result of infectious disease, but proper handling of dead birds will help to reduce the impact that an infectious disease might have on a flock and reduce the risk of disease from spreading to another flock.

1. Handling Dead Birds

Dead birds are a potential reservoir for infectious disease that can affect other birds or the owner. The flock should be checked at least once daily to look for dead birds and to generally assess the health of the flock. Be sure to check corners, nest boxes, and other hidden areas as sick birds will tend to find spots away from their flock-mates.

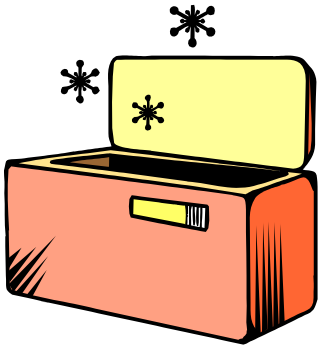
When handling mortalities, hands should be protected with disposable latex or nitrile gloves or even an intact plastic bag over the hand. Once the carcass has been secured the gloves should be discarded and hands washed and sanitized.

Dead birds should be removed from the flock as soon as they are found and placed into a sealed container. This could be a plastic bucket with a lid or a double plastic bag tied closed. The outside of the container should be cleaned and disinfected before removing it from the barn.

Each barn or shed should have its own collection vessel to prevent possible disease transfer through sharing. Once the dead birds have been removed from the transport container, the container should be thoroughly cleaned and disinfected before it is used again, or discarded well away from any poultry.

2. Storing Dead Birds

Mortalities may have to be stored for a period of time before disposal. Stored mortalities should be contained in a clean, secure container or secured double plastic bag. If keeping carcasses for only a day or two, they should be kept chilled. For longer periods of time, carcasses should be frozen.



The storage vessel, whether it is a refrigerator, freezer, or other container, must protect the contents from exposure to rodents or scavengers.

The freezer or refrigerator in which mortalities are stored should be used only for this purpose and not used to store other things such as food, vaccines, or medicines. Once mortalities have been removed, the inside of the refrigerator or freezer should be cleaned and disinfected.

3. Disposal of Dead Birds

At some point, the dead birds will have to be disposed. This can be done in a number of ways but the method may be influenced by local regulations.

a. Incineration

The best method of disposal is proper incineration; this method ensures destruction of any infectious organisms and also eliminates any risk of noxious odours disturbing neighbours. It is likely not cost-effective, however, for most small flock owners to invest in a proper incinerator.

b. Carcass Removal

Removing carcasses from the farm to another disposal area is another option. It is critical, however, that they be properly secured in a sealed container to prevent possible spread of any infectious organisms as they are transported. Some landfills may accept limited numbers of poultry carcasses, so this option can be explored. If using a disposal option, such as an incinerator, on another farm, it is critical that the mortalities be handled with care to prevent any spread of disease to poultry populations that might be on that farm.

c. Composting

Composting is yet another option for disposal of carcasses, but this option requires a great deal of care to ensure it is done properly. The compost area must be contained so that wild scavengers, including birds, cannot get at carcasses. The dead birds must be buried within the compost pile to ensure that good bacterial action can happen to break the carcass down. The temperature of the compost should be measured to ensure that it rises above 37° C for 5 days. Once the temperature starts to drop, the pile must be turned to encourage further bacterial action. Done properly, composting will eliminate a chicken carcass in just a few days.

Rotating Drum Composter

More information on proper composting can be found in the BC Agricultural Composting Handbook, available on the BC Ministry of Agriculture website at: http://www.al.gov.bc.ca/resmgmt/publist/300Series/382500-0.pdf

d. Burial

Burial may be allowed in some jurisdictions, but it is best to check with municipal regulations. If there is a high water table, then carcasses cannot be buried in that area. They must, also, be buried deeply enough to prevent scavengers from getting at the carcasses.

Mortality management is a key element in flock health management and biosecurity. Careful attention to proper handling, transport, and disposal of dead birds is an essential step toward keeping your birds healthy and preventing the transfer of diseases from your farm to another.

More details on burial options can be found in the BC Ministry of Agriculture Factsheet 384.300-3, http://www.al.gov.bc.ca/resmgmt/publist/300Series/384300-3.pdf available at the BC Ministry of Agriculture website.
Further recommended reading on mortality management can be found at:
http://www.agf.gov.bc.ca/resmgmt/publist/300Series/382500-8.pdf

http://www1.agric.gov.ab.ca/$Department/deptdocs.nsf/all/agdex6117/$FILE/450_29-1.pdf

Section III - Sanitation and Biosecurity

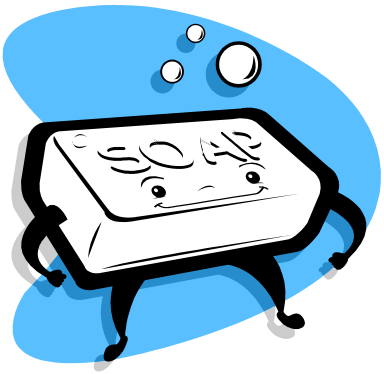
As it minimizes access and build-up of pathogens, limiting visitors, an 'all-in/all out' system, or quarantine provisions if adding new birds, and just keeping your farm overall neat and clean will prevent most disease problems. A good biosecurity program has four components. The first two parts deal with access to the farm and the barns respectively, the third considers flock health provisions, and the fourth one is an accumulation of farm management standards aimed to minimize and manage pathogens on the farm.

All four components have these three aspects in common: prevention, segregation, and sanitation. In the appendix you can find all 19 mandatory standards of the BC Poultry Biosecurity Program on page 129. Many people are surprised about two things when it comes to disease transmission: firstly, how much impact people have on pathogen transmission and secondly, how much of good biosecurity is just little more than common sense and elbow grease. Now, let's talk about our own impact first.

People: the number one culprit in bringing in infectious diseases

One of the most common ways to transmit disease into a flock is actually through human action and interaction. Where neighbouring flocks come down with the same disease, the majority of cases observed can be traced back to farm-to-farm contacts and insufficient biosecurity measures. The Canadian Food Inspection Agency promotes biosecurity by reminding producers to ask themselves: is this visit necessary? Allied trades and other necessary visitors, like feed representatives, rendering services, etc., should consider at the minimum the following questions:

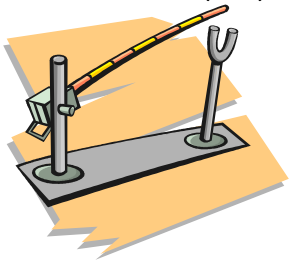
- Do I know how to enter production zones? Where do I park and sign in?
- Do I have everything I need to perform my service? Double check!
- Am I following effective cleaning measures for equipment and personal wear?



Limiting unsupervised access to your birds by people in contact with other poultry flocks, and assuring vehicles that have to enter the flock raising areas are visibly clean, are the best way to prevent accidental disease transmission. Boot change, coveralls, and hand-washing facilities are a must for anyone taking biosecurity seriously.

To facilitate keeping diseases, respectively, out or in, the industry has coined the terms **Controlled Access Zone (CAZ)** and **Restricted Access Zone (RAZ)**. The 'Controlled Access Zone' is the area or zone where we have to manage and 'control' the pathogens entering as much as possible. The 'Restricted Access Zone' is the barn-space and/or free-run area, where we can actually restrict the access to visitors, and therefore many pathogens. Many producers find it helpful to draw an actual map, or use the pictures available on Google, to visualize these distinct areas on their farm.

While free-range facilities often do not have a separate entrance room, an enclosed area to change at least the footwear and sanitize our hands is highly recommended. In commercial operations this area is referred to as the anteroom. This anteroom provides a visually recognizable transition zone and must according to the BC Poultry Biosecurity Program from January 2011:



- permit adequate space for a distinct physical separation of the "outside area" (CAZ) and all "inside areas" (RAZs)
- have a clearly identifiable demarcation between the CAZ and the RAZ, be it a barrier, a line, a door, a bench, etc.
- must be equipped for hands to be cleaned with appropriate disinfectants
- must have a change of clean/disinfected boots to cross the outside and inside demarcation
- must have a change of clean/disinfected outerwear including head cover
- as well as sufficient space for the number of personnel utilizing the anteroom.

Preparatory cleaning, and/or disinfection, of the footwear with a hose or boot brush located at the entrance to the anteroom or the bird raising area

to prevent dirt dragged into the change area is a good idea. As is the simple act of washing the footwear as this will remove many pathogens.

Changing your footwear is the best way to avoid carrying germs from A to B, but some people still like to use boot-dips. Boot-dips with liquid disinfectants are being steadily replaced by a so called 'dry footbath' system, a shallow pan filled with dry bleach (granular powder), or detergent + dry bleach. Use of liquid disinfectants requires the footwear to be exposed between 2 to 10 minutes and the liquid needs to be replaced every day or whenever organic particles are added through normal use. Most producers find this very cumbersome, ineffective, and expensive. Trials in a commercial hatchery setting showed that the dry-maintained systems were effective for 14 days and longer (*Foot Pan Presentation*, Robert Owen, 2003). Although, changing your footwear is still the best way to avoid transmission of diseases.

To prevent the spread of viruses and bacteria, implements and tool used in the poultry raising area shouldn't be used in other parts of the farm. For poultry owners with more than one age group, it's also a good idea to attend to the younger birds first. To prevent carrying the pathogen into the healthy flock, healthy birds should always receive daily care before sick ones. Keep in mind that we as owners and managers can constitute a risk to our flocks. Many a flock has been exposed to new pathogens by owners returning from places where poultry owners mingle, maybe the feedstore, at the coffee shop, or an agricultural fair. Our own actions should be exemplary to friends, family and employees when dealing with poultry.

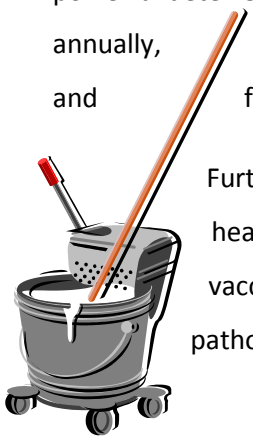
If you like to see the potential for disease transmission under a new light, more specifically under UV light, check out at http://www.poultryindustrycouncil.ca/biosecurity/bugtravel.php. There you can see, with the aid of something like GloGerm, how easily germs spread. This is also a neat way to get your kids to wash their hands more often!

Bird replacement: 'all in/all out' is better than partial substitution

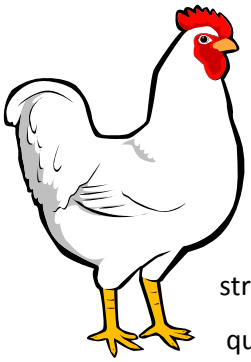
Many small flock owners wrestle at one point or another with the task of replacing pullets or adding birds to expand the flock. Accidents or disease happens, predators might loot your coop, or you would like to fulfill increased demand. Maybe the replacement is needed simply because, as the flock ages, the amount of eggs produced is declining and some hens have stopped laying now for good.

The question arises then on how best to deal with the needed birds. Should I get a rooster and raise some of my own? Should I get pullets from a commercial source? Which commercial source should I get them from? There is no easy answer and each owner has to consider his or her preferences, and the restrictions and possibilities for each farm operation. Though from a biosecurity point of view, the best answer is 'all-in / all-out'.

Replacing all birds at once per section or barn allows for thorough cleaning of the premises. Emptying the barns completely - birds, feed, litter - and leaving the premises empty for a couple of weeks, can make a big difference in rodent, darkling beetle, and disease control. It gives us a chance to remove all cobwebs, and clean all nooks, crannies, and crevices thoroughly with soap and hot water. Maybe we will apply disinfectants. Rodent control is easier, too, when we don't worry about birds present and feed being an alternative food source. Simply the absence of food and quiet shelter serves as a powerful deterrent for pests to stick around. Thorough cleaning, done at least more or less annually, is one of the best ways to avoid disease problems and enhance biosecurity and food safety.



Furthermore, an 'all-in/all-out' system avoids having to worry about the differing health history of the birds and potential 'carrier' issues due to the nature of vaccines. As birds from different sources are mingled, the different exposure to pathogens in the past might leave part of the newly assembled flock exposed to the



shedding of disease causing organisms by their new flock mates. For example, birds previously exposed to pathogen X that have recovered, or birds that have been vaccinated, can shed that pathogen and be carriers, even though they now seem healthy. Shedding is also always higher in stressful situations like joining a new group and, because of that stress factor, quarantine alone will not allow us to recognize these birds visually. The only sure way to diagnose these birds would be through some lab sample submissions, which can add considerable cost to your new birds.

It is always recommended to buy new stock from a reputable source with good records of vaccines given and health issues occurred. Some poultry owners will accept roughly 1 year old hens from commercial layer barns, where the hens no longer meet the minimum production requirements. 'Spend hens' though, while likely healthy because they are vaccinated, can be possibly carriers because of the immunizations received.

Last not least, adding replacement birds isn't as easy as it sounds. Most birds are quite territorial and will not readily accept newcomers. Adding individuals to an existent flock can be a long, hazardous process. A stressful process for all involved - new birds, present birds, and the owner!

C/D is a 3-step program: clean out, wash/dry, disinfect

C/D stands for cleaning and disinfection. While we can probably all agree on the importance of cleaning, disinfecting the poultry premise is sometimes neglected in smaller flocks. So, is disinfection necessary? Some might argue that disinfection is only necessary if a disease is present or related mortalities have occurred. Others point out that disease might very well be present without symptoms in the birds - yet. Any type of livestock housing has generally on feeders, pipes, walls, etc. some form of biofilm, a mix of build-up minerals like calcium and organic cell structures, like moulds, algae, fungi, and bacteria. When conditions are favourable, eventually these biofilms will release additional pathogens.

Commercial poultry barns are always disinfected in between flocks, and while there is a big difference between cleaning and disinfecting, the later works only well if the first is done properly. So for disinfection agents to work properly, barns have to be first thoroughly cleaned. Step by step, here are a few points to observe:

1. Empty the barn completely. Remove the litter completely, empty all feeders and drinkers, and clean out all visible dry dirt.

2. Wash down the ceiling, walls, equipment and floor with a cleaning agent, allowing for enough contact time (about 20 minutes, read the label on the product and follow the instructions closely). 'Top/down' is important. For serious grime this step might have to be repeated.

3. Rinse well and let dry, sometimes this will require waiting to the next day. Ideally cleaning will be done on a warm, dry day. Sunshine and airflow help in proper sanitation and the process can be likely finished on the same day.

4. Time to disinfect. Generally done with spray or foam products. Foaming products will allow you to see better where the product has been applied. It also stays longer on vertical surfaces and ceilings, giving the product more time to work properly on remaining bacteria.

5. Once the disinfectant had time to dry you can bring in the new litter, re-install and fill the cleaned feeders and drinkers.

6. Consider continued use of disinfectants for vehicles (wheel dips or sprayer), and people (hand hygiene, boot dips/change).

Be aware that for cleaning and disinfection to give the best results, it requires the use of compatible products. Not every detergent and cleaner is working equally well with a given disinfectant. Some cleaners and disinfectants aren't compatible with respect to the pH (acidity) required to work properly. In that case the detergent's residues left over from the cleaning process can interfere with the efficacy of the disinfectant. Certain companies have now colour-coded their product lines for easier matching of compatible products.

When using detergents to clean, rotate the occasional acid based one into the alkaline detergents regime because acid works better on scale from lime and calcium build-up. Alkaline detergents work better on fats, oils and the protein of biofilm we often find in livestock barns.

Your free resource kit can be ordered from http://www.omafra.gov.on.ca/english/livestock/poultry/facts/hbresourcekit.htm

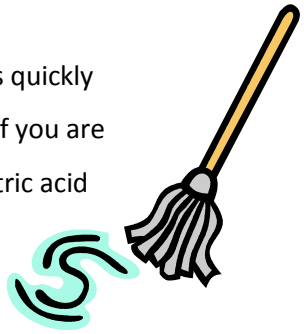
Last not least a quick tip with regards to disinfectants: they should be mixed and applied in a timely manner, meaning when you need them. Most of these dry products, once water is added and they are exposed to light, air, and temperature change, will lose their efficacy in a few days. So, having a disinfectant sprayer filled and ready to use at the entrance to your property for vehicles is a great idea in theory. Unfortunately it is not very practical, though costly, in the long run.

Do you consistently applied best management practices, like proper clean-out where the barns are remaining empty for a period of time, but you still repeatedly have health issues in your birds such as E. coli, necrotic enteritis or respiratory challenges? Sometimes the root cause of these problems is in your water supply. In particular the water regulators and drinker lines, if you use nipple waterers, can be a sanitary challenge.

Depending on your source, city water or well water, you will have to thoroughly clean the waterlines periodically. Untreated well water (water that is not treated continuously with some sort of sanitizer) is most vulnerable to the formation of slime or biofilm in the drinker lines. Most municipal or rural water supplier add a minimum amount of chlorine, thus greatly reducing bacteria growth, but even then warm water temperatures and slow flow will make periodical cleaning of the lines with a sanitizing product necessary.

Check to make sure that when adding sanitizer, it reaches the furthest point of your waterline. Let the mixture work in the lines for the described time (see product label) and flush the lines thoroughly with clean water before the birds can access them again. Many small flock owners prefer the easier

cleaning of the bell drinkers but, because this form of water dispenser gets quickly contaminated by litter and feed, bell types need to be cleaned daily. Btw, if you are adding vitamins and minerals to the water to improve bird health, using citric acid rather than sugar as a carrier helps reduce potential slime build up, too.

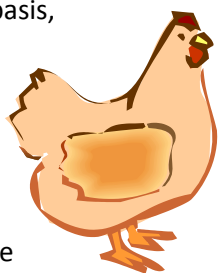


Cleaning and Disinfecting in the appendix on page 98 has more tips and details on barn cleaning. A short step-by-step version of the 'how to' can be found in Section V under Standard Operating Procedure #8, on page 73. Other good resources on cleaning and disinfection, including water line cleaning, can be found through your local animal health product supplier. You also might like to check with your vet, the feed rep, or the feed store, and on the internet you can find reputable sites like the BC Agri-Food Knowledge Platform at http://www.kmwpp.ca/.

And remember, it is better not to wait for general clean-up time to come around. Flushing the waterlines, removing cobwebs and dust frequently, keeping the nest boxes clean, and removing droppings that accumulate in certain spots, frequently or even daily will go a long way to keep the coop environment reasonably clean. Especially 'spot cleaning' of manure will make the barns less humid, reduces ammonia in the air, and will make the barns overall cleanliness last that much longer.

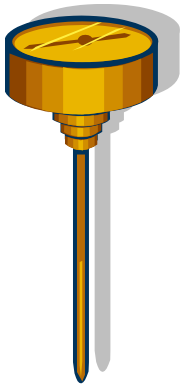
Manure management

So, we cleaned the barns, maybe we even clean up manure on a frequent basis, but what do to with this material that is potentially full of live pathogens?



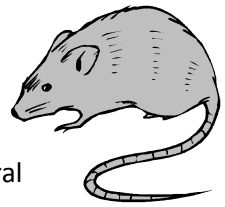
Common manure management practices include often some form of composting the birds' litter and feces to minimize pathogens before the manure is used, spread on fields, vegetable gardens, etc. Some owners have arrangements made for their manure to be picked up by either neighbouring farmers or commercial enterprises. A few lucky ones get paid for their raw manure. Especially if you run a certified organic enterprise, it might be worthwhile to get in touch with an organic association or certification body like COABC to find an outlet for your manure.

Composted manure has to have reached a certain temperature for a certain number of days before it is considered properly composted. Proper composting needs the right mix of 'food', the litter and manure, and moisture. The carbon:nitrogen ratio should be 30:1 and the pile should be moist, but not wet. The active composting period happens usually during temperatures of 45°C (mesophilic) to 65°C (thermophilic, high heat), for two weeks minimum. However, destruction of most pathogens will only happen in the high temperature zone in the center and not on the cooler edges. Therefore to assure all areas have reached the required temperature for the time needed to kill the pathogens, the pile has to be rotated. Chemical contaminants, btw, are not affected by composting. During the active composting stage, the temperature should be monitored regularly. Thermometers for this purpose can be purchased. See also http://www.omafra.gov.on.ca/english/engineer/facts/05-021.htm.



Many farms use their manure composting piles also as a mortality composting facility. In these cases, not only should the daily temperatures be closely observed, but it is also best to have a strategy that separates freshly added manure from aged, almost ready-to-be-spread, manure. This avoids accidentally spreading fresh carcasses with the aged, composted material onto the fields. Improper set-up of compost piles can result in an influx of rodents and other scavengers, attracted by smells and the promise of an easy meal.

For obvious reasons rodents like to hang out around composting manure piles. Pest control in the composting area must therefore include 'keep out' provisions. First of all consider the location. While we don't want the compost location in close proximity to our birds, - and people aren't fond of manure piles in close proximity of their living quarters neither, - choosing a remote corner of your property for the composting manure pile will just enhance its desirability as a home for rodents. Rodents are generally shy and a certain amount of daily coming and going in the general area will avoid making rats and mice too comfortable.



The next step of making the place less desirable is making access to the content difficult. Concrete flooring and walls on three sides, as well as sturdy boards to cover the entrance, are highly recommended. The top part is ideally covered in heavy-duty wire mesh between the walls and the roof. A roof will not only help keeping rodents and flying pests, like scavenging

birds, out but will also help to avoid the manure being soaked by rain and the resulting run-off problems. Beside physical means to exclude rodents, many farms use bait traps in that area.

A last word here about pest control: pesticides used, just as cleaning products in sanitation and disinfection, must be stored appropriately to avoid the risk of contamination of eggs and/or meat, as well as the potential for poisoning the birds, pets, and possibly yourself or your children. Products used must be clearly marked, stored separately, and the storage containing pesticides such as rodent poison or weed killers should be locked and have a warning sign. For more tips on appropriate handling and storage see the BC Ministry of Agriculture @ http://www.agf.gov.bc.ca/pesticides/d_6.htm or contact their industry specialist at 604-556-3001.

