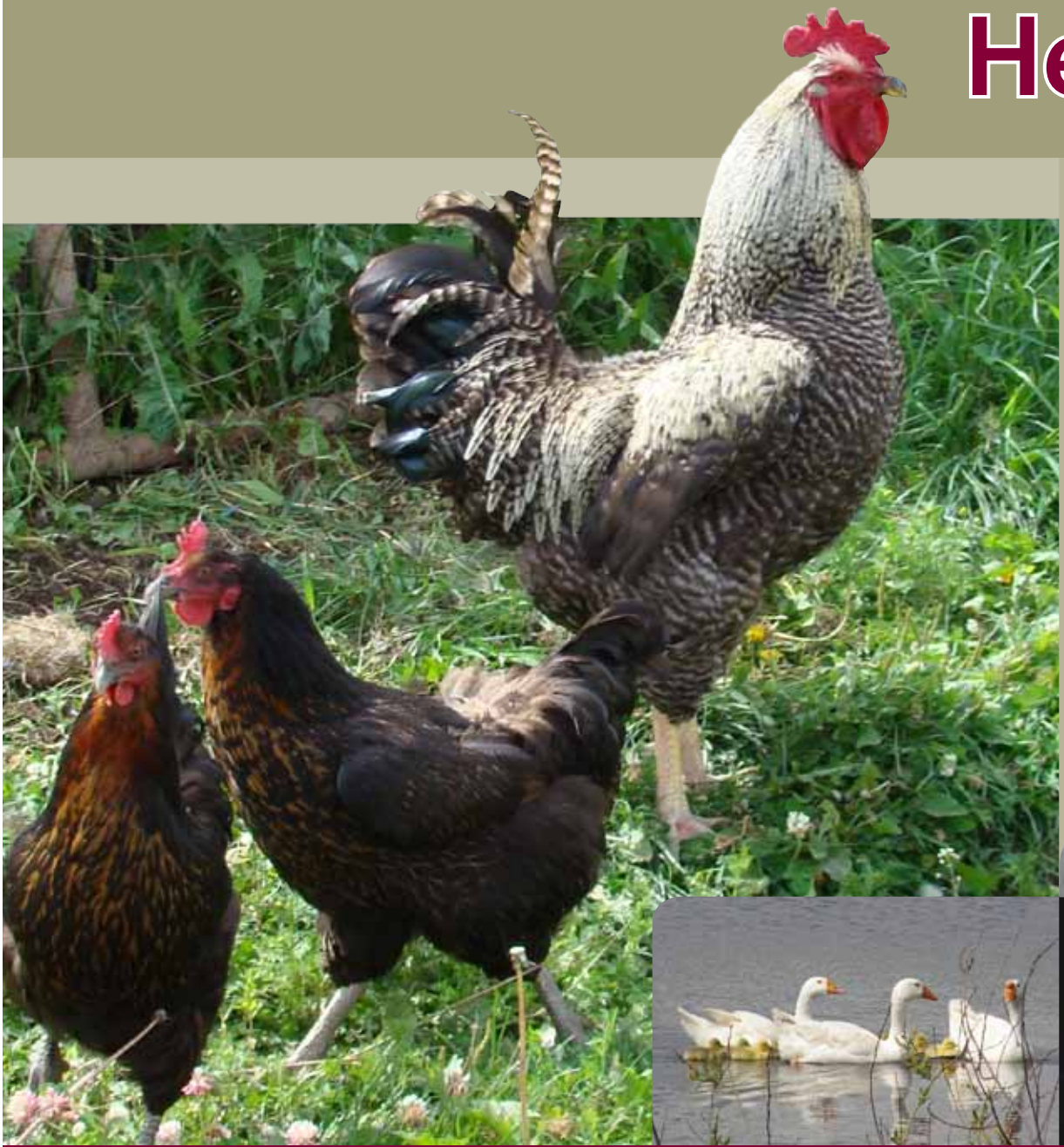
Small Flock Poultry Health



Disease Prevention and Good Management

Canada

Growing Forward

British Columbia

Acknowledgements:

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Articles for this manual have been contributed by authors from universities, government agencies, and companies across North America and have been included here with their permission. These authors and their respective institutions are gratefully acknowledged.

Legal disclaimer:

This document provides a general description of management and health for keeping poultry, especially for small producers and hobby flock owners. It should not be viewed as a substitute for legal advice.

All legislation identified in this guide refers to British Columbia or Canada legislation.

This publication should not be viewed as a substitute for legal advice. An individual or farming operation that requires legal advice as to legal requirements or potential liability should retain a lawyer who has examined the current state of the applicable law and has acquired an understanding of the operation's particular circumstances. Certain examples and references are provided for illustrative purposes and may not constitute a complete statement of the law. The law with respect to Animal Health and Disease Control is changing and information contained in this publication may be outdated; it was current as of January 1, 2011.

British Columbia legislation can be viewed at:
http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/00_96014_01

Federal legislation can be viewed at:
http://laws.justice.gc.ca/en/H-3.3

The materials presented in the guide, except for law, were current at the time of publication. However, revisions may have occurred since publication. For information concerning revisions, contact the BC Ministry of Agriculture.

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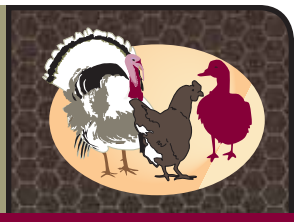
French translation upon request.

Need more information?

For more information on poultry health and management or to obtain a copy of this manual, call the Animal Health Centre, BC Ministry of Agriculture at (604) 556-3003 or 1-800-661-9903.



Introduction

Keeping poultry can be an enjoyable and rewarding experience. While it seems that it would be an intuitively simple task for those who enjoy owning and caring for animals, it is actually much more complex than, for example, caring for a dog. Poultry generally do not become a part of the household family and therefore must be provided with all the tools necessary in order to thrive in their own environment. This means not just providing food and water but also ensuring that the diet is balanced according to the type of birds, allowing access to a controlled environment, protecting from pests and predators, and so on.

In recent years, a new term, "Biosecurity", has gained prominence among livestock owners. This is a term that refers to the collection of procedures that are employed to keep livestock healthy and it is particularly appropriate for poultry. All the elements of poultry production, whether in a large scale or small scale operation, are essential to the execution of good biosecurity. Without adequate housing and management of that housing, without adequate management of the birds themselves, without good infectious disease prevention strategies, and without implementation of all those elements of poultry production, good biosecurity would be impossible.

This manual covers all the elements of poultry production with the goal of helping the small flock owner keep their birds as healthy as possible. It covers areas including housing and management, basics of poultry diseases, disease prevention and control, and food safety. While not a complete encyclopaedia of poultry health and management it will help to guide owners in the care of their flocks. For those wishing to explore more detail in some areas, references are provided.

This manual is a collation of information by many authors, and their contributions are gratefully acknowledged. The authors and their affiliations are cited with their particular pieces. Articles have been drawn from experts around North America, providing an excellent pool of sound information. Most are aimed specifically at small flocks, but some reference to commercial flocks is also included where concepts apply to both production cultures.

Hopefully this manual will be informative enough to encourage healthy flock practices and to provide enough mental stimulation to encourage the quest for even more information.

May 1, 2011

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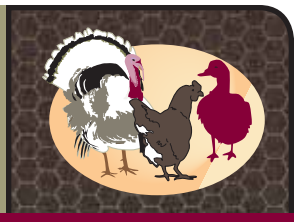

Management of the Small Flock

Keeping your flock healthy requires attention to all elements of its care, which, in turn, contributes to its security from illness or disease. Proper management of everything from feed and water to cleaning and sanitizing equipment and housing will contribute to a high level of biosecurity. Regardless of the size of a flock, a majority of health issues can be related back to some problem in management. Attention to these details will significantly reduce the risk of a disease breaking out in your flock.

Several articles in this section describe elements of basic management and all will have an impact on the health security of your birds. But the execution of the details is as critical as, or perhaps even more critical than having the pieces in place. Putting everything to work and ensuring that they are working properly is the art behind good management and is also referred to as husbandry. Systematic daily assessment of each part of your management will make your husbandry practices more efficient and more complete. The final article in this section provides a framework for assessing management; using the acronym "FLAWS" as a guide, an owner or manager can go through the flock daily and ensure that all elements of their management meet their standards.

Attention to the information in this section will lay the groundwork for disease prevention, found in the following section.

Housing

Housing Backyard Chickens

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Owning a small flock of chickens is increasing in popularity, particularly in areas where local ordinances prohibit larger domestic animals, but allow for birds and/or small animals. Chickens not only furnish a ready source of home-grown meat and eggs, but also provide great pleasure as exhibition stock and even as pets. The purpose of this fact sheet is to give an overview of basic housing principles for small flocks of chickens.

Objectives

Reasons for providing proper housing facilities for chickens include:

- Protection from predators;
- Protection from rain, snow, and other inclement weather;
- Protection from excessive heat and cold (i.e,. moderation of extreme temperature changes); and
- Provision of feed and water space and nesting facilities.

General Considerations

Chickens are very adaptable and no single best way exists to house them. Creative architectural construction may even be considered in building a "designer" chicken house in order to enhance the backyard landscape. Regardless of ultimate design, the following practical considerations should be observed. The building must:

- Be large enough for proper air circulation (i.e. ventilation) but small enough to keep from getting too cold and drafty in winter;
- Allow 1.5 to 2.0 ft^2 (0.14 to 0.19 m^2) floor space per adult chicken;
- Provide easy access to feed and water; and
- Provide nesting areas for hens in egg production.

Building Design

As previously mentioned, workable designs of chicken houses are highly variable and may even be extremely decorative in some cases. Many sites are available on the Web and in reference books that may help you in designing your facility. A few selected resources are listed here.

- House design:
  - » "How to Raise Chickens" by Christine Heinrichs. Voyageur Press. 2007. ISBN-13: 978-0-7603-2828-6

  - » Virginia Cooperative Extension: http://www.ext.vt.edu/pubs/poultry/factsheets/designs.html
  - » University of Minnesota: http://www.ansci.umn.edu/poultry/resources/housing_small-scale.htm
  - » Appropriate Technology Transfer for Rural Areas (Range poultry housing): http://ceplacer.ucdavis.edu/files/46820.pdf
  - » The Bantam Roost, "A Small Hen House": http://www.geocities.com/Heartland/Plains/4175/henhouse.html
- Energy management and solar heating concepts: http://www.ces.purdue.edu/extmedia/AE/AE-99.html

Ventilation Basics

In order to provide a comfortable building for chickens, it is necessary to keep in mind a few basic concepts regarding ventilation:

- Warm air rises and cooler air, being heavier, settles to the floor. Adequate air circulation and exchange is necessary to keep different air temperatures from stratifying and air from becoming stale.
- Warm air holds more moisture than cold air. For every 18°F (10°C) increase in air temperature, its water-holding capacity doubles. This concept is important in managing potential moisture buildup, particularly in well-insulated, tightly-sealed chicken houses.
- Ventilation needs in summer are different than in winter. During summer, warm stale air must be removed, allowing fresh air to enter and circulate. During cold seasons, only enough cold outside air should be allowed in for adequate air exchange. It is preferred to bring this air in from near the roof of the building which allows it to warm as it drops towards the floor. This colder air will warm (by the birds' own body heat and/or with additional heaters) and pick up moisture. A method must be available to vent this air from the building allowing the cycle to continue. (Refer to Figures 1 and 2 for summer and winter ventilation concepts.)

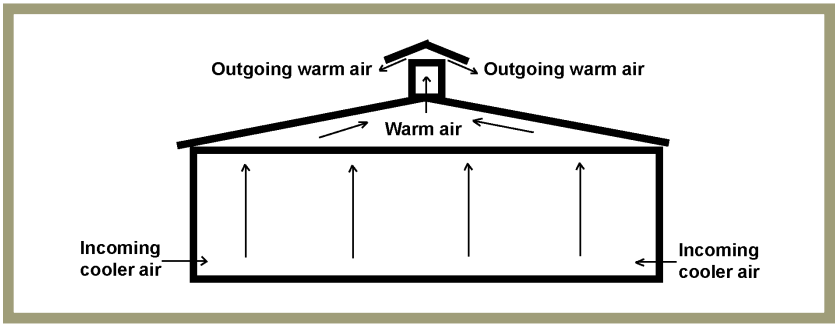


Figure 1. Concept of summertime ventilation.

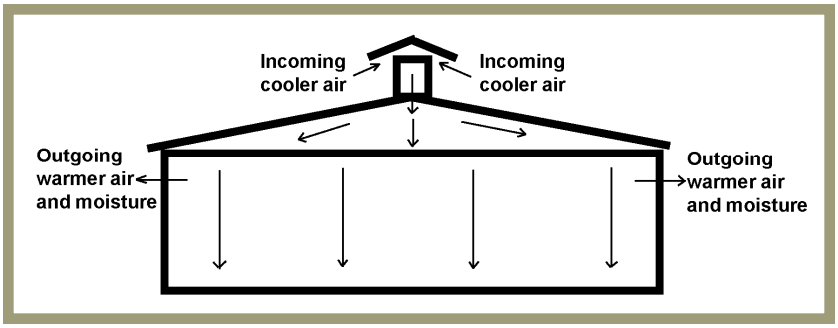


Figure 2. Concept of wintertime ventilation.

In small chicken houses, these factors can generally be sufficiently controlled without employing power ventilation (i.e. fans). The judicious and well-placed use of windows and vents will usually suffice. During summer, natural convection and/or gentle breezes will usually be adequate to drive air out the upper vents, or cupola, and bring in fresh air through windows or lower vent openings. Place upper vent openings on the side opposite of wind direction (i.e. leeward side).

Perches

Although not mandatory, it is usually a good idea to provide perches for your chickens. Perches will allow birds to stay off the floor – particularly as they roost at night. Most breeds seem to enjoy spending time on perches. Manure will tend to accumulate in greatest concentration under the roost area, thereby helping to keep the rest of the bedding material in the house cleaner. A good rule of thumb is to allow 6 to 10 inches (15 to 25 cm) of linear perch space for each chicken housed.

Perches should be located in an area of the house that will not interfere with daily chores such as feeding, watering, and egg gathering. Construct the perches so they are removable or are hinged for lifting out of the way for easier cleanout of manure. It is worth the extra effort to build them right in the beginning – it will save you a lot of time and effort during house cleanup. Perches should not be more than about 3 feet (0.9 m) off the ground; otherwise, there may be an increased tendency to bruise feet or cause egg rupture as the hens mount the roost. Plan at least 12 inches (30 cm) clearance under the perches; final height and dimensions will depend on individual building design and convenience of being able to clean out the manure underneath them.

Any suitable building material may be used to construct perches: 2 × 2 inch (5 × 5 cm) material with rounded tops is ideal. Space the perch bars 14 inches (36 m) apart.

Nest Boxes

Nest boxes are essential furnishings of any hen house because she will seek a secluded place to lay her eggs. Properly constructed and maintained nest boxes provide a clean environment for laid eggs and facilitate gathering them. Also, nests make it easier to identify and remove "broody" hens. (A broody hen is one that has ceased laying eggs and desires to raise a clutch of chicks. She will remain in the nest box for prolonged periods, become territorial, and not allow entry of other hens needing to lay eggs.)

Again, there are no hard and fast rules for nest box construction. Commercial boxes are available from various retail sources or you may wish to construct your own. Nest box height and width should be 12 to 15 inches (30 to 38 cm); depth should be least 12 inches (30 cm). Figure 3 illustrates a generic nest box design that is functional for most applications.

- One next box is required for each four to five hens.
- Place nest boxes no less than 18 inches (46 cm) off the floor.
- A front panel, 4 to 6 inches (10 to 15 cm) high, is necessary to provide seclusion and keep eggs from rolling out of the nest.
- A perch may be attached to each box, running parallel to the front of the box and located 6 to 8 inches out, to facilitate access.

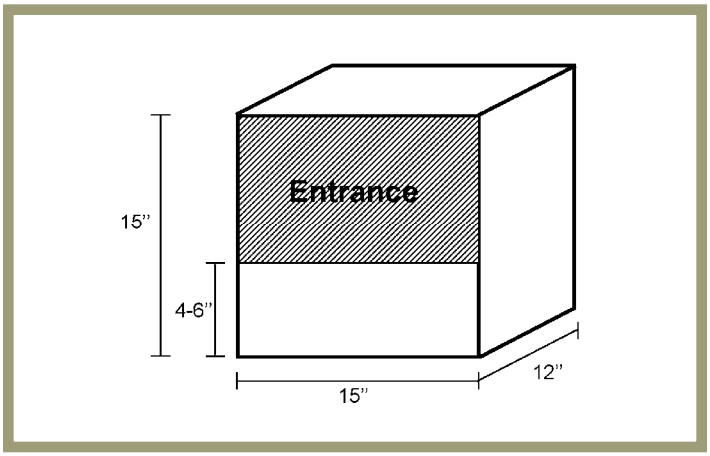


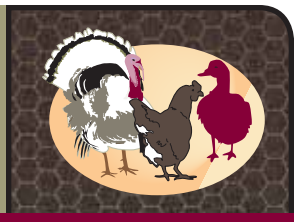
Figure 3. Generic nest box design.

Predator Control

- Maintain a rodent control program around the poultry house. An excellent fact sheet on rodent control is found at http://osuextra.okstate.edu/pdfs/F-8207web.pdf
- When building the floor, integrate heavy-gauge wire mesh beneath the subflooring to discourage entrance of predators.
- Cover windows and vent openings with good quality poultry wire to keep out birds.
- Make sure doors and windows fit tight. Caulk and seal all cracks and crevices. Small rodents can gain entry through holes the size of a nickel or quarter.
- Keep the poultry house locked to discourage theft and uninvited visitors.

Additional Housing Considerations

- Allow adequate space within the structure for feeders and waterers. (Feeding and watering equipment not discussed in this fact sheet.)
- Position equipment for ease of cleaning, egg gathering, and general upkeep.
- Before beginning to build, consider anticipated high/low temperatures, potential snow load, other environmental conditions, and local ordinances.
- For specific recommendations in your area, contact your local county agent or Extension poultry specialist.



Small Scale Poultry Housing

Phillip J. Clauer, Poultry Extension Specialist, Animal and Poultry Sciences
Virginia Cooperative Extension
Virginia Tech and Virginia State University

Small scale poultry coops seem to be built in almost every possible shape and size. Those building a new coop often ask for plans for the perfect chicken coop. However, few plans for small poultry houses are available. Many existing buildings can easily be adapted to accommodate poultry. Poultry housing can be as crude or elaborate as you wish to build as long as you provide the following:

1. Protection:

A good poultry house protects the birds from the elements (weather), predators, injury and theft.