More information and details on biosecurity and how to best manage your farm to minimize disease transmission potential can be found on the following websites:

- http://www.poultryindustrycouncil.ca/2012/06/04/biosecurity-factsheets/
- http://bcegg.com/documents/BiosecurityReferenceGuide.pdf
- http://www.agf.gov.bc.ca/ahc/poultry/biosecurity.pdf
- http://www.canadianpoultrymag.com/images/stories/biosecutrity2010_p8.pdf
- http://www.omafra.gov.on.ca/english/livestock/poultry/health.html

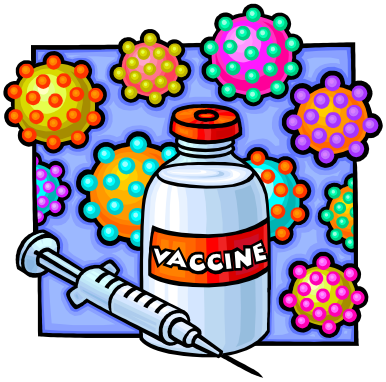
Section IV - Flock Health

Animal health is a puzzle made of many interconnecting pieces. One of the keys to disease resistance, and the body's ability to deal with exposure to potential pathogens, is excellent health. And the best way to assure optimum flock health and the birds' good overall condition is prevention. Cleanliness, segregation (quarantine facilities for new or sick birds, and limiting off-farm visitors), a reputable stock source, as well as good pest control will go a long way to avoid disease problems. Write down every day how many eggs, good and bad ones, your hens have layed and save those records. Just like your feed records, these records will give you valuable hints on your management performance and potentially pending disease problems.

Many diseases are affecting laying performance, as the stress caused by a disease will reduce energy conversion to egg production. Likely the feed, and maybe even the water, intake of the birds is affected. The reduced feed intake in turn can result in calcium deficiency, which will result in egg shell problems. This connection between reduced feed intake and an emerging disease problem becomes obvious when dissecting accurate detailed records. As chickens are born prey and not predator, their natural defence mechanism is hiding illness till the last possible moment. This makes recognizing a sick bird early on difficult - but even more important! Keep detailed records that can give you valuable hints and early warning.

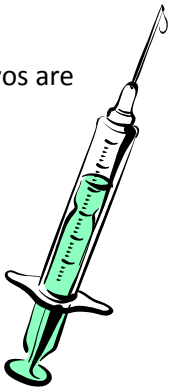
Having a veterinarian at hand that is specialized in livestock and/or poultry will doubtless facilitate your communication in case of a disease outbreak and assure faster, better treatment of your flock. When in doubt, don't hesitate to submit samples to the Animal Health Lab of the BC Ministry of Agriculture in Abbotsford.

Vaccination



Many diseases in poultry, just like in humans, have been battled and reduced in the last few decades through the use of vaccines. In commercial poultry operations day-old chicks are

vaccinated against Infectious Bronchitis (IB). *In ovo*, inside the egg, 18-day old embryos are now vaccinated routinely for Marek's Disease.



In small flocks though, birds aren't necessarily protected through vaccines. For one, there is the small chance (about 1/1000) that a bird will contract the disease from the vaccination. This is similar to a child contracting a disease for which it has been vaccinated, such as measles or mumps. Then there are the questions of cost, of availability and sourcing, and also of the correct administration of the preventative medication. Lastly, chickens that have already stressed immune systems, be it through latent infections with diseases like IB or Marek's Disease, or maybe because of mycotoxins in the feed, do not necessarily develop full immunity after the vaccination. The last point though should not prevent us to consider vaccines as part of the tool kit that keeps our flocks healthy.

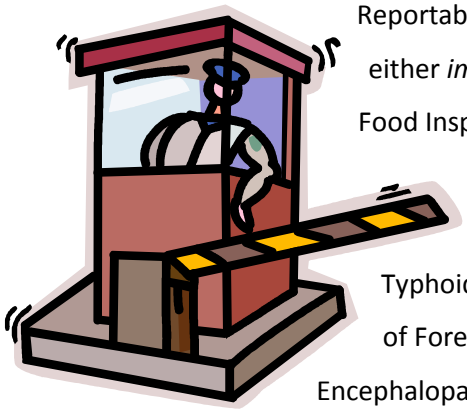
Spray vaccines and eye drops are popular methods, the latter mostly for smaller flocks because each bird has to be handled. Vaccination through the drinking water is a common method for most live vaccines in mass vaccination of birds. Your veterinarian will help you to asses which vaccine is most useful for your flock. Much depends on the flocks', and previous flocks, health history and the circumstances of the farm. Your vet is likely the best source for supplying you with the chosen vaccine(s).

Even if you have 'only' 350 birds, and each vaccine comes in a 1000 doses/pack, the money spend on the relatively inexpensive vaccines, like the one for ILT prevention, is well worth it. If you know other small flock owners interested in preventative measures, maybe you can even share a supply. Just be sure to follow the label directions closely and as your vet recommends. Live vaccines, for example, have to be stored properly and used up quickly to be effective.

Remember, too, that in a given flock, vaccination with a live vaccine has to be an 'all-or-nothing' approach. Potentially, the vaccinated birds can shed the vaccine in their droppings and 'infect' birds that have not been vaccinated. This also means that adding birds from a commercial flock to a backyard flock that isn't vaccinated against the same diseases can cause problems, related to the differing immunization schedule.

Maybe the most promising vaccine with regards to food safety is the relatively new vaccine for Salmonella enteritidis (SE). It prevents or at least minimizes SE bacteria from colonizing the chickens' intestine by 'competitive exclusion'. This doesn't mean much to a bird who can live symptom free with a low-grade SE infection but it reduces the likelihood of pathogens being shed into the barn environment and the potential contamination of eggs. It is a promising option that can help to further improve food safety in eggs, and meat, for human consumption.

Foreign animal diseases, reportable diseases and the implications



Reportable diseases are diseases that are foreign to Canada and are either *immediately notifiable* or *annually notifiable* to the Canadian Food Inspection Agency (CFIA). Presently, there are four poultry diseases to be reported: Notifiable Avian Influenza (H5 or H7 strains), Exotic Newcastle Disease (END), Fowl Typhoid (Salmonella Typhoid), and Pullorum Disease (Salmonella pullorum). Other examples of Foreign Animal Diseases (FAD's) are Bovine Spongiform Encephalopathy (BSE), and Foot and Mouth Disease (FMD). The complete list can be found at http://www.inspection.gc.ca/english/anima/disemala/guidee.shtml on the CFIA website.

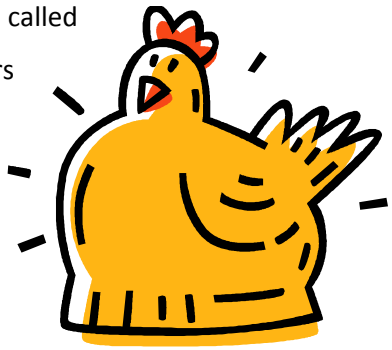
What these diseases have in common is that each of the ones listed is highly contagious, easily transmissible, and capable of causing severe production or mortality losses. The AI outbreak in British Columbia in 2004 resulted in 18.9 million birds destroyed, and economic losses exceeding $370 million at the farm gate and $850 million in retail. It also caused severe international trade restrictions. Each outbreak can cripple the Canadian export market, as well as the domestic market, by eroding consumer confidence in our product.

Hence control measures are necessary to prevent spread of pathogens and to protect your farm, other poultry producers, as well as other livestock, and the Canadian public. When any one of these diseases is confirmed, the CFIA will immediately begin control and eradication procedures but owners are compensated, at least financially, for birds that are destroyed during an FAD outbreak.

Another important factor to consider in the case of a reportable disease occurrence is the impact on genetic selection when wide areas have to be depopulated. The BC poultry industry is working with Canadian authorities to protect genetic strain variability and assure the survival of birds considered heritage breeds.

Diseases and parasites

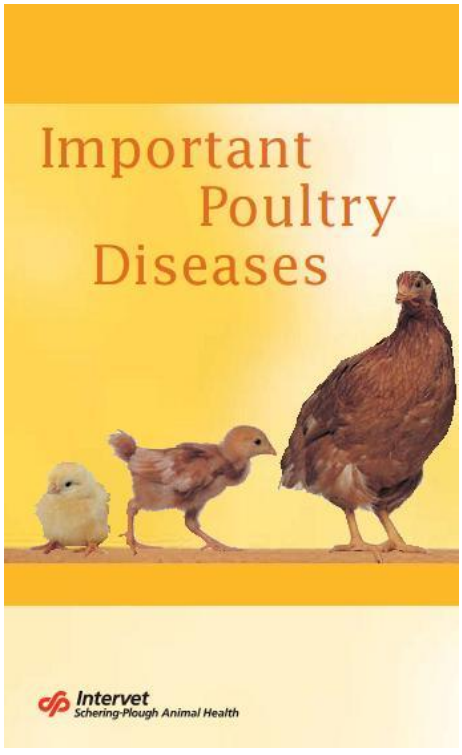
Healthy birds are raised in a stress-free, clean environment, with easy access to clean and nutritious fresh food and water. But sometimes, especially when exposed to stressors like transport or a predator attack that might be unavoidable, pathogens and parasites can sneak in nonetheless, causing disease in a flock. Diagnosing the pathogen as soon as possible, and starting appropriate treatment immediately after identifying the cause, is crucial to successful treatment. Any samples send to a lab, and the results received, should be written down and the records kept. Careful screening of detailed records will often show a (delayed) connection between certain events and the start of symptoms, making it easier to avoid these situations, or alter them, in the future. For the same reason the management response (medication given, management adjustments done, etc) and the birds' response to the treatment should be recorded, too.



Not a disease, but a normal condition where hens stop laying eggs, is called *molt*. During molt, each year your chickens will lose the older feathers and grow new ones. During this time most hens, but not all, stop producing eggs until their molt is completed. For some hens the rate of egg-laying may not be affected, but their molting time is much longer. Late molters, which lay for 12 to 14 months before molting, are generally the better laying hens but will have a more ragged and tattered appearance. Early molters may begin to molt after only a few months in production. They have a smoother, better-groomed appearance because it may take them as long as four to six months to complete the molt. The advantage of late molters, besides longer initial egg production, is that the loss of feathers and their replacement take both place during the same two to three month, and the hens return to full production sooner.

The full article from the Mississippi State University Extension Service on the details of molting, though originally written about culling and the need to remove birds from the flock for different reasons, can be found in their *Small Flock Management* factsheets under http://msucares.com/poultry/management/culling.html.

The following pages consider only the most important diseases and parasites that impact flocks here in British Columbia. Theoretically your chickens might come down with an entirely different pathogen than the ones mentioned here. The following pages are adapted from the Intervet Schering-Plough Animal Health compendium of *Important Poultry Diseases*, and can be found in its entirety on the internet.



Marek's Disease

(MD, Neurolymphomatosis)

Cause

Marek's disease is caused by a herpes virus.

Transmission

Main transmission is by infected premises, where day-old chicks will become infected by the oral and respiratory routes. Dander from feather follicles of MD-infected chickens can remain infectious for more than a year. Young chicks are particularly susceptible to horizontal transmission. Susceptibility decreases rapidly after the first few days of age.

Species affected

All domestic fowl (chickens, turkey, geese, ducks, etc.) can be affected.

Clinical signs

Infected birds show weight loss, or may exhibit some form of paralysis. Mortality varies from 5 to 50 % in unvaccinated birds. The classical form (paralysis) with leg nerve involvement causes a bird to lie on its side with one leg stretched forward and the other backward. When the gizzard nerve is involved, the birds will have a very small gizzard and intestines and will waste away. Mortality usually occurs between 10 and 20 weeks of age.

MD leg paralysis in chicken

Diagnosis

The presence of tumours in liver, spleen, kidneys, lungs, ovary, muscles, or other tissues is indicative of MD, but they can also be indicative of lymphoid leucosis. However, nerve involvement, either grossly (swelling of leg, wing or other nerves) or microscopically, is typical of MD. Eye involvement can be visible as an irregular constriction of the iris (ocular lymphomatosis). Skin involvement (skin leucosis) often consists of tumours of feather follicles or in between follicles. Skin leucosis is a reason for broiler condemnation in certain parts of the world. A proper diagnosis to differentiate MD from LL requires histological examination.

Treatment and control

Vaccination of day-old chicks is an effective mean of control. It has been demonstrated that MD vaccine only prevents the appearance of Marek's Disease tumours and paralysis. It does not prevent the birds from becoming infected with MD-virus. It is therefore of major importance to maintain high hygienic and sanitary measures by good management to avoid early exposure of young chickens.

Infectious Laryngotracheitis (ILT)

Cause

ILT is caused by a virus belonging to the herpes group. Only one serotype is known.

Transmission

Field infection occurs from bird to bird by the respiratory route. Most outbreaks of ILT on farms are traced back to transmission by contaminated people or equipment (visitors, shoes, clothing, egg boxes, used feeders, waterers, cages, crates etc.). The incubation period varies from 4 to 12 days.

Species affected

Chickens and pheasants are natural hosts for ILT.

Clinical signs

Respiratory distress is usually quite pronounced due to build up of blood, sloughed tracheal lining and even caseous exudate in larynx and trachea. When a caseous plug occludes the larynx or trachea, the affected chickens will have extreme difficulty breathing ("pump handle" breathing) and will frequently die from suffocation. Mortality is approximately 1 % per day in a typical ILT outbreak. Milder forms of ILT outbreaks occur where less virulent strains of ILT virus are involved. Conjunctivitis and respiratory sounds (wheezing) can be observed, with little or no mortality in such cases. The disease spreads through a chicken house more slowly than either IB or ND. Egg production in laying flocks will usually decrease 10 to 50 %, but will return to normal after 3 to 4 weeks. Some birds show symptoms of gasping with the head extended and the beak open (**pictured on the right**).

Diagnosis

In a chicken flock, spreading of respiratory distress, with possible coughing up of blood and mortality is indicative of ILT. Bloody mucus and cheesy exudate can be found in larynx and trachea. In the laboratory a definite diagnosis can be made by histological examination of tracheal tissues or virus isolation from tracheal mucus in embryonated chicken eggs.

Treatment and control

Prevention of ILT by vaccination with mild eye-drop vaccine is by far the best control method. Sometimes such vaccines are applied by drinking water or spray methods with variable success. Even when an outbreak of ILT has been detected in a chicken flock, immediate vaccination is advisable to stop the spread of infection.

Infectious Bronchitis (IB)

Cause

Corona-virus is the causal agent. Several different serotypes of IB virus are known to exist.

Transmission

The virus is transmitted from bird to bird through the airborne route. The virus can also be transmitted via the air between chicken houses and even from farm to farm.

Species affected

Only chickens are susceptible to IB virus.

Clinical signs

In young chicks IB virus infection causes a cheesy exudate in the bifurcation of the bronchi, thereby causing asphyxia, preceded by severe respiratory distress ("pump handle" breathing). In older birds IB does not cause mortality. Egg production will decrease dramatically, deformed eggs with wrinkled shells will often be laid.

Respiratory symptoms of IB in a chicken

Internal lesions

Mucus and redness in tracheas, froth in airsacs in older chickens. In young chicks a yellow cheesy plug at the tracheal bifurcation is indicative of IB infection.

Diagnosis

There are three main factors to be considered in order to arrive at a diagnosis.

a. The clinical picture including post-mortem findings in the flock.

b. Isolation of the virus in the laboratory.

c. A rising antibody titre when the serum is tested against a known strain of bronchitis virus.

Treatment and control

There is no treatment for infectious bronchitis. Secondary bacterial infections may be prevented by, or treated with, antibiotics.
Prevention by vaccination is the best method to control IB.

Misshaped, and shell-less eggs in the first and second picture, versus normal eggs in the last

Newcastle Disease (ND)

Cause

Newcastle disease is caused by a paramyxovirus. Only one serotype of ND is known. ND virus has mild strains (lentogenic), medium strength strains (mesogenic), and virulent strains (velogenic). The strains used for live vaccines are mainly lentogenic.

Transmission

Newcastle disease virus is highly contagious through infected droppings and respiratory discharge between birds. Spread between farms is by infected equipment, trucks, personnel, wild birds or air. The incubation period is variable but usually about 3 to 6 days.

Species affected

Chickens and turkeys

Clinical signs

Newcastle disease causes high mortality with depression and death in 3 to 5 days as major signs. Affected chickens do not always exhibit respiratory or nervous signs. Mesogenic strains cause typical signs of respiratory distress. Labored breathing with wheezing and gurgling, accompanied by nervous signs, such as paralysis or twisted necks (torticollis) are the main signs. Egg production will decrease 30 to 50% or more, returning to normal levels in about 2 weeks. Eggs may have thin shells and eggs without shells may also be found. In well-vaccinated chicken flocks clinical signs may be difficult to find.

Internal lesions

Inflamed tracheas, pneumonia, and/or froth in the airsacs are the main lesions. Haemorrhagic lesions are observed in the proventriculus and the intestines.

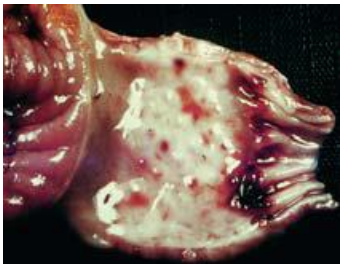
Diagnosis

Is made by virus isolation from tracheal or cloacal swabs together with blood testing to demonstrate high antibody levels. Infectious bronchitis or infectious laryngotracheitis can give similar clinical signs, but lesions, blood tests, and virus isolation tests are decisive.

Treatment and control

There is no treatment for Newcastle disease. Vaccination against ND with live and/or inactivated (killed) adjuvant vaccines is the only reliable control method.

Neurotropic form of ND



Haemorrhagic proventriculus

Avian Influenza

Cause

Avian influenza is caused by a myxovirus. There are several serotypes.

Transmission

Airborne virus particles from the respiratory tract, droppings, and people-carrying virus on their clothing and equipment are the main routes of transmission.

Species affected

Turkeys and ducks are mainly affected but chickens, geese, and wild birds can also be infected.

Clinical signs

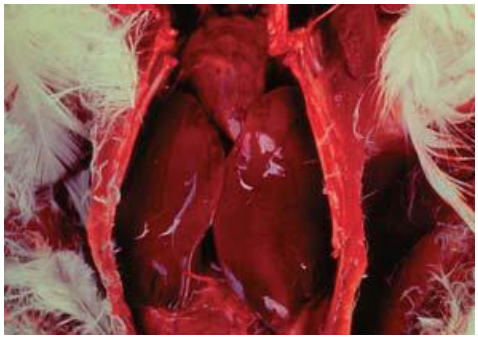
Clinical signs may vary, depending on the type of influenza virus. Respiratory disease with mortality in turkeys has been observed, but a drop in egg production without clinical signs has also been seen in chickens. Swelling of the head and neck, swollen sinuses with nasal discharge can be seen with respiratory involvement. Mortality is usually low. Fowl plague, also an avian influenza, is an exception to the rule in that it causes high mortality in turkeys and chickens.

Diagnosis

A laboratory diagnosis is necessary by serological (agar gel precipitation AGP) or virological methods (virus isolation). Avian influenza can be confused with Newcastle disease, fowl pox, Mycoplasma infection, Staphylococcus, or other respiratory or systemic infections.

Treatment and control

There is no treatment for avian influenza. Antibiotics will help prevent secondary bacterial infections.



AI infected heart and proventriculus

Infectious Bursal Disease

(IBD, Gumboro Disease)

Cause

The disease is caused by a birna virus of serotype 1. Virus strains can be divided in classical and variant strains. The virus is very stable and is difficult to eradicate from an infected farm.

Transmission

IBD virus is very infectious and spreads easily from bird to bird by way of droppings. Infected clothing and equipment are means of transmission between farms.

Species affected

Chickens and turkeys appear to be natural hosts.

Infected bird on right

Clinical signs

Clinical IBD occurs usually between 4 and 8 weeks of age. Affected birds are listless and depressed, pale and huddling. Mortality varies. Usually new cases of IBD have a mortality rate of about 5 to10% but can be as high as 60% depending on the pathogenicity of the strain involved. In subsequent infection on the same farm, mortality is lower and eventually, with successive attacks, there is no mortality noted. The subclinical form caused by the immunosuppressive effect of the IBD virus is now of more economic importance in that the immune system of the bird is damaged. Gumboro disease related diseases such as inclusion body hepatitis are more frequent in these birds. In broilers this form of the disease results in bad performance with lower weight gains and higher feed conversion ratios.

Diagnosis

In acute cases the bursa of Fabricius is enlarged and gelatinous, sometimes even bloody. Muscle haemorrhages and pale kidneys can be seen. Infection by variant strains is usually accompanied by a fast bursal atrophy (in 24-48 hours) without the typical signs of Gumboro disease. Also in chronic cases the bursa is smaller than normal (atrophy). The bursa destruction is apparent on histologic examination. The lack of white blood cells (lymphocytes) results in a reduction in the development of immunity and decreased resistance of the birds to other infections. Typical signs and lesions are diagnostic of IBD. Histopathological examination, serology and/or virus isolation are helpful tools. IBD can be confused with sulfonamide poisoning, aflatoxicosis, and pale bird syndrome (Vitamin E deficiency).

Treatment and control

No treatment is available for IBD. Vaccination of parent breeders and/or young chicks is the best means of control. The induction of a high maternal immunity in the progeny of vaccinated breeders, together with the vaccination of the offspring is the most effective approach to successful IBD control.

Avian Encephalomyelitis

(AE, Epidemic Tremor)

Cause

Avian encephalomyelitis (AE) is caused by an enterovirus belonging to the picornavirus group.

Transmission

Egg transmission is the major route of transmission of AE virus. Infected breeders will transmit the AE virus for several weeks and cause a decrease in egg hatchability. Infected chicks that hatch will show clinical signs of the disease and spread the infection in the incubator to other newly hatched susceptible chicks. Young chicks can also be infected on the farm. The incubation period varies from 5 to 14 days depending on the route of infection.

Species affected

Primarily chickens are susceptible to AE, but turkeys and pheasants have been reported as natural hosts.

AE infected young chickens

Clinical signs

The disease is mainly seen in young chicks, between 1 and 3 weeks of age. Affected chicks sit on their hocks, do not move well, and many fall on their sides. A fine, rapid trembling of the head and neck can be seen, but especially felt when affected chicks are held in the hand. In laying and breeding flocks, AE virus infection causes a marked drop in egg production which returns to normal in about 2 weeks. Mortality in naturally infected chicks varies and can be as high as 75%.

Diagnosis

Clinical tremors in chicks, together with a drop in production and hatchability in the parent breeders, is indicative of AE infection. Chicks will not have gross lesions, but histological examination of brain, proventriculus and pancreas reveals typical lesions of AE. This will also differentiate the diagnosis of AE from encephalomalacia (Vitamin A deficiency, crazy chick disease). Laboratory testing of blood serum from breeder flocks, or their hatching eggs, can determine if an infection occurred.

Treatment and control

Preventive vaccination of breeder pullets with live AE vaccine before egg production is the only effective means of AE control. If a breeder flock has not been, or has been inadequately, vaccinated against AE and an outbreak occurs, it is advisable to stop hatching eggs from the flock for several weeks until the breeders have acquired immunity and no longer transmit AE virus through their eggs.