Poultry require a dry, draft-free house. This can be accomplished by building a relatively draft free house with windows and/or doors which can be opened for ventilation when necessary. Build the coop on high, well-drained areas. This prevents prolonged dampness and water saturation of the floor of the coop and outside runs. Face the front of the coop, the windows and outside run to the south which allows the sun to warm and dry the coop and soil. Allowing an adequate level of space per bird also helps keep the humidity level in the coop to a minimum.

Keeping poultry totally confined together with fence and covered runs are your best protection from predators. If you are building a new facility, consider laying a concrete floor, and start the wall with one or two concrete blocks. This prevents rodents, snakes, and predators from digging under the walls and the floors. Windows and doors must be securely covered with heavy-gauge mesh wire or screening when opened.

With outside runs, bury the wire along the pen border at least 12" deep, and toe the fence outward about 6 inches. This stops most predators from digging under the fence. Animals always dig at the base of a fence. By toeing the fence outward and burying it, the predator digs down right into more fencing. Some people run electric fencing around the outside of their pens 4" off the ground about one foot from the main fence to discourage predators. If your outside runs are not predator-proof, you need to lock up your poultry before dark.

To prevent problems with hawks and owls, cover your outside runs with mesh wire or netting. A good ground cover of millet, broomcorn, sorghum or other tall leafy vegetation also provides cover for the birds to hide under. Many times a 3-4 ft. grid over the pen constructed of boiling twine will give excellent protection from flying predators.

To protect the birds from theft, lock your building and pens securely whenever you are not home. Have your neighbors watch for visitors while you are away. Some people actually have burglar alarms in their bird coops. A protective dog kept near your coop usually works well to discourage predators and unwanted visitors. Build your poultry house to prevent possible injury to your birds. Remove any loose or ragged wire, nails, or other sharp-edged objects from the coop. Eliminate all areas other than perches where the birds could perch more than 4 feet above the floor. Remove perching areas such as window sills, nest box tops, or electric cords whenever possible. These extra measures could eliminate any injury to you or your birds and may prevent damage to the coop, as well.

2. Adequate Space:

Birds need adequate space for movement and exercise as well as areas to nest and roost. Space requirements vary with the type of bird you raise.

Pigeons require a minimum of 4 square feet per breeding pair. One-eighth inch perch and two 9" × 9" nests per breeding pair are recommended.

Minimum Space Requirements		
Type of Bird	**Sq ft/bird inside**	**Sq ft/bird outside runs**
Bantam Chickens	1	4
Laying Hens	1.5	8
Large Chickens	2	10
Quail	1	4
Pheasant	5	25
Ducks	3	15
Geese	6	18

Perches: With chickens, always provide 6 to 10 inches of perch space per bird. Perches are not usually used with meat chickens and waterfowl.

Nests: Always provide at least one nest for every 4-5 females in the flock.

3. Easy Access to Feed and Water:

Feeders and waters should be placed conveniently throughout the pen for birds' access. Place the bottom of the waterers and top lip of the feeders at the birds' back height. This will keep the feed and water clean and prevent wastage.

Small birds like pigeons, bantams and quail, only require 1 linear inch/bird of feeder and water space and large birds require 2-3 linear inches/bird.

When possible, place the waterer in the outside runs, especially for waterfowl. This helps to keep the humidity level lower inside the coop.

4. Source of Light:

If you wish to produce eggs from your flock year-round, you must have a source for electric light. One electric light every 40 feet at ceiling height is appropriate. Most small poultry houses do very well with one light above the feeding and watering area.

Windows placed on the southside of the coop will also be a good source of light and warmth in winter and a good source of ventilation in summer.

5. Ventilation:

Ample air movement without a draft is essential. Fresh air brings in oxygen while excess moisture, ammonia or carbon dioxide are removed the stale air moves out of the house. Dampness and ammonia build-up are a sign that there is not enough ventilation. For small coops windows or vents on one side of the house usually provide plenty of ventilation. Well-ventilated houses must also have plenty of insulation and a good vapor barrier. Failure to insulate or ventilate properly causes moisture to accumulate on the walls and ceiling in cool weather. Poultry can handle cold very well if they are dry. However, cool and humid conditions can create many health problems. Locate openings on the side away from prevailing winds. The south or east side is usually best.

6. Appearance:

The appearance of any poultry house or outside run that is visible to the neighborhood should never detract from the over-all appearance of the surroundings. Exteriors of structures should be kept painted and well-maintained. Weeds and trash should be removed from around all facilities. Proper landscaping can provide screening and also help muffle sounds from the birds. Unsightly structures are not good for the image of bird raising and may lead to new laws restricting the raising of birds in your area.

7. Use Common Sense:

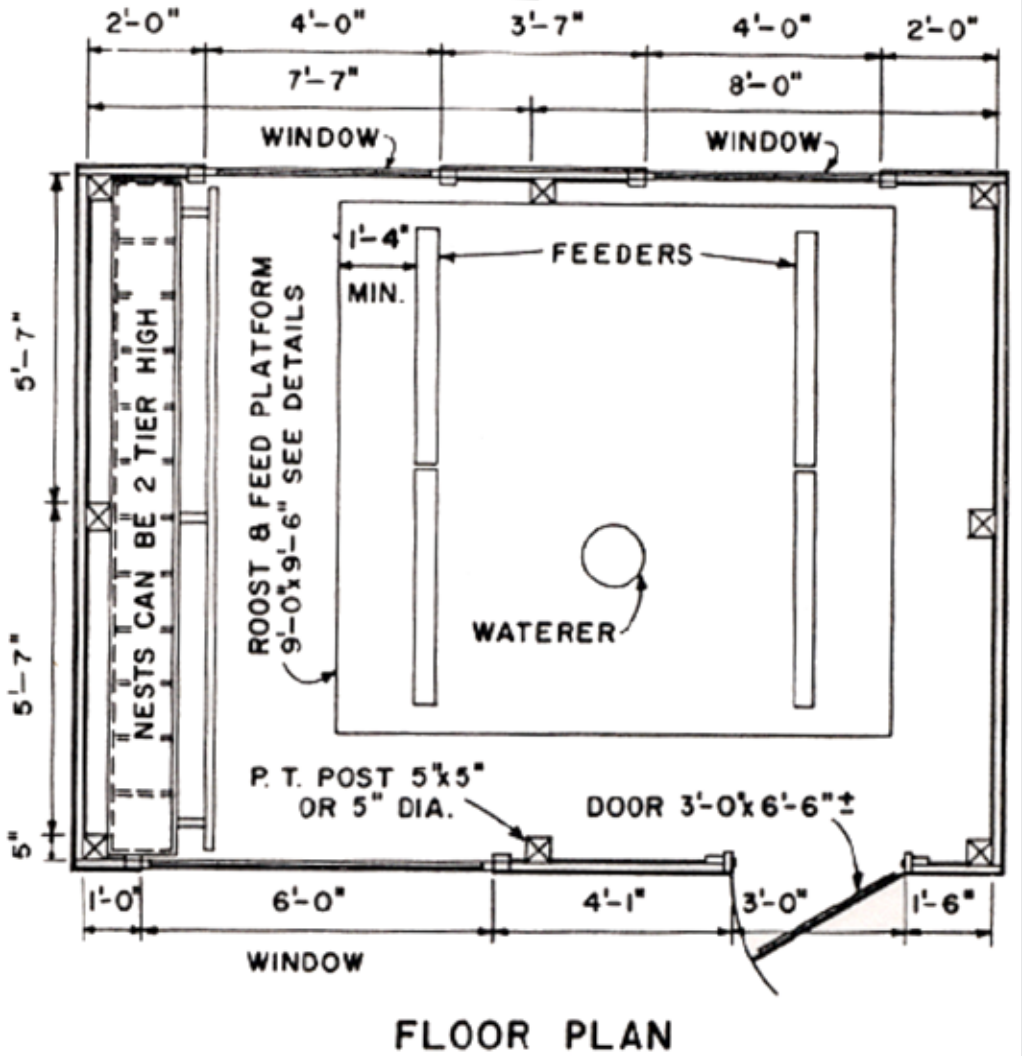
When building a poultry house, use common sense in designing the structure. Build the roof high enough and situate such permanent structures as nests, roosts, and feeders for easy access and to make it easier to clean all areas of the house. Install doors so that they open inward. Using sliding windows so that the birds cannot roost on them rather than windows which swing in or out. Use building materials which will be easy to clean and disinfect. Slightly sloping the floor toward the door can help prevent puddling in the building and will make the building easier to spray out and dry between uses.

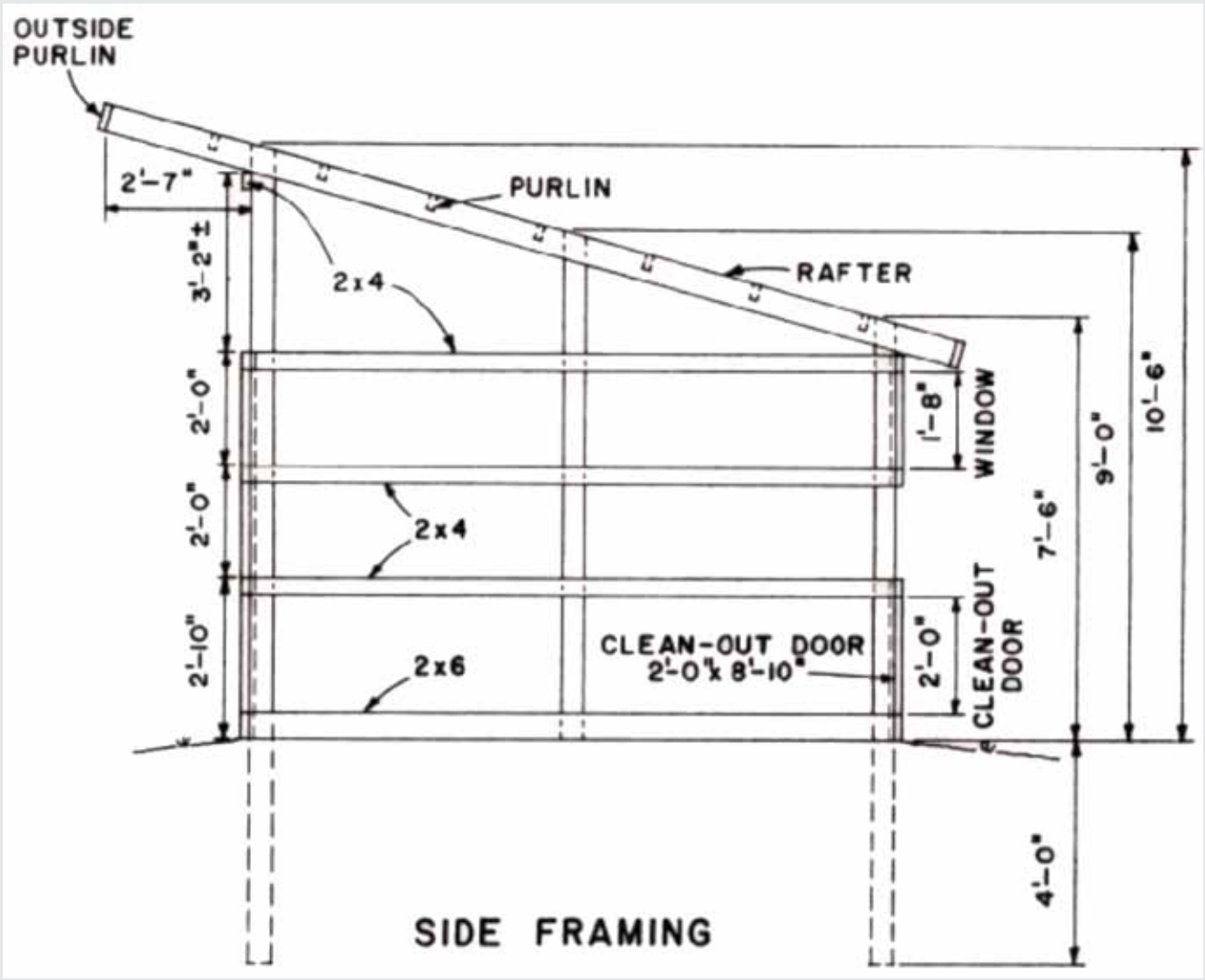
Reviewed by Audrey McElroy, associate professor, Animal and Poultry Sciences

Designs for Small Poultry Structures

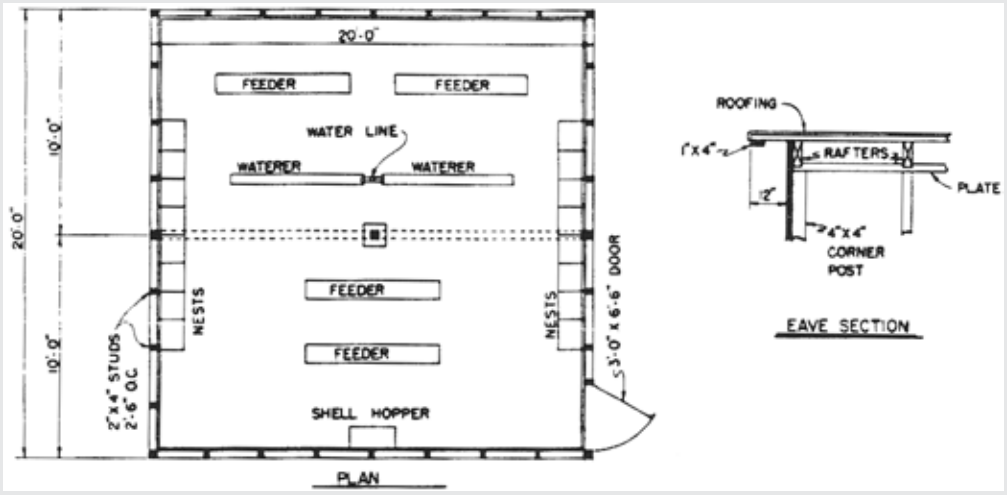
The following are some designs of a few small poultry structures. However, remember, most existing structures can easily be adapted to accommodate a small poultry flock.

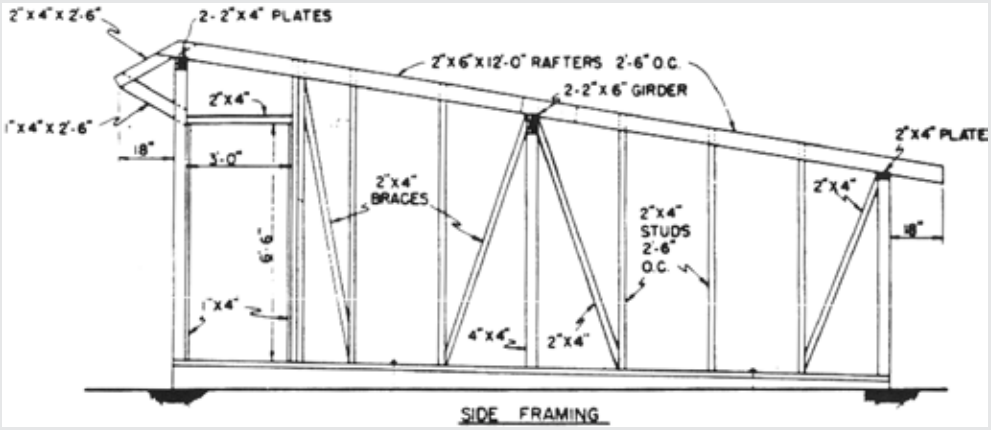
Plan No. 6188, 50 to 80 Layers

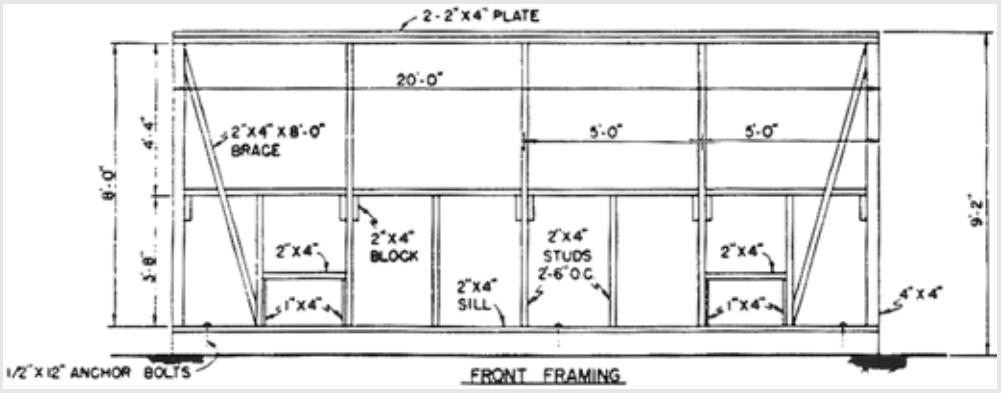



OUTSIDE PURLIN
2'-7"
PURLIN
RAFTER
2x4
3'-2"±
2'-0"
2'-0"
2'-10"
2x4
2x6
1'-8"
WINDOW
9'-0"
10'-6"
7'-6"
CLEAN-OUT DOOR
2'-0" x 8'-10"
2'-0"
CLEAN-OUT DOOR
4'-0"
SIDE FRAMING

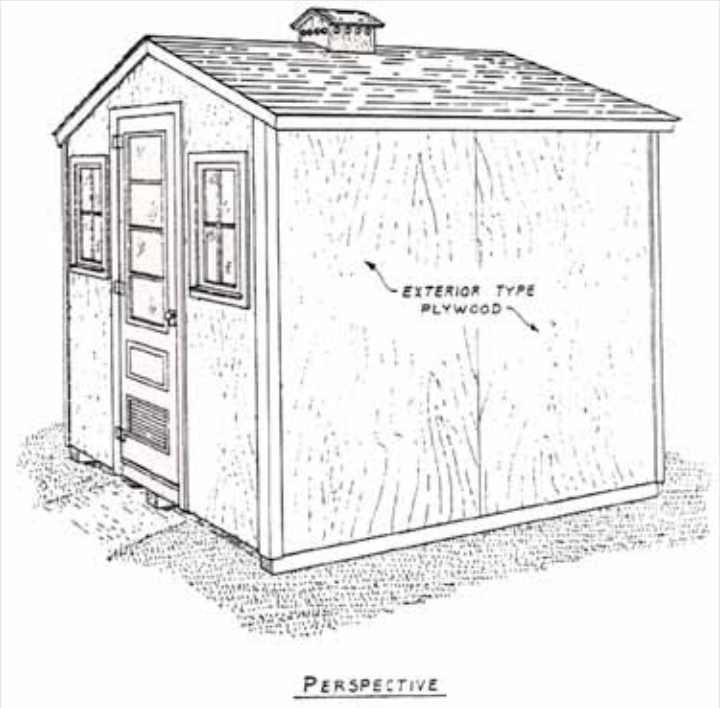
Plan for a 20' x 20' Layer House



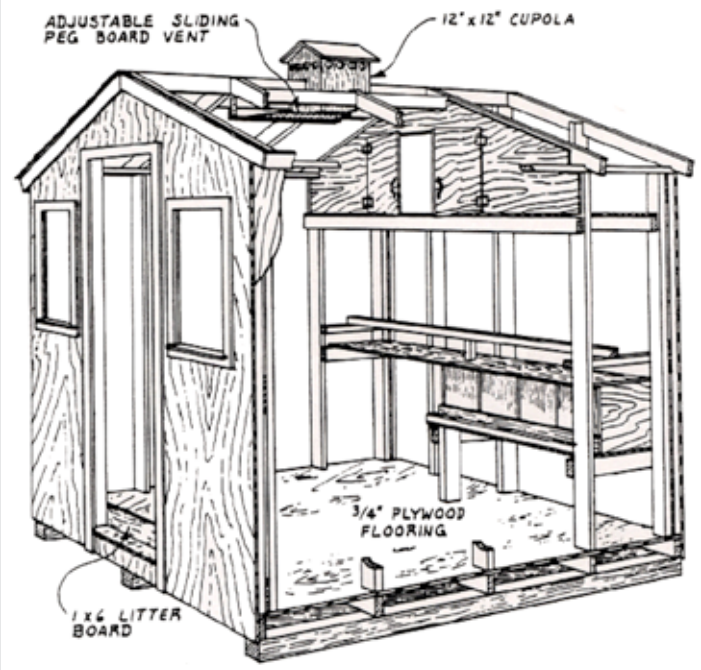




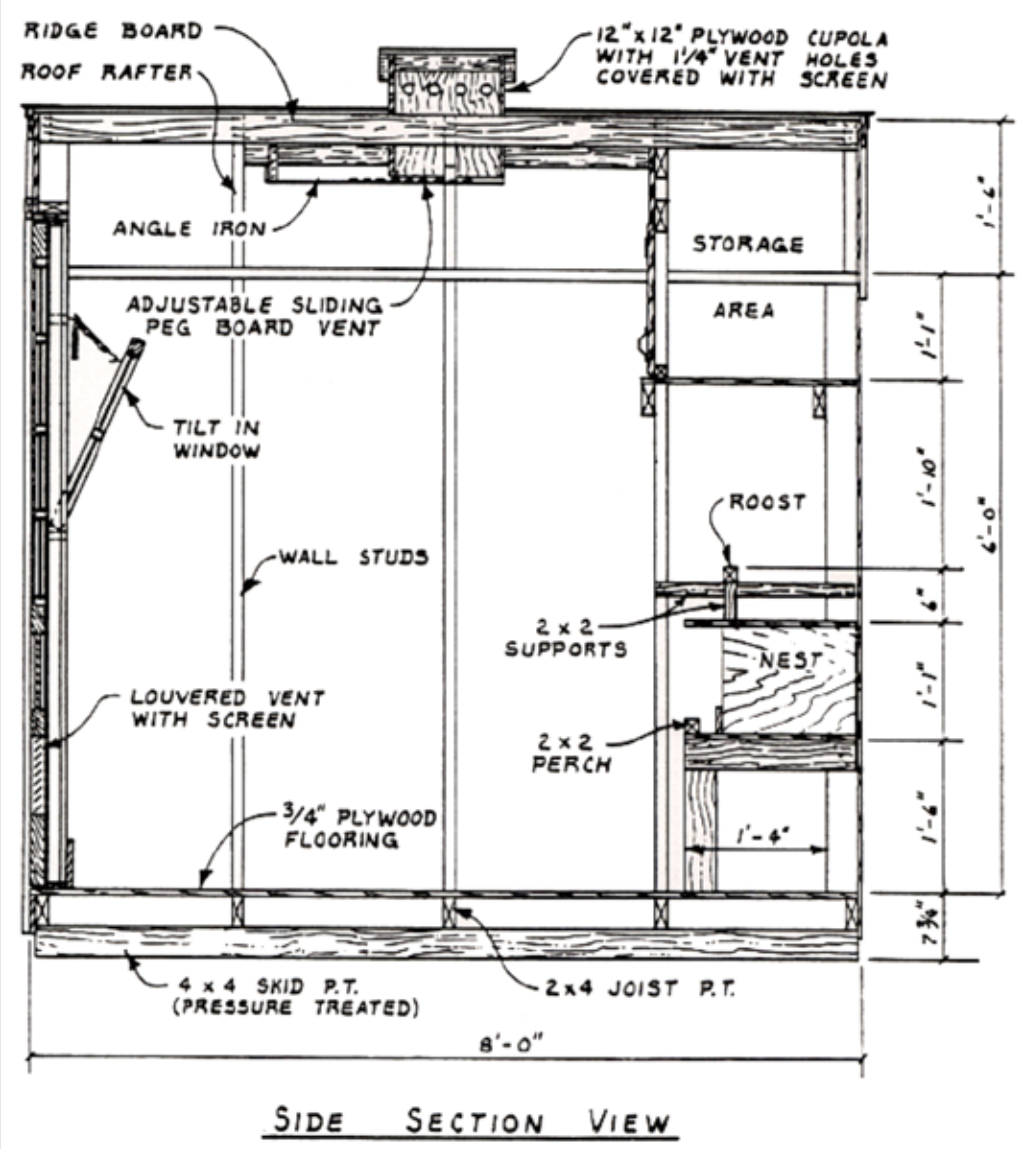
Plan for an 8' x 8' Layer House – 15 to 20 Hens



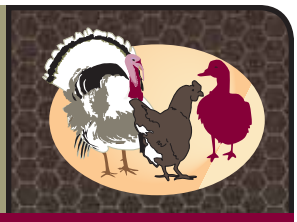
PERSPECTIVE



CUTAWAY VIEW



SIDE SECTION VIEW



Lighting for Poultry

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.

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 1 to 2 week period until the desired day length is met. More detailed information on programs can usually be found with the technical 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.

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.

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:

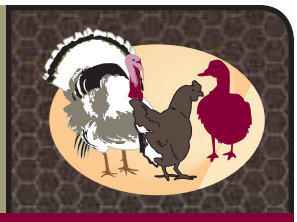
- For the first week, have high intensity lighting (at least 20 to 30 lux) that attracts chicks to water. Poultry will instinctively peck at shining surfaces and water that is highlighted by good lighting will attract chicks very quickly.
- Allow some rest time, with at least 1 to 4 hours of darkness 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.

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.



Feed and Water

Poultry Nutrition Information for the Small Flock

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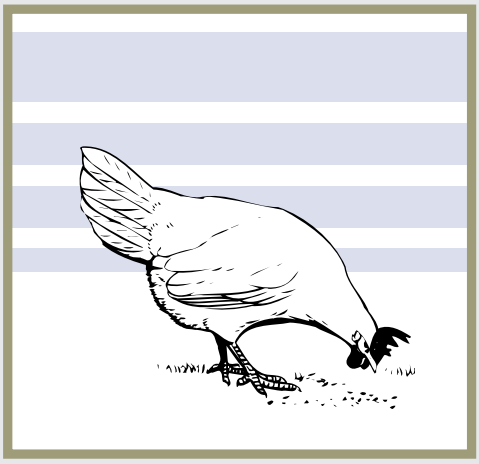
A sound nutrition program is essential to a successful poultry operation. From an economic standpoint, feeding accounts for 60 to 70 percent of the cost of production. To maximize production at the least cost, producers should pay close attention to the nutritional requirements of the species. The word nutrient refers to a broad category of organic and inorganic compounds found in food that are essential for maximum growth, egg production and feed efficiency. Feed efficiency refers to the amount of food, in pounds, required to produce a pound of body weight, or in the case of egg production, pounds of feed required to produce a dozen eggs. Nutrients essential for building and maintaining a successful poultry flock include water, carbohydrates, fat, protein, vitamins, and minerals. This publication addresses the function of individual nutrients and notes variations in nutrient requirements among classes of poultry. It may be useful for small flock producers, hobbyists, and commercial producers.



Water

Without a doubt, water is the most important nutrient required by poultry. It is the least expensive, and usually the most neglected. Water represents about 70 percent of the total body weight of poultry and around 65 percent of the total weight of eggs.

Decreased production or mortality will occur sooner with water deprivation than food deprivation. This is especially noticeable during the summer when outside temperatures are high. Water helps regulate body temperature, lubricate and transport feed through the digestive tract, and eliminate waste.

There is no precise water requirement for poultry because water intake is related to numerous factors including age, body condition, diet, temperature, humidity, and accessibility. As a rule of thumb, poultry will consume twice as much water as feed. This is subject to change depending on environmental conditions.

For the flock to achieve maximum production efficiency, water should be readily available and free of pathogenic microorganisms and toxic levels of minerals and chemicals. Zero units total bacteria and total coliform bacteria per milliliter of water is desirable. The maximum acceptable level is 100 units of total bacteria and 50 units of coliform bacteria per milliliter of water.

Excessive mineral levels may adversely affect performance. One of the main consequences of high mineral levels in drinking water is an increase in wet litter. Wet litter provides a good

growth medium for mold and bacteria, which can reduce performance and flock health. The water supply should be tested if there is concern about its safety for consumption.

Carbohydrates

Certain carbohydrates are required in order for the body to use other nutrients. Carbohydrate storage in the body is relatively small compared to fat storage. The limited carbohydrate storage occurs in the liver and muscle in the form of glycogen. Glycogen is a highly branched structure composed of glucose. Plant carbohydrate energy is stored in the form of starch, which is also a highly branched structure composed of glucose. Carbohydrates and fats are usually grouped together under a larger category referred to as energy.

Dietary energy is needed to support production and maintenance. Growth rate and/or egg production are factors that affect the energy required for production. Other factors include body size, environmental conditions, level of activity, stress factors, such as disease and parasites, and rate of feathering.

Carbohydrates are the largest source of energy used in poultry diets. Carbohydrates common in poultry diets are starches, sugars, cellulose, and other non-starch compounds. Cellulose and the nonstarch compounds are typically classified as crude fiber. Most starches and sugars are used well by poultry; the fiber portion is not.

In formulating poultry diets efforts are made to minimize the fiber concentration. This is in contrast to human nutrition where a high-fiber diet is recommended. Poultry lack certain digestive enzymes required to digest the various fiber components.

Important sources of carbohydrates for poultry include cereal grains and cereal grain by-products.

Fats

Fats perform certain physiological functions within the body. They are used as an energy reserve, insulation against temperature extremes, tissue membranes, and to protect vital organs. A group of vitamins referred to as fat soluble require the presence of fat in order to be effectively absorbed by the body. Fats are used to increase the energy content of the diet. Using carbohydrates by themselves fails to achieve the target energy level. Fat has 2.25 times more energy than carbohydrates on an equal-weight basis. Fats are composed of smaller components known as fatty acids. Of these fatty acids, poultry have a specific requirement for linoleic acid, so it is termed an essential dietary fatty acid. Essential means it must be provided in the diet because the body can not construct it out of other compounds. The feeding value of fat varies depending on whether it is unsaturated or saturated. Young poultry are less able to digest saturated fats. At room temperature, unsaturated fat is a liquid, while saturated fat is a solid.

Corn oil, soy oil, and canola oil are examples of unsaturated fat. Tallow, lard, poultry fat, and choice white grease are examples of saturated fat. In addition to its nutritional value, adding fat to the feed aids in reducing grain dust. Nutritionists typically use animal fat or an animal-vegetable fat blend when balancing poultry diets. Competition with the human food market usually results in high prices for vegetable oils. The high cost prohibits use when formulating least-cost rations. An antioxidant should be added to poultry diets when fat is added in order to prevent the fat from turning rancid. This is especially important during hot weather.

Proteins

Proteins are a large complex Class of nutrients composed of smaller units known as amino acids. The location of proteins in the body is quite broad. Proteins are found in structural tissue, blood, enzymes, and hormones. On a dry-weight basis, the body of a mature broiler is more than 65 percent protein. The contents of an egg are about 50 percent protein. Digestion of feed proteins results in the liberation of individual amino acids.

For nutritional purposes amino acids are grouped into two categories known as essential (indispensable) and non-essential (dispensable). Essential amino acids are those that cannot be synthesized in adequate amounts to meet growth and maintenance requirements. There are 22 amino acids commonly found in feed ingredients. Eleven of the 22 amino acids, referred to as essential amino acids, must be provided in poultry diets.

Nonessential amino acids are those the body can make in sufficient amounts as long as the appropriate starting compounds are available. The presence or absence of essential amino acids will dictate the quality of the feed protein. Lysine and methionine are the two most critical amino acids in poultry nutrition. Deficiencies of these two amino acids leads to a significant loss in productive efficiency.

Nutritionists will typically employ multiple ingredients to meet the amino acid needs of poultry because there is no single ingredient that contains adequate amounts of the essential amino acids. This concept is referred to as the use of complementary proteins. An example is the use of corn, which is low in lysine, and soybean meal, which is low in methionine, together in a ration. By themselves neither corn or soybean meal can provide enough essential amino acids to maximize performance. But when the two are combined, they provide adequate amounts of the essential amino acids and are said to complement each other.

Amino acid supplements are typically included in poultry diets because of the economic advantage of adding them to the diets. These amino acid supplements include l-lysine hydrochloride and dl-methionine.

Vitamins

Vitamins are a group of organic compounds found in foods in small quantities. Like the other nutrients, they are an essential part of a good nutrition program. Adequate intake levels of vitamins are necessary for normal body functions, growth and reproduction. Vitamin deficiencies can lead to a number of diseases or syndromes.

Vitamins can be divided into two classes: fat soluble and water soluble. The fat soluble vitamins include vitamins A, D_3, E, and K. Vitamin A is required for normal growth and development of epithelial tissue and reproduction in poultry. Vitamin D_3 is required for normal growth and development of bones and for eggshell formation. Vitamin K is an essential part of blood-clot formation. Vitamin E is a powerful antioxidant.

The water-soluble vitamins include the B-complex vitamins — vitamin B_{12}, biotin, choline, folacin, niacin, pantothenic acid, pyridoxine, riboflavin, and thiamin — and vitamin C. The B-complex vitamins are involved with many metabolic functions including energy metabolism. Poultry can synthesize vitamin C, so no requirement has been established for this vitamin. It may be beneficial in some circumstances, such as birds subjected to stress.

Nutritionists usually add a vitamin premix to the diet to compensate for fluctuating levels found naturally in food. This ensures the bird has the required amounts necessary for normal productive efficiency.

Minerals

Minerals are inorganic compounds divided into two classes: macrominerals and microminerals. Macrominerals are needed in relatively large amounts, and microminerals in small amounts.

The macrominerals include calcium, phosphorus, chlorine, magnesium, potassium, and sodium. Calcium is important for normal bone development, blood-clot formation, muscle contraction and maintaining good eggshell quality. Phosphorus also is important for normal bone development. It is a a component of cellular membranes and a requirement for many metabolic functions.

Chlorine is used in digestion as a component of hydrochloric acid found in the stomach. It is involved in water and acid/ base balance in the body. Sodium and potassium are electrolytes important for metabolic, muscle, and nerve functions. They also are involved with water and acid/base balance. Magnesium assists with metabolic and muscle functions.

The microminerals involved in metabolic functions include copper, iodine, iron, manganese, selenium and zinc. Iodine is used to produce thyroid hormones that regulate the rate of energy metabolism. Zinc is involved with many enzymatic processes in the body. Iron aids in oxygen transportation within the body. Selenium has antioxidative properties but may be toxic at high levels. Ground limestone and oyster shell are the primary sources of calcium. Phosphorus and other calcium sources include monocalcium phosphate, dicalcium phosphate and deflourinated phosphate. Common salt is the primary source of sodium and chlorine.

The levels of magnesium, potassium and other minerals not listed here typically will be supplied by other dietary ingredients such as corn, soybean meal, and meat and bone meal. Nutritionists use trace mineral (micromineral) premixes when formulating diets to supply the required amounts of microminerals needed for production and maintenance.

Summary

The productivity, reproduction and health of the flock greatly depends on the quality of the feed they receive. Make sure the feed is appropriate for the bird species. For example, do not feed layer mash to growing chicks because the calcium content will be too high and other nutrients too low. This will result in reduced performance and can lead to mortality.

Likewise, do not feed broiler or turkey feed to laying hens because the calcium is too low and other nutrients too high. This will result in poor eggshell quality and reduced egg production.

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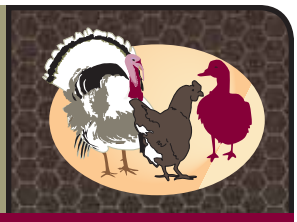

Feed and Water Management

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Feed is a major expense in livestock production. Birds require carbohydrates, protein, fats, vitamins, minerals, and water. Nutrients offered above a maintenance level are used for growth in young birds and egg production in adult birds. How we provide these very important nutrients to our birds is critical in maintaining healthy and productive animals. Good quality feed and water is paramount in producing a flock that will deliver optimum performance.

Feed should be selected based on the age of the birds and the activities which they will perform (egg production, growth, racing, hunting/release, etc.). Specially formulated feeds offer the nutrients needed for these specific activities. Specific vitamins that need to be supplemented in a diet include vitamin A, D_3, B_{12}, riboflavin, pantothenic acid, niacin, folic acid, thiamine, selenium, and biotin. Critical minerals including: calcium, phosphorus, sodium, chlorine, magnesium, potassium, etc. may need to be supplemented as well if the raw ingredients in the diet do not contain sufficient levels. Common ingredients used in manufacturing a complete feed include: corn, wheat, wheat-by-products, barley, soybean, soybean meal, flax, canola meal, bakery-by-products, etc. By-products of animal origin (poultry fat, meat meal, blood meal, meat and bone meal and tallow) are now very seldom used.

In commercial poultry production, feeds can come in the form of a mash, a pellet (also extruded pellets), or a crumble. A mash or crumble feed is generally fed to young birds. Pellets are meant for larger birds. Feeds are also formulated based on the age and production status of the bird. In general, younger birds need higher protein levels. Once the birds organs and skeleton have reached full size, protein levels are decreased. As birds grow older and go into egg production, the nutrient needs are again reviewed to address the additional physiological requirements.