Coccidiosis

Cause

Coccidiosis is caused by protozoa, unicellular parasites. In chickens there are 9 different species of coccidia of which the main 5 are Eimeria acervulina, Eimeria necatrix, Eimeria tenella, Eimeria maxima and Eimeria brunetti.

Transmission

Infected droppings, containing oocysts of coccidia are the main means of transmission, between birds. The incubation period is 4 to 6 days.

Species affected

Chickens have their own specific coccidiosis types which do not cross-infect other bird species.

Clinical signs/Diagnosis

Coccidiosis can be divided into 2 groups:

The caecum is involved **(Caecal coccidiosis)**. Mainly caused by **E. tenella** in chickens up to 12 weeks. Mortality may run as high as 50 %. Infected birds are listless, have bloody droppings, a pale comb and show a lack of appetite. Laboratory examination will show haemorrhages in the caecal wall. After severe bleeding a core will be formed in the lumen.

The small intestine is involved **(small intestinal coccidiosis)**.
Caused by E. acervulina, E. brunetti, E. maxima, E. necatrix. The first 3 may affect birds of any age, the later is generally seen in birds up to 4 months.

E. acervulina

E. acervulina is not normally very pathogenic, but in some cases considerable mortality may be seen. Birds infected show loss of weight, combs may be shrivelled and a drop or even cessation of egg production in layers may be seen. At necropsy, haemorrhagic lesions of E. acervulina are seen
throughout the upper portion of the affected intestine and also grey or whitish patches may be present.

E. brunetti

E. brunetti is definitely pathogenic; in severe infections mortality can be high. Birds infected show emaciation and diarrhoea. At necropsy a white cheese-like material is found in the lumen of the lower intestine and rectum. The caeca and cloaca are inflamed. The gut wall is thickened.

E. maxima

E. maxima is less pathogenic than E. acervulina, necatrix and brunetti, mortality is generally low.

Diarrhea, loss of weight and a drop in egg production of layers will be seen; bloody droppings are common. At necropsy the lower portion of the small intestine is dilated and the wall is thickened; the gut is filled with thick mucus, greyish, brownish or pinkish in color.

E. necratix

E. necratrix is very pathogenic. Infection with E. necratrix may result in a two stage clinical outbreak of coccidiosis. In the acute stage mortality may be high in the first week after infection.

In the chronic stage blood may be seen in the droppings, the birds are listless and lose weight. In layers a drop in egg production will be observed. At necropsy the middle portion of the intestine is affected, haemorrhage will be seen. The unopened intestine looks spotty, white areas (schizonts) intermingled with bright or dull red spots (haemorrhages) will be observed.

Treatment and control

This heading is most appropriate in the case of coccidiosis as there is no disease group in poultry where both control and treatment are employed more.

The well established principles of good management and husbandry are of basic importance. It is common practice to include low levels of chemotherapeutics in the feed of birds. These chemicals are referred to as coccidiostats and as such keep in check the development of the parasites so that a pathological situation does not develop. It should, however, be taken into account that coccidian can develop a resistance to all chemicals so far used for this purpose and for this reason it is necessary to change from one chemical to another periodically.

Treatment of infected flocks may be carried out by the administration of coccidiostats at a higher therapeutic level to the affected birds. There are certain products available which are specifically designed for treatment and which are not satisfactory for prevention. These chemicals are sometimes referred to as coccidiocidal agents.

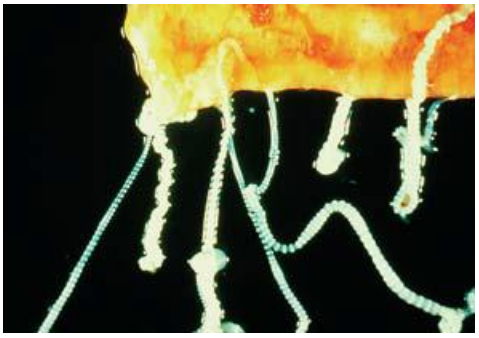
Whenever administering these products, particular attention should be paid to the dosage recommendation of the manufacturer.

Endoparasites

Worms living in the intestines of chickens fall mainly into four categories:

Roundworms (Ascarids), usually 5 to 7 cm (2-3 inches) long
Hairworms (Capillaria), only measure 1-1.5 cm long
Caecal worms (Heterakis), usually 1.5 cm long
Tape worms, usually 7 to 10 cm long, consisting of many small segments

Hairworms



Tapeworms

Roundworms

Clinical signs
Mature roundworms are not a major cause of the disease, but the larvae can damage the intestinal lining, causing enteritis, anaemia, decreased egg production and at times eggs with pale yolks.
Capillaria cause more damage to the intestinal lining and can cause enteritis and anaemia with decreased egg production and the appearance of pale egg yolks ("platinum yolks").
Caecal worms are found in the caeca and do not cause serious damage, except that their eggs can transmit blackhead – mainly in turkeys.
Tape worms are infrequently found and do not cause serious damage, except that they use the nutrients of the host chicken.

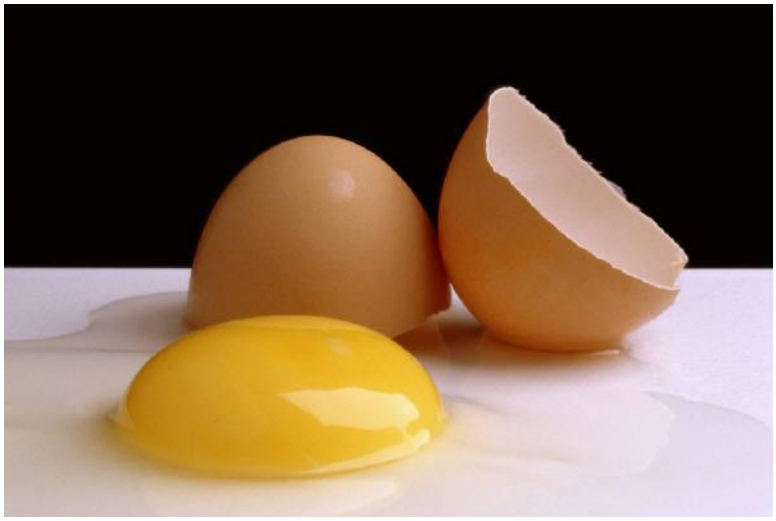
Diagnosis
Examination of the intestinal contents will reveal roundworms, caecal worms, and tape worms without difficulty. Capillaria can usually be found when intestinal contents are washed through a fine mesh sieve.

Treatment and control
Roundworms and caecal worm infections can be treated with piperazine. Piperazine is not effective against tape worms and capillaria for which other anthelmintics are required.

Infections caused by Salmonella enteritidis, Escheria coli, and Campylobacter are especially important for food safety because they can be transmitted to humans.

Salmonella enteritidis (SE)

Salmonella enteritidis is difficult to diagnose in chickens as there are generally no symptoms in the bird. This is a serious problem because SE can be found in eggs and poultry meat, and is an important cause of human food-borne illnesses. To make matters worse, food contamination can not always be recognized with the naked eye and in case of bacterial infections it is impossible to tell apart an infected egg from a clean one without a lab test. Preventing or at least minimizing the potential for infection is our only weapon.



The following information on E. coli, disease symptoms, treatment, and prevention was adapted from the OMAFRA factsheet 6.9 from March 2008 and has been written by Dr. Bruce Hunter and Ashley Whiteman, both from the University of Guelph, and Dr. Babak Sanei and Al Dam, both from the Ontario Ministry of Agriculture, Food and Rural Affairs.

E. Coli (Colibacillosis)

The bacterium Eschericia coli (E. coli) is one of the most important causes of disease in confined or aviary birds regardless of the species. In commercial poultry E. coli is by far the most common bacteria associated with disease. All ages of bird are susceptible but the disease is particularly important in young birds either immediately post hatching or within the first few weeks of life. Disease may be much more severe if birds are housed in unsanitary conditions or in areas with high ammonia levels or poor ventilation.

Etiology

There are hundreds of different varieties (serotypes) of avian E. coli. Most of these do not cause disease and are part of the normal flora of the intestinal tract of the bird. The disease Colibacillosis is caused by certain strains of E. coli. Serogroups 01, 02, and 078 are the most common pathogenic (disease causing) serogroups in poultry. Other E. coli serogroups may be associated with respiratory tract infections, generalized infections affecting many body systems and diarrhea in pet birds, ratites, waterfowl and pigeons.

The Disease - E. coli infections can cause several different disease conditions.

Colibacillosis - is the term used for the sudden onset (acute), generalized infection (septicemia) with E. coli bacteria in young growing broiler chickens or turkey poults. Young birds may be infected in the hatchery and these birds develop navel infections and omphalitis. Young birds can also be infected when they arrive at the farm if they are placed in areas contaminated with the bacteria. Pathogenic E. coli is able to survive in barns between flocks or it may be tracked into the barn through breaches in biosecurity.

Cellulitis - is the term used for E. coli infections of the skin and subcutaneous tissues (areas under the skin). Cellulitis is the number one cause of condemnation in commercial broiler chickens going through processing. Affected birds develop inflammation and accumulation of

exudates under the skin of the belly and between their legs. These infections are caused by bacterial contamination of scratches on the backs of the birds as they crowd around feeders and water drinkers.

Modern broiler chickens may grow so fast that as they near market weight they still are not fully feathered. If these birds are crowded and have to compete with each other for feeder and drinker space they often scramble over each other trying to access the feeders resulting in scratches to the skin. Cellulitis can also occur over the head region, likely an extension of an E. coli infection of the sinuses and upper respiratory tract. E. coli may also cause airsacculitis, peritonitis, sinusitis, diarrhea and septicemic disease in pet birds.

Septicemia - is the term used to describe generalized bacterial infections affecting many organs in the body. E. coli bacteria are a common cause of septicemia in birds. The initial infection may start as a diarrhea or perhaps as a respiratory infection and as the bacteria causes damage to that organ it enters the blood stream and is disseminated throughout the body, often affecting many organs. Husbandry practices, particularly poor air quality (eg. high dust levels or ammonia levels), poor sanitation or high levels of stress are common factors that predispose birds to E. coli infections.

Treatment

Treatment is by using the appropriate antibiotics as directed by your veterinarian. A high level of barn sanitation and good husbandry will reduce the amount of bacteria and reduce the risk.

Prevention

There are no vaccines that successfully prevent E. coli infections in birds. If you raise your own breeder birds and incubate your own eggs then proper egg collection and handling is critical. It is important to ensure that cracked eggs and those with surfaces contaminated by feces are not placed into the incubator. Careful incubator/hatcher cleanliness and sanitation will help prevent early infections in hatching chicks.

Biosecurity, good barn management (ventilation and litter quality) and a good cleaning and sanitation program will decrease the risk of E. coli infections by reducing the amount of bacteria present. Slowing the growth rates of birds and making sure they are not over-crowded (i.e. there is suitable floor space and adequate numbers of feeders and drinkers for each bird) will greatly decrease the risk of cellulitis.

The following information on Campylobacter, disease symptoms, treatment, and prevention was adapted from *A Pocket Guide to Poultry Health And Diseases* by Paul Mullen, 2004:

Campylobacter Infection

Introduction

Campylobacter spp. are bacteria that commonly infect a broad range of livestock species, pets and wild animals. In poultry they tend to multiply in large numbers in the hindgut, principally in the caecae. Campylobacters are a significant cause of enteritis in man. Infected poultry are a potential reservoir of this zoonosis.
Campylobacter jejuni is the commonest species found in poultry. All campylobacters are delicate organisms that survive for relatively short periods outside the host unless protected by organic material, biofilm or engulfed by protozoa.
Campylobacter jejuni infection is not currently considered to be pathogenic in poultry though a Campylobacter-like organism is considered to be the cause of 'Vibrionic Hepatitis'.

There are indications that plantar pododermatitis, carcass quality, and litter quality are better on farms which tend to have Campylobacter-negative stock. The reason for this is unclear. It may be that management that favours dry litter reduces the risk of infection and/or transmission within the flock.

There is an annual cycle with increased risk of infection in the summer months in some countries.

Clinical signs

None.

Post-mortem lesions

None.

Diagnosis

Isolation of the organism from caecal contents, cloacal swabs or composite faeces. The organism is sensitive to air so swabs should be collected into transport medium and other samples placed in airtight containers with minimal airspace. Samples should be tested as quickly as possible after collection.

Treatment

Not required on clinical grounds.

Prevention

In principle, housed poultry can be maintained free of Campylobacter infection by consistent application of excellent biosecurity. Key aspects of this include effective sanitation of drinking water, sourcing of water from high quality supplies, avoidance of contact with pets and other farmed species, good hand hygiene by stockmen, and changing of overalls and boots on entering bird areas.

In practice the success of this will also depend upon the degree of environmental contamination by the organism. For this reason it may be difficult to stop the spread of infection between houses once it becomes established in one house.

Many infections are introduced during thinning or other forms of partial depopulation. Insects and rodents may act as a means of transfer of the infection from the general environment into the poultry buildings.

Research is ongoing on the development of vaccines, phage treatments, and competitive exclusion approaches, as well as processing plant technologies to reduce carcass contamination

Section V - Records Management

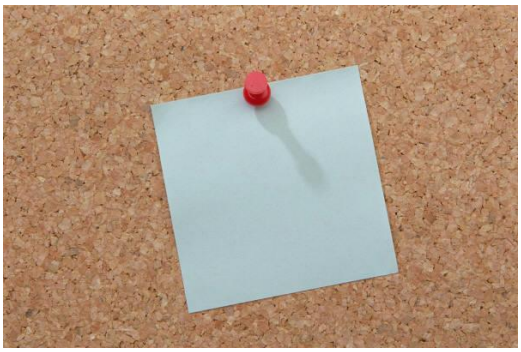
Records and paperwork, to one extent or another, are a fact of life today. Do you want to see how much money you will receive for the egg shipment from last Monday? How many dozens did you ship? How many boxes? To one location or do you supply several customers? Once the flock is a certain size, you better have records!

Detailed records are useful. They can give us valuable advance warning with regards to our flock's health and while most people aren't particularly fond of paperwork, records are a part of paperwork that we as producers should embrace, - even if sometimes rather grudgingly. Keeping good records may allow us also to run a more productive farm operation. Detailed records help you to compare the differing results of different management decision. For example, if you know what you pay in heating each year you can quickly compare different insulation techniques, their prices, and how long each improvement in heating efficiency will take to amortize. In other words, if I spend X amount on insulation, how many years does my heating bill have to shrink and by what amount, until I break even and have that investment pay off. And when things go wrong, and sooner or later they tend to, accurate record keeping can also be invaluable in proving due diligence and will greatly facilitate potential insurance claims.

Efficient food safety and biosecurity requires paperwork too. It doesn't have to be complicated or long, but certain details and a convenient set-up are crucial. One of those important details is simply leaving enough space for the information required. Using a lot of abbreviations results at least in a confused reader, but more importantly, in the potential for misunderstood and therefore misleading information gathered.

We have to make sure the set-up of the data to be gathered makes sense to everyone involved in filling the records. Nothing will kill detailed record keeping quicker than the frustration of not being sure exactly what data is wanted or required. Well, maybe with the exception of not being able to find a pen that writes. That will also result in blank

sheets for sure. And don't hide your egg collecting record sheet '3 doors down', in the cellar, lowest bottom drawer on the left, - under a stack of old newspapers. Chances are those sheets stay blank, too!



Temperature recording sheets for the cool-storage, in example, belong on the door to the storage, - pen attached -, not in the kitchen underneath the bread basket. Convenience and accessibility for the user will assure the paperwork gets filled out properly. And as long as the records kept are complete and easily accessible we are in good shape.

Those complete and easily accessible records are absolutely essential when things go wrong. Should you ever be faced with a food safety breach, for example sick laying hens that have been diagnosed with a virulent strain of SE, you must be able to quickly inform your industry partner and recall the shipment(s) that included the eggs in question. Without a customer log containing detailed information, we are potentially jeopardizing our customer's health and well-being, and therefore our own.

On that subject, some people may think that by acknowledging a certain risk, they are opening themselves up to a potential court suit and maybe greater level of liability. The fact is, whether or not we are aware of our responsibilities, we can be held accountable for ensuring we meet those responsibilities. Ignoring a risk, or simply not being aware of it, is likely to increase our level of liability in the eyes of the legal system.

So let's get the record keeping started or maybe expanded. Standard Operating Procedures (SOPs) and log books, do you know the difference? Often flock owners are confused as to the difference between the two. Maybe it helps to think of your SOPs as 'the plan'. It is the step-by-step of activities done in and around the barns on a regular basis. If you go on vacation, 'the plan' is what you'd want the people that take care of the flock in your absence to follow. It is simply what you intend to do under routine circumstances.

Your logs on the other hand, are the factsheets of what actually happened. For example, let's say your SOP for mortality management says that "birds are removed immediately, collected in a freezer, and incinerated bi-weekly". But what if the big maple by the barn toppled in the last storm? Now the incinerator is smashed and the SOP plan has to change. Our entry in the mortality management log will now maybe read: "April 12, rendering company XX came today and took content of freezer A, 100kg."

Beginning on the next page, the following examples of SOPs and logs related to food safety and biosecurity show that paperwork can be detailed yet simple, - as long as the farm operators are diligent in creating and filling the required records.

Standard Operating Procedures (SOP) Content

Please keep in mind the following SOPs are just examples that may be useful in designing your own SOPs. While some specific details are given in these examples, they are farm generalizations only and, depending on the set-up of your operation, do not necessarily need to be followed. For SOPs to be useful, the details in each SOP must reflect your procedures on your farm!

1. **Self quarantine procedures**
2. **Egg gathering procedures**
3. **Egg cooling-storage provisions**
4. **Recall procedures**
5. **Farm access policies**
6. **Driveway maintenance and access housekeeping**
7. **Poultry area entrance/exit procedures**
8. **Building cleaning and disinfection procedures**
9. **Pest control program**
10. **Bird replacement policies**
11. **Mortality disposal procedures**
12. **Manure management strategies**

SOPs recognize that food safety and biosecurity are on-going activities but having written SOPs will ensure that tasks are understood and carried out accurately, no matter who is following them. Maybe you can think of more tasks on your farm that would benefit from written SOPs, for example routine maintenance and check-up of the emergency generator. Feel free to add or combine!

Standard Operating Procedures (SOPs)

Food safety and Biosecurity

Farm Name: _____

Owner/Manager: _____

Address: _____

_____

Person completing SOP's: _____

Completion Date: _____

Review Date:	_____	**Signature:**	_____
Review Date:	_____	**Signature:**	_____
Review Date:	_____	**Signature:**	_____
Review Date:	_____	**Signature:**	_____
Review Date:	_____	**Signature:**	_____
Review Date:	_____	**Signature:**	_____

STANDARD OPERATING PROCEDURE 1

Self Quarantine

Objective: To provide the steps required in imposing a self-quarantine if an infectious disease is suspected

Introduction:

On the suspicion of an infectious disease, characterized by a rise in the number of sick or dead birds, it is important to take all possible measures to limit the spread of the infecting organism. These measures will help to protect other birds on your farm that are not yet affected and other poultry operations in your area.

Farms veterinary _____Phone Number _____

Procedures:

1. Lock the gate or barrier to the poultry raising area, everything beyond entrance, leading to your birds and used for accessing the barn/range area.

2. Begin enhanced biosecurity procedures:

    - Restrict access to the affected barn. If possible assign 1 person to that barn only.
    - If you have more than one group of chickens, service the unaffected flock first.
    - Change your clothing completely after servicing affected barn(s).
    - Restrict any movement by non-essential persons between residential area and poultry raising zone.

3. Notify essential farm visitors (e.g. feed delivery) of the situation and request they make your farm the last of the day.

4. Postpone any bird movement on or off of the farm (e.g. bird shows, flock additions).

5. Postpone any vaccinations planned.

6. Dispose of all carcasses on-farm (should be protected compost or incineration).

7. Clean and disinfect any vehicle leaving the farm (including personal vehicle).

8. Change into non-farm clothing when leaving the farm.

9. Postpone any non-essential visits to or from other farms.

STANDARD OPERATING PROCEDURE 2

Egg Gathering Procedures

Objective: To provide the steps required in gathering eggs safely and effectively day by day

Introduction:

Eggs are fragile and begin to loose quality soon after being laid. One way to minimize the deterioration of freshness, and prevent potentially occurring bacterial growth, is to collect them as soon as possible and to place the gathered eggs into cool-storage. Collecting the eggs at least twice daily will also protect them quickly from cracking by other birds and organic contamination.

Procedures:

1. Gather the eggs often - at least twice a day.
2. Before gathering starts, check that cooling room is in receiving condition (cool, clean, sufficient space).
3. Entering the layer barn, walk slowly and talk calmly to avoid unnecessary stress for the birds.
4. Gather the eggs in baskets or containers with good airflow that will allow rapid cooling.
5. Do not handle eggs or their containers in a rough manner. Eggs are fragile and rough handling can break shells or internal membranes, resulting in potential downgrading of an otherwise top quality egg.
6. Utilize at all times the egg storage room to cool and store all eggs collected.
7. After cooling, pack the eggs with the small end down into cartons or flats and, if used, place cartons into shipping boxes.

STANDARD OPERATING PROCEDURE 3

Egg Cool-Storage Provisions

Objective: To describe the procedures for maintaining on-farm a cool-storage for daily eggs gathered.

Introduction:

Every Producer must maintain a clean, well ventilated egg storage room that is maintaining a controlled temperature of 10°C to 13°C (50-56 degrees F.), at all times of the year. The cooler must be in close proximity to the hen raising area and large enough to accommodate all egg production until such time that egg production can be marketed.

Procedures:

1. Assure daily before egg gathering begins that cooler is at required working temperature.
2. Check periodically during the day that required temperature is maintained.

   (Consider investing in a temperature regulating thermostat with automatic alarm if temperature approaches the prescribed limits.)
3. Check for organic contamination and debris, clean cooler as needed.
4. At least once a week the cooler must be cleaned thoroughly and disinfected.
5. Keep records of the eggs collected and appropriate cleaning.

STANDARD OPERATING PROCEDURE 4

Recall Procedures

Objective: To describe the procedures for recalling farm product, be it eggs, meat, or live birds.

Introduction:

Traceability is a key element in a functioning food safety program, albeit as a last resource and back-up when all else has failed. When a potential contamination is recognized, detailed records of the product or shipment leaving the farm is the first line of defence in minimizing the impact of pathogens in food products, or infectious diseases in birds, coming from that farm. A written recall program must be maintained by keeping a log of all products leaving the farm, as they leave. Retrievable information, is not limited to, but must include:

Procedures:

1. Write down as the product is leaving, or daily:
    a) "Shipped to:" Customer name and phone number at a minimum, address if possible
    b) Date of egg collecting / date leaving
    c) Numbers of eggs in shipment/sale (could be recorded as # of cartons or boxes)
    d) Best before Date and Grade
    e) Individual container identification, if available
    f) Barn #: originating flock, if there is more than one
    g) Date slaughtered and weight for meat
    h) Strain/breed, age, and numbers for live birds
2. Traceability data must be made available to the grading station, BC Egg or CFIA if required.