In the game bird industry, nutrient requirements have not been well established because of the variation in the type of markets that they cater to. Diets that have been formulated for commercial turkeys have been used with some success. Additional feeds can be given to birds to supplement their requirements and provide variety. These supplements may be plants or weeds, seeds, grains, fruits, and nuts. It is important to be aware of the management style for your Class of bird and always take this into consideration when selecting a feeding

Feed should always be fresh. Old or spoiled feed may cause illness in birds. Periodically check the quality of the feed, paying attention to color, texture, and smell. Clean up spilled feed around the feed bin and surrounding feeders as this will be an attraction for moulds, rodents, and other vermin. Keep a record of the feed that has been fed to your birds and collect a sample from each batch in case a feed problem ever occurs. The feed sample should be placed in a sealed bag that is properly labeled with the date and batch number and stored in a freezer.

Additional information on feed rations for different types of birds is available in the book Commercial Poultry Nutrition, third edition, by Dr. Steve Leeson and Dr. John D. Summers.*

** Mention of specific sources of information is not intended to be an endorsement.*

Water

Good quality water is vital for keeping your birds healthy. Water makes up about 70% of a bird's body weight and on a daily basis, birds will drink at least twice the volume of water compared to the amount of food they consume.

Factors that Affect Water Quality

Food can be stored in an old freezer (not functioning). This keeps the food fresh and safe from pests.

Everyone who raises livestock or poultry should check the quality of the drinking water regularly. Water that comes from surface sources may contain pathogens or chemicals from runoff. Even water coming from deep wells can change in quality from season to season. Knowing the quality of your water by monitoring different parameters can aid in diagnosing bird health or management problems. Water should be tested a minimum of once a year.

Bacterial level

Water is usually analyzed for total bacteria and total coliforms (*E. coli* is used as the indicator). The level considered ideal for both tests is zero CFU/ml (Colony Forming Units of bacteria per milliliter of water). However, the maximum

acceptable levels are 100 CFU/ml total bacteria and 50 CFU/ml total coliforms. The presence of coliform bacteria in the water means that it has been contaminated with fecal materials. If the water supply is contaminated, measures should be initiated to treat it.

- Check the water source making sure that it is protected from surface drainage, sewage problems, and surface application of manure. If it is a well, make sure that well casings and general construction of the well head is sound.
- Contaminated water can be treated using appropriate filtration or a sanitizing chemical like chlorine, iodine, or hydrogen peroxide. Chlorine levels should be maintained at 1 ppm (parts per million) while hydrogen peroxide's recommended level is 30 ppm. Higher than the recommended levels may cause toxicity or water refusal from birds
- Drinkers should be cleaned regularly to get rid of slime, calcium deposit, and accumulated organic materials.

Sample bottle for testing bacterial level in water.

Minerals

Calcium, chloride, copper, iron, lead, manganese, nitrate, sulfate, zinc, and sodium should all be tested. Birds may not experience serious health problems with higher levels of certain minerals. For example, high levels of calcium will not be absorbed and will be passed out of the bird in the feces. However, certain minerals in water, when combined with the same mineral in a balanced feed ration can potentially cause problems. For example, combined levels of sodium may result in increased water consumption, wet bedding and loose stool. If using automatic drinkers, clean calcium and biofilms from the water lines. Acidifiers have been used effectively in the commercial industry for this purpose.

Iron and manganese give a bitter metallic taste and iron also supports the growth of bacteria like *E. coli* and *Pseudomonas sp.* Iron, manganese, and sulfur will produce a rotten-egg smell. Chlorination and filtration will alleviate these problems. Chlorine also reduces the oxidation of iron and can therefore prevent the development of rust. The level of calcium and magnesium will determine water hardness. This causes the build-up of scale and sludge that can reduce pipe volume and negatively impact cleaners and disinfectants. Softeners can be used to reduce this problem.

Clean feeders and drinkers on a regular basis or in between flocks to avoid scum built-up and pathogens being passed to new birds.

Fresh water in a clean drinker. Apple cider vinegar can be added to waterers to help keep them clean.

Water pH

pH is measured on a scale of 1-14 with 7 being neutral. Anything below 7 is acidic and intensifies as it gets closer to 1 while anything above 7 is alkaline (basic). Drinking water pH should be close to the neutral level or slightly acidic. A basic water pH level will make chlorination ineffective. On the other hand, very acidic water can be corrosive and unpalatable for birds. Recent studies have shown that acidifying water (using organic and/or inorganic acids) to a pH of 4-6 may provide beneficial protection against bacteria in the digestive tract. You can safely add a small amount of apple cider vinegar to your water to achieve this effect.

Key Points to Remember:

- Fresh, properly balanced complete feeds should be the target. The use of scratch grains as a supplement will dilute the nutrient content of the ration.
- Fresh potable water should be always available to your birds.
- Test your water at least once a year for bacteria levels, mineral levels and pH and treat if necessary.
- If you are going to acidify and sanitize your water, use the acidifier first.

- Do not mix chlorine and acid as this will result in the release of dangerous chlorine gas.
- Do not mix vaccines intended for water application with chlorinated water as the chlorine will neutralize the vaccine. Skim milk can be added to water (91 grams per 38 liters of water) to neutralize sanitizers.

TAKE HOME MESSAGE

Feed and water quality and delivery are very important for all types of birds. Providing the right feed to address the needs of the birds as they grow can make a big difference in their over-all health and performance. Clean, wholesome water promotes optimal performance and prevents many health concerns. Proper monitoring, cleaning, and sanitation are required to maintain water quality. Lastly, ensure that feed and water are always available. Always check.

Suggested References

Additional information on water quality, cleaning and sanitizing:

Hydrogen Peroxide in Drinking Water:
http://www.poultryindustrycouncil.ca/factsheets/fs_12.html

What is the Quality and Safety of Ontario Farm Drinking Water:
http://www.poultryindustrycouncil.ca/factsheets/fs_37.pdf

Water Quality: An Important Consideration:
http://www.poultryindustrycouncil.ca/factsheets/fs_65.pdf

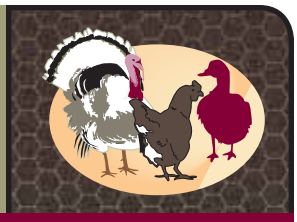
Water Sanitation:
http://www.poultryindustrycouncil.ca/factsheets/fs_85.pdf

Water Quality for Poultry:
http://www.poultryindustrycouncil.ca/factsheets/fs_111.pdf

Avian Advice: Index for all concerns:
http://www.poultryscience.uark.edu/avianindex.html

Poultry Nutrition:
http://www.omafra.gov.on.ca/english/livestock/poultry/facts/introduction.htm

Water Safety: Putting your well water to the test.
http://www.health.gov.on.ca/english/public/pub/watersafe/watersafe_welltest.html



Pest Management

Pest Management

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The primary goal of all pest control programs is the prevention and elimination of insects, rodents, free-flying birds, predators (i.e. raccoons and weasels) and other pests. Pests may introduce or maintain disease causing agents on a farm, kill or maim your birds and consume and contaminate animal feeds. Also many pests, like boring beetles and rodents, can destroy barn insulation, chew on electrical wiring and create serious fire hazards. Good housekeeping and sanitation are central to pest control in all facilities. Chemical and physical pest control measures maybe necessary in conjunction with proper sanitation, storage practices, insect and rodent proofing, and a regular maintenance program.

In commercial animal facilities, an Integrated Pest Management program (IPM) is a requirement for a successful and productive operation. IPM is a system that makes use of several tools to manage pests and lessen their impact on your bird's health. The first line of defense in an IPM program includes proper facility design and construction, regular facility maintenance, an organized and tidy environment and proper sanitation. Pesticides should be used only as a second line of defense. A facility that relies only on chemical control and does not focus on more basic preventive measures runs the risk of inadequate control, environmental damage, and non-target species effects.

- A sound **construction** program for new or rebuilt structures creates a barrier that prevents pests from entering the facility. This includes, easily cleanable barn floors (such as concrete), proper sweeps on barn doors to keep out rodents and careful screening of soffit and fan openings to prevent wild bird entry etc.
- A sound **maintenance** program ensures that any breaks in these construction barriers are promptly repaired and sealed.
- A sound **exclusion** program prevents the entry of pests through windows, doors, vents, and on incoming goods.
- A sound **sanitation** program removes pest hiding places, and spilled feed or water on floors/around feed bins that could attract and support a pest population.

Daily Activities in Pest Management

1. Eliminate sources of standing water.
2. Keep grass and weeds cut around the barn (3-5 feet).
3. Pick up and dispose of any refuse and garbage. Have proper, well maintained disposal containers that can be sealed; empty them regularly.
4. Close all doors when not in use. All windows should be screened.
5. Carefully check all incoming bedding for pests and reject any infested or contaminated incoming supplies. For example: straw

Solid covering over feed and water as well as netting over and around birds will protect them from the majority of pests.

contaminated with raccoon feces and then used as animal bedding often results in raccoon round worms infecting birds resulting in neurological disease.

6. Clean and remove dust as frequently as possible. Set up a cleaning schedule and follow it.
7. Keep feed bins in good repair and rodent proof lids on feed storage containers and quickly clean up any spillage.
8. Remove old equipment, lumber or debris that encourages hiding or nesting.
9. Keep records of all of these activities. These records become the basis for effective on-farm biosecurity programs.

All animals are potential carriers of pathogens. Key pests on bird farms include rats, mice, darkling beetles, mites, flies, wild birds, weasels, raccoons, skunks, and stray cats and dogs. Know what pests are present in your facility and for each type of pest find out about their life cycles, where they are found and how they could have arrived at your farm. Then design a monitoring regimen and an effective eradication and control plan.

Rodents (rats and mice)

Bait traps should be checked often. They should be kept away from the bird pens to avoid causing harm to your birds.

Rodents are major vectors and reservoirs of bacteria and viruses. Map your facility and identify the severity of the infestation. Watch for droppings, rodent runs, burrows, gnawing marks, odours, and other signs of activity. Obtain baiting stations or traps and choose the bait that is applicable to your problem. Bait stations can be bought from feed supply stores, from rodent control companies, or they can be home-made. The most common one is a simple 18" × 3" diameter PVC pipe. Bait stations keep the rodenticides protected from the elements and away from non-target animals. These bait stations should be placed about 20-60 feet apart (depending on severity of problem) around the perimeter of the building, in the attic, entry rooms, or even near fences. Bring the baits to the rodents! Baits should be monitored for activity and always kept available, dry, and fresh (no moulds, dust, stale bait). Wear gloves when handling them.

Baiting is most effective if your bird housing area is empty (i.e. during periods when birds have been sold, moved or between flocks) as you can intensify the effort during these periods. Once feed becomes unavailable, bait acceptance is enhanced. A good description of rodenticides available in Ontario can be found in the OMAFRA factsheet #07-009: Rodent Control in Livestock and Poultry Facilities, which is in the Supplementary factsheets (4.3).

Darkling Beetles (*Alphatobius diaperinus*)

Insect bait.

Darkling beetles (adults) and lesser mealworms (larvae) have been found to carry Salmonella and other organisms including some viruses. They shed them in their droppings for up to 28 days. Examine used bedding and floor wall junctions for larvae and adult beetles after a flock is removed or pens are being cleaned. Monitoring traps can be made from PVC tubes, 12" × 1-1.5" diameter containing 12" × 12" piece of paper towel. Roll this and place it inside the tube. Place traps along the walls and near feeders for 1-2 days or even longer if the manure is still in the barn. After the sampling, dump the trap contents and count the insects. Score can range from slight (0-9) to severe (100+) infestation. Apply an insecticide after cleaning and disinfecting the premises. There are many insecticide products on the market. The total amount of solution to be used will depend on the types of surface being sprayed. Always read and follow the product instructions carefully.

Flies

Flies are best controlled through:

a) Proper management of feed, manure, and facilities;

b) Use of beneficial insects (tiny wasps) that feed on immature fly eggs and larvae;

c) Use of chemicals including various fly baits and papers.

Monitor the severity of the fly infestation using sticky tapes, speck fly counting, or baited jug traps. Fly traps with bait (i.e. dichlorvos) are usually the best way to use baits. Flies may also develop resistance, so switching to other compounds maybe necessary. Some chemicals have residual activity. Some of the products available* include: Disvap Spray, Vapona, Ectiban (permethrin), Tempo, Larvadex, Rabon, etc. Most of these can be obtained through local retail outlets, feed suppliers, farm supply stores or commercial pesticide companies.

Keep pools fresh and remove any stagnant water that will attract insects.

Mites and Lice

There are two main types of mites that occur in poultry in Ontario: red mites (*Dermanyssus gallinae*) and Northern fowl mites (*Ornithonyssus sylviarum*). Both types feed on blood and are found close to the skin. Due to the birds' feathers, penetration of insecticide to the site of infestation is often difficult. Spraying or direct contact application with a rag is necessary. Chemicals like permethrin (Ectiban), carbaryl (Sevin), malathion (Malathion 50) and dichlorvos (Ravap) have been used successfully. Other species of birds such as pigeons and ratites have their own species of mites, but the same chemicals have been found to be effective.

Insects

Insects such as mosquitoes and black flies can also be important transmitters of disease. Mosquitoes are well known to carry avian pox viruses as well as West Nile Virus. Blackflies can transmit bird malaria. Usually chemical means do not control these pests, but good facility maintenance, removing all possible sources of stagnant water and selected use of screening may help reduce the problem.

Cats

Cats can carry organisms pathogenic to birds and therefore should not be allowed entry to the restricted area. In many cases the food and water left out for the cat may be the reason there is a rodent problem. In some commercial operations cats have been used for rodent control. They should be regularly tested to be free of certain pathogens, (i.e. Salmonella), and not allowed access outside the barn once living indoors.

Other Pests

Weasels, foxes, skunks, raccoons, opossums and predatory birds like members of the accipiter hawks (Sharp-shinned hawk, Cooper's hawk and Goshawk) are common predators in pigeon lofts and game bird operations. Proper fencing and netting, secure penning and screening of windows will help prevent these pests from entering. If these species become a problem contact a pest control professional.

Moles, gophers, ground hogs and squirrels may damage facilities. The best defense is to minimize habitats which they find comfortable for nesting and make certain they do not have access to feed. There should be no wood or garbage piles in the area

Small rodents and mammals can cause severe damage and are a disease risk. Lowering suitable habitats like brush and long grass will reduce risks. Humane removal (such as this raccoon in a live trap) of pests is recommended.

and there are some mechanical repellants available including irritants, water sprayer, and sound devices. Eraze, Mole and Gopher Bait, Ground Squirrel Bait, and Tomcat are some chemical preparations that can be used.

Be Aware of Human Safety Concerns

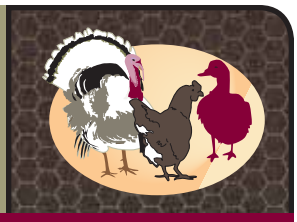
Be aware that all rodent and pest control products have biological, environmental, food safety, welfare, occupational safety, and regulatory implications. Always consult with pest control professionals and regulatory bodies to ensure that these issues are covered. Everyone that handles these products should be educated and trained.

SUGGESTED REFERENCES

Rodent Control in Livestock and Poultry Facilities. OMAFRA factsheet #07-009 (4.3) in the Supplementary factsheets:
http://www.omafra.gov.on.ca/english/livestock/dairy/facts/07-009.htm#rodenticides

A Guide for managing Poultry Insects
http://www.ianrpubs.unl.edu/epublic/pages/publicationD.jsp?publicationId=499

*Mention of trade names is not an endorsement for the products.



Rodent Control in Livestock and Poultry Facilities

This Factsheet by Brian Lang from the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) explains rat and mouse behaviour as a means for better rodent control.

Rats and mice have long been a problem on farms where food and nesting sites are plentiful. These animals consume and contaminate food destined for livestock and other animals, as well as humans. Each rat on a farm will eat, spoil or damage approximately C$25 worth of grain per year. The adaptability and agility of these animals make getting rid of them particularly difficult. Mice are capable of running up a vertical surface, negotiating a wire like the finest circus performer and can easily jump to a height of 30 cm (12 inches) from a flat surface.

Why Control Rodents?

Damage comes in many forms:

- **Damage to buildings.** Mice and rats will damage wood and electrical wiring, which can be a fire hazard.
- **Destruction of insulation.** Many livestock and poultry facilities show serious deterioration within five years. Associated with this damage are costs for re-insulation, increased energy costs and poorer feed conversions by animals.
- **Feed consumed.** A colony of 100 rats will consume over one tonne of feed in one year.
- **Feed contaminated.** A rat can contaminate 10 times the amount of feed it eats with its droppings, urine and hair. A rat produces 25,000 droppings per year, a mouse 17,000. The US Department of Agriculture estimates that the equivalent of more than US$2 billion in feed is destroyed by rodents each year.
- **Biosecurity.** Rodents are recognized as carriers of approximately 45 diseases, including salmonellosis, pasteurellosis, leptospirosis, swine dysentery, trichinosis, toxoplasmosis and rabies. Mice and rats can carry disease-causing organisms on their feet, increasing the spread of disease.

Understanding Rodents

Mice and rats have tremendous breeding potential. Under ideal situations, a pair of rats and their offspring can produce 20 million young in three years. Mice reproduce even faster. One female mouse can give birth to five to 10 litters per year, yielding five to six young per litter. The gestation period is a mere 19 to 21 days. These babies are sexually mature in six to 10 weeks. The average female mouse lives to be nine months. One female rat is capable of producing another 22 breeding females in a year (assuming a 50:50 male/female ratio of offspring), which mature in three months after parturition.

Rats and mice have poor eyesight but excellent senses of smell, taste, touch and hearing. They do not like open areas and prefer contact with walls and other objects. They do not range far from the nest. The maximum range for rats is 45 metres (148 feet), for mice nine metres (30 feet). Rats are extremely apprehensive about new objects and will avoid them for several days. Leaving a trap out for about five days is necessary to ensure acceptance. Mice quickly accept new objects. These tendencies become very important when designing baiting or trapping programmes.

Does Your Farm Have a Problem?

Producers should not be embarrassed to admit they have a rodent problem. Surveys in Ontario indicate that 80 per cent of poultry producers and 89 per cent of swine producers have rodent problems. The probability is that mice or rats currently exist on your farm. The embarrassment and costs occur if something is not done to confront the problem.