STANDARD OPERATING PROCEDURE 5

Farm Access Policy

Objective: To describe the procedures for entering the farm.

Introduction:

A secure barrier that restricts vehicle entry must be present at all primary and secondary accesses to the CAZ (Controlled Access Zone). Secure barriers are the first line of defence in minimizing the transmission of infectious diseases both to and from the farm.

Procedures:

1. Keep a log of all truck traffic and visitors to the CAZ.
2. Consider posting *Biosecurity in effect - do not enter* signs at property access point(s).
3. All vehicles are to stop at the gate.
4. Examine vehicles for debris (especially wheel wells, on tires or on undercarriage).
5. If debris is visible, use hose or pressure washer to remove debris.
6. If needed, spray vehicle with disinfectant.
7. Open gate, have vehicle enter the CAZ and then close the gate.
8. Have vehicle proceed to the appropriate area.
9. Close the gate after the vehicle leaves the farm.

STANDARD OPERATING PROCEDURE 6

Access Cleaning and Maintenance

Objective: To describe the steps in cleaning and maintaining the controlled access zone (CAZ) and the entrance(s) to the farm.

Introduction:

Visible accumulation of organic matter can transport infectious disease onto or off the premises. This debris can serve as a reservoir that may re-infect the farm. In the event of an infectious disease outbreak, disinfection may be required to reduce the spread of disease to or from the premises. Therefore, in order to keep the driveway and access area clean, we need to maintain in close vicinity of the entrance area a hose of sufficient length with enough water pressure, a handheld or back pack sprayer to apply disinfectant if needed, and any other tool that will help us to accomplish this task.

Procedures:

1. Check for and repair driveway potholes that allow persistent accumulation of water.
2. Hose down any areas that have accumulation of debris or organic matter.
3. Hose debris away from roadway into a catchments area.
4. Keep disinfectant spray container accessible to the primary access of the controlled access zone.
5. Ensure pressurized water or directions to access it are available at the primary access.
6. Ensure primary and secondary access signs are visible and in good repair.
7. Keep grass and vegetation in the area as short possible.
8. Remove any non-essential equipment from the immediate area around the barns.
9. Check to ensure all signs, which remind visitors of biosecurity measures are in place, are intact and legible.

STANDARD OPERATING PROCEDURE 7

Poultry Area Entrance/Exit Procedures

Objective: To describe the steps in cleaning hands and changing outerwear and footwear when making the transition from the controlled access zone (CAZ) around the barn to the restricted access zone (RAZ) inside the barn.

Introduction:

In order respectively, we need to assure we don't cross contaminate our respective areas. At a minimum this means we observe the 'demarcation line' (be it a line, an actual barrier, or the inside door, and make sure clothing, footwear and hands are clean.

Procedures:

1. Barn Entry
    - Check outside footwear. Rinse or brush to remove soil and other organic material as needed.
    - Enter the anteroom. (If using it, step into 'dry footbath' (pan filled with dry bleach or detergent + dry bleach) while entering.)
    - Remove outside outerwear (coats, sweaters, hats) and hang in "outward" side of the anteroom barrier.
    - Wash or sanitize hands.
    - Remove outside footwear while stepping over demarcation to "inward" side, putting on inside boots (or while putting on plastic boot covers).
    - Put on barn outerwear (i.e. coveralls, head-cover).
    - Enter barn area. If using it, step through second 'dry footbath' (another pan filled with dry bleach or detergent + dry bleach) while entering the barn area.

2. Barn Exit
    - Brush or scrape all manure off boots before leaving the bird holding area.
    - Step through footbath while leaving the bird holding area.
    - Remove outerwear.
    - Remove boots and step over demarcation, putting on outside footwear.
    - If plastic boot covers used, remove while stepping out of the "inward" side of the anteroom and dispose into proper container.
    - Wash and/or sanitize hands.
    - Take outside outerwear, step through the 'dry footbath' and depart.

STANDARD OPERATING PROCEDURE 8

Barn Cleaning and Disinfection

Objective: To describe the procedures for cleaning and disinfecting a barn

Introduction:

Thorough cleaning and disinfection of the barn is a critical control point for the reduction of potential pathogens. Following proper procedures is essential for ensuring that any challenge is reduced to a minimum. Check labels to make sure that cleaning agents and disinfectants are compatible and mix according to label directions.

Procedures:

1. Clean all moveable equipment and, if necessary, remove it from the barn.
2. Remove manure and litter to the appropriate location. Make sure trailings left behind when the manure was moved are also cleaned up.
3. Blow down the barn, beginning with the highest surfaces and working the debris down to the floor.
4. Sweep out dislodged debris.
5. Thoroughly soak all surfaces with water plus _____ (*detergent or cleaner*) and leave overnight.
6. With a high-pressure sprayer using _____ (*detergent or cleaner*), wash down ceiling, walls, fixed equipment, and then floors.
7. Wash all debris out of the barn.
8. Rinse all surfaces with water.
9. Empty all residual water from feeder trays.
10. Allow all surfaces to dry thoroughly.
11. Spray all surfaces with _____ (*disinfectant*), beginning at the ceiling and spraying down. Make sure the surfaces are thoroughly covered just to the point of run-off.
12. Empty residual disinfectant from feeder trays or any other equipment in which liquid may accumulate.
13. Allow ____ minutes contact time (*refer to disinfectant instructions*) or allow all surfaces to dry thoroughly.
14. If required, rinse disinfected surfaces.
15. Repeat the disinfectant treatment.
16. Allow all surfaces to dry thoroughly.
17. Disinfect equipment belonging in the barn before returning it.
18. Treat the barn as biosecure from this point forward.

Follow steps 5, 6, 8, 10, 11, 14, 16 for equipment that has been removed from the barn.

STANDARD OPERATING PROCEDURE 9

Pest Control Program

Objective: To document the procedures, including trapping, baiting and insecticide use, for maintaining an effective pest control program.

Introduction:

Pest control is an essential element of food safety and biosecurity. A meticulous control program will help to reduce or eliminate pests. Rodents are the foremost target but insects and wild birds are equally high on the priority list, due to their ability to transmit likewise pathogens that will infect birds and people.

Procedures:

General Control

a)	Daily:	Clean up any spilled feed and broken eggs.
b)	Weekly:	Clean up any material that could attract flies (garbage).
c)	Weekly:	Cut grass and vegetation around barns for a distance of ~ 5 metres (15 feet).
d)	Biweekly:	Remove any clutter or debris inside or outside the barn that may provide cover for rodents. Assure no water holding containers remain as mosquito breeding sites.
e)	Periodically:	Check inside and outside for openings and defects and repair ASAP.

Baiting Procedures - should the numbers warrant intervention

a)	Place bait stations at _____ metre intervals around each barn.	
b)	Monthly:	Check all bait stations and remove and dispose of all dead rodents.
c)	Weekly:	Replace any consumed/expired bait at each station.
d)	Monthly:	Spray insecticide for flies in barn and anteroom area and/or replace fly strips
e)	Yearly:	Review bait usage and replace all bait at all stations with a different class of rodenticide. This might of to be done semi-annually, depending on pest pressure present.

If you feel the above outlined measures do not provide satisfactorily results, a pest control company can be employed. It is essential to keep the effective pest control program well documented.

STANDARD OPERATING PROCEDURE 10

Bird Replacement Policies

Objective: To document the procedures, including sourcing, shipping, and preparation of barns, for an effective bird replacement program, assuring the healthiest animals possible.

Introduction:

A big difference in the potential of pathogens entering the farm can be made by assuring livestock added from outside is healthy. Replacement birds brought in, no matter if they come as one flock or bird-by-bird, must have a clean bill of health. Dealing with a reputable source is of utmost importance to assure our farm stays disease free.

Procedures:

- Do your homework on the supplier before purchasing or accepting new birds.
- Ask for the health records and make sure a copy of that paperwork accompanies the birds.
- Try to commit to the all-in/all-out system, so you won't have to worry about a differing health history of the birds and their stress of adapting to new flock mates.
- When adding new birds to the present flock make sure they are confined for 3 weeks separately before introduced to your present birds.
- The quarantine facility to separate newcomers must be of sufficient distance to the main flock.
- Take your time to introduce the newcomers slowly and in sensible stages of proximity. Older birds can be aggressive and territorial towards younger ones, especially if the older birds were on the farm first. This means that, short of being chased, the new ones might also have less access to feed and water for some time.
- If the new flock arrives all at once, assure the barn is properly prepared for the birds and you observe all birds accessing water and feed. Consider dimming the lights for the first few days, if getting mature birds. Chicks on the other hand, need a well-lit place to find the water and feed supplies.
- If you show your birds at fairs or similar events, do not mix these birds from the flock immediately back into it. Treat them like newcomers to assure they weren't exposed to infectious pathogens while away from the rest of your flock.

STANDARD OPERATING PROCEDURE 11

Disposal of Mortalities and Cull Eggs

Objective: To describe the procedures for disposing of mortalities and cull eggs

Introduction:

Dead birds and cull eggs may be a high risk source of infectious disease organisms and must therefore be handled and disposed of in an improved manner. Daily records of mortality and production parameters, such as egg quantity and quality (percentage culls versus good eggs) is important as this data will prove invaluable in diagnosing and preventing disease.

Procedures:

1. Mortalities should be collected at minimum once per day during a flock walk through. 2-3 times is ideal.
2. Collected mortalities should be removed from the restricted area, and if necessary through the anteroom, with great care to reduce potential contamination of the surrounding area.
3. If mortalities are stored in a freezer, movement from the freezer to the disposal location (if off farm) must be in sealed totes that are capable of being washed and disinfected.
4. Mortalities disposed of by incineration should be incinerated 2-3 times per week.

Disposal of large number of mortalities

(When the mortalities are due to power outages or heat stress, but not disease related)

If mortalities are less than 24 hours old, you can contact West Coast Reduction in Vancouver at (604) 255-9301 or the BC Sustainable Poultry Farming Group at (604) 826-7786 in the Fraser Valley. If the mortalities require composting, you can call Transform Compost Systems (John Paul) in Abbotsford, office (604) 504-5660, cell (604) 302-4367 for either on-farm composting or removal from the farm.

STANDARD OPERATING PROCEDURE 12

Manure Management

Objective: To describe the procedures for managing manure

Introduction:

Manure can be a high risk source of disease transmission. Handling of manure in a way that minimizes this risk is highly recommended, i.e. through proper storage and composting. In case of an infectious disease outbreak it is crucial for the industry to be aware of the locations where the manure has been spread and therefore quarantine distances needed.

Procedures:

1. Manure must be handled according to provincial regulations.
2. Manure is removed from the barn and stored at/on _____ for _____days/weeks.
3. Manure is removed from the farm by _____ (company) and it is disposed of at _____.
4. Keep records of volume of manure leaving the premises and the name of the trucking firm with your flock records.

Logs

As mentioned before, logs are important because they reflect what actually happened on a certain day with regards to a given biosecurity and food safety related issue or standard.

The following log sheets for record keeping are only examples. If you like them and they reflect your operation, feel free to open the binder rings and copy what you see here so your farm can keep track of these essential records. If not, we hope you will find inspiration here to tweak or create logs that are indicative of your farm operation.

Log Content

1. **Visitor Log**
2. **Egg Collection Records**
3. **Temperature Record of Cool-storage**
4. **Daily feed and Water**
5. **Pest Control**
6. **Bird Movement**
7. **Flock Health, i.e. vaccines**
8. **Mortality Log**
9. **Mortality / Manure Removal**
10. **Barn Cleaning**
11. **Annual items (i.e. water test, Biosecurity training, and update of SOPs)**

Certain actions described here might, or might not, apply to you and your operation. Disregard as you see fit so the final logs to be completed reflect your particular farm and its very own circumstances, just like the previous Standard Operating Procedures.

1 - Visitor Log

(Visitors include anyone that enters the CAZ but is not on the farm daily)

Date	Name/Company	Phone	Comments

2 - Egg Collection Log

(If you have more than one barn or flock, separate by flock or barn)

Date	Time	Total # of Eggs Collected:	Total # of Eggs Discarded:	Comments

3 - Temperature Record of Cool-Storage

(To prove diligence and minimize liability record temperature when eggs are added, write down daily temperature checks, - frequency depends on the system used)

Date	Time	Temperature	Signature of recorder	Comment

4 - Daily Feed and Water

(Check-off F/W, especially useful when more than one person is responsible for care of birds)

Date	Feed	Water	Comments

5 - Pest Control Record

(Rodents, insects, birds and vegetation, inside and outside; use several lines per date if necessary; under comments insert name of service provider if applicable)

Date	Type	Task	Comment

6 - Bird Movement Log

(Fill as needed when live birds are entering or leaving the farm.)

Date	# of birds	Location (either to or from):	Health record Y/N	Transported by:	Comments

7 - Flock Health

(Routine like vaccines, unusual circumstances requiring treatment and/or medication, lab test, need for follow up, depending on existing 'paper trail')

Date	# of Birds or Barn ID	Symptom/Problem	Treatment/Adjustment

8 - Mortality Log

(If you have more than one flock or barn, each flock or barn needs a separate record)

Date	# of dead birds	Suspected reason	Comments

9 - Mortality and Manure Disposal Log

(Keep pertinent manure management and mortality disposal records)

Date	Transported by:	Location to:	Comments /or loads #

10 - Barn Cleaning

(Record cleaning for barn and entrance room, partial or complete, annual, disinfectant, etc)

Date	Barn #	Disinfect Y/N	Task	Comment

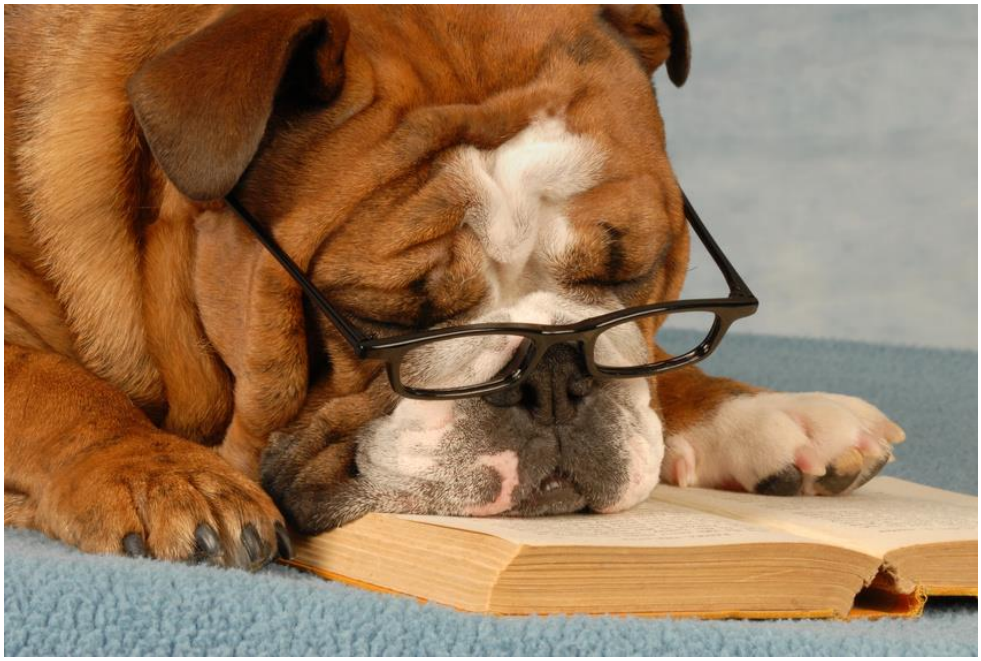
11 - Annual Events Records

(Water test, salmonella test, biosecurity training, follow-up on tests, access maintenance (like hose, sprayer, signs in good order) etc, - **as needed)**

Date	Action	Result	Comments/signature

We hope you found the information in this binder useful. For any questions you might have please feel free to contact your veterinarian, the BC Ministry of Agriculture's industry expert, or the helpful folks from the BC Egg Marketing Board. A lot of good information can be found on the web, as long as you choose reputable websites. Consider joining a poultry association or a similar organization. They can be another good source to help you stay-up-to-date with improvements and research on flock health, bird management, and food safety.

For more information on the previous sections and helpful tips, like further sources of information, please browse through the following appendix.



Appendix

List of places offering water testing

To facilitate an annual test of the drinking water your birds have access to, we have included here a list, up-to-date to July 2011, which includes companies that perform this kind of service in BC. The listing here is not an endorsement of a particular company by BCEGG but only an informal service to poultry owners. The water testing services listed below provide water testing for E. coli, total coliforms and fecal coliforms, at a minimum.

COMPANY	ADDRESS	CONTACT INFO
Lower Mainland		
Maxxam Analytics*	4606 Canada Way, Burnaby	604-734-7276 1-800-665-856
Caro Analytical Services	#150-12791 Clarke Place, Richmond	604-279-1499
Exova*	#104 -19575 55A Avenue, Surrey	604-514-3322 1-800-889-1433
IG Micromed Environmental Inc.	#190-12860 Clarke Place, Richmond	604-279-0666
Silliker J R Laboratories Inc.	#12-3871 North Fraser Way, Burnaby	604-432-9311
Pacific Soil Analysis	#5-11720 Voyageur Way Richmond, BC V6X 3G9	604-273-8226 604-273-8082
Vancouver Island		
Levelton Consultants Ltd	760 Enterprise Cres, Victoria	250-475-1000
	1935 Bollinger Road, Nanaimo	250-753-1077
	#8-2663 Kilpatrick Avenue, Courtenay	250-334-9222
M B Laboratories*	2062 Henry Avenue West, Sidney	250-656-1334

Vancouver Island cont.		
North Island laboratories	2755B Moray Avenue, Courtenay	250-338-7786 1-877-533-3313
	#2-532B Comox Road, Nanaimo	250-716-8731 1-866-220-2221
Fraser Valley		
EDS Pumps & Water Treatment Ltd	23184 Fraser Hwy, Langley	604-534-1115 1-800-900-2220
Grotek Analytical Lab	9850 201 Street, Langley	604-882-7699 1-888-747-4769 604-882-7659 (Fax)
Okanagan		
Caro Environmental Svc	3677 Highway 97 N, Kelowna	250-765-9646 250-765-3893 (Fax)
Maxxam Analytics*	915 Ellis Street, Kelowna	250-470-1818 1-800-665-8566 (LM) 250-765-7509 (Fax)
For other locations that provide water testing please contact your municipal water services provider.		

Water System Cleaning

The following excerpt, adapted from the factsheet Water Sanitation by Michael Leslie, is included here courtesy of Canadian Poultry Consultants Ltd. Please be aware that details of the factsheet are presented here in different order. Table 1 becomes therefore Table 2, etc. The original can be viewed in full length at http://www.canadianpoultry.ca/water_sanitation.htm.

During routine use, material build up and contamination of a water system can and will occur. As lime and scale deposits, rust, dirt and algae collect in the water lines, affecting the functioning of the system. The build up of these substances on the inner surface of the system can, and will, provide a place for microorganisms to take hold. The organic material can supply nutrients for growth and multiplication of microbes such as E.coli. Every time the bird consumes water it will be exposed to an increased microbial load through the drinking water which could result in poor feed conversions, down grading of carcasses, increased mortality and possibly condemnation.

The build up of this organic material could also have a negative effect on medication and vaccines delivered through the drinking water. To keep the watering system in proper working order, a routine monitoring, cleaning and sanitizing program should be developed and applied. The following information is to inform the reader of the choices available for water line sanitation and disinfection. One must continue to strive for water quality, as this ingredient is a key component towards poultry health.

Cleaning and Sanitizing of Water Lines

I. Cleaning With Birds Present

The objective is to keep the water lines clean while birds are in the house. This helps to remove and prevent organic build up in the water lines:

1. Medicate or dilute the indicated concentrations to provide the level needed for cleaning (Table 1).
2. Cleaning should be stopped 2 days prior to vaccination and water medication.
3. When starting this program, monitor the birds' behaviour to make sure they are drinking water.

Table 1: Cleaner concentrations for cleaning when flock is present

Cleaner	Proportioned	Bulk Tank
Citric acid	200 grams/gallon	200 grams/128 gallons
Vinegar	4 liters/gallon	4 liters/128 gallons
Ammonia	100-150ml/gallon	100-150 ml/128 gallons

II) Cleaning between flocks (shocking the line)

This is probably the most critical time period for the cleaning of a water line system. Cleaning water lines should be part of the routine barn cleaning and disinfection program.

1. Flush the lines with high-pressure water to dislodge heavy organic matter.
2. Fill the lines with the cleaning solution and leave it in the lines for 3 to 6 hours.
3. Clean the proportioner and change filters.
4. Flush the water lines with clean water.
5. All plasons, cups and other open drinkers must be cleaned as well.

Table 2: Cleaner concentrations for 'in-between' flocks

* Barns are empty. Never use these concentrations when birds are in the barn.

Cleaner	Proportioned	Bulk Tank
Citric acid	800-1000 grams/gallon	800-1000 grams/128 gallons
Vinegar	No dilution	1 gallon/128 gallons
Ammonia	350-500ml/gallon	350-500 ml/128 gallons
Chlorine	350 ml per gallon	350 ml/128 gallons

III) Sanitizing Water Lines

The objective of water sanitizing is to decrease the number of microorganisms (bacteria and viruses) in the water lines. The addition of a sanitizer to the watering system not only helps to reduce the microbial load but also aids in minimizing the algae growth, mineral deposits and slime

build up. The addition of chlorine also helps to reduce oxidation of iron, which helps control rust deposits in the water lines. Keep in mind that a sanitizer should not be used 48 hours prior to and 24 hours after vaccination.

Table 3: Sanitizer concentration for water lines while birds are in present.

Sanitizer	Proportioned	Bulk Tank
Chlorine 5 %	Open system 150 ml / gallon Closed system 60 ml / gallon	150 ml /128 gallons 60 ml / 128 gallons
Iodine 18.5%	350 ml /gallon	350 ml / 128 gallons
Peroxide 35%	30 ml per gallon	30 ml / 128 gallons

Points to consider when cleaning and sanitizing water lines:

1) Some cleaners in combination with medications can enhance delivery and activity.
   i) Ammonia, at low levels, helps to increase the solubility of sulfa drugs.
   ii) Citric acid helps keep tetracycline in solution.
   iii) Citric acid as a carrier for vitamins and minerals, rather than sugar, helps reduce slime build up.

2) Some products and combinations warrant some caution.
   i) Hydrogen peroxide at full concentrations can be corrosive and tissue damaging.
   ii) Iodine is corrosive to galvanized steel, rubber and latex.
   iii) Citric acid is corrosive to galvanized steel.
   iv) Chlorine at high levels can be corrosive to all metals including stainless steel.
   v) Chlorine, ammonia and commercial cleaning agents should not be mixed together since some combinations can react, producing dangerous gases.

The following excerpt, adapted from the Factsheet 3.3 Cleaning and Disinfection, out of the Keeping your Birds Healthy series from OMAFRA, has been written by Dr. Bruce Hunter and Ashley Whiteman, both from the University of Guelph, and Dr. Babak Sanei and Al Dam, both from the Ontario Ministry of Agriculture, Food and Rural Affairs, as well as Dr. Teresa Cereno. The original can be found at http://www.healthybirds.ca/Factsheets/Management/CleaningDisinfecting.pdf.

Cleaning and Disinfecting

By Dr. Bruce Hunter, Ashley Whiteman, Dr. Babak Sanei, Al Dam and Dr. Teresa Cereno

Animals are continually exposed to microorganisms, many of which can cause diseases. Some of these microorganisms can survive in the environment, flock after flock, because they are protected by organic materials/manure or bio-films that are in the environment. In order to prevent diseases, we have to BREAK THE CHAIN!

Cleaning and disinfecting (C&D) are two very important steps of a complete biosecurity program and are important tools used in breaking the chain of infection. A good sanitation plan must always be included in any health program. Isolation of the birds and sterilizing the environment would be the
ultimate objectives but are not realistic. Therefore, attainable goals must be established so an effective level of sanitation can be maintained.

Sanitation Objectives

- Thoroughly clean all animal facilities, handling or transport equipment and barn tools – there should be no exception in the areas that are included in the program. After cleaning there should be no visible organic matter left behind.
- Reduce microorganisms to the lowest possible level through proper disinfection.
- Obtain new birds from known, disease free sources – to ensure that they do not arrive at your facilities harbouring pathogens like Newcastle Disease virus or Salmonella organisms.

Preparing to Clean

- It is best to clean when birds are not in the facility or can be kept away from the area/pen that is being cleaned.
- Cut the grass around the facilities.

- Remove equipment and other tools that cannot be cleaned and disinfected in the barn or loft, i.e. heaters, drinkers, and feeders.
- Remove left-over feed from feed bins and feeders.
- Remove litter/bedding from the barn and take to a proper storage, disposal or compost area.

Cleaning Procedures

The goal of cleaning is to physically remove all visible debris, dirt, soil, feces, and other organic matter. You need to use a lot of elbow grease! Sweep/blow down dust, cobwebs, and feathers from walls, nest, cages, beams, rafters, fans, and other accessible areas inside and outside the barn. Do not forget the service rooms. It is also a good idea to clean and disinfect the feed bins (if in use) at least once a year.

Scrape off any built-up debris and pay attention to hard to reach areas. Wash all surfaces with water and detergent. The detergent or cleaning agent aids in decreasing surface tension (makes water "wetter"), splits up organic material, emulsifies oils and fats, floats dirt particles, dissolves salts, and carries dirt off the surfaces that you are cleaning.

There are two basic types of detergents that can be used:

a) Alkaline-based detergents that remove proteins and fats

b) Acid-based detergents that remove mineral deposits like scale.

The thoroughness of cleaning (use of high pressure washer), use of detergent and exposure time (low pressure application of foam/gel remains on surface longer), and use of hot vs. cold water all contribute to the efficacy of the cleaning job.

Disinfecting Procedures

A good cleaning job should ensure that the disinfectant will be able to get to the remaining microorganisms on surfaces and reduce them by at least 99%. **Many disinfectants are inactivated by feces/organic matter.** To avoid wasting time and money make sure that cleaning efforts are thorough before disinfecting.

Choose the disinfectant and the application process based on your facilities and the equipment that you have. (See the **Introduction to Disinfectants** factsheet (3.4) for different products and their characteristics.

Disinfectants can be applied by several methods including: low pressure (garden hose), through foam using a foam lance, or by thermo-fogging. Some commercial poultry operations use formaldehyde fumigation. This method has significant health and safety challenges and is not recommended for the backyard flock or inexperienced operator. Be sure to observe all safety precautions. Choose a disinfectant and application method that will work in your barn setup, with your bird management system and addresses any human health and safety concerns.

Here are the steps to proper disinfection:

- Read chemical labels thoroughly and make sure that you have the MSDS (Materials Safety Data Sheet) from the manufacturer. This will help you understand the precautions that you must take to protect yourself and what to do in the event of an emergency.
- Always wear protective equipment (clothing, mask, eyewear) when handling chemicals.
- Make sure from the label that you understand the application method. Some disinfectants work best when applied to a dry surface (air dried after cleaning) and some to a moist surface.
- Determine the surface area (in square feet) to be disinfected using the following formula for barns without cages: Length x width x 2.6 = area (sq ft)
- Prepare the disinfectant solution based on the total area to be treated and use the dose provided by the manufacturer. Start application from the top of the barn and work your way down to the floor.
- Close and lock the barn. Keep people and animals out of the barn for a minimum of eight hours to allow sufficient contact time for the disinfectant to work. Ventilate the barn properly before repopulating.
- If possible, monitor the C&D by taking environmental samples for bacterial counts. This will tell you how effective your method was.

Key Points to Remember:

- Clean and disinfect all equipment and tools removed from the barn. This includes drinkers, heaters, feeders, fans, shovels forks, wheelbarrows, equipment used for the C&D activity etc.
- Only return equipment to the barn after it has been disinfected.
- Include trucks and other delivery/ service vehicles in the C&D program.
- Make needed barn repairs. Do not put them off.
- Institute rodent and pest control. See **Pest Management in Bird Production** factsheet (3.5).
- Clean and flush water lines to remove calcium deposits.

TAKE HOME MESSAGE

- Clean out as thoroughly as possible before disinfecting.
- Use appropriate disinfectants and application methods.
- Follow all manufacture label instructions and take safety precautions when handling chemicals.
- Complete C&D program before bringing in disease free birds.

The following write-ups explain in detail the potential cause for weak egg shells and lower egg production in adult hens.

Concepts of Eggshell Quality

By Gary D. Butcher, D.V.M., Ph.D. and Richard Miles, Ph.D.

Much information has been learned about eggshell quality during the past fifty years. During this period of time, the genetics of the chicken, diets, house design and management practices have changed dramatically. In the future it is very likely that additional changes will have to be made by the commercial egg industry. No matter what changes occur, the eggshell needs to be as strong as possible to maximize the number of eggs reaching market.

Many factors influence eggshell breakage. Eggshell breakage is directly related to the quality of the shell. It is impossible, even with current knowledge, to correct all eggshell quality problems. We can, however, make significant reductions in the number of eggs lost due to poor shell quality. This can be accomplished if one realizes that no one factor is usually responsible for egg breakage. Many factors are known to be related to eggshell quality including: adequacy of nutrition, flock health problems, management practices, environmental conditions, and breeding. The following are some of the major factors associated with eggshell quality. A brief account of each factor is provided.

THE EGGSHELL ITSELF: What do we know?

Most good quality eggshells from commercial layers contain approximately 2.2 grams of calcium in the form of calcium carbonate. About 95% of the dry eggshell is calcium carbonate weighing 5.5 grams. The average eggshell contains about .3% phosphorus and .3% magnesium and traces of sodium, potassium, zinc, manganese, iron and copper. If the calcium from the shell is removed, the organic matrix material is left behind. This organic material has calcium binding properties and its organization during shell formation influences the strength of the shell. The organic material must be deposited so that the size and organization of the crystalline components (calcium carbonate mostly) are ideal, thus leading to a strong shell. The majority of the true shell is composed of long columns of calcium carbonate. There are other zones that are involved in the self-organization giving the eggshell its strength properties. Thus, shell thickness is the main factor but not the only factor that determines strength. Presently, dietary manipulation is the primary means of trying to correct eggshell quality problems. However, the shell to organic membrane relationship is also critical to good shell quality and must be considered.

An eggshell that is smooth is desirable as rough shelled eggs fracture more easily. Large sized eggs will usually break more easily than small ones. The main reason for this is that the hen is genetically capable of placing only a finite amount of calcium in the shell. As the hen ages and the eggs get bigger a similar amount of calcium has to be spread over a larger surface. Therefore,

controlling the rate of egg weight change can influence eggshell quality as the hen ages. Controlling feed intake by changing the temperature inside the layer house influences egg size. It must be remembered that many factors can influence the amount of calcium being laid down by the hen. Just because an eggshell is thick does not necessarily mean that it is strong. Sometimes a thinner eggshell is stronger than a thicker eggshell. The reason for this is due to the shape and organization of the organic and inorganic components of the shell.

FEEDING

The importance of adequate nutrition in providing the hen what she needs to maintain adequate eggshell quality is obvious. A hen lays approximately 250 eggs per year which corresponds to 20 times the quantity of calcium in her bones at any one time. Therefore, the calcium requirement of the laying hen is great. It can be calculated that during the 20 hours that are required to form an eggshell, 25 milligrams of calcium must be deposited on the egg every 15 minutes. This amount of calcium is the total amount of calcium in a normal hen's circulatory system at any given point in time. The laying hen is also not 100% efficient in extracting calcium from the available sources in the diet. Therefore, many times the diet has to furnish in excess of 4 grams of calcium to the hen daily. Calcium availability values are sometimes not known and it must be remembered that higher daily intakes are needed when the availability values are known to be low.

A high phosphorus content in the feed and excess chlorine may have a negative effect on eggshell quality. It is possible that these two elements act negatively on eggshell quality through their influence on acid-base balance (pH) in the blood. The importance of adequate vitamin D intake by the hen is obvious and it is essential for proper calcium and phosphorus utilization. However, excess vitamin D and its metabolites have not been shown to benefit eggshell quality when normal hens are already consuming adequate vitamin D. Other vitamins and trace minerals, when fed above the hen's requirements, have failed to improve eggshell quality.

ENVIRONMENT

Usually, eggshell quality is not as much of a problem in cooler environments as compared to hot environments. One of the contributing factors causing poorer eggshell quality in hot weather is hens not consuming adequate feed. This can lead to problems in body weight, egg production, egg size, and eggshell quality if measures are not taken to assure adequate daily nutrient and energy consumption. When environmental temperature becomes excessively hot, feed intake decreases and energy becomes the first limiting factor to the hen. Inadequate consumption of amino acids, calcium, phosphorus and other nutrients can usually be corrected by adjusting the nutrient density of the diet. However, it must also not be forgotten that in hot weather, unlike cooler weather, the laying hen has to make critical "life sustaining" physiological adjustments in order to cope with the increased environmental temperature.

The laying hen, through panting, resists the rise in body temperature during periods of heat stress. At the same time, the acid-base balance in the bird's blood is changed. We sometimes forget that the laying hen has to cool her body in extremely hot environments and this will shift her physiological priorities from producing eggs and maintaining an adequately calcified eggshell to that of staying alive. In such situations maximum egg mass (egg production times egg weight) along with maximum eggshell quality are difficult to achieve with any age bird.

DISEASE AND EGGSHELL QUALITY

Not all diseases which affect chickens cause a decline in eggshell quality. However, egg production will usually decline. An example of a disease that can affect the numbers of eggs and not necessarily the quality is infectious laryngotracheitis. Other common viral diseases such as egg drop syndrome (EDS), avian influenza (AI), Newcastle disease (ND) and infectious bronchitis (IB) may produce severe effects on eggshell and internal quality. Many times the total number of eggs is not influenced even though the egg records indicate a drop in total collectable eggs. This is due to the increase in non-collectable eggs (shell-less or ultra-thin shells) that are lost under the cages. This is a common occurrence with EDS. It has been established that the EDS virus affects only the shell gland but with ND and IB every portion of the reproductive tract can be affected.

If one disease had to be singled out as being the one responsible for the majority of the economically significant production losses in egg layers it would have to be Infectious bronchitis. Infectious bronchitis virus, a coronavirus, has a preference for the mucus membranes of the respiratory and reproductive tracts.

The kidney is also affected by certain IB virus strains. Not only is eggshell quality affected but internal quality also declines. Watery whites are very common and can persist for long periods after egg production returns. Also, an IB outbreak can result in a pale colored shell in brown shells.

Footnotes

1.
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2.
Gary D. Butcher, D.V.M., Ph.D., Assoicate Professor, Avian Veterinarian, College of Veterinary Medicine, and Richard Miles, Ph.D., Poultry Nutritionist, Poultry Science, Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida, Gainesville FL 32611.

The next article is by Carlyle Bennett, Business Development Specialist from Manitoba Agriculture Food, & Rural Initiatives.

Weak Shelled Eggs and Your Small Flock of Laying Hens

The mess left behind by broken eggs is an obvious reason for you to care about the shell quality of the eggs laid by your hens. A less visible reason is the higher level of salmonella found in cracked compared to intact eggs – especially if they are improperly washed.

The most **common causes of weak shells** eggs in your flock are:

- **Old Hens** – Shell strength declines steadily as hens get older. If you buy old hens from a commercial farm, they are already well past their prime for shell quality.
- **Calcium Deficiency** – To supply the calcium needed to make good shells, 10% of the feed must be supplied as limestone or oyster shell. For birds in floor pens, a hanging feeder of limestone or oyster shell can be used as the calcium source. When a layer diet is used as the sole source of calcium, restricted feed consumption due to crowding and other problems can also restrict calcium intake.
- **Poor Calcium Sources** – Insoluble granite grit and egg shells are poor sources.
- **Excess Phosphorous** – Too much phosphorous in the diet will decrease shell thickness. If you make your own feed, carefully weigh out the amount of mineral phosphorous.
- **Early Production** – Hens that begin egg production before you get them on a good layer diet can rapidly deplete their bone reserves of calcium.
- **High Temperature** – Temperature over 32°C stresses the hens and reduces shell strength.
- **Vitamin D3 Deficiency** – Hens need a commercial source of vitamin D3 in the feed. Deficiency is most visible in the winter months when the birds get less sunlight and make less vitamin D3 on their own.
- **Infectious Bronchitis** – This virus readily attacks the shell gland of unvaccinated birds.
- **Excitable Hens** – Hens that are excited may produce thin or poorly constructed shells.

Less common problems include insufficient manganese in the feed, toxins or pesticides, and miscellaneous diseases such as coccidiosis and Infectious Laryngotracheitis (ILT).

Shell quality can be improved by providing the nutrients needed for the hen to build her bone reserves of calcium and make good shells:

- Feed a third to half of the calcium as large particles that are approximately ½ cm in size. Both oyster shell and limestone the size of small pebbles will last longer in the gizzard and supply calcium at night when the hen makes the shell.
- Supply a pre-lay diet containing 2% calcium for the two weeks prior to the start of egg production. Due to hormonal changes as the birds ready for egg production, they are able to use the extra calcium to build up their bone reserves. A hanging feeder of limestone or oyster shell is another way to give the birds access to the calcium they need.
- Switch the flock immediately to a laying diet which has 3.5% or more calcium when you see the first egg laid by the flock. Approximately 10% of the diet must be limestone or oyster shell to provide this much calcium
- Let the hens will pick limestone or oyster shell as they need it from a hanging feeder. See the MAFRI web page on choice feeding.
- Give vitamin D3 in the water one day a week. Follow the package instruction and do not add more vitamin D3 than recommended.
- Keep your birds calm. Do not give them more than 16 hours of daylight. Letting them sleep longer will keep them calm during the time of day when they are forming the shell.

These practices will not stop the natural weakening of the shells as your hens age but will help to prevent any premature problems. If your old hens go into a moult, shell thickness will be temporarily improved.

The next two tables summarize infectious and non-infectious causes for reduced egg production. The tables are adapted from the factsheet *Factors Affecting Egg Production in Backyard Chicken Flocks* by J.P. Jacob, H.R. Wilson, R.D. Miles, G. D. Butcher, and F.B. Mather courtesy of the University of Florida, IFAS Extension. The complete version of both tables and the accompanying detailed explanations can be found at http://edis.ifas.ufl.edu/ps029.

Infectious Causes of Reduced Egg Production

Typical diagnostic signs associated with common diseases and conditions which can cause a drop in egg production.

DISEASE	**SIGNS**
Fowl pox	- scab-like lesions on the un-feathered body parts (especially face and comb)
Coccidiosis	- characteristic gross lesions in the intestinal tract - higher mortality in some cases - bloody droppings
Infectious bronchitis	- coughing, sneezing, and rales - egg production drops markedly (by as much as 50%) - soft-shelled or misshapen eggs - watery egg white - poor pigmentation of brown-shelled eggs
Newcastle disease	Mild form: - reduction in feed and water consumption Acute form: - respiratory distress - dramatic drop in egg production - twisted neck - decreased shell quality - increased mortality
Avian influenza	Mildly pathogenic form: - listlessness- diarrhea - sneezing, coughing Highly pathogenic form: - dark red/white spots on legs and combs - facial swelling - respiratory distress
Avian encephalomyelitis	- seldom show clinical signs - slight, transient drop in egg production
Mycoplasma gallisepticum	- coughing, sneezing, snicks, rales, nasal and ocular discharge - decrease in feed consumption and egg production
Fowl cholera	- sudden unexpected deaths - reduction in feed consumption - swollen wattles - nasal and ocular discharge - cyanosis of head - white water or green mucoid diarrhea
Infectious coryza	- swelling and puffiness around the face and wattles - thick, foul-smelling nasal discharge - labored breathing - decrease in feed and water consumption

Non-infectious Causes of Reduced Egg Production

Typical diagnostic signs associated with parasitic loads, or management practices and environmental conditions which can cause also a drop in egg production.

Causes of Decline	Signs/Symptoms
Omission feed Ingredients	
Salt	Nervous flock, increased pecking, feathers in digestive tract
Calcium	Birds down in cages, increased incidence of shell-less eggs
Vitamin D3	Increased mortality from calcium depletion, increased shell-less eggs
Protein	Increased nervousness, increased mortality (peckouts), poor albumen quality, feather eating
Fat	Low body weight gains, drop in egg size
Toxicoses	
Salt	Increased mortality due to urolithiasis, lowered feed intake
Phosphorus	Lower feed intake, soft bones, thin shells, increased shell-less eggs
Vitamin D3	Increased shell-less eggs, soft bones
Mycotoxins	Nervousness, mouth lesions, fatty livers, biliary hyperplasia in liver tissue, reduced feed intake, thin shell
Botulism	Weakness, limp neck, neck feathers easy to pull out, prostration
Anticoccidials	
Nicarbazin	Shell-less eggs, loss of pigment of brown eggs, lowered hatch, of fertile eggs
Monensin	Reduced feed consumption, birds lack coordination
Management Mistakes	
Out of feed	Nervous flock, decreased feed consumption
Out of water	Blue combs, birds gathered around waterers
Inadequate day length	Unusual pattern of egg production
High ambient temperature	Reduced egg size, reduced feed consumption, increased water consumption, panting

Ectoparasites	
Northern fowl mite	Nervousness, finding mites on birds (usually around the cloaca)
Lice	Nervousness, weight loss, reduced feed intake
Stick-tight fleas	Fleas embedded in the fleshy parts of the chickens's head around the eyes, ulceration and irritation of skin around the eyes
Endoparasites	
Nematodes (roundworms)	Unthriftiness, poor feed efficiency, increased mortality (in severe infestations)
Cestodes (tapeworms)	General unthriftiness, dry and unkempt feathers, hearty appetite but weight loss

Tips on Candling

The following website URLs might be useful for becoming familiar with the techniques of candling. Some of the URLs have 'how-to's for making a candling device yourself.

http://www.backyardchickens.com/LC-candling.html

http://www.surehatch.co.za/Egg-Incubation-Info-Incubation-Candling-Eggs.htm

http://www.shilala.com/incubating.html

The following factsheet was published by Mickey Aglio, Technical Manager, Aviagen NA in August 2001. The reproduction here is courtesy of Canadian Poultry Consultants Ltd. and can be found online at http://www.canadianpoultry.ca/breeder_nest_management.htm. See also the checklist on the bottom to find a list of useful points to remember.

Encouraging Hens to Lay in Nests and Minimizing Floor and Slat Egg Problems

by Mickey Aglio, Technical Manager, Aviagen NA, August 2001

Floor and slat eggs have become a common problem in many areas. Understanding the reason for these eggs being laid outside of nests and what can be done to minimize them is important. Because many companies now utilize the blackout rearing system, they have changed from "brood-grow-lay" systems to "brood-grow and move" [to lay houses] systems. This means that growers are now more specialized in either brooding and growing or production. This specialization should lead to better breeder management and performance.

Most meat-type chicken breeders today are grown completely sex separate. The social interaction of females and males in the lay house now becomes a factor. The male - female ratio and the level of sexual maturity of both the females and males can affect nest use. Most breeding companies recommend maintaining male - female ratio of 1:9. Males mixed for mating should be the same age, properly sized and conditioned to dominate females. When placed in the production houses, males tend to prefer the floor litter area in conventional one third – two-thirds slat houses. If for some reason the males are younger, in poor condition or smaller than the females, female aggression can occur, resulting in increased floor and slat eggs as well as poor fertility. When properly prepared, males become a factor helping to discourage females from nesting in the floor litter area.

House Preparation

It is generally accepted that there are certain preparations that must be made prior to the arrival of chicks into brooding facilities. Quite simply, properly prepared brooding housing must be comfortable and contain clean water and fresh feed to ensure chick survival.

Like the brooding facilities, production housing should also have minimum conditions to ensure comfort and optimum production. All equipment should be installed and operational, including the ventilation, feeders and watering systems. In most cases feeders and waterers are located on

slats. Males are usually fed separately and need to find their own feed. Manual egg collection nests should be properly bedded and ready. Mechanical gathering systems should be operational as soon after the birds are moved into the house so that collection belts can be run to acclimate birds to their operation and noise well before the onset of production. With brood-grow-lay facilities, the growing facilities must be transitionalized into a timely proper production facility. All production equipment, especially the nests must be prepared well before the expected onset of production.

Feeding and Watering

If a water restriction program is employed, water should be made available to the flock at the same time, or slightly before the lights are turned on in the morning. Water should be available throughout the feeding period, in most cases throughout the morning, and should coincide with the most active laying period. Late watering may draw hens off nests and they can "drop eggs" as they seek water.