The following are signs of rodent infestation:

- **Sounds.** Gnawing, climbing noises in walls, squeaks.
- **Droppings.** Found along walls, behind objects and near food supplies.
- **Burrows.** Rat burrows are indicated by fresh diggings along foundations, through floorboards into wall spaces.
- **Runs.** Look for dust-free areas along walls and behind storage material.
- **Gnawing marks.** Look for wood chips around boards, bins and crates. Fresh gnawing marks will be pale in colour.
- **Rodent odours.** Persistent musky odours are a positive sign of infestation.
- **Visual sighting.** Daylight sighting of mice is common. Rats are seen in daylight only if populations are high. Quietly enter your barn at night, wait in silence for five minutes and listen for the sound of rodent activity. Look around with a powerful flashlight; rat eyes will reflect the light.
- **Smudge marks.** These may be found on pipes or rafters where dirt and oil from their fur leave a greasy film.

It is a generally accepted rule of thumb that there are approximately 25 mice or rats for every one that is seen.

Is It a Rat or a Mouse Problem?

Since rats and mice require different control strategies, determine whether the problem is rats or mice (Table 1). The simplest way to differentiate between the types of infestation is by examining the droppings. Mouse droppings are black and rice-kernel size, whereas rat droppings are black and bean-sized.

Table 1. Physical and behavioural characteristics of adult rats and mice

Characteristic	Norway rat	Mouse
Size (including tail)	42cm (16.5 inches)	16cm (6 inches)
Average weight (adult)	500g (18 oz)	20g (0.7 oz)
When active	nocturnal	nocturnal
Sight	poor (1.5 metres; 4.9 feet)	poor (1.0 metre; 3.0 feet)
Smell, touch, taste	excellent	excellent
Hearing	highly accurate	highly accurate
Range from nest	45 metres (148 feet)	9 metres (30 feet)
Fear of new objects	3-7 days	3-5 hours
Water requirements	daily	2-4 days without
Food per day	28g (1 oz)	3g (0.1 oz)
Water	57g (2 oz)	3g (0.1 oz)

Characteristic	Norway rat	Mouse
Favourite foods	rolled oats, meat, fish, vegetable oil	grains, rolled oats, sugar, raisins
Droppings	bean size	rice size
Minimum width for entrance (hole diameter)	12mm (0.5 in.)	6mm (0.2 in.)
Can chew through (given edge to gnaw on)	rubber, aluminium, cinder blocks, plastic, wool	same as rats

What Do Mice and Rats Like to Eat?

Rats and mice can be considered to be omnivorous. Given a choice, they prefer cereal grains. Rats eat meat when available. However, when food supplies are scarce, they will eat almost anything, including plaster and even soap or animal carcasses. Mice have been known to nest over winter inside the carcass of a deer stricken with rabies, consume the meat and become infected. They then become vectors of this disease. Rats and mice eat every day and prefer a water supply. Rats usually drink every day, but mice can survive several days without water.

Rodent Control – The Principles

Rodent control requires an integrated pest-management strategy involving many techniques. The producer's first objective should be to prevent, or at least greatly reduce, rodent numbers through management programmes that eliminate entrance to the facility, nesting sites for the rodents, food supplies and water. Populations build when food, water and nesting sites are readily available.

Habits and biology

To control mice and rats, we have to understand their habits and biology first. Mice and rats are similar in their habits and biology, although there are some differences between the two (Table 1).

- Both are highly reproductive and extremely capable of surviving in all kinds of conditions. Theoretically, if there is one pair of mice (one male and one female) in your barn at the beginning of a year, under fair living conditions, by the end of the year, you may have thousands of them on your farm.
- On farms, mice and rats will be near a food source such as barns, granaries, livestock buildings and silos.
- Rats and mice can climb and jump. Rats can jump vertically as high as 91 cm (36 inches) and horizontally as far as 122 cm (48 inches).
- Mice and rats can climb brick and other rough walls, and travel along utility wires.
- Rats can cross (sneak in) through openings as small as 1cm (½ in.) and mice can squeeze through openings of 0.6 cm (¼ in.), or less, in diameter.
- Both mice and rats are active at night, particularly right after dusk.
- Rats are smart and tend to avoid new objects. Therefore, it may take a few days for traps and baits to work.

Rodent-proofing farm buildings

Proper construction and maintenance of buildings helps prevent rodents from entering your barn. Initial construction footings should extend 50 cm (19 inches) into the ground with an apron that extends 20 cm (8 inches) outward. This prevents rodents from burrowing

into your building. To prevent frost damage, footings may have to be deeper. Examine your building at least once a year for possible entry ways for rodents. Remember, a mouse needs only a 0.6 cm (¼ in.) opening to gain access; rats need a 1 cm (½ in.) opening. Cracks around door frames, under doors, broken windows, water and utility hook-ups, vents and holes surrounding feed augers are potential points of entry. Use coarse steel wool, hardware cloth or sheet metal to cover any entrances. Do not use plastic, wood or insulation, as rodents simply gnaw their way through.

When constructing walls, ensure that sheeting lies flush to the wall studs rather than on strapping. This keeps nesting sites confined to a single section between studs rather than allowing complete access to all wall spaces. For further information, see Plan No. M 9451 of the Canada Plan Service Series, Rodent and Bird Control in Farm Buildings. A well-maintained structure is your first defence against rodents. Most rodents enter your barn directly from the fields, then the population builds. It is important to maintain good sanitation outside the barn. Eliminate vegetation for one metre (3 feet) around buildings, clean up spilled feed, remove loose wood, garbage, etc. Do not attract rodents from fields to your operation.

Eliminating hiding places and nesting sites

Rodents do not like to be exposed. Maintain sound housekeeping, eliminate loosely piled building materials, old feed bags or anything else that a rodent can hide in or under. Keep piles of lumber, miscellaneous equipment 24 to 30 cm (9-12 inches) off the floor and at least 24 cm (9 inches) out from a wall. Look for entrances into double wall construction. Most rodents nest in the insulation of double walls. Block off all entrances into walls and destroy all nesting material.

Remove food and water

Eliminate water sources such as leaky taps, open water troughs, sweating pipes and open drains. Keep all feeds in rodent-proof bins, covered cans or metal hoppers. Reduce feed spillage and immediately dispose of dead animals. Without readily available food and water, populations cannot build.

Control of Existing Population

If there is already a rodent problem inside the barns, prevention alone will not solve the problem. In this case, consider a population-reduction programme.

Snap traps

For small populations, snap traps or box traps are very useful for eliminating rodents. Rats prefer fresh bacon, fish and meat, while mice favour cheese, peanut butter or seeds. Try several baits to find out which your rodents prefer. Rats are distrustful of anything new in their environment, so leave baited non-set traps out for four to five days to allow them to get used to the traps. Ensure that previous baits have been taken before actually setting the traps. If rats are the problem, use rat traps. If mice are the problem, use a mouse trap. Locate traps close to walls, behind objects, in dark corners, where you see droppings or gnaw marks. When trapping next to a wall, set the trap at right angles to the wall with the trigger and bait closest to the wall. Orient multiple-catch traps with the entrance hole parallel to the wall. Live traps can work very well near runways used by mice and rats.

Glue boards

Glue boards are very effective against mice and are the method of choice in locations where toxic baits are a concern. Glue boards will not work well if there is too much dust. They are only recommended where dust can be kept away from them. Check glue boards and traps

daily and remove and dispose of dead mice and rats. Wear rubber gloves when handling them to prevent any chance of disease infection.

Abundant food supplies make baited traps less effective. Eliminate as many sources of food as possible before starting the programme. For barns and poultry houses with moderate infestations, set 50 to 100 traps. The trapping programme should be short and decisive to prevent trap shyness. Odours from humans or previously caught rodents do not cause trap shyness. When disposing of dead rodents, use plastic gloves and place the rodents in tightly sealed plastic bags.

Predators

Cats may limit low-level mouse or rat populations. However, if conditions are ideal for rodents, cats cannot eliminate a problem. Cats may introduce disease into a facility by bringing in rodents caught in fields. Cats will not be able to catch mice as quickly as they multiply.

Sound and ultrasound devices

These two methods may not be effective. Rodents may be frightened by strange noises in the first few days but then quickly become used to them.

Rodenticides (toxic baits)

All products are poisonous to other animals. Always observe label precautions regarding use, handling and storage.

In BC, to purchase or apply Restricted Pesticides, a producer must be certified through the Pesticide Applicator Certification. Restricted Pesticides have the word RESTRICTED in bold letters on the label. Worker's Compensation Board may also require pesticide applicators on farms to have a pesticide applicator certificate. Occasionally pesticide labels state that a product can only be used by a certified pesticide applicator. To find out if you need an applicator certificate, either check the pesticide label or visit the BC Ministry of Agriculture's Pesticide Wise web site (http://www.al.gov.bc.ca/pesticides/).

All pest control products used on-farm should be authorized for agricultural production, approved under various federal and provincial laws and not prohibited under these laws or regulation, and sold in accordance with these laws, for example, the *Pest Control Products Act (Canada), 2002*, c. 28 and requirements of the *Integrated Pest Management Act*, S.B.C. 2003, c. 58, P2, *Integrated Pest Management Regulation*, Reg. 604/2004, and *Hazardous Products Act* (Canada), R.S. 1985, c. H-3.

Pest control products must not cause contamination of foods that are listed in the *Food and Drugs Act* (Canada), R.S. 1985, c. F-27, Food and Drug Regulations, Division 15. Under the *Food Safety Act*, S.B.C. 2002, c. 28, *Meat Inspection Regulation*, Reg. 349/04, food animals are inspected against the standards related to food safety and animal health established under the *Food and Drugs Act* (Canada) and the *Meat Inspection Act* (Canada).

The pest control product label is a legal document that specifies restrictions on its use. The *Pest Control Products Regulations*, C.R.C., c. 1253, s. 45 (1) specifies that no person shall use a control product in a manner that is inconsistent with the directions or limitations respecting its use shown on the label; (2) No person shall use a control product imported for the importer's own use in a manner that is inconsistent with the conditions set forth on the importer's declaration respecting the control product. Similarly, the *Integrated Pest Management Act*, S.B.C. 2003, c. 58, s. 3 (1) (c) specifies that no person shall use a pest control product except in accordance with the label for that product.

The *Pest Control Products Act, 2002*, c. 28, s. 6 prohibits the manufacture, storage, display, distribution or use of pest control products under unsafe conditions or contrary to the regulations. Certain pesticides may be prohibited under any circumstances.

There are two basic types of rodenticides: acute poisons and anti-coagulants. Use rodenticides (Table 2) when control of moderate-to-large rodent populations is necessary. Many of the newer anti-coagulant products, i.e. bromadiolone and brodifacoum require single feedings by rodents to cause mortality. Occasionally, rodents may develop a bait shyness after being made sick but not killed by a rodenticide. The shyness develops to the bait carrier, e.g. grain, and not to the rodenticide. Simply use another formulated product or different attractant if bait shyness develops. For rats, pre-bait using baits without the poison for about one week to get them accustomed to the bait. Place baits in areas of high rodent activity. Many people under-bait in their control programme. Baits should be 1 to 2 metres (3 to 6 feet) apart for mice and 7 to 10 metres (23 to 33 feet) for rats. **Remove all uneaten baits and properly dispose of them after the poisoning programme.**

Table 2. List of approved active ingredients for rodent control in Ontario, May 2010*

Active Ingredient	Ontario Approved Class(es)
brodifacoum	4,6
bromadiolone	4,5,6
bromethalin	3
cellulose from powdered corn cobs	4,5,6
chlorophacinone	4,5,6
difethialone	4,6
diphacinone	4,5,6
warfarin and sulfaquinoxaline	4,6
warfarin	3,4,5,6
zinc phosphide	3
* excludes Class 1 products used by manufacturers	

Precautions When Using Rodenticides

Ideally, cover all baits to prevent consumption by children, cats, dogs, poultry and swine. This can be done by placing baits in bait stations or bait boxes that allow ready access by rodents but prevent larger animals from gaining access. A baiting station designed from PVC piping (Figure 1) has proven very effective in reducing rodent numbers. The cap and interior baffles keep the bait from falling out.

The advantages of this station include:

- station is easy to fill and replenish
- bait stays dry, making baits more attractive to rodents
- small entrance attracts rodents and increases feeding, particularly if plenty of additional feed is available
- design prevents feeding by pets, birds and livestock

Ensure that pets, livestock and poultry have no access to water bait stations.

Conclusion

Elimination of rats and mice from livestock and poultry barns is extremely difficult. It is preferable for producers to prevent infestations from occurring. If a problem does exist, the options described in this Factsheet should be useful in limiting rat and mice populations.

References

- Factsheet: Rodent Control. Solvay Animal Health, Inc.
- The Veterinarian's Guide to Managing Poisoning by Anticoagulant Rodenticides. Liphatech. 2001.
- Ontario Ministry of the Environment. Pesticide Product Information System.

This Factsheet was originally authored by G.A. Surgeoner, Professor, University of Guelph, and revised by Betty Summerhayes, Product Development Specialist, OMAFRA, Guelph, and Brian Lang, Dairy Cattle Production Systems Specialist, OMAFRA, Woodstock. Information on the PVC baiting station by B. Corrigan, Purdue University, is gratefully acknowledged.

December 2010

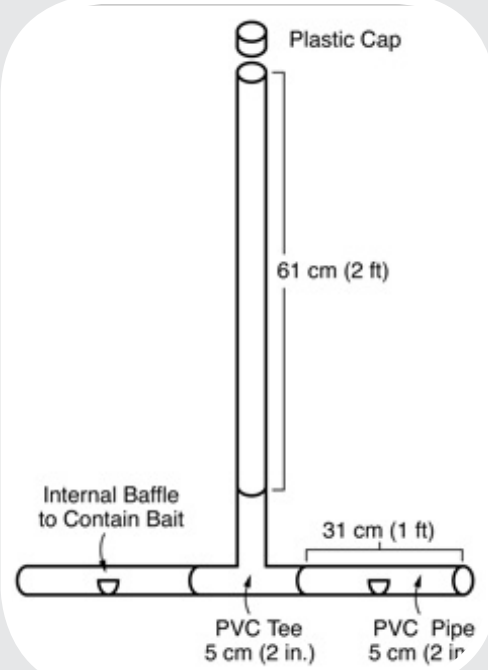
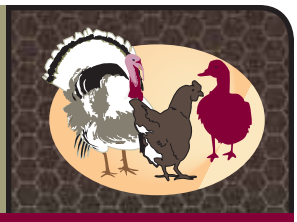


Figure 1. Drawing of a safe, effective, homemade baiting station (Purdue University)



Predators: Thieves in the Night

Joe Berry
Extension Poultry Specialist
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Poultry producers should be aware of the possibility of losses to predators. Owners of small flocks usually have more difficulty with predators than those with large flocks, primarily due to differences in housing. Small flocks are sometimes housed in buildings that need repair or are not specifically designed for poultry. As a result, predators have less difficulty gaining access to the birds. However, large flocks housed in new buildings in good repair can also be victims if proper precautions are not taken. Anticipating problems and taking necessary preventative action is the best defense against predators.

Housing

Properly constructed houses can do much to discourage predators. Deep foundations keep animals from tunneling under, tight fitting windows and doors that are screened with poultry netting or hardware cloth keep unwanted visitors out, and siding and/or curtains kept in good repair also prevent entry from outside. These suggestions apply to all sizes of houses and all sizes of flocks.

Rats and mice, although not usually problems as predators, encourage the entry of other predatory animals by gnawing holes in the wood or by burrowing around buildings. A good rodent control program is necessary for proper predator control.

Fences

If small flocks are allowed outside the house, fences are important. Fences not only confine the birds to a desired location, but if they are properly constructed, they keep out most predators. A mesh wire with openings smaller than one inch is recommended. Burying fencing with the lower 6-12 inches turned outward deters predators from digging under the fence. A convenient method of burying the lower part of the fence is to plow a furrow against the turned portion.

Playing Detective

The following key may aid in identifying the predator:

	Clues	Possible Predators
1.	Several birds killed	
	a. Birds mauled, but not eaten	Dogs
	b. Birds killed by small bites on body – neatly piled – some heads eaten	Mink or Weasel

	Clues	Possible Predators
	c. Heads and crops eaten on several birds	Raccoon
2.	One or two birds killed	
	a. Birds mauled, abdomen eaten	Opossum
	b. Deep marks on head and neck, some meat eaten	Owl
3.	One bird gone – feathers remain	Fox or Coyote
4.	Chicks killed – abdomen eaten – lingering smell	Skunk
5.	Several birds gone – no clues	Human

In many instances predators leave clues to their identity when they have visited a poultry house. From these clues the poultry producer may be able to identify the culprit and take the necessary steps to prevent a reoccurrence.

Dogs. A dog usually kills chickens for the sport. Several dead birds with much mauling of the carcasses is usually evidence of a dog. Dogs usually visit the chicken pen during daylight hours rather than at night.

Mink-Weasel. Birds usually show signs of attack on the sides of the head if a mink or weasel has visited the poultry house. With these predators, several birds will probably be killed and piled neatly together. The back of the head and neck are frequently the only parts of the carcass consumed.

Raccoon. If a predator visits only once each 5 to 7 days and eats the head and the crop of the dead birds, a raccoon is probably responsible. Sometimes more than one bird will be killed at each visit.

Opossum. The opossum generally attacks only one bird at each visit. Usually, the bird's abdomen has been eaten. Eggs may also be the object of the opossum's raid on the chicken house.

Owl. The only likely culprit here is the great horned owl, which does sometimes attack poultry. One or two birds are usually killed, with the talons being used to pierce the brain. The owl will usually eat only the head and neck. Feathers found on a fence-post near the chicken house or pen may provide an additional clue.

Fox-Coyote. The old sayings about the sly fox were not by accident. The fox and the coyote are very smart and difficult to catch in the act of raiding the flock. Since birds are frequently carried away with little evidence left behind, the only way of determining losses may be a head count. Visits from these predators will usually be very early in the morning. Keeping birds in a secure pen or poultry house until late morning is good insurance against losses from a fox or coyote.

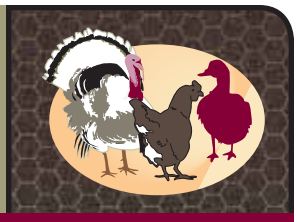
Skunks. Skunks do not usually attack adult birds. They may kill a few chicks and eat the abdomen. Eggs may also be the targets. If skunks have been in the poultry house the odor is usually a clue.