Birds should be fed about 30 minutes after the watering and lighting, usually females a few minutes before the males. If a second quantity of feed is required, it should be scheduled to run as early as possible and before the initial quantity is consumed in order to provide a single continuous daily feeding. Two daily feedings should be avoided especially after hens go to the nests. Young hens are attracted to the feeders, so they leave the nests to satisfy their appetite and will lay eggs at the feeders.

Most separate male feeding systems are located in the litter area in the center of the house. Male pan feeders should be raised as soon as the male feed is consumed to prevent hens from laying under them.

Bell type drinkers should be maintained at an optimum height that allows all birds to obtain water but at the same time should not become potential protected nesting sites. Nipple systems minimize this problem.

Nest Management

It is important that birds be housed at the capacity of the equipment and available floor space. Birds should not be housed based on the available floor space alone. Consider two houses equipped with mechanical egg collection systems of different widths but with the same floor

space. Wider houses, more than 40 feet (12 meters) wide, tend to increase the number of hens per nest, while narrower houses, less than 40 feet (12 meters) wide, tend to decrease the of number hens per nest. The linear measurement of the house becomes the limiting factor on the number of nest holes that can be provided in houses equipped with mechanical egg gathering nests. The only way to avoid nest crowding is to add additional nest sections and reduce the passageway space between the nest units. This is not as much of a concern in houses equipped with conventional nests as increased nest space is easily added. It is strongly suggested to place no more than five and a half hens per hole for mechanical nests and four hens per nest hole for conventional nests.

Some companies have bowed to grower pressure to increase bird densities as a means of increasing grower pay while the amount of available equipment remains the same. This increases the number of hens per nest hole to a critical level, especially during the onset of production and at the peak production period. Hens do not have vacant nest holes available to them in the heavy laying periods and therefore, by necessity, lay on slats or find an alternative nesting site on the floor. This becomes especially critical in the morning hours when the demand for nest space is highest. Before the peak of production, most flocks will lay 80% or more of the day's production before 11:00 in the morning. This places a tremendous demand on nest space and tends to be the period when floor/slat eggs are the greatest.

Many times two hens will use the same nest hole. Often eggs are ejected from the nest or broken when either or both hens leave the nest. After production peaks, the daily laying cycle becomes more extended and nest demand is somewhat reduced. Crowding the capacity of the facilities can definitely increase the incidence of floor and slat eggs and lost production.

In accordance with some of the earlier recommendations, caretakers tend to delay opening nests to young birds until just before the expected first egg or after obtaining the first egg for fear of pullets fouling bedding or mechanical nest space. With intended nest space unavailable early, young hens look elsewhere for nest sites. Nesting space should be made available to pullets as early as possible, preferably as soon as moved birds become acclimated to new housing. Nest fouling can be largely discouraged by closing the nests late in the day preventing birds from roosting in the nest holes at night, and then open them before the lights come on in the morning. Most growers rebel at the thought of this extra work, and at the same time they do not hesitate to complain bitterly of the number of non-nest eggs. At least one third of the nests spaced

throughout the house should be accessible immediately after the initial light stimulation period, and all nest space should be available by the 22nd week of age.

Hens tend to have an affinity for the nest holes facing the litter area and toward the middle of the house rather than the nest hole facing the curtains or walls. The demand for these preferential nest spaces further adds to the shortage of usable nest holes. This means that hens simply do not have the desired nest space when they need it.

Making the nests attractive to young hens is very important. Nests must be in good repair with sound, solid bottoms, pads or fresh clean, dry bedding material. Fouled nests and dirty egg gathering belts need to be cleaned or replaced. Nest units should be stabilized and should not rock or move when hens enter or leave the unit. Perches need to be in good repair and structurally strong enough to support the potential weight of several birds at once.

Like feeding and watering systems, stray voltage can be an unseen problem with both conventional and mechanical egg collection systems. Producers are more likely to notice the existence of stray voltage in feeders or waters more quickly by the reduced consumption. Stray voltage in nests will invisibly discourage hens from using the nests causing them to seek alternative nest sites. Like feeder and drinker systems, nests should be checked for stray voltage with a meter before the birds are housed and several times throughout the laying cycle. It is important to check mechanical nest systems while the belts are running and stopped. Chickens can detect very low amounts of electricity, as low as 3 volts.

For safety, all systems should be grounded, however, in some cases grounding can actually increase the amount of stray voltage. Grounding is not a solution. The solution to any type of stray voltage problem is to find the source of the voltage and eliminate it. In difficult situations power companies can be very helpful.

Hens seem to have an attraction for new egg collection belts on mechanical egg collection systems. The choice of single center belt or double side belt types of mechanical egg collection nests does not seem to be a major factor in acceptance by hens. Managers seem too adamant in their opinions and preference. There are mechanical advantages to each system but all things being equal, this seems to matter little to hens. Producers seem to be successful with both systems and hens seem to accept them both.

Hens appear to prefer concave-shaped, molded plastic and artificial turf nest bottoms. Some producers utilize decoy eggs to attract hens to the nests. The presence of other eggs is often a clue for a hen looking for a nest site.

Training Birds to Lay in the Nests

Slats and litter areas should be slowly walked often, starting as soon as the birds are moved into the house. The critical time for pullets to look for nest sites is in the early morning but not exclusively early mornings. When caretakers walk slowly around the slats and litter areas, it should be with the express purpose of looking for pullets that appear to be making nests. (Walking 10 to 12 times in the morning is not too often.) This may be the single proactive management tool a caretaker has to discourage hens from floor nesting. As an added benefit, flocks with lots of human activity tend to be much calmer and less flighty. Pullets looking for alternative nest sites tend to be attracted to dark or solid walls, corners, next to steps, feed room walls, next to slat fronts, under bell drinkers and nests. Caretakers should try to gently pick up pullets attempting to establish nest sites and place them in nests. Disturbing birds trying to nest discourages them from using these sites. If it is apparent that hens will continue to utilize these areas, it may be necessary to fence birds from these areas with wire netting. After being disturbed several times, pullets usually seek quieter places - hopefully the intended proper nests.

Any time a floor or slat egg is found it should be collected. Gather floor and slat eggs frequently as uncollected eggs beget more eggs. As the flock increases in production, usually the number of times a caretaker must walk his house decreases, as does the incidence of floor eggs.

Mechanical egg gathering belts should be run several times each day, even before obtaining the first egg to acclimate pullets to the sound and vibration of the equipment. A good practice is to initially run egg gathering belts slowly in conjunction with the operation of the feeders. This should be done well before the expected arrival of the first egg. This tends to help hens adjust to the sounds and vibration of operating the system. After several days the egg collection system should gradually be run more often, several times during the morning and afternoon.

Slat Management

Slat height with heavy breeders is critical, especially with the yield type hens. Slat height with mechanical egg gathering systems should be no more than 50 to 56 cm. (20 to 22 inches) high, with the nests set back from the edge of the slats 30 to 36 cm. (12 to 14 inches). Nest openings

should be easily approachable to hens and may require lowering into the slat surface or with properly inclined ramps/perches. Feeder lines should be no closer than 24 inches from the front of the nest so as to not interfere with entry into the nest.

The slat height of conventional manual egg gathering systems is slightly less critical and may be increased to slightly higher levels, up to 60 cm. (24 inches), to help ease back strain on egg collection workers. Lower slats in conventional nest houses encourage birds to nest under the nests. Litter levels should be maintained at 5-8 cm (2-3 inches) deep to discourage birds from digging deep comfortable holes and laying in them. Very deep litter encourages floor hens to lay on the floor. With floor operations, conventional nests should be constructed so as to eliminate the more attractive dark space under the nests.

Lighting Management

Today, most breeder flocks are grown in light controlled or blackout housing. Breeder pullets should not be light stimulated before 21 weeks of age and in most cases waiting until the 22nd week of age enhances sexual maturity, prevents the early onset of production and small eggs. Pullets being placed in non-light controlled production houses should not be moved until the point of increased light stimulation. At the point of light stimulation, young hens, while not yet laying eggs, instinctively begin to look for attractive nest sites. The degree to which this happens tends to be influenced by the time of the year, environmental temperatures and several other factors.

Initial light stimulation should always exceed the threshold of light - 12 hours of light and 12 hours of darkness. The recommended first increase should be to 14 hours light and 10 hours of darkness. Increasing the uniform light intensity by approximately 10 times the growing intensity to at least 32 lux (3 foot candles) at bird level not only amplifies stimulation but helps to reduce living area shadows and make the darkened nests more attractive. Young hens tend to seek out these laying sites. Most of the newer halide-type lights offer more economical lighting and HPS lighting systems seem to be an advantage, especially when used in conjunction with mechanical egg gathering systems.

Evidence shows that there is no advantage to gradual pre-lighting of blackout grown pullets before the 21st week of age. In fact, gradual pre-lighting may tend to suppress and delay peaks. The recommended initial lighting is usually from 8 hours of light during the growing period to 14 hours of light at 22 weeks, followed by 1-hour weekly increases.

Evaporative pad cooling equipped houses normally need extra lights installed over the slats in front of the air inlet pad areas to brighten these normally darker areas. These additional lights should be wired into the main light clock circuit. The additional intensity will help discourage hens from laying in these normally problem areas.

Temperatures - Ventilation

There appears to be a strong correlation between the number of floor eggs, the onset of production and hen house temperature. Flocks coming into production in very warm or very cold conditions seem to lay more non-nest eggs. Chickens will seek the most comfortable conditions. Ventilation systems should be adjusted to maintain as comfortable an environment as possible. Temperatures should be ideally controlled in the 18° to 24 °C (65° to 75°F) range. Fans, foggers, tunnel ventilation and evaporative cooling all are extremely helpful. Housing and nest temperatures in excess of, or below the recommended range, can cause birds to shun nests. It is a fact that the body temperature of a hen increases up to 1°C (3°F) when laying an egg. In hot temperatures hens are reluctant to move to poorly ventilated nest spaces and prefer to remain in the more comfortable areas where the air is moving and feels cooler.

Hen house temperatures approaching 35°C (95°F) with raised humidity levels are very uncomfortable to chickens. Air movement helps chickens dissipate heat and remove water vapor (heat through respiration). When temperatures increase chickens will naturally seek areas where air temperature is even a degree or two cooler or where increased air movement makes the birds feel better. In extreme heat, more often than not the coolest temperatures are on the slats early in the morning and in the litter area later in the day. By dropping down even 50 cm (20 inches) to the floor birds can feel and will seek even as little as 0.5°C (about 1°F) drop in temperature. Rather than be exposed to the harsher temperatures, hens will lay where they are and remain cooler. Proper uniform tunnel ventilated housing with the effective use of evaporative cooling will help encourage the use of nests by hens in warm periods.

In extreme cold temperatures floor eggs can also be nearly as much of a problem as in very warm temperatures. When hen house temperatures approach freezing or below, birds will huddle together for warmth, usually in the litter area on floor and the hens will not venture to the nests. In these harsh conditions pullets and hens prefer to lay where they are and where temperatures are the most comfortable.

Hen house temperature/ventilation is the most common condition that has the greatest influence on inducing hens to use nests. Hens will always seek the most comfortable environment. If the nest conditions are uncomfortable or perceived to be threatening, hens will locate more favorable sites. Fans and fogging systems should not blow forcibly and directly into the nests. Wet breezy conditions tend to discourage hens from utilizing the offending nests except in the most extreme hot weather.

In most cases as flocks get older, they tend to lay more in the nests. It does appear that those flocks with more extreme floor/slat egg problems continue to be problem flocks throughout the laying period. The extra effort of planning, prevention and early training of pullets to lay in the nests, although not one hundred percent, seems to be the only means to help induce high production of nest laid eggs. As new management techniques and equipment is developed, new methods will be developed to attract hens to become proficient nest layers, thus producing clean high quality hatching eggs.

CHECK LIST

- House length and length, and bird density are factors affecting the number of hens per nest hole. Place no more than 5.5 hens per nest hole. Exceeding this usually increases the incidence of non-nest eggs.
- Maintain 2 to 3 inches (5 to 8 cm) of litter on the floor. Deep litter tends to encourage floor nesting.
- Slat height should be 20 to 22 inches (50 to 56 cm) high for mechanical nests and 24 inches (61 cm) high for conventional nests.
- This does not include litter.
- Light intensity should be uniformly at least 3-foot candles (32 lux) at bird level with a minimum of shadows or dark areas. Center mounted HPS lights seem to be an advantage.
- Provide adequate ventilation. Strive to maintain a uniform 65 to 75°F (18 to 24°) hen house temperature as much as possible. If the hen house temperature exceeds 86°F (30°C), then air movement (convection) is important.
- Mechanical nests require a clear open space 12 to 14 inches (30 to 36 cm) from the slat edge and 24 inches (61 cm) from any obstructions such as feeder lines or drinkers.

- Insure nests are in good repair, and stable and do not rock or move.
- Make properly prepared nests available to hens no later than the 22nd week of age.
- Nests, bedding, pads and egg collection belts must be kept clean and in good repair. Birds seem to be more attracted to nests with new egg collection belts.
- Initially run mechanical egg collection belts on slow speed while feeders run and then gradually several times during the day to acclimate hens to their sound and vibration well before the expected onset of production.
- All nests, both mechanical and conventional should be checked for the existence of stray voltage. The required grounding is not the solution. It is imperative that the source of any stray voltage be located and eliminated.
- Concave shaped, molded plastic and artificial turf bottoms appears to be preferred by hens. Some producers use decoy eggs to attract hens to the nests. It is believed that the presence of other eggs in a nesting site could be a clue for a hen looking for a nest site.
- As the onset of production approaches, slowly walk slats and litter area (10 to 12 times before noon is not too often) looking for birds attempting to nest outside the nests. Gently try to catch and place nesting birds into nests.
- Pick up floor or slat eggs frequently.
- Feed and water birds as soon as the lights are turned on each morning to reduce pulling hens from the nests.
- Feed females a few minutes before the males to move females onto the slats and closer to the nests.
- Raise center-mounted male pan feeders after the male feed has been consumed to discourage hens from nesting under them.
- Bell type drinkers and nipples should be properly adjusted high enough to remove protected nesting sites.
- Fence off particularly troublesome and attractive nesting areas (corners, fan tops or feed rooms) to prevent hens from laying in those areas. If dark areas can not be eliminated, fence them out.
- Planning, prevention and early bird training in the first four or five weeks of the pre-production and early production cycle is easier that collecting floor and slat eggs, and less costly than the egg losses during the entire forty weeks of production. The economics and benefits of the extra work are well worth the effort.

The following has been adapted from the 'Lesser Mealworm' factsheet by the University of North Carolina that can be found under http://ipm.ncsu.edu/AG369/notes/lesser_mealworm.html online. See the online version also for a diagram on the lifecycle of A. diapernis.

Lesser Mealworm

Alphitobius diapernis (Panzer), Tenebrionidae, COLEOPTERA

DESCRIPTION

Adult -- Lesser mealworm adults are shiny black, somewhat flattened darkling beetles with an oval outline (6 mm long). The head and thorax are densely covered with tiny depressions. The wing covers have tiny depressions arranged in more or less parallel rows. Newly molted adults are reddish-brown and slowly turn black.

Egg -- Lesser mealworm eggs are slender with rounded ends (1.5 mm long). The eggs are creamy white but darken with age.

Larva -- Lesser mealworms are slender, segmented, worm-like insects with three pairs of tiny legs on the thorax and one abdominal proleg at the rear. Lesser mealworms grow to 7.5 mm long.

Pupa -- Lesser mealworm pupae are somewhat worm-like in appearance and are creamy white just after molting (6 mm long). The pupae become tannish-brown just before molting to darkling beetle adults.

BIOLOGY

Distribution -- Lesser mealworms are found in grain bins, mills, and poultry houses throughout the world.

Food -- Lesser mealworms feed in grains and flour, particularly in damp, musty sites. Poultry houses with deep litter are ideal breeding grounds. Adults have been found feeding on carcasses in poultry houses.

Damage -- Lesser mealworms destroy insulation in poultry houses by extensive tunneling. In severe infestations, as much as 25% of insulation may be destroyed in one year. The virus causing Marek's disease of poultry and poultry tapeworms may be transmitted by darkling beetles. Occasionally young birds or sick birds may be attacked by darkling beetles.

Life History -- Lesser mealworms develop more rapidly in warm weather than in cold weather. Eggs hatch in 4-7 days. Tiny lesser mealworms hatch and develop in the litter. Lesser mealworms develop through several stages before they molt into the pupal stage. Larval development takes up to 7 weeks. Mature larvae seek a sheltered place to pupate because the darkling beetles prey on the lesser mealworms. Most of the damage to insulation is done by lesser mealworms seeking a safe place to pupate. The pupal stage lasts 7-11 days. Newly molted adult beetles are tannish-brown and darken slowly to black. A beetle may live two years and females lay up to at least 110 eggs a month.

Darkling beetles are commonly found in woods or around feed bins. These beetles fly well and are attracted to lights at night but hide during the day. The beetles are attracted to poultry operations because of the ideal conditions for their development (warm, humid litter and abundant feed). Certain aspects of the behavior of lesser mealworms and darkling beetles in poultry houses are presently unclear, particularly as to why adults enter the insulation and what can be done to inhibit this movement.

CONTROL

Monitoring lesser mealworm infestations in poultry houses is done with a beetle trap. One type of trap is plastic (PVC schedule 40) pipe 10 inches long with a roll of corrugated cardboard inside. When placed on the litter, lesser mealworms and darkling beetles crawl into the trap. The cardboard can be removed and the insects counted every week or two. Thus by using 3 to 5 traps per house, a producer can at least tell if his beetle population is increasing or decreasing. A rapid rise in the number of lesser mealworms per trap indicates a chemical treatment is necessary to prevent excessive damage to the insulation. By treating before the larvae become adults, the life cycle of the beetles is disrupted and longer control achieved.

Probably the single best strategy for darkling beetle control is frequent litter cleanout. This is not always feasible since total cleanout is costly and time consuming. Also, depending on the time of

year, cropland on which to spread the litter is not always available. Before removing infested litter to spread on a field, the litter should be treated with an insecticide 2 to 3 days before it is removed and then disked in after spreading. This will prevent beetles from migrating to nearby homes and other buildings and becoming a nuisance. As a cultural control measure, when cleaning out houses during cold weather, the curtains should be completely lowered for several days. This will allow the house to drop below 45 degrees F which kills the beetle eggs. It is also helpful to prevent extremely wet spots under waterers by either using spare waterers while the litter dries or by occasionally changing the waterers' positions.

In poultry houses with a prior history of darkling beetle problems, chemical control is recommended. Ideally, the litter, posts, and sidewalls to a height of 2 to 3 feet, should be treated as soon as possible after birds are removed from a heavily infested house. In cool weather, after birds are removed from a house, the beetles move quickly away from the surface of the litter. In cool weather, if the temperature in the house is allowed to drop before chemical application, poor control can be expected. It may also be helpful to treat new litter 1 or 2 days before birds are placed into the house. In houses that are half-brooded, chemic al costs may be reduced by treating only the brooded half, since beetle numbers are usually very low in the non-brooded section.

In houses with birds 8 weeks old or older, chemicals recommended for control may be applied with the birds present. Chemical treatments applied to the litter, however, cannot be expected to provide effective residual control over a long period of time, since most insecticides readily combine with the high organic content of the litter. Insecticides and disinfectants should not be mixed and sprayed together since most combinations are not compatible.

The following management advice, written by Eric R. Day, has been adapted from *FIELD CROPS 2011*, which contains recommendations for fly management by Virginia Tech.

Poultry Area Fly Control

By Eric R. Day, Extension Entomologist, Virginia Tech

There are several species of flies commonly found around caged layer poultry houses. The most common species are the housefly and the lesser house fly. Other annoying flies are blow flies (which breed on bird carcasses, broken eggs, and other garbage), soldier flies, fruit flies, gnats, and rat tailed maggots.

The house fly is by far the most important problem in caged layer operations. Not only are they a nuisance but they also are carriers of diseases. With the spread of non-farm residences into rural areas near poultry operations, egg producers are faced with increasing pressures from non-farm residents and health officials to control house flies. Also, the shift to large poultry operations has resulted in heavy concentrations of manure, a major source of fly breeding. According to workers in Georgia, as many as 1000 flies can develop in one pound of suitable breeding media. They are difficult to control, especially when the population becomes extremely high. A dedicated effort involving integrated pest management (IPM) will be needed to maintain house flies at a low level.

Fly Biology

All flies pass through four life stages: egg, larva (maggot), pupa, and adult. During its life cycle, which is about 30 days, a house fly female can lay up to 1000 eggs. These eggs are deposited on moist manure or any type of moist rotten or decaying organic matter. The eggs hatch in 10-12 hours and the maggots move into the wet manure. Fly maggots mature in 4-5 days under warm moist conditions. Pupation occurs in the drier parts of manure with the adult flies emerging in 3-5 days. Under ideal conditions a house fly can complete its life cycle in 9-14 days. The life cycle can be much longer in cooler temperatures.

Although capable of movement up to several miles, house flies normally move no more than one half to three quarters of a mile from their breeding sites.

An IPM Program to Control House Flies:

Step 1. Population Monitoring

It is essential to know as early as possible which houses are the major sources of fly breeding. The simplest and quickest method of taking quantitative fly counts is the moving tape method. A roll of ordinary sticky fly tape is carefully extended full length and held by the top loop so that the cardboard carton is almost touching the floor. The operator then walks at a normal pace up and down a standardized number of rows (at least 2 full rows) holding the tape by his or her side and slightly in front.

At the end of the circuit, the number of flies that have stuck on the tapes is counted and recorded on a chart. These counts should be made in each house twice a week. Population increases and decreases can then be seen and compared from each house. The problem houses can thus be determined early enough to begin supplemental control measures before the fly population gets out of control. The producer also has quantitative evidence of the progress of his or her IPM program to present to interested neighbours or health officials.

Treatment threshold: The producer has to judge, based on the population dynamics in each house, when to apply supplementary control measures. This decision is based on application costs and the nuisance situation to the surrounding residents.

Step 2. Sanitation and Manure Management

Inside: Manure is usually removed once a year in high-rise egg houses. It is allowed to cone up under the cages and kept as dry as possible. If at all possible, this manure should be removed during the cooler months of the year. Do not disturb the manure during the summer months. When it is spread on fields it is important to scatter the manure thinly so that the eggs and larvae are killed by drying. It is best to plow or disk it under immediately after spreading. In shallow pit houses, frequent removal of manure once or twice a week reduces fly breeding. It is important to make sure that spilled manure is not left in wet piles around the disposal equipment and in areas that the disposal equipment does not reach. If manure has to be stored, be sure to cover it completely with a heavy grade of black plastic. Cover the edges of the plastic with soil to prevent

house flies from entering. House fly eggs need relative humidity levels of 90% or higher to develop successfully.