Humans. Unfortunately, there can be problems from people as well as animals. If birds are missing with very little evidence, particularly from a predator proof pen or house, the possibility of humans being involved should not be overlooked.

Preventing Repeat Visits

Determining the identity of the predator is essential in preventing repeat visits. Once identification has been made, appropriate steps can be taken. Eliminating the point of entry is the first deterrent and eliminating the source of the problem by trapping or other means is the second. Trapping should be done properly to minimize the chances of catching an innocent animal. Seeking advice from a wildlife specialist is desirable if individuals have no experience with trapping.

Again, prevention is the best solution to the predator problem.



Sanitation

Introduction to Disinfectants

Dr. Bruce Hunter, Ashley Whiteman, Dr. Babak Sanei, and Al Dam
University of Guelph and Ontario Ministry of Agriculture, Food, and Rural Affairs

The Cleaning and Disinfecting factsheet (3.3) has already described the rational and procedures for properly sanitizing your facility. Physical cleaning (i.e. by pressure washing) of the barn and the removal of all organic material including food, carcasses, bedding, litter, dust on the walls etc. is a critical step that must be done before disinfectants are applied. It is known that cleaning before disinfecting will save you time and significantly reduce the pathogen load.

Disinfectants are the chemicals (see table) or physical agents (heat, sunlight, etc.) that when applied to surfaces will kill or inactivate microorganisms. Each disinfectant has different strengths and weaknesses and there is no single ideal disinfectant. If there was an ideal disinfectant it would be: fast acting, inexpensive, non-corrosive, non-toxic, would work in the presence of organic matter at any temperature and would be effective against a broad spectrum of microorganisms. Unfortunately there is no disinfectant that fulfills all of these criteria.

How do I select a disinfectant?

Disinfectants can be organized into categories based on their chemical properties. They can kill the microorganisms by various methods including: protein denaturation, membrane disruption, nucleic acid damage, etc. Some disinfectants work better against bacteria vs. viruses vs. fungi, etc. A broad spectrum of activity will kill bacteria, viruses and fungi. The following table provides some information that will help you decide which disinfectant is appropriate for your application. Regardless of the disinfectant that you choose make sure that you read the label, follow the instructions and adhere to all human health and safety precautions.

All available product label information for disinfectants made and sold in Canada can be found under Product Used for Chickens: Disinfectants and/or Sanitation of Animal Facilities: http://bam.naccvp.com/?u=country&p=msds

Properties of Commonly Used Disinfectants

Type	Mode of Action	Properties	Limitations	Spectrum of Activity	Remarks
Aldehydes	Kills by protein denaturation. Binds to amine groups in the cell causing a toxic effect and killing the cell.	Rapid action, residual property, non-corrosive, not affected by small amounts of organic matter	Irritating vapours	Kills a broad spectrum of bacteria, fungi and viruses. Sporicidal in high concentration	May come in combination with other chemicals like quats. and alcohol Product examples: Virocid

Type	Mode of Action	Properties	Limitations	Spectrum of Activity	Remarks
Chlorines	Kills by protein denaturation, inactivation of nucleic acids, and oxidation	Kills quickly, inexpensive	Easily inactivated by organic materials, volatile, corrosive, non-residual, pH dependent	Broad Spectrum	Do not mix with other disinfectants or cleaners. Strong odour. Product examples: Bleach
Cresylic Acid	Invades the cell causing it to rupture	Good organic soil tolerance, some residual action, creates hostile environment for vectors	Can be toxic, strong odor, irritant, corrosive, must be saponified to be water soluble. May be too strong to use frequently or in hatcheries.	Fast acting, strong antimicrobial activity but limited virucidal and sporicidal activity. Will kill gram negative bacteria, but not positive.	Coal tar derivative Product example: Creolin is available in most co-op stores. It can also act as an insecticide. It also has phenols in it.
Formaldehyde	Kills by penetrating membranes and changing the amine group in the proteins within the cell, Interference with metabolism causes death	Commonly used for fumigation, effective at barn temperature of 21 degrees C and a relative humidity of over 70%. Avoid human exposure	Toxicity concern, gas penetration can be limited	Broad Spectrum	Product examples: Profilm, Formaline and Fumalyse II is used for fumigation and disinfection: www.bioagrimix.com/engnew/ html/products.html
Iodine (chlorhexidine)	Kills by oxidation, interferes with cell metabolism	Quick kill, inexpensive, can be used in the presence of birds. Can also be used for footbath and water sanitizing due to low toxicity.	Corrosive, non-residual, volatile, inactivated by organic materials,	Broad spectrum	Product examples: Biodine, Hibitane Disinfectant, Nolvasan and Premise Disinfectant
Peroxygen (oxidizing agents)	Adsorbed into cell wall. Reactions lead to a porous membrane. Causes precipitation and leakage	Fast-acting, effective on porous surfaces, hard water, low temperature. Can come in powder or tablet form for easy storage	May be corrosive in high concentrations	Broad spectrum	Product examples: Kilco, VIREX, hyperox Virkon tablets and Virkon Disinfectant & Cleaner P.W.S /www.vetoquinol.ca/en/index.asp?page=63
Phenols	Invades the cell causing it to rupture	Rapid kill, not greatly affected by organic materials, residual action. Incompatible with nonionic wetting agents.	Can be corrosive, irritating to skin, environmental disposal problems.	Broad spectrum of activity	Product examples: Multi- Phenolic Disinfectant, which also has detergent mixed in. www.bioagrimix.com/engnew/ html/products.html Also LpH, and Environ LpH (contains alcohol also)

Type	Mode of Action	Properties	Limitations	Spectrum of Activity	Remarks
Quaternary Ammonium (Quats)	Increases the permeability of membrane. Water diffuses inward until cell bursts	Odourless, can be used with animals present, Least corrosive. Different formulations out on the market. i.e. ammonium chloride vs. Cetrimonium Bromide	Incompatible with anionic detergents, must be formulated correctly to work in hard water. Organic material reduces efficacy, but may some products are not effected.	Limited fungicidal activity, may not work for "naked" viruses	Product examples: Coverage 256, PF 300, Proquat and Rocco. Also available is DuPont 904. It has virucidal abilities and is also safe for use in hatcheries: www.vetoquinol.ca/en/index.asp?ref=63&page=187

Key Points to Remember:

- **READ THE LABEL.** This will give you everything you need to know. This includes: effectiveness, dilution rate, toxicity, corrosiveness, application methods, storage, contact time and safety information.
- **Safety first.** Take the needed precautions when applying the disinfectant to keep yourself protected (i.e. gloves, long sleeves, eye protection).
- **Use the instructed dilution rate.** More is not always better.
- **Allow** at least the suggested exposure time. This is the time that the disinfectant requires to be left on the surface or in the environment before being rinsed or vented. Exposure times vary. Leave the area. Vent well afterwards.
- **Disinfectants should never be mixed together** unless directed by the label. The different properties could cause dangerous chemical reactions.
- Always **mix/dilute a new solution of disinfectant every time.** Once mixed, chemical properties change over time and become unpredictable.
- Take note of the **application method** (be sure you have the proper equipment) and the amount of product needed to cover the entire area.
- **Store the disinfectant properly.** Usually it is best to have the chemicals in a separate and secure area (away from children and pets), in air tight containers away from direct heat or humidity.
- **Clean the area with soap and water before you disinfect.** Most disinfectants are inactivated by organic matter. Remove as much organic material as possible.
- **Keep records** of which disinfectants you used for each section of your operation (i.e. hatchery vs. outdoor pen).

Suggested References

Cleaning and Disinfecting to Prevent a Foreign Animal Disease Outbreak PIC factsheet 157, Supplementary factsheets 4.4:
http://www.poultryindustrycouncil.ca/factsheets/fs_157.pdf

Disease Prevention through proper Disinfection and Sanitation:
http://habitrail.com/hari/docu/tabcon6.html

Clean and Mean: Effective targeting for Disinfectants
http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/pou3653?

Compendium of Veterinary Products
http://bam.naccvp.com/?u=country&p=msds

*Mention of trade names is not an endorsement for the products.

Cleaning and Disinfection

Dr. Bruce Hunter, Ashley Whiteman, Dr. Babak Sanei, Al Dam and Dr. Teresa Cereno
University of Guelph and Ontario Ministry of Agriculture, Food, and Rural Affairs

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 disinfection (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.

An example of a facility with C&D challenges.

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.

Clean all debris off of cages with water and preferably a detergent as well (there are varying types, including organic) before disinfecting.

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 surface that you are cleaning.

There are two basic types of detergents that can be used: a) Alkaline-based detergents that remove proteins and fats, and b) Acid-based detergents that remove mineral deposits like scales. 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.

Organic material cannot be disinfected!!

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.
- It is best to apply the disinfectant on a dry surface. So air-out the barn after cleaning.

- Determine the surface area (in square feet) to be disinfected using the following formula:

  Barn without cages:
  Length × width × 2.6 = area (sq ft)

  Barn with cages:
  Length × width × 3 = area (sq ft)

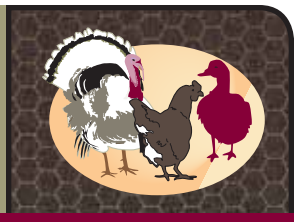
- Prepare the disinfectant solution based on the total area to be treated and use the dose provided by the manufacturer. Start application from the top of the barn and work your way down to the floor.
- Close and lock the barn. Keep people and animals out of the barn for a **minimum** of eight hours 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.*



Step-by-Step Cleaning and Disinfection

Dr. Claude Thibault
Manager, Technical Services
Vétoquinol N-A Inc.

Steps in Terminal Disinfection

Terminal cleaning and disinfection are done after the flock has been removed from the premises or buildings. The elements of terminal cleaning and disinfection include:

- Gross Soil Removal
- Water Line Sanitation
- Cleaning
- Disinfection
- Fogging

1. Gross Soil Removal

- Removal of all organic matter is essential.
- Litter, feces and refuse contain **high levels of contamination.** High levels of soil **reduce the efficacy** of the cleaning and disinfecting processes.
- Remove any **residual feed** from the feeder system and the silos.
- Remove, clean and disinfect all **mobile equipment.**
- Clean and dust **ceiling, walls, posts** and all **fixed equipment.**
- Remove the **soiled litter,** scrape and sweep floor.
- Make all necessary **repairs** and **upkeep**.

2. Water Line Sanitation

- Water lines are contaminated with accumulated **organic matter,** as well as with **mineral and scale build-up**.
- A good cleaning / disinfection will eliminate bacterial and mold growth.
- **Acidic cleaners / disinfectants** will ensure mineral deposits and scale are efficiently removed.
- Clean all **water troughs** and **equipment**.
- Mix the cleaning / disinfecting solution and introduce it **at the intake** of the medicator.
- Make sure that the solution has reached the **end of the water line.**

- Let the water run until you can smell of see the solution at the most remote part of the water line.
- **Leave the solution** in the drinking system for some time before draining: this will improve the results.
- If there is a lot of mold and debris in the system, the process will loosen the build up from the water lines.
- Avoid clogging up your watering system.
- **Drain** the water lines after disinfection and **flush** with clean water.

3. Cleaning

- Thorough washing with a **detergent** is essential to:
  - » **Reduce time and water** required for the cleaning process
  - » Help **remove the biofilm**
  - » Help **maximize the efficacy** of disinfectants
- Normal **application rates:**
  - » 500 – 1000 ml/m^2, or:
  - » 250 – 500 ml/m^2 when with detergent at double strength (and/or) when and foamed
  - » **Soak** for 15 – 20 min before rinsing off.
  - » Consider **pH rotation** of cleaners.
- Thoroughly wash the ceiling, walls, fixed equipment and **finish with the floor** using **500 to 1000 mL** of solution per square meter.
- **Spray** or **foam** and **let** heavily soiled areas **soak** for **20 to 30 minutes.**
- Do not neglect any communicating service rooms and the outside of the building.
- Put cleaned equipment back into the room.
- **Allow all surfaces to dry.**
- **pH Rotation of Cleaners**
  - » Presence of **high soiling** suggests the regular use of **alkaline** detergents.
  - » Presence of **hard water** suggests the periodical use of **acidic** detergents.
  - » **Rotation** between alkaline and acidic detergents **is therefore recommended:**
    - 7 cleanings with alkaline and 1 with acid (7/1) is ideal for most cases.
    - 6/2, 5/3, 1/1 could be required for very hard water situations.

4. Disinfection

Even though cleaning eliminates > 90% of the contaminants, what's left will be more than enough to be harmful to your flock. Live organisms and porous surfaces lead to **higher contamination and more viruses**. Using a proven disinfectant against bacteria, fungi and especially viruses **is therefore essential.**

- Normal application rates:
  - » 250 – 300 ml/m^2 (until run-off), or
  - » 125 ml/m^2 at double strength when foamed
- Make sure surfaces are **as dry as possible:**
  - » Prevents **over dilution**
  - » Prevents chemical **incompatibilities**
  - » Improves **penetration**
- Never mix disinfectants with other disinfectants or anything else.
- Application:
  - » Apply the disinfectant with a **sprayer**, a **pressure washer** or as a **foam** on all surfaces.
  - » Use **250 to 300 mL** of solution per square meter or **until it runs off**. (Same repetition than the above?)
  - » Pay particular attention to corners, cracks, beams, posts and porous surfaces.
  - » Start from the apex of the roof and work down the walls **to the floors.**
  - » When finished, leave, close the doors and **allow to dry.**
- Make sure that the **surfaces are dry** before preparing the barn or coop for the next flock.

5. Fogging / Misting

Fogging is recommended to disinfect **inaccessible areas,** or simply to complete your disinfection program after mobile equipment and litter is returned.

- Referred to as '**double disinfection**'.
- ***"Fogging does not replace disinfection"***
- Spray in a very **fine mist** using a mechanical, pulse or thermal fogger.
- Dilution and application rates could vary according to the presence of known disease problem or not:
  - » From **1 to 4 L per 100 m3**.
  - » Room **temperature, humidity** levels and room **saturation** are critical.
  - » **Size of droplets** and **distance they travel** depend on the fogger's **flow rate**. Propylene glycol may improve results.

Mortality management

Mortality Management for Poultry Flocks

Bill Cox, DVM
Animal Health Centre
BC Ministry of Agriculture

One unfortunate consequence of owning poultry is having 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.

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.

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.

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

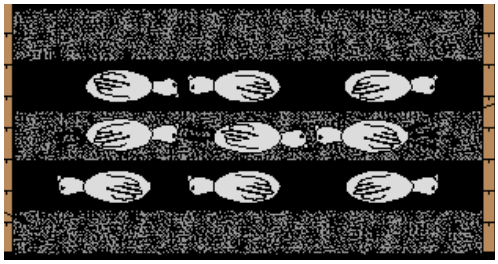
The best method of disposal is proper incineration; this method ensures destruction of any infectious organisms and also eliminates any risk of noxious odours disturbing neighbours. It is likely not cost-effective, however, for most small flock owners to invest in a proper incineration.

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. When done properly, composting will eliminate a chicken carcass in just a few days.



Layering of Carcasses in a Compost Bin.

Rotary Drum Composter from Industrial Piping Inc.

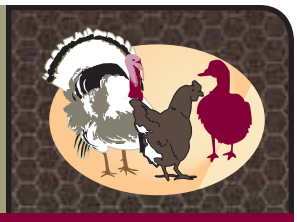
More information on proper composting can be found in the BC Agricultural Composting Handbook, available on the BC Ministry of Agriculture website at: http://www.al.gov.bc.ca/resmgmt/publist/300Series/382500-0.pdf

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.

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

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.



Assessing your management

Using FLAWS to Guide Your Management

Bill Cox, DVM
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Animal Health Centre
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The apparently oxymoronic title highlights the acronym FLAWS, which is a good reminder for evaluating the basic elements of good management. Regardless of the size of flock or the production model being followed, the fundamentals of good management will provide the foundation for excellent flock health.

FLAWS, or (FLLAWSSS in an expanded form) refers to Feed, Light, Litter, Air, Water, Space, Security, and Sanitation, and attention to these elements is essential to good management. While all of these seem to be intuitive, the details can often be overlooked, even by the best of managers. So, when I visit a farm to assess flock health, the first things I observe are the FLAWS, using the acronym like a check-list to help me systematically review everything. This same approach can be used routinely by a flock manager reviewing the flock status.

Feed

All birds obviously need feed to sustain proper growth and production. However, just providing the feed does not always mean that the birds are eating it or that they are getting the right nutrition. Following are a few points to consider when assessing feed:

- Is the feed accessible to the birds; are the feed pans at the right height to allow access and is there enough functional space. The rule of thumb is that the rim of the feeder is at the height of the shoulders of the bird for most poultry. Remember, if the feeders are in an area that the birds avoid, then the total feeder space is reduced by that amount.
- Is the feed of good quality with little separation if a mash or a small proportion of fines if pelleted? Separation of feed can lead to or be due to “high-grading”, where birds pick out the most palatable ingredients. This can lead to a nutritional imbalance. Fines indicate poor pellet quality and tend to stay in the bottom of the feeder pan. Not only does this lead to feed wastage, but the dusty material can be of poor nutritional value and its accumulation can support the growth of mould or bacteria.
- Is there any mould in the feed or the feeders and feeding system? Many molds produce toxins that can adversely affect the health of your birds. While the feed itself may not be mouldy, there could be clumps of old, mouldy feed caught up in corners of the feeding equipment.
- Is the diet properly balanced or is the right feed being used for the birds being fed. If the feed is a purchased diet, it is likely that the balance is correct. However, if the flock is of laying hens, it is important that they are on a layer diet rather than a developer diet due to the importance of proper calcium / phosphorus ratio.

- Is feed being well managed to prevent spillage and stored in a manner that does not attract rodents. If bagged, is it being rotated properly to ensure a constant supply of fresh feed to the birds.

Light

In nature, birds are normally stimulated to begin egg production by increasing daylight hours. Layer and breeding birds kept domestically are stimulated to produce eggs as they become mature by increasing the light period up to about 16 hours per day. To maintain egg production, daylight should be kept at 16 hours, even in the fall and winter, when daylight hours are shortening. During the time in which birds are stimulated by artificial light, it is useful to routinely check the timers, ensuring adequate daylight exposure.

The intensity of light will also have significant effects. When brooding chicks, light intensity of at least 20 lux and up to 100 lux is recommended to stimulate activity and encourage eating and drinking. The reflection of light on water is especially important to attract the young birds and start them drinking early.