Flies normally breed in wet manure (above 40% moisture). **Leaking waterers are a major source of wet manure.** Thousands of house flies can breed in just one leaking water spot. Daily inspection and repair of all leaking waterers is essential. Provide abundant cross ventilation by the use of fans above the cages and in the manure pits, especially in hot weather.

Outside: All garbage, leaking feed, spilled manure, bird carcasses, eggs, and miscellaneous trash should be removed regularly. Vegetation, weeds, and grass should be kept trimmed around the houses. Junk, trash, and rusting equipment which provide resting sites for flies should be removed. Install proper eave troughs and down spouts on houses to carry rain water away from buildings. Provide proper drainage in poultry yards and roadways.

Step 3. Biological Control

Natural fly predators (insects and mites that actively feed on fly eggs and larvae) and parasites (small, stingless wasps that lay their eggs in and kill the pupae of house flies) can build up in manure accumulations. They can significantly reduce house fly breeding. Biological control is more effective if the sanitation and manure management as listed in Step 2 is conscientiously applied. In high-rise houses, never clean out a house completely of manure. Leave at least a fourth of the manure undisturbed so that the natural enemies can survive and move into the new manure. Biological control is not as effective in shallow-pit houses; however, if manure is kept dry, the natural enemies are more effective.

Several commercial companies sell parasites for release in poultry houses. These parasites are supposed to be self-propagating in the process of controlling flies; however, quality control of these commercially available parasites is quite variable. Often, only a small percentage of the parasites are actually alive by the time the producer receives them. Producers intending to use these parasites are advised to set aside a small sample of them to check for emergence before releasing them in the houses.

A specific biological control program for house flies in high-rise poultry houses has been developed for Virginia. A predaceous fly larva, Hydrotaea aenescens, is mass-reared and released,

resulting in a low house fly population with a reduced need for chemical control. (For more information, see VCE publication 444-769, “Instructions on Insectary Establishment, Mass Rearing, and Release of *Hydrotaea aenescens*: a House Fly Predator”)

Step 4. Chemical Control

Insecticides should be used to supplement steps 2 (sanitation) and 3 (biological control). Insecticides can be used to attract and kill those flies that survived the larval stages. They should be applied so that they will not contact and kill house fly predators and parasites. Other insecticides can be used as an emergency control measure when fly populations threaten to overwhelm IPM control measures.

Fly Baits: These are designed to kill flies that have escaped the natural enemies in the manure and should be a regular part of the house fly IPM program. They are inexpensive and simple to use. They should be put out at the beginning of the fly season and renewed at least once a week through warm weather. Baits should be placed in containers (i.e., egg cartons) or glued onto cardboard panels so they will not fall into the manure pits.

Contact Sprays: If the moving tape counts indicate that the fly population in a house is threatening to overwhelm the natural controls, contact sprays can be used. As the name implies, these sprays kill flies on contact and are effective as a quick knock down treatment. Contact spray insecticides have a short residual life and will not prevent a later re-infestation. Do not spray in the manure pits or directly on the birds, eggs, feed, or water.

Residual Sprays: These insecticides have a longer residual life and can be used both inside and outside where flies congregate. In darkness, flies tend to “roost” on the upper walls and ceilings of layer houses, so residual insecticides should be concentrated in these areas. Because insecticide resistance is possible, residual sprays should be applied only to problem houses and areas where the moving tape counts indicate that the population growth is becoming serious.

Lighting for Poultry

By Bill Cox, DVM, Poultry Extension Veterinarian, BC Ministry of Agriculture

The importance of lighting as an element of good management is often overlooked. But there are some critical times at which good lighting will improve not only production but also the health and well-being of a flock. Lighting requirements will be quite different between flocks that are kept for egg-laying, whether table eggs or hatching eggs, and those kept for meat.

1. Lighting Basics

Managing the light for any birds requires attention to intensity and duration. Light intensity is measured in several ways, but the most relevant terms are "lumens" and "lux" or "foot-candles". The actual light output from a light source is measured in lumens; for example, incandescent bulbs emit about 13 lumens per watt. The further away from a light source a working surface is, the more the light is diffused or spread out. This means that the light loses its intensity as one moves away from the source. The measure of light at any point away from the source is termed "lux" or "foot-candles". One foot-candle is equivalent to 10 lux. This is the measure that is most important when managing lighting intensity for poultry. Light intensity of 10 lux is sufficient to read a newspaper. Intensity on a bright, sunny day in mid-summer is about 80,000 lux.

Generally speaking, light intensity should be between 10 and 30 lux at bird level for most layer chickens. Because the intensity lessens with distance from the light source, the desired light density should be measured in corners that are furthest away from the source.

Lighting duration must meet the biological requirements of the bird. So, for young layer breeds, the goal is to provide a period of time for growth and maturity before the birds are brought into production. Light duration, therefore, should be only 8 hours during the development period. Beginning at about 17 or 18 weeks of age, light duration can be raised to stimulate egg production. The minimum lighting duration for laying birds is 14 hours per 24 hour period, and this can be as high as 18 hours, depending upon the breed of bird. Light duration should be lengthened gradually over a 1 to 2 week period until the desired day length is met. More detailed information on lighting programs can usually be found with the specifications for the breed.

The optical spectrum is the range of wavelengths of energy that collectively make up light. This spectrum is broken down into three categories which are known to most: ultraviolet, visible, and infrared. The visible range includes those wavelengths (and colours) that are visible to humans, while ultraviolet and infrared are invisible to our eye. Generally, increasing the duration of visible light is used to stimulate sexual maturity and egg production.

The question is often asked about whether or not the use of infrared heating lamps will interfere with the bird's "lights out" time. Most research indicates that chickens perceive a similar spectrum to humans, but will also perceive some of the ultraviolet wavelengths. There is no indication that they perceive infrared as visible light. Most infrared lamps, however, are not purely infrared and actually do include some of the visible spectrum, so such lamps should be considered as visible to chickens as well. On the other hand, drowsiness and sleep are initiated by the body's production of a hormone called melatonin. The production of melatonin is suppressed by light, thus creating wakefulness during daytime. It is known that this suppression is caused by the blue and violet end of the spectrum; therefore it is likely that birds exposed to the red wavelengths accompanying infrared will not suppress melatonin production. This means that heating benefits of infrared lamps will outweigh any negative effects of associated visible red wavelengths, which are likely negligible.

2. Lighting Quality

In addition to intensity and duration, it is important that light be evenly distributed around the barn or coop. Providing more bulbs with lower wattage is a better arrangement than fewer bulbs with high wattage. Bulbs should be placed so that few shadows are cast in the bird area. Lights should also be placed so that nest boxes do have some shading, making them desirable for hens in which to lay their eggs. If shadows are present in the barn or range area, hens will often use those areas to lay their eggs. This is an undesirable arrangement as eggs laid on the floor or ground will have a greater chance of being contaminated by various bacteria, including Salmonella.

Dirty or dusty bulbs will significantly cut the amount of light reaching bird level and, so, should be cleaned frequently. Any dead bulbs should be replaced immediately so that dark, inviting areas are not created. Such spots can become a favoured egg-laying area if the birds are allowed to habituate those areas.

3. Brooding

The first 1 to 2 weeks is the most important time of the flock's life. Whatever happens to a flock during that period will have a significant effect on its long-term well-being. The key to good brooding is to get all birds on feed and water within the first 24 hours, and good lighting will help to achieve that goal. Some tips for lighting during brooding:

- For the first week, have high intensity lighting (at least 20 to 30 lux) that attracts chicks to water. Poultry will instinctively peck at shining surfaces and water that is highlighted by good lighting will attract chicks very quickly.
- Allow some rest time, with at least 1 to 4 hours of darkness during a 24 hour period for up to 3 days. Rest is as important to chicks as feeding time.
- At 3 to 4 days, day length can be reduced. This should be done gradually to 8 hours light over a period of a few days.
- For birds that are being raised for meat, the lighting duration can be dropped less drastically, to provide up to 16 hours of light per day.

4. Stimulating Egg Production

Birds typically come into egg production over spring and into summer, stimulated by the lengthening daylight. This same natural process can be simulated with artificial light. The technical details around the process of lighting the birds may vary, and the best source of information for specific birds is to request it from the breeding company that supplied the chicks.

Lighting duration is increased beginning at about 17 or 18 weeks of age and increased gradually over 1 to 2 weeks until the duration is 14 to 16 hours daily.

Lighting is an important part of the array of management tools available and should not be taken for granted. Good lighting applied in the appropriate manner at the appropriate times will go a long way to ensuring a healthy flock.

Official BC Biosecurity Standards for commercial poultry production

BC Poultry Biosecurity Program

January 15, 2011

Applicability: These biosecurity standards apply to those poultry producers in the province of British Columbia regulated by the BC Chicken Marketing Board, the BC Egg Marketing Board, the BC Broiler Hatching Egg Commission or the BC Turkey Marketing Board.

Risk Assessment: Where it is either not feasible or not economically reasonable for a poultry producer to implement certain mandatory biosecurity standards, and where an alternate approach can be implemented that meets the intent of the standard, and where that alternate approach has by virtue of a risk assessment an acceptable level of biosecurity risk, the certification agent may, upon a successfully completed audit of the standards, issue a biosecurity certificate of compliance to the farm.

1. Farm Access Standards

1.1 Secure Barrier Mandatory Standard # 1

1.1.1 A secure barrier that restricts vehicle entry must be present at all primary and secondary accesses to the Controlled Access Zone.

Rationale: *Secure barriers are the first line of defence in minimizing the transmission of infectious diseases both to and from the farm operation.*

1.1.2 Interpretive Guidelines:

a. The barrier should be a fixed gate, chain or equivalent that restricts access.
b. The secure barrier must remain closed other than:
    i. When a vehicle is passing into or out of the CAZ

ii. When a limited activity such as feed delivery or manure handling is underway
iii. When the CAZ is supervised

c. The secure barrier should deter unauthorized foot traffic.
d. The barrier must be capable of being secured with a lock.
e. All secondary access barriers must be closed other than when a vehicle is passing through them or when a time limited activity such as a manure hauling is underway.
f. Driveways that do not provide vehicular access to the Controlled Access Zone do not require a secure barrier.
g. For safety reasons, the primary access should provide sufficient room for all vehicles to get completely off a public road.
h. Where feasible, farm residences should be accessed from outside the Controlled Access Zone.

1.2 Access Signage Mandatory Standard # 2

1.2.1 Approved biosecurity signage must be clearly displayed at all primary and secondary accesses.

Rationale: *The security of the Controlled Access Zone is strengthened by effective signage.*

1.2.2 Interpretive Guidelines:

a. Biosecurity signage must be those approved by the appropriate board or commission.
b. Signs must be readily visible, clean, and legible and located where they can be readily viewed.
c. The sign for secondary accesses must include instructions to locate the primary access.
d. Signs must communicate that the zone to be entered is a biosecure area.

1.3 Primary Access Surface Mandatory Standard # 3

1.3.1 All primary accesses to the Controlled Access Zone must be constructed of hard surface or gravel that prevents any persistent accumulation of pooled water.

Rationale: *Standing water can harbour infectious diseases that may be transported to or from the premises by vehicular traffic and people. Such protected pathogens also serve as a reservoir that may re-infect the farm after cleaning and disinfection.*

1.3.2 Interpretive Guidelines:

a. Persistent standing water must not be evident on the driveway.
b. All driveways, particularly gravel driveways, must be maintained to prevent grades or potholes that allow the persistent accumulation of pooled water.

1.4 Cleaning and Decontamination Site Mandatory Standard # 4

1.4.1 All primary accesses to the Controlled Access Zone must have an approved cleaning and decontamination site for vehicles and personnel.

Rationale: *Visible accumulations of organic matter can transport infectious disease onto or off of the premises. As with water-protected organisms, this organic debris can serve as a reservoir that may re-infect the farm. These accumulations must be removed to reduce the risk of disease transmission. In the event of an infectious disease outbreak, disinfection may be required to further reduce the opportunity for disease to spread to or from the premises.*

1.4.2 Interpretive Guidelines:

a. The cleaning site must include the availability of a source of pressurized water.
b. The decontamination site must provide the potential to undertake disinfection measures as deemed necessary.
c. Procedures must be available that describe how vehicles and personnel are to be cleaned and/or decontaminated.

1.5 Access Maintenance Mandatory Standard # 5

1.5.1 The Controlled Access Zone must be maintained clean and free of organic debris at all times.

Rationale: *Visible accumulations of organic matter can harbour and allow transport of infectious organisms onto or off of the premises and can serve as a reservoir for re-infection.*

1.5.2 Interpretive Guidelines:

a. Any organic material accumulation in the Controlled Access Zone that might result in infectious material being transported onto or from the farm by footwear, vehicle tires or a vehicle's undercarriage must be cleaned up.

2. Barn Access Standards

2.1 Locked Barn Entrance Mandatory Standard # 6

2.1.1 All poultry barn entrances shall remain locked at all times that the barn is unsupervised by farm personnel.

Rationale: *Barn entrances are high disease transmission risk areas and are the last line of defence in preventing disease transmission. It is therefore necessary to prevent inappropriate access*.

2.1.2 Interpretive Guidelines:

a. Barn entrances that can only be opened from the inside are considered locked.
b. Barns should provide sufficient functional exits for the safety of personnel inside the building.
c. All animals are prohibited from the Restricted Access Zone, unless in compliance with other Board audited programs.

2.2 Approved Signage Mandatory Standard # 7

2.2.1 Approved restricted access signs shall be posted at all barn entrances.

Rationale: *The barn entrance is a high disease transmission risk area and is the last line of defence in preventing disease transmission. It is therefore appropriate to post signs to limit non-essential access*.

2.2.2 Interpretive Guidelines:

a. Signs posted must be those approved by the appropriate board or commission.
b. Entrance signs will identify that the area beyond the entrance is a Restricted Access Zone.
c. Entrance signs must be readily visible, clean and legible.

2.3 Anteroom Mandatory Standard # 8

2.3.1 All poultry barns must have an ante room at all primary entrances that allow personnel to comply with the farm biosecurity procedures during entry and exit.

Rationale: *Primary barn entrances are the last line of defence in preventing disease transmission. The ante room provides a unique opportunity to reduce the risk of disease transmission by minimizing any contaminants moving from the outside environment to the inside and from the inside environment to the outside.*

2.3.2 Interpretive Guidelines:

a. The anteroom provides a transition zone and must:

- permit adequate space for a distinct physical separation of the "outside area" and all "inside areas"
- have a clearly identifiable demarcation between the outside and the inside area

b. The anteroom must be equipped for:

- hands to be cleaned with appropriate disinfectants
- a change of clean/disinfected boots across the outside / inside demarcation
- a change of clean/disinfected outerwear including head cover
- sufficient space for the number of personnel utilizing the anteroom

c. The minimum standard for a free range farm anteroom will consist of a covered area with demarcation and boot change when entering or leaving the range area.

2.4 Anteroom Maintenance Mandatory Standard # 9

2.4.1 Barn entryways and ante rooms must be maintained clean and free of debris at all times.

Rationale: *Visible accumulations of organic matter may harbour infectious organisms and increase the risk of the transmission of these organisms either into or out of the barn. Accumulations of organic matter must be removed to reduce the risk of disease transmission.*

2.4.2 Interpretive Guideline: anterooms must be regularly cleaned and disinfected.

3. Flock Health Management Standards

3.1 Flock Health Records Mandatory Standard # 10

3.1.1 Individual flock health records must be maintained.

Rationale: *In the event of a disease outbreak the individual flock health records will provide invaluable information to assist in containing the outbreak.*

3.1.2 Interpretive Guideline:

a. Records must include a count of mortalities collected at least once each day.
b. Production records must be kept.
c. Veterinary and diagnostic reports are also part of the health records.
d. Any response to an unusual mortality rise, including submission for diagnosis, treatments undertaken, or management adjustments, must be recorded.
e. Any addition or removal of birds to or from a flock must be recorded and all health records accompanying the birds must be kept in the flock records.

3.2 Mortality Management Mandatory Standard # 11

3.2.1 Poultry mortalities and cull eggs must be handled and disposed of in an approved manner.

Rationale: *Dead birds and cull eggs may be a high risk source of infectious disease organisms and must therefore be handled and disposed of in an approved manner.*

3.2.2 Interpretive Guidelines:

a. Producers must dispose of mortalities and cull eggs in a manner that is consistent with provincial standards such as incineration or composting.
b. Disposal of mortalities and cull eggs on farm is preferred to off farm transport.
c. All mortalities transported off-farm must be placed in clean disinfected containers and the containers sealed prior to leaving the premises.
d. Large numbers of mortalities that result from a disease outbreak must be handled in a manner consistent with industry and government requirements.

4. Farm Management

4.1 Pest Control Mandatory Standard # 12

4.1.1 An effective pest control program must be in place.

Rationale: *Pests are active and passive disease transmitting vectors. Minimizing pest populations will reduce the risk of disease transmission.*

4.1.2 Interpretive Guideline:

a. Premises should be maintained in a manner that minimizes pest infestations.
b. Rodent and insect control programs that are designed to reduce existing pest populations and prevent further establishment of pests must be documented.

4.2 Protection of Feed and Water from Contamination Mandatory Standard # 13

4.2.1 A management program that prevents the contamination of feed and water sources must be in place.

Rationale: *Contamination from the external environment may introduce and/or transmit disease.*

4.2.2 Interpretive Guidelines:

a. Premises should be maintained in a manner that minimizes environmental contamination including, but not limited to, the proper storage of feed, the elimination of water leaks, the maintenance of water quality and generally good housekeeping measures such as the removal of debris.

4.3 Cleaning and Decontamination of Equipment Mandatory Standard # 14

4.3.1 All equipment and materials related to the production of poultry that enter or leave the Controlled Access Zone, regardless of size or use, must be clean and decontaminated.

Rationale: *Visible accumulations of organic matter can harbour infectious organisms, allowing their transport onto or off of the premises. These accumulations must be removed to reduce the risk of disease transmission.*

4.3.2 Interpretive Guidelines:

a. All equipment and materials related to the production of poultry and poultry products that are not visibly free of organic matter accumulations must not enter or exit the primary or secondary access.
b. Recycled poultry related equipment such as egg pallets, catching crates, sawdust pipes and manure handling equipment is considered high risk and should be treated appropriately.
c. Producers are encouraged to conduct business with allied trades that have adopted biosecurity practices complementary to the BC On-Farm Biosecurity Program and the relevant standards.

4.4 Manure Management Mandatory Standard # 15

4.4.1 All farms must have a documented manure management strategy.

Rationale: *Manure can be a high risk source of disease transmission. The strategy for manure management can therefore be critical in the event of a disease outbreak.*

4.4.2 Interpretive Guideline:

a. A manure management strategy will, at a minimum, document how the manure was utilized and/or who transported it from the farm.

4.5 On-Farm Biosecurity Training for Producers and Farm Employees Mandatory Standard # 16

4.5.1 On-farm biosecurity training is required for all producers and farm employees.

Rationale: *In order to achieve the intent of the standards it is essential that producers and employees understand the reasons for the standards and their ability to affect the level of biosecurity attained on the premises.*

4.5.2 Interpretive Guidelines:

a. An on-farm biosecurity training program must be in place.
b. On-farm biosecurity training is an on-going requirement with the need to update farm personnel and train new personnel at regular intervals.

4.6 Standard Operating Procedures Mandatory Standard # 17

4.6.1 Standard Operating Procedures for on-farm biosecurity must be available.

Rationale: *Standard operating procedures recognize that biosecurity is an on-going activity and provide processes for maintaining biosecurity standards and assist with biosecurity training.*

4.6.2 Interpretive Guidelines:

Standard operating procedures will include but not be limited to:

- Self quarantine procedures
- Farm access policies for employees, allied trades, and visitors
- Primary and secondary access maintenance scheduling
- Cleaning and decontamination site operation and maintenance
- Controlled Access Zone housekeeping procedures
- Ante room procedures and housekeeping
- Building cleaning and disinfection procedures
- Pest control program
- Biosecurity training approach
- Mortality disposal procedures
- Manure management strategies
- Scheduling for the review and updating of standard operating procedures

4.7 Activity Log Book Mandatory Standard # 18

4.7.1 An activity logbook for the premises that records daily on-farm activities relevant to the biosecurity standard operating procedures must be maintained.

Rationale: *In the event of a disease outbreak the activity logbook for the premises will provide critical information to assist in containing the outbreak. The premises logbook will also provide documentation verifying that biosecurity standard operating procedures are being followed.*

4.7.2 Interpretive Guidelines:

The activity logbook for the premises will regularly document activities including but not limited to:

- Primary access, secondary access, and Controlled Access Zone maintenance
- Cleaning and decontamination undertaken including barn sanitation and dust management
- Pest control measures undertaken.

- All visitors and allied trades entering the Controlled Access and Restricted Access Zones (allied trade documentation such as feed slips and/or invoices with date and personal entering the zone may serve as CAZ or RAZ documentation)
- Biosecurity training undertaken
- Flock health diagnostic reports, treatments and mortality
- The name of company or individual transporting manure off the farm and, where known, the receiver

4.8 Multiple Species within a Controlled Access Zone Mandatory Standard # 19

4.8.1 No unlicensed avian species or porcine species may be kept within a Controlled Access Zone or a Restricted Access Zone where licensed production is occurring.

Rationale: *Domesticated birds and porcine species may harbour infectious diseases that can increase the risk of disease transmission to chickens or turkeys.*

4.8.2 Interpretive Guidelines:

a. Chickens and Turkeys must not be raised on bedding that was previously used for rearing waterfowl.
b. Where any waterfowl are raised in a barn followed by a flock of chickens or turkeys in the same barn (Restricted Access Zone), the producers' standard operating procedures must clearly describe the extra measures, such as manure removal, thorough cleaning, disinfection, and drying that will be undertaken to minimize the risk of disease transmission to any subsequent licensed production.
c. All birds particularly waterfowl, should be discouraged from entering the Controlled Access Zone.
d. All birds, other than those being reared for commercial purposes, must be prevented from entering the Restricted Access Zone while production is underway.

Definitions *(for the purposes of the above 19 standards)*:

Allied Trades: Service personnel such as veterinarians, meter readers, equipment repair and installation technicians, government officials and construction workers who may, from time to time, be required to enter the Controlled Access or Restricted Access Zone.

Ante Room: A service area or room that immediately precedes the poultry production area and provides a clean, dry transition area from the outside environment into the bird housing section of the barn.

Approved: Approved by the relevant Poultry Marketing Board or Commission.

Barn: Any structure that encloses poultry flocks including free range pens.