Care should be taken to keep lighting quality optimum. It is beneficial to the flock to have even lighting, minimizing shadows and bright spots. Shadows are particularly important, because birds will tend to use such areas as refuge and nesting spots. For layers, this will result in excessive numbers of floor eggs, which will be more soiled than those laid in nest boxes.

Litter

Litter quality is another basic element important to bird health. Poor litter quality can indicate a number of deficiencies, including ventilation, temperature, diet, or gut health. Litter includes the bedding material, usually sawdust or wood shavings, and accumulated droppings. Straw is also used as bedding, but this substrate can support the growth of mould. Good quality litter is soft and homogeneous in appearance. There should be no crusts on top, which indicate excessive moisture.

Birds on good quality litter will have clean, healthy-looking feet. Poor litter, on the other hand, will attach to the feet, often forming balls attached to the tips of the toes (called toe-tags). The softened skin becomes vulnerable to cracking and invasion by opportunistic pathogens, leading to a condition called pododermatitis or bumble-foot.

Other characteristics of litter quality include:

- Good litter should not be too wet or too dry. A rule of thumb is that when forming a ball of litter, it should hold its shape but easily fall apart when released; if it will not form a ball it is too dry and if it forms a stable ball it is too wet.
- Wet litter will foster the growth or development of pathogens. Bacterial pathogens such as *E. coli* and Salmonella are encouraged by wet litter. Very importantly, sporulation of coccidial oocysts is favoured by wet litter and will significantly increase the challenge by this parasite.
- Ammonia is produced as a product of bacterial action on uric acid in the litter and this process is enhanced when the litter is too damp. Ammonia concentrations of greater than about 25 ppm, a concentration that is just detectable by smell, can have serious health effects on poultry. Ammonia is toxic to cells that form a protective layer to airways and can set up conditions favourable to respiratory disease. Furthermore, a high ammonia concentration is a significant irritant to the eye and can lead to inflamed or ulcerated cornea.

- Litter that is too dry, on the other hand, can create dusty conditions, which can also predispose to respiratory disease.

Air

Good air quality includes appropriate ambient temperature, minimal ammonia content, and minimal dust. While outdoor air is generally of good quality, many elements cannot be controlled. During periods of inclement weather or overnight, however, when birds are sheltered, some environmental controls may be required.

Correct air temperature is critical for chicks or poults and must be carefully controlled for the first few weeks of a bird's life. Generally, air temperatures should be about 90° F when the chicks are first placed. As they grow, temperature can be reduced by about 5° F per week to about 70° F, once the birds are fully feathered. Steady air temperature, good air exchange, and a minimum of drafts provide a quality indoor environment for poultry.

In poultry production, ammonia is the most important noxious gas component of indoor air. Ammonia is produced by bacterial action on the nitrogenous wastes in poultry droppings. Outside, there is good dilution and ammonia is unlikely to reach concentrations that may be harmful. When birds are housed, however, good air exchange is necessary to ensure that moisture is removed and excess gas is diluted.

Water

A source of good quality, accessible water is essential for the maintenance of good health. Good water quality includes low bacterial counts and low concentrations of harmful solids, such as heavy metals, or organic compounds. It is advisable for flock owners to have water quality tested routinely, at least annually, if it is from a well or natural surface source.

The drinking water system itself may also be a source of contamination. If the flock is drinking from hanging bell-style waterers or troughs, the water is usually contaminated with litter and feed very quickly, potentially leading to high bacterial counts. These drinkers should be cleaned daily. Closed watering systems, such as nipple drinkers, are very good tools for maintaining a constant supply of clean water. With time, the water lines will accumulate organic material that can foster the growth of bacterial contaminants; so, it is important to regularly flush the system. Depending upon the quality of water, a number of different products are available. For hard water, flushing lines with a descaling solution such as citric acid (800 grams per 128 gallons of water) between flocks is a useful practice. Sanitizers such as hydrogen peroxide at about 30 ml per 128 gallons of water or 30 ml per gallon through the proportioner can be used to flush water lines to minimize bacterial accumulations. Make sure the lines are filled and the disinfectant water mix is held in the lines for at least 10 minutes. After an appropriate contact time, ensure that lines are flushed well with fresh water prior to allowing birds access.

Available functional water space can be affected by a number of factors. As a general rule of thumb, there should be between ½ inch and 2 inches of watering space available per bird, depending upon the size and type of bird. For nipple drinkers, the limit is 15 birds per nipple, but fewer is preferable. If drinkers are not at the proper height, they may be effectively removed from bird access. A rule of thumb is that the rim of the bell style drinker should be at the level of the birds' shoulders; nipple drinkers should be over the birds' head such that they can easily access it with their neck extended and at a 45º angle, with feet flat on the ground. If nipple drinkers are not maintained well, they can plug up, effectively taking away drinking space from the flock. Nipple drinkers should be checked routinely and frequently to make sure they are all working.

Space

Space allocation for various bird types are dictated by the standards under which the birds are raised. However, it is important to look at the functional space available – that is the actual space used by the birds. If some of the space is not attractive, or is a deterrent to the birds, then density will effectively be increased. Regardless of the outdoor space available, if a shelter does not have enough functional space, housed birds may actually be overcrowded. On the other hand, in colder weather, the fewer birds present, the more added heat will be needed to maintain a comfortable temperature, so a good density balance indoors is necessary.

Security

Security includes procedures and barriers to keep predators and infectious diseases out. Birds that are kept outdoors are particularly vulnerable to predators, and it is important to provide barriers to such animals. In addition to the loss of individual birds, the stress associated with the predator's activity can impact the health of surviving birds. Ensure that secure fencing and, if necessary, overhead netting is adequate to keep out hunting animals. Trees or shrubs may be available in the range area as shelter or cover. However, it is important to keep vegetative cover away from the housing area so as to not encourage wild birds to nest nearby. Lower shrubs should be kept clear of the ground so rodents are not attracted to the cover. The shelter should be secured and not have openings that will allow predators inside.

Security against infectious diseases is referred to as "biosecurity" and is an important concept in this age of increasing poultry populations. While biosecurity refers intuitively to keeping diseases out, it is also important that these same procedures help to keep a potential pathogen from leaving a premises to infect another susceptible flock. There are several principles that guide the procedures needed to implement good biosecurity. The most important concept to consider is that people are the most common vectors of disease causing organisms. Therefore, the most basic steps revolve around that.

Some important elements to good biosecurity include:

- Allow people to have access to a flock only when it is necessary.
- If people are going to have contact with the flock, make sure that they follow procedures to minimize the chance of pathogens being carried in, including washing hands, wearing clean head cover, wearing clean outerwear such as coveralls over street clothing, and wearing farm-specific boots or disposable boot covers.
- If any equipment is being carried into the flock, make sure it is cleaned and disinfected.
- Make sure any vehicles entering the farm area are clean.
- Avoid bringing in birds from other farms into an existing flock. If birds must be introduced, isolate them from the existing flock for 30 days.
- Ensure that a good rodent control program is in place, including maintaining clean and neat conditions on the property that will discourage rodents.
- Keep good health records.

Sanitation

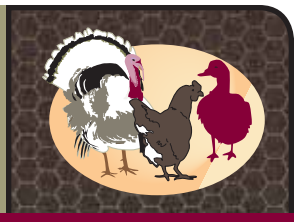
Excellent sanitation is required to prevent the accumulation of pathogenic or harmful organisms and to prevent their carryover to the next flock. There are many elements to good cleaning and disinfection.

General sanitation, while birds are present, is an ongoing process. Buildings and grounds around the buildings must be kept free of clutter. The ground around the perimeter of the barns or sheds should be kept free of tall grass, weeds, or plants. This kind of cover is excellent harbourage for rodents; if a wide area, at least 5 or 6 feet, is kept free of vegetation or tall grass, mice and rats will be discouraged from crossing from outside areas into the barns.

Equipment and supplies that are used during production should be kept clean at all times. Watering and feeding equipment should be inspected daily to ensure that it is clean. Frequently used tools could be kept as barn-specific instruments in order to reduce the amount of cleaning required.

When the flock is finished and the barn is empty, a thorough cleaning and disinfection should be done to provide a clean environment for the next flock. The following steps are critical in achieving that goal:

- Dry cleaning – This step includes the removal of all debris accumulation from walls, ceilings, ventilation equipment, floors, and even grounds, if there is significant build-up. All of this is removed with the manure and litter. Critical attention to this step makes all subsequent steps much easier.
- Rinse – All surfaces to be cleaned should be rinsed first. A thorough soaking and allowing time for some penetration makes removal of residual organic debris much easier. If a thorough job has been done on the dry cleaning, then this step will be much easier to accomplish.
- Wash – All surfaces should be washed with soap or detergent and water; use hot water if possible, as this will significantly improve cleaning efficacy and reduce cleaning time. Wash the surfaces from top down – ceiling, walls, then floor.
- Dry – allow time for drying.
- Disinfect – Thoroughly cover all surfaces with an approved disinfectant and allow it to penetrate for an appropriate contact time. If necessary, the residual disinfectant can be rinsed off after the contact time.
- Dry – allow time for drying before placing new litter down and before allowing birds into the cleaned building. The longer a down-time allowed, the greater will be the reduction in potential pathogens.



Disease Fundamentals

Like all living things that share our world, birds can be affected by an array of diseases. Many of the diseases experienced by our domestic poultry are affected by the conditions to which they are exposed while others may just be a matter of being exposed to disease agents at the wrong time. The special anatomy and physiology of birds that makes them capable of flight also presents opportunities for diseases that we don't see in mammals.

The fundamental causes of disease are no different in birds than they are in mammals. Most focus is on infectious diseases, those caused by virus, bacteria, parasites, and moulds, but many other abnormalities can afflict chickens. These include nutritional imbalances, toxicity, metabolic, and neoplastic (cancer) among others. While there are many infectious diseases that can cause significant damage within a flock as a primary infection, there are diseases that are precipitated by environmental conditions. A majority of the problems observed in poultry will actually be secondary to a stressor; the disease causing agent itself would not necessarily cause problems on its own. Examples of some stressors include:

- Temperature fluctuations
- Cold or hot temperatures
- Drafts
- Ammonia
- Crowding
- Restricted feed or water space
- Exposure to predators or other threats
- Sudden events (e.g. violent thunderstorm)

Usually diseases secondary to stressors are caused by various types of bacteria.

If an infectious disease gets into a flock, then a quick response to that disease is critical. At the first sign of illness, a pre-planned response should be followed. The first step involves tightening up your biosecurity and making all efforts to keep the infection from affecting someone else's birds. For example, do not allow any visitors near the birds; do not meet with other bird owners without completely showering and changing into clean clothing; and stop all deliveries if possible.

The second step is to get a diagnosis. It is only when you know exactly what you are dealing with will it be possible to take effective control measures. Contact your veterinarian or send a sample of affected birds to the Animal Health Centre Diagnostic Laboratory. Submission information can be found at the BC Ministry of Agriculture and Lands, Animal Health Branch website: http://www.agf.gov.bc.ca/ahc/lab_services.htm

Once the diagnosis is made, follow the advice of your veterinarian.

The following articles in this section will cover these points in more detail and help you to understand the principles of disease, disease spread, and its control.

Infectious Diseases: Spread, Prevention, and Control

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What are Infectious Diseases?

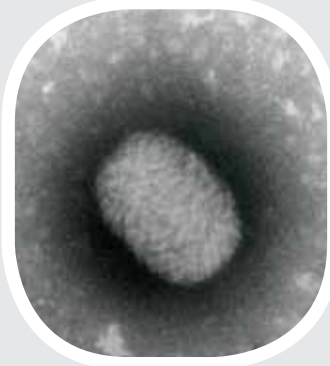
Infectious diseases are caused by organisms that take advantage of or, in some cases, even depend upon a host for their survival. While many organisms exist closely with a host species, those that cause infectious disease actually invade cells or tissues, causing damage and an immune response. The host may be any living organism, including humans, but the hosts we are most interested in are poultry. When infectious organisms invade a host, they cause what we know as "an infection".

Organisms that are able to cause a disease are referred to as being "pathogenic" and are sometimes called "pathogens". The specific pathogenic organisms in which we are interested include Viruses, Bacteria, and Parasites.

Viruses

Viruses are sub-microscopic particles that actually require a host cell in which to survive and without which they cannot grow and reproduce. Viruses multiply using the "machinery" of the host cells (the patient). By invading right into the cell, the virus releases its genetic material so that the mechanisms of the infected cell will go to work replicating viruses instead of making new host cells.

Coronavirus



Pox Virus

Influenza Virus

Viruses are very simple particles, consisting principally of the genetic material (DNA or RNA) and a protein capsule. Outside of the capsule, there may or may not be an envelope, depending upon the particular virus. There is a wide variety of virus shapes and sizes and these characteristics can be used to define the virus (Figures 1,2, and 3).

Viruses are spread readily from one bird to another via body excretions (respiratory secretions, droppings, and even whole cells in some cases). The infectious particles gain entry into a new host through mucous membranes, lungs, intestines, or other avenues. Generally, a virus must enter a host or it will not survive for long. Depending upon the specific virus and environmental conditions, survival time outside of the host can range from a few hours to several months.

There are no treatments for viral diseases and medications we have for treating poultry, including antibiotics, will not kill viruses. While antibiotics may be prescribed in some cases of viral diseases, this is not to treat the virus condition but to protect against or treat superimposed bacterial condition. Only time, which will allow a bird to develop its own naturally immunity, will cure a virus infection in poultry. Many disinfectants, however, will kill viruses outside of the host, and thorough cleaning and disinfection using appropriate disinfectants is an essential step in reducing the risk of spreading virus infections.

Viruses cause many types of diseases. Some viral diseases can be mild, or even asymptomatic, while others can be severe, resulting in debilitating illness or high mortality in a flock. Various viruses can cause serious primary disease, some examples of which include:

- ***Avian Influenza***
- ***Infectious Larygotracheitis (ILT)***
- ***Newcastle Disease***
- ***Infectious Bronchitis***

ILT in a layer hen.

Photo courtesy AAAP.

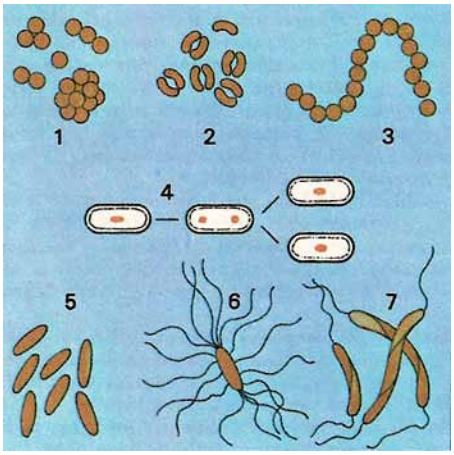
ILT in a broiler chicken.

Avian Influenza.

More commonly than overt disease, milder forms of viral infections can be superimposed with bacterial organisms to set up a much more serious illness.

Bacteria

Bacteria are single celled organisms that consist of a cell wall, cell membrane, cytoplasm, genome (DNA), and subcellular organelles. In some ways, they are similar to the cells that make up plants. Unlike viruses, which are so small that they can be seen only with very powerful electron microscopes, bacteria can be seen with the aid of a regular light microscope; they cannot be seen with the naked eye. Bacteria are classified by a number of factors including their shape and their growth characteristics. Some types of bacteria include:



(1) cocci,

(2) diplococci,

(3) streptococci,

(5) bacilli. Some bacteria possess hairlike flagella, for example

(6) flagellate rods or

(7) flagellate spirilla.

At (4) a bacillus is shown undergoing reproduction by binary fission

Unlike viruses, bacteria can survive away from a host. They also possess their own "machinery" to reproduce so they can also grow without the aid of a host being. In fact, many bacteria have protective mechanisms that enhance their survival in the environment. For example, *Clostridium perfringens*, the bacteria that causes necrotic enteritis in chickens, can form a spore that protects the basic material required for growth and reproduction when challenged by adverse environmental conditions. When favourable conditions return, the spore reverts to the normal "vegetative" form. Other bacteria, such as some strains of Salmonella can form a cover, called a "biofilm", which protects a population of the organisms against adverse conditions such as drying or even some disinfectants.

Bacteria spread readily from one bird to another through body excretions including respiratory droplets (mucus or phlegm) and manure. Once infecting a host, they can cause a variety of serious diseases. Some examples of bacterial diseases include:

- ***Necrotic enteritis***
- ***Fowl Cholera***
- ***Colibacillosis (infection with E. coli)***
- ***Coryza***
- ***Salmonellosis***
- ***Mycoplasma gallisepticum (MG)***

Mycoplasma gallisepticum (MG)

Photo courtesy AAAP.

Bacteria are often susceptible to antibiotics so such treatment may be indicated in infected flocks, depending upon the nature of the disease. Some illnesses, such as necrotic enteritis, respond very readily to treatment while others, such as colibacillosis, can be difficult to treat. Bacteria are also susceptible to most disinfectants, so cleaning and disinfection is an important part of disease control.

There are thousands, if not millions of bacterial species and only some are pathogenic. Most bacteria are quite innocuous, but many are beneficial. So, total annihilation of bacterial populations is not a desirable goal.

Parasites

Parasites are the most complex of the pathogenic organisms. These invaders may be single-celled or multicellular; they may be microscopic or macroscopic (visible to the naked eye); and they may be in the form of a worm, an insect, or a single cell.

Parasites usually have complicated life cycles, often involving more than one host. The life cycle includes their transformation through different stages which may involve infective forms, vegetative forms, and reproductive forms. The more complex and "successful" parasites will not cause fatal disease, although mortality due to a parasite infestation is always possible.

Most parasites require a host in which to complete its life cycle, but they do possess the physiological machinery to reproduce. Rather than using the host as an aid to reproduction, the parasite uses the host as a food source. While some parasites can complete their life cycle within its chosen host, most require a certain period of time outside of the host. This "free-living" phase usually prepares the parasite for infectivity and presents the parasite to a new host. Some parasites, such as tapeworms, require two hosts, the first that grows an adult form that produces the eggs, the second, such as a slug or an insect, that hosts a cyst; when the secondary host (a slug) is eaten by the final host (a chicken), the cyst opens, releasing a myriad of infective forms and the cycle is then completed.

Parasites usually have specific survival strategies for their time away from the host. For example, early roundworm larvae are protected inside a very tough shell. Infective coccidial forms also are well protected inside an outer shell. Being so well protected, disinfectants

have very little, if any, effect on parasites. Some parasites can also survive adverse environmental conditions and may live in soil or barns for many years. Consequently, physical removal of infective forms, thereby reducing the available "dose" to host birds, is an important tactic in controlling these pathogens. Antibiotics also have little or no effect on most parasites and treatment or control in or on the animal requires the use of such drugs as anthelmintics (wormers), anticoccidials, and insecticides, as well as strategies to eliminate intermediate hosts.