Barn entrance: An opening into the production area that provides personnel with access to the interior of a barn but that is not normally used by personnel to enter the barn.

Canine Species: A species that includes dogs.

Clean: Free of any visible accumulation of organic matter and debris that might contaminate the Controlled Access Zone.

Cleaning and decontamination site: A facility just inside a primary access that provides for the cleaning, decontamination and possible disinfection of equipment and personnel that is constructed to withstand repeated use and provides for appropriate containment and management of waste water and disinfectants as required.

Controlled Access Zone: The area of land and the exterior of buildings constituting the premises that is accessed through a secure primary access.

Debris: Scattered remains, organic matter, or material that may be capable of harbouring disease-causing organisms.

Lock: A secure fastening device that requires a key, code or key fob to open.

Hard Surface: A durable concrete or asphalt surface constructed to maintain a grade that allows for the rapid draining of water.

Licensed Production: Any poultry production regulated by the BC Chicken Marketing Board, BC Egg Marketing Board, BC Broiler Hatching Egg Commission or the BC Turkey Marketing Board.

Organic Matter: Visible debris that is capable of disease organism transmission including, but not limited to, manure, egg white, egg yolk, egg shells, feathers, and soil.

Porcine: A species that includes all domesticated and wild pigs, swine or hogs.

Poultry: Chickens and turkeys used for food or for their eggs.

Premises: A poultry farm that is under the ownership or management of the producer and that is a discreet operational unit with a contiguous property boundary.

Primary access: The primary access is the main entry point through which all necessary traffic, such as workers and feed trucks, will enter the Controlled Access Zone. There is only one secure primary access.

Primary barn entrance: The point of entry to a barn that would normally be utilized for day to day barn access.

Residence: A dwelling or house that provides living quarters.

Restricted Access Zone: The interior area of all structures on the premises intended to house poultry, regardless of whether or not they are populated. The Restricted Access Zone is contained within, but is not part of, the Controlled Access Zone.

Secondary access: The secondary access is a farm entry point for farm use or emergency use only.

Secure barrier: An obstruction such as a chain, gate or equivalent located at all primary and secondary accesses that delineates a Controlled Access Zone and constrains the passage of vehicles and deters unauthorized foot traffic.

Treatment: Any product or procedure to remedy or prevent a disease.

Unlicensed Avian Species: Any avian species not regulated by the BC Chicken Marketing Board, BC Egg Marketing Board, BC Broiler Hatching Egg Commission or the BC Turkey Marketing Board.

Visitor: Includes any person that enters the Controlled Access or Restricted Access Zone, excepting regular farm employees and those persons that are only travelling directly to and from a farm residence.

Biosecurity

Standard Operating Procedures (SOPs)

Farm Name: _____

Owner / Manager: _____

Address: _____

Date: _____

Revised: November 1, 2007

Mandatory Standard #17
Standard operating procedures (SOPs) for on-farm biosecurity must be available for audit review.

Interpretive Guidelines
SOPs recognize that biosecurity is an on-going activity and provide processes for maintaining biosecurity standards and assist with biosecurity training,

SOPs will include but are not limited to:

1. **Self quarantine procedures**
2. **Farm access policies**
3. **Primary and secondary access maintenance, Cleaning and Decontamination site operation and maintenance, and Controlled Access Zone Housekeeping**
4. **Anteroom procedures and housekeeping**
5. **Building cleaning and disinfection procedures**
6. **Pest control program**
7. **Biosecurity training approach**
8. **Mortality disposal procedures**
9. **Manure management strategies**
10. **Scheduling for the review and updating of SOPs**

Having written SOPs will ensure that tasks are understood and carried out accurately, no matter who is following them.

- SOPs provide direction
- Reduce training time for staff
- Increase efficiency
- Reduce the need for extra record keeping

Mandatory Standards are arranged under four major groups according to specific elements of biosecurity. Each section has SOPs to assist in training and contribute to improvement in how things are done.

1. Farm Access Standards
2. Barn Access Standards
3. Flock Health Management Standards
4. Farm Management Standards

The following Standard Operating Procedures are examples you may use in designing your own SOPs

Alternatively, a universal template is presented at the end of this section, which can be used to create any Standard Operating Procedure. In its electronic form, details can be typed directly into the template or sections can be cut from the examples and pasted into the template.

It is important, however, that the procedures outlined be edited to properly reflect the procedures actually used on your farm. While some specific details are given in these examples, they are generalizations only and do not necessarily need to be followed. The details in the SOPs must reflect your procedures on that farm unit.

STANDARD OPERATING PROCEDURE 1

FARM NAME: _____

TITLE: Self-quarantine

Date: _____ **Supersedes: _____**

Objective: To provide the steps required in imposing a self-quarantine if an infectious disease is suspected

Responsibility: _____

Introduction:

On the suspicion of an infectious disease, characterized by a rise in the number of sick or dead birds, it is important to take all possible measures to limit the spread of the infecting organism. These measures will help to protect other birds on your farm that are not yet affected and other poultry operations in your area.

Procedures:

1. Lock the gate to the Controlled Access Zone.

2. Begin enhanced biosecurity procedures:
   - Restrict access to the affected barn. If possible assign 1 person to that barn only.
   - Service unaffected barns first.
   - Full clothing change after servicing affected barn(s).
   - Restrict any movement by non-essential personnel between residential area and controlled access zone.

3. Postpone any non-essential farm visits.

4. Notify essential farm visitors (e.g. feed delivery) of the situation and request they make delivery to your farm the last of the day.

5. Postpone any vaccinations.

6. Postpone any bird movement on or off of the farm.

7. Dispose of all carcasses on-farm (protected compost or incineration).

8. Clean and disinfect any vehicle leaving the farm (including personal vehicle).

9. Change into non-farm clothing when leaving the farm.

If Applicable:

Please refer to SOP # in your Board or Commission's On-Farm Food Safety Programs.
Chicken (Safe, Safer, Safest) –Table Egg (Start Clean, Stay Clean)
Hatching Egg (Cheq Program) – Turkey (Turkey On-Farm Food Safety)

STANDARD OPERATING PROCEDURE 2

FARM NAME: _____

TITLE: **Farm Access Policy**

Date: _____ **Supersedes:** _____

Objective: **To describe the procedures for entering the farm**

Responsibility: _____

Introduction:

A secure barrier that restricts vehicle entry must be present at all primary and secondary accesses to the CAZ (Controlled Access Zone). Secure barriers are the first line of defence in minimizing the transmission of infectious diseases both to and from the farm.

Procedures:

1. Keep a log of all truck traffic and visitors entering the CAZ.
2. All vehicles are to stop at the gate and use cleaning and decontamination facilities if necessary..
3. Examine vehicles for debris in wheel wells, on tires or on undercarriage.
4. If debris is visible, use pressurized water to remove debris.
5. Spray wheels and wheel wells with disinfectant if necessary.
6. Open gate.
7. Have vehicle enter the CAZ and then close the gate.
8. Have vehicle proceed to the appropriate area.
9. Close the gate after the vehicle leaves the farm.

If Applicable:

Please refer to SOP # in your Board or Commission's On-Farm Food Safety Programs.
Chicken (Safe, Safer, Safest) –Table Egg (Start Clean, Stay Clean)
Hatching Egg (Cheq Program) – Turkey (Turkey On-Farm Food Safety)

STANDARD OPERATING PROCEDURE 3

FARM NAME: _____

TITLE: Primary and Secondary Access Maintenance Scheduling, Cleaning and Decontamination Site Maintenance, and Controlled Access Zone (CAZ) Housekeeping

Date: _____ **Supersedes:** _____

Objective: To describe the steps in maintaining the controlled access zone and entrance(s) to the farm.

Responsibility: _____

Introduction:

Visible accumulation of organic matter can transport infectious disease onto or off the premises. This debris can serve as a reservoir that may re-infect the farm. In the event of an infectious disease outbreak, disinfection may be required to reduce the spread of disease to or from the premises.

Procedures:

1. Check for and repair driveway potholes that allow persistent accumulation of water.
2. Hose down any areas that have accumulation of debris from vehicle traffic.
3. Hose debris away from roadway into a catchments area.
4. Keep disinfectant spray container accessible at the primary access of the controlled access zone.
5. Ensure pressurized water or directions to access it are available at the primary access.
6. Ensure primary and secondary access signs are visible and in good repair.
7. Keep grass and vegetation in CAZ mowed or controlled with herbicide.
8. Remove any non-essential equipment from the immediate area around the barns.
9. Check to ensure all signs are intact and legible.

If Applicable:

Please refer to SOP # in your Board or Commission's On-Farm Food Safety Programs.
Chicken (Safe, Safer, Safest) –Table Egg (Start Clean, Stay Clean)
Hatching Egg (Cheq Program) – Turkey (Turkey On-Farm Food Safety)

STANDARD OPERATING PROCEDURE 4

FARM NAME: _____

TITLE: Anteroom Housekeeping and Entry & Exiting Procedures

Date: _____ **Supersedes: _____**

Objective: To describe the procedures for maintaining the anteroom

Responsibility: _____.

_____

Introduction:

A clean and tidy anteroom not only reflects on the perceived quality of care that the flock within the barn receives but also provides an environment in which the risk for accumulation of pathogens is significantly reduced. This will also be an environment that discourages the presence of pests that may be vectors of pathogens.

A. Housekeeping Procedures:

The anteroom must have a distinct physical separation between the "outside" and "inside" areas.

1. Cleaning and disinfection
   - The anteroom will be cleaned and disinfected every _____ weeks *(or after each flock is removed)*.
2. Routine Maintenance
   - Replace all used coveralls with clean outerwear every _____ days
     i. Remove used coveralls from the barn in clean plastic bags for transport for washing
     ii. Dump the coveralls directly into the washing machine and discard the plastic bags, preferably by incineration. Clean the floor and washing machine with a disinfecting cleaner to remove any potential contamination.
   - Check all supplies every _____ weeks and ensure that a sufficient inventory is readily available. The following minimum amounts should be in stock:
     - Hand sanitizer bottle at least ___ full.
     - ___ bottle of disinfectant for footbath.
     - ___ pairs of boot covers.
     - ___ head covers and masks.
     - ___ dust masks.
     - ___ pairs of spare coveralls.
   - If any of these supplies are below the minimum, have a new supply readily available.
   - Check and replace the footbath solution as required. This should be replaced at least once every 2 days and more as required.
   - Check for and remove any non-essential equipment every ___ days.
   - Sweep the floor and remove the debris every ___ days:
     - On the "inward" side of the barrier, sweep up all debris and dispose of it in the bird holding area (into the litter or manure pit).
     - On the "outward" side of the barrier, sweep up all debris and dispose of the sweepings in an area away from the barn entrance.

B. Procedures for entering or exiting the anteroom

Introduction:

In order to prevent any potentially infectious material from entering or leaving the CAZ and RAZ

Procedures:

1. Barn Entry
    - Rinse or brush outside footwear to remove soil and other organic material.
    - Step into footbath while entering anteroom.
    - Remove outside outerwear (coats, sweaters, hats) and hang in "outward" side of the anteroom barrier.
    - Wash or sanitize hands.
    - Remove outside footwear while stepping over demarcation to "inward" side, putting on inside boots (or while putting on plastic boot covers).
    - Put on barn outerwear (coveralls, head-cover).
    - Step through footbath while entering the barn area.

2. Barn Exit
    - Brush or scrape all manure off boots before leaving the bird holding area.
    - Step through footbath while leaving the bird holding area.
    - Remove outerwear.
    - Remove boots and step over demarcation, putting on outside footwear.
    - If plastic boot covers used, remove while stepping out of the "inward" side of the anteroom and dispose into proper container.
    - Wash or sanitize hands.
    - Take outside outerwear, step through the footbath and depart.

If Applicable:

Please refer to SOP # in your Board or Commission's On-Farm Food Safety Programs.
Chicken (Safe, Safer, Safest) –Table Egg (Start Clean, Stay Clean)
Hatching Egg (Cheq Program) – Turkey (Turkey On-Farm Food Safety)

STANDARD OPERATING PROCEDURE 5

FARM NAME: _____

TITLE: Barn Cleaning and Disinfection

Date: _____ Supersedes: _____

Objective: To describe the procedures for cleaning and disinfecting a barn

Responsibility: _____
_____

Introduction:

Thorough cleaning and disinfection of the barn is a critical control point for the reduction of potential pathogens. Following proper procedures is essential for ensuring that any challenge is reduced to a minimum. Check labels to make sure that cleaning agents and disinfectants are compatible and mix according to label directions.

Procedures:

1. Clean all moveable equipment and, if necessary, remove it from the barn.
2. Remove manure and litter to the appropriate location. Make sure trailings left behind when the manure was moved are also cleaned up.
3. Blow down the barn, beginning with the highest surfaces and working the debris down to the floor.
4. Sweep out dislodged debris.
5. Thoroughly soak all surfaces with water plus _____ (*detergent or cleaner*) and leave overnight.
6. With a high-pressure sprayer using _____ (*detergent or cleaner*), wash down ceiling, walls, fixed equipment, and then floors.
7. Wash all debris out of the barn.
8. Rinse all surfaces with water.
9. Empty all residual water from feeder trays.
10. Allow all surfaces to dry thoroughly.
11. Spray all surfaces with _____ (*disinfectant*), beginning at the ceiling and spraying down. Make sure the surfaces are thoroughly covered just to the point of run-off.
12. Empty residual disinfectant from feeder trays or any other equipment in which liquid may accumulate.
13. Allow ____ minutes contact time (*refer to disinfectant instructions*) or allow all surfaces to dry thoroughly.
14. If required, rinse disinfected surfaces.
15. Repeat the disinfectant treatment.
16. Allow all surfaces to dry thoroughly.
17. Disinfect equipment belonging in the barn before returning it.
18. Treat the barn as biosecure from this point forward.

Follow steps 5, 6, 8, 10, 11, 14, 16 for equipment that has been removed from the barn.

If Applicable:
Please refer to SOP # in your Board or Commission's On-Farm Food Safety Programs.
Chicken (Safe, Safer, Safest) –Table Egg (Start Clean, Stay Clean)
Hatching Egg (Cheq Program) – Turkey (Turkey On-Farm Food Safety)

STANDARD OPERATING PROCEDURE 6

FARM NAME: _____

TITLE: Pest Control Program

Date: _____ **Supersedes: _____**

Objective: To document the procedures, including trapping, baiting and insecticide use, for maintaining an effective pest control program.

Responsibility: _____.

Introduction:

Pest control is an essential element of biosecurity. A specific control program will help to reduce or eliminate pests.

Procedures:

1. General Control

a) Daily: Clean up any spilled feed.
b) Biweekly: Clean up any material that could attract flies (eggs and garbage).
c) Weekly: Remove any clutter or debris inside or outside the barn that may provide cover for rodents.
d) Weekly: Cut grass and vegetation around each barn for a distance of 4.5 metres (15 feet).
e) At cleanout: Inspect inside and outside perimeter for openings and defects and repair immediately.

2. Baiting Procedures

a) Place bait stations at _____ metre intervals around each barn.
b) Monthly: Check all bait stations and remove and dispose of all dead rodents.
c) Monthly: Replace any consumed/expired bait at each station.
d) Monthly: Replace fly strips in anteroom area and or spray insecticide for flies in barn and anteroom.
e) Quarterly: Review bait usage and replace all bait at all stations with a different class of rodenticide.

3. Keep Records

a) It is essential to keep an effective documented pest control program.

If Applicable:

Please refer to SOP # in your Board or Commission's On-Farm Food Safety Programs.
Chicken (Safe, Safer, Safest) –Table Egg (Start Clean, Stay Clean)
Hatching Egg (Cheq Program) – Turkey (Turkey On-Farm Food Safety)

STANDARD OPERATING PROCEDURE 7

FARM NAME: _____

TITLE: Biosecurity Training

Date: _____ **Supersedes:** _____

Objective: On-farm biosecurity training procedures

Responsibility: _____

_____

Introduction:

In order to **a**chieve the intent of the standards it is essential that producers and employees understand the reasons for the standards and their ability to affect the level of biosecurity attained on the premises.

Procedures:

1. Seek assistance from your board or commission.
2. Seek assistance from the BC Poultry Association or others.
3. Mandatory Standards and SOPs should be reviewed with staff and when hiring new employees.
4. Revised SOPs should be written when new information or procedures are adopted.
5. SOPs are to be reviewed on a yearly basis.
6. Set a schedule for biosecurity training, re-training and review.

Training delivered to:

Name: Date:

Name: Date:

Name: Date:

Name: Date:

Name: Date:

If Applicable:

Please refer to SOP # in your Board or Commission's On-Farm Food Safety Programs.
Chicken (Safe, Safer, Safest) –Table Egg (Start Clean, Stay Clean)
Hatching Egg (Cheq Program) – Turkey (Turkey On-Farm Food Safety)

STANDARD OPERATING PROCEDURE 8

FARM NAME: _____

TITLE: Disposal of Mortalities and Cull Eggs

Date: _____ **Supersedes: _____**

Objective: To describe the procedures for disposing of mortalities and cull eggs

Responsibility: _____

Introduction:

Dead birds and cull eggs may be a high risk source of infectious disease organisms and must therefore be handled and disposed of in an improved manner. Daily records of mortality and production parameters, such as egg quantity and quality (percentage culls versus good eggs) is important as this data will prove invaluable in diagnosing and preventing disease.

Procedures:

1. Mortalities should be collected at minimum once per day during a flock walk through. 2-3 times is ideal.
2. Collected mortalities should be removed from the restricted area, and if necessary through the anteroom, with great care to reduce potential contamination of the surrounding area.
3. If mortalities are stored in a freezer, movement from the freezer to the disposal location (if off farm) must be in sealed totes that are capable of being washed and disinfected.
4. Mortalities disposed of by incineration should be incinerated 2-3 times per week.

Disposal of large number of mortalities

If the mortalities are due to power outages or heat stress (not disease related)

If mortalities are less than 24 hours old, contact West Coast Reduction in Vancouver at (604) 255-9301 or the BC Sustainable Poultry Farming Group (Kevin Chipperfield) (604) 556-7781.

If the mortalities require composting then call Transform Compost Systems (John Paul) in Abbotsford, office (604) 504-5660, cell (604) 302-4367 for either on-farm composting or removal from the farm.

If Applicable:

Please refer to SOP # in your Board or Commission's On-Farm Food Safety Programs.
Chicken (Safe, Safer, Safest) –Table Egg (Start Clean, Stay Clean)
Hatching Egg (Cheq Program) – Turkey (Turkey On-Farm Food Safety)

STANDARD OPERATING PROCEDURE 9

FARM NAME: _____

TITLE: Manure Management

Date: _____ **Supersedes: _____**

Objective: To describe the procedures for managing manure

Responsibility: _____

_____

Introduction:

Manure can be a high risk source of disease transmission.

Procedures:

1. Manure should be handled according to provincial regulations.
2. Manure is removed from the barn and stored at/on _____ for _____days/weeks.
3. Manure is removed from the farm by _____ (company) and it is disposed of at _____.
4. Keep records of volume of manure leaving the premises and the name of the trucking firm with your flock records.

If Applicable:

Please refer to SOP # in your Board or Commission's On-Farm Food Safety Programs.
Chicken (Safe, Safer, Safest) –Table Egg (Start Clean, Stay Clean)
Hatching Egg (Cheq Program) – Turkey (Turkey On-Farm Food Safety)

STANDARD OPERATING PROCEDURE 10

FARM NAME: _____

TITLE: Scheduled Review of SOPs

Date: _____ **Supersedes: _____**

Objective: To describe the procedures for reviewing SOPs

Responsibility: _____

Introduction:

SOPs must be written, available for audit review and up to date.

Procedures:

- Review and update biosecurity protocols as needed or at least on a yearly basis.
- Use information obtained from biosecurity auditors, the government, BC Poultry Association and from others experienced in utilizing SOPs.
- These SOPs are to be kept on file and available to board or commission auditors.

Standard Operation Procedures reviewed and updated:

Name: Date:

Name: Date:

Name: Date:

Name: Date:

Name: Date:

If Applicable:
Please refer to SOP # in your Board or Commission's On-Farm Food Safety Programs.
Chicken (Safe, Safer, Safest) –Table Egg (Start Clean, Stay Clean)
Hatching Egg (Cheq Program) – Turkey (Turkey On-Farm Food Safety)

INSTRUCTIONS FOR FILLING OUT A STANDARD OPERATING PROCEDURE TEMPLATE

Standard Operating Procedures are fundamentally "recipes" that describe how you wish a procedure to be done on your farm. For some Standard Operating Procedures, the steps may be identical for all farms; others will vary widely. For that reason, these documents must be prepared uniquely for each farm. An electronic template is available. It is designed to allow you to build your own Standard Operating Procedures quickly and easily.

The Standard Operating Procedures presented here and in Appendix 5 of the Biosecurity Reference Manual are examples only, but they may be used if they reflect the practices of the farm accurately. The electronic template may be used to produce farm Standard Operating Procedures either from scratch or by cutting and pasting from the example documents. Electronic versions of the documents can be provided if you choose to follow this route.

When the template is opened, you will be asked if you wish to open it as a "Read-Only" document. By answering "yes", it will open and allow you to make all the changes that you want, but then prompt you for a file name when you save it. This way, the template will remain intact for repeated use.

The following page gives directions for filling out each field in the template.

STANDARD OPERATING PROCEDURE

Template Instructions

FARM NAME: Type in your farm name

Title:	Give the SOP a title (e.g. "Anteroom Maintenance")		
Date:	Enter the date this SOP was written	**Supersedes:**	If this is a new SOP, enter "New" or "N/A"; if a revised SOP, enter the date of the previous one.

Responsibilities: Type in the name or position of the people who will be responsible for carrying out these procedures. Giving each employee a position or "title" then using that "title" here means that you don't have to change the SOP every time someone leaves your employment.

Objective of This SOP:

Employees responsible for carrying out the SOP will have a much better understanding and will do a much better job of the tasks if they understand the reasons for doing it. This also keeps the document focussed on the specific purpose, rather than growing into something too complicated as time goes on and revisions are made.

Procedures:

Enter the procedures in a step-by-step manner, like writing a recipe. This makes the procedure clear and concise, improving compliance. Write the procedures in the simplest terms, without compromising the spirit of the objective. Also, make sure each step put in this section meets with the objective.

STANDARD OPERATING PROCEDURE

FARM NAME: [Click here and type Farm Name]	
Title: [Click here and type title of SOP]	
Date: [Type date of this document]	**Supersedes** [Enter date of previous version]
Responsibilities: [Click here and enter name or position of personnel responsible]	
Objective of This SOP: [Click here and type a description of the purpose of this SOP]	
Procedures: [Click here and enter step-by-step procedures]	