Northern Fowl Mite

Photo by: Jeb Owen (University of California at Riverside).

Spread of Infectious Diseases

Requirements for an Infection

Pathogens maintain their existence by moving from host to host, continuously expanding their population and "searching" for new hosts. But it is not really a simple matter for a pathogen to spread – a number of conditions apply before an infectious disease will actually happen:

1. **A naturally susceptible host species**
   Many pathogens are very species-specific or specialized. So, a chicken pathogen, such as the ILT virus, needs another chicken to spread to. Other pathogens, such as Avian Influenza virus, can infect a number of different species, but those species must be naturally susceptible.
2. **A susceptible host**
   A naturally susceptible host must also be susceptible to the pathogen. For important primary pathogens, such as Infectious Bronchitis in chickens, a properly vaccinated bird will be protected against that virus and therefore not susceptible. Similarly, for more opportunistic pathogens like the bacteria E. coli, a healthy host with a robust immune system will have an increased resistance to infection.
3. **To be carried to the host**
   If a susceptible host exists, then the pathogen must "find" or be carried to that host before an infection will occur. This can happen in a number of ways. From a flock perspective, the pathogen must gain entry into the flock. The contaminated exudates and excretions from sick birds can contaminate people, supplies, equipment, and even other animals such as dogs or cats. People or other animals that have been contaminated with pathogens do not necessarily have to become ill to spread the

organism - a bit of contaminated manure on the bottom of a boot that drops off the footwear into a flock will provide the opportunity to infect a chicken. All it takes is for one chicken to become infected and the disease can then spread. Contaminated excretions, such as mucus droplets from an infected respiratory tract will then spread to other birds.

5. **To gain the appropriate "portal of entry"**

   The route by which a pathogen enters a susceptible host is referred to as the "portal of entry". So, for a respiratory disease, the portal of entry is usually the nasal passages, trachea, or lungs. If the organism does not find that portal of entry, then infection will not occur. It is difficult to protect the portal of entry from infection; for example we cannot put masks on our birds to prevent viruses from entering the respiratory tract. However, some other measures are taken. For example, separating birds from their manure with screen flooring will prevent coccidiosis. Some pathogens can gain entry through injuries or wounds, so ensuring that the environment is maintained to prevent such occurrences, diseases such as Staphylococcal or Poxvirus infections can be minimized.

6. **Be in a high enough "dose" to cause infection.**

   Many pathogens must be present in sufficient numbers to cause an infection. For example, one or even 10 Salmonella organisms will not usually cause an illness, but 10,000 might. So, infection can be prevented by taking steps, such as thorough cleaning and disinfection, to make sure the dose of infective organisms remains low in the environment into which new birds will be introduced.

   It is evident from the above details that, if a pathogen is carried by a person, animal or equipment into a susceptible flock of birds and it is able to gain entry into that animal, an infectious disease will result and that disease will spread within the flock. If sloppy practices continue to be followed, then that disease will be carried from the newly infected flock into more susceptible flocks. So, it should be the goal of poultry owners to take all the measures necessary to prevent that from happening.

Concepts in Prevention and Control of Disease in Poultry

"An ounce of prevention is worth a pound of cure" – this old saying is still valid. Prevention incorporates a number of strategies to keep infectious diseases out and to keep a flock healthy. If a crack in the armour is found by a disease organism, then measures must be taken to control the disease, and these strategies are aimed at limiting the damage in the flock and reducing the risk of that disease from getting out of one flock and into another.

Disease Prevention

A number of strategies can be employed to help prevent a disease from infecting a flock. These strategies are directly related to the conditions required for a disease to occur.

1. **Susceptible host**

   There is a number of specific diseases to which birds can gain solid immunity. We can take advantage of this by vaccinating the flock before they are exposed to the pathogen and thereby prevent the flock from becoming infected. But a bird with a suppressed immunity can also be susceptible, especially to less aggressive pathogens. So, an essential part of reducing susceptibility is to keep the birds otherwise very healthy. This is accomplished through good management, good nutrition, and robust stock in the beginning.

Introducing new birds into an existing flock is a very good way in which to import a new disease. In some cases, a disease pathogen may be innocuous in one species but deadly in another. For example, chickens can carry the Blackhead parasite (*Histomonas*) with minimal or no ill effects. If turkeys are introduced into such a flock of chickens, however, the parasite will infect the turkeys and cause serious illness and mortality. The pathogen has transmitted from a less susceptible to a more susceptible species. Ideally, no new birds should be introduced into a flock and this includes different species of birds.

2. Carry the Pathogen into the Flock

One major strategy of disease prevention is keeping the disease organisms out. There are numerous tactics available to achieve this goal, and most are common sense. For example, keeping a flock closed to new birds will prevent the possible entry of a pathogen by an inapparent carrier (that is a bird that is infected with or carrying the organism without showing signs of illness). Many diseases, such as Infectious Laryngotracheitis (ILT) or *Mycoplasma gallisepticum* (MG) can remain in a dormant state, only to later reappear to cause illness in susceptible birds.

Wild birds can also carry pathogens into a flock, not only while infected but also by mechanically carrying it in. Excluding wild birds from the flock, and especially away from feed and water, will reduce the chances for a disease-causing organism to enter.

Another important barrier to disease entry is the exclusion of contaminated material from a flock. Contaminated equipment, contaminated footwear, contaminated clothing, or contaminated hands are all effective vehicles on which pathogens can gain access to a flock. No equipment, supplies, or people that are not needed should enter a farm and what does need to be there should be cleaned and disinfected prior to entry.

All of the tactics designed to prevent entry of a pathogen into a flock are collectively referred to as "Biosecurity". There are many documents presenting these methods in much greater detail.

3. Gain the Portal of Entry

It is difficult to prevent total access to the portal of entry for many pathogens. However, some things can be done to help reduce risk. For example, most small flocks have access to range, which provides some dilutional effect, but birds can be separated from pathogens in manure by having the congregated areas raised with slats or screens. Manure falls through to the floor below. Or, deep litter is provided into which the droppings will be buried and diluted.

Well-maintained, raised feeders will be less likely to be contaminated with droppings and keep feed clean and free of pathogens. Closed water systems, such as nipple drinkers, help to significantly reduce contamination of the water, which is often a very good source for pathogens.

Maintaining the environment free of hazards such as protruding nails, wire, or sharp edges will prevent injury, which can provide an entry point for some pathogenic bacteria such as Staph and *E. coli* or viruses such as Avian Poxvirus.

4. Adequate Dose of the Pathogen

Reducing the pathogen load significantly reduces the risk of infection. This involves plenty of hard work and attention to detail, but will pay off in the long run. Thorough cleaning and disinfection is what is required to achieve this goal. This effort must be applied to equipment and supplies, buildings, vehicles, hands, clothing, footwear, etc.

Preventative medication can sometimes be used to reduce the dose of a pathogen. This is most frequently done to prevent coccidiosis with the inclusion of anti-coccidial compounds in the feed. Rarely are antibiotics or other drugs used to control other

conditions, especially in longer-lived birds where vaccination is a viable option. Any consideration of using medications to help prevent disease should be done in consultation with a veterinarian.

Vaccination

Vaccination is an important and effective way of making poultry less susceptible to specific infectious diseases. There are several vaccines available for a variety of poultry species. But vaccination can be done for reasons other than just preventing disease in the target flock:

- Protect the vaccinated bird – vaccination is a key step in preventing infection with a variety of infectious diseases in poultry.
- Immunize parent stock for the development of maternal antibodies for progeny – when a bird or any animal mounts an immune response to a specific pathogen, it produces specific proteins called antibodies whose action it is to immobilize the pathogen on contact. Those antibodies will also pass into the yolk of chick embryos, providing passive protection to a hen's offspring while it develops its own immune system.
- Prevent colonization by human pathogens (for food-producing birds) – this area of vaccination is gaining prominence today and an important example for poultry is the Salmonella Enteritidis (SE) vaccination. SE is a human pathogen and it can readily colonize the intestines and reproductive tract of the chicken without causing illness in the bird. Vaccination of the chicken helps to reduce colonization and shedding by SE, thereby reducing the risk of infection in humans.

Viral Diseases	Bacterial Diseases	Parasitic Diseases
Infectious Bronchitis	Bordetella avium (Coryza)	Coccidiosis
Infectious Bursal Disease	Pasteurella multocida (Fowl Cholera)	
Newcastle Disease	Salmonella enteritidis	
Infectious Laryngotracheitis		
Avian Encephalomyelitis		
Reovirus		
Chick Anemia Virus		
Marek's Disease		
Hemorrhagic Enteritis of Turkeys		

METHODS OF VACCINATION

Vaccines can be made from modified live pathogens, changed so that they can cause a very mild infection (with minimal clinical signs) and still stimulate an immune response. Other vaccines are made from killed pathogens (called "bacterins" when made from killed bacteria). Vaccination procedures vary depending upon whether a vaccine is live or killed and on the nature of the organism. Details on the procedures for each vaccine are provided with the vaccines chosen, and those directions should be followed closely. Some basic steps for the various delivery methods are given in the following bullet points.

Vaccines are generally made for administration to large commercial flocks, making it difficult to administer to small flocks. Some, such as Marek's Disease vaccination and Coccidiosis vaccination, can be administered at the hatchery. Others that have to be given to older birds must be given on the farm. Many of the live vaccines can be given by eyedrop rather than water or spray, and could be considered. Vaccine strategies should be discussed with a veterinarian and options chosen based on risk of exposure, vaccine side-effects, and, possibly, cost.

Water Vaccination Procedures (for live vaccines)

- Should be mixed in its final concentration in a tank or drinker
- Calculate the volume that the birds will drink in a two hour period
- Ensure that no sanitizer (e.g., chlorine) is in the water
- Mix 10 grams of skim milk powder for each 4 L of water to be used
- Mix the vaccine in the appropriate amount of water
- Water "starve" the birds for 2 to 3 hours before administering the vaccine
- If an automatic water system, pump or gravity flow the vaccine/water into the lines until visible at the source
- Thoroughly clean all equipment before use – NO disinfectants
- Ensure birds consume all the vaccine/water before resuming regular water
- Make sure equipment is well cleaned after use

Spray Vaccination Procedures (live vaccines)

- Use an appropriate sprayer that delivers an appropriate droplet size
- Use distilled water
- Do a walk-through spraying with plain water to estimate the volume needed
- Guidelines given with vaccine insert
- Mix the appropriate number of doses into the estimated volume of water
- Dim the lights or turn them off completely and use a flashlight to illuminate the area being sprayed
- Walk the floor twice while spraying, once "North-South" and the second time "East-West" to optimize coverage
- Aim for the birds' faces as they respond to the light – avoid overspraying

Eye Drop Vaccination (live vaccines)

- Very labour intensive
- Applicable for respiratory disease vaccines and especially for ILT
- Ideal method for small flock owners
- Hold the bird on its side
- When the eye is open, allow one drop to fall directly onto the eye
- Hold the bird for a moment to make sure the vaccine does not just roll off the eye
- If there is dye in the vaccine, it will show at the nares after a few moments

Photo courtesy Intervet / Schering Plough Animal Health.

Vaccine Injection (usually killed vaccines)

- Injection given intramuscularly into the breast muscle or subcutaneously at the back of the neck
- Follow instructions of the manufacturer
- Be careful not to inject yourself!

Wing-web Vaccination

- This is used for only very few vaccines, most notable Avian Pox vaccination.
- Essentially a scarification procedure
- The administering device is provided with the vaccine
- Dip the applicator into the vaccine solution and push it through the skin of the wing web.
- For Fowl Pox vaccination by this route, a sample of birds should be examined 7 to 10 days after administration to ensure a "take"; this will be characterized by red swelling and scab formation

Photo courtesy Intervet / Schering Plough Animal Health.

Controlling an Infectious Disease

If a disease breaks through the prevention barriers and an outbreak occurs in a flock, then there are measures that can be taken to help control the disease and reduce its impact on the flock. Control of the disease on the farm includes measures taken to prevent its escape and spreading to other susceptible flocks. Some of the techniques employed are similar to those used to prevent a disease.

1. Early Detection

Early detection is critical to controlling a disease. The sooner the diagnosis is made the sooner measures will be implemented to stop the progress of the disease. The flock should be checked frequently and observed for activity and alertness. Sometimes unusual sounds can be heard indicating a possible respiratory disease. Watch for birds that isolate themselves from others.

Records of activity, mortality, feed and water consumption, and egg production can help to detect early signs of an illness in the flock. Very often the first sign is a drop in feed consumption or a drop in egg production. Sometimes, there may be a change in egg quality. If careful records are kept, then these details will become evident quite quickly.

If there are any signs of illness, a veterinarian or the Animal Health Centre laboratory should be contacted so an accurate diagnosis can be made and a response plan can be implemented.

2. Reduce the Number of Susceptible Individuals

The number of susceptible individuals can be reduced, even in the face of an infection. In very serious infections, such as Avian Influenza, it is sometimes best to destroy the whole flock, which will immediately stop the spread of the disease. Some diseases, such

as ILT, spread very slowly and, in such cases, vaccination in the face of the infection may help to reduce the spread.

Good supportive care by providing optimum environmental conditions, good water, and optimum feed will help to keep unaffected birds healthy, potentially reducing the chance of their becoming clinically ill.

3. Reduce the Amount of Pathogen in the Environment

Even though the disease may be present in a flock, taking measures to reduce the volume of pathogens, or effectively reducing the dose, can help to limit the spread of an infection. Pathogen reduction can be achieved by first removing sick or dead birds as frequently and as soon as possible. Disease-causing organisms multiply exponentially in infected birds, so removing sick birds, either by euthanasia or isolation, significantly reduces the volume of available pathogens for the rest of the flock.

Cleaning and disinfection, where it is possible, will reduce the load of pathogens in the environment. Even removal of manure and organic material without disinfection may help. Of course, this step is critical once the flock is gone.

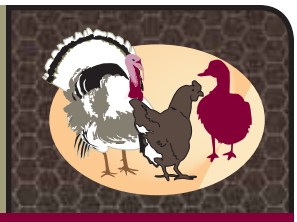
Proper manure management, once it is removed from a barn or once the flock is gone, is also key to reducing pathogens, especially for new flocks introduced after the infected flock is gone. Manure should be stored and covered as far away from the bird holding area as possible. Proper composting will significantly reduce the pathogen load as high temperatures are generated by the fermentation process.

4. Prevent the Movement of the Disease

This is a part of containing the disease to a small area and preventing its transmission to other flocks. The first and most important part of this is to restrict the movement of birds. If the flock is not being depopulated, then the birds should be well contained on to the premises. Good biosecurity practices will prevent the carriage of contaminated material off of the farm. Avoid visiting other farms and, if a visit is necessary for some reason, then make sure that you shower and change clothing completely. Notify your neighbours of the situation so they can enhance their biosecurity procedures. If removing dead birds or manure from the farm, make sure that the material is well covered so dust or feathers that will be contaminated with pathogens will not be able to fly off of the pile and travel on the wind to a neighbouring farm.

Summary

Disease prevention and control in poultry is a multifaceted process that requires work and attention to detail rather than technical expertise. Most elements of a disease prevention plan, including biosecurity, are common sense and, once instituted, take little effort to continue. Some of the important elements of disease prevention and control include Management, Nutrition, Biosecurity, Vaccination, Accurate Diagnosis, Treatment, and Records.



Recognizing Illness in Poultry

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There are several different causes of disease in poultry, many of which we know, some of which we don't. The main categories of disease causes include:

- *Nutritional*
- *Metabolic*
- *Genetic, hereditary*
- *Congenital*
- *Degenerative*
- *Toxicity*
- *Non-specific (management)*
- *Neoplastic (cancers)*
- *Infectious agents*

Knowing the cause of a disease is the first step in resolving the problem, not only in the short term but often more importantly, in the long term. But the presence of a disease must be recognized before actions can be taken. Perhaps more importantly, the earlier a disease is recognized and defined, the more successful an intervention or treatment will be. Successful, early treatment of a disease will reduce the associated losses and costs.

Early Detection of Illness in Birds

Birds in general and the types of birds we keep as poultry in particular are prey species, so it is critical to their survival to avoid any signs of vulnerability. Consequently, they will mask their illness very effectively, making it difficult to spot diseases early. But there are steps that can be taken that will improve the chances of early detection.

Before any abnormal signs can be recognized, you must know what is normal. So, get to know your birds well. This does not necessarily mean knowing each and every bird, but know what the overall behaviour is like under normal circumstances. Check your birds at least once daily and don't just take a quick look – spend some time watching how the flock behaves and interacts. Observe the flock from a distance, so they will not feel threatened by your presence or even excited by what you might have to offer (i.e. feeding time).

A number of clues may be seen before anything overt presents itself. Some of these clues might include:

- reduced feed and/or water intake
- reduced egg production
- reduced weight gain
- lethargy, inactivity
- segregation

Some of these early signs will take keen observation and good knowledge of the flock. Sick birds may initially appear to be quite bright and active on first observation, but as the flock adjusts to your presence, they will calm down and that sick bird will isolate itself or behave differently that the rest of the flock. But even earlier signs such as loss of appetite or lost production may only appear in your records.

Record-Keeping

Good records are an important part of good management. There are many observations that can be recorded that could prove to be of value when investigating a problem, even if you have only a few birds. Having ongoing records also prompts you to regularly observe the flock. There is never too much information to be recorded, but some of the basic observations should include:

- Production records – even if you have only a few birds, knowing how they are producing, including egg production and weight gain, is important. Loss of egg quality, including frequency of misshapen shells and frequency of cracks, can be an early signal of disease problems and such records are also important. Some owners of very small layer flocks have records of egg production of each bird. While this may be impractical if you have 25 birds, it illustrates the detail that can be accomplished. If a drop in egg production is noted, then an investigation can be launched, even if it is only to check out and ensure that all management elements are optimum.
- Feed and water consumption – a drop in appetite is often the first effect of illness in birds. With good records, any change in consumption will be quickly spotted.
- Flock health records – flock health records not only document the health of your flock but also provide excellent background information should a disease event happen. Very relevant information may be contained in previous health records.
- Medications & treatments
- Genetics program – if you are breeding your own stock, good family records will help you to identify conditions that could have a genetic basis.
- New introductions
- Document farm visitors and service activity – Information from such records will help to trace the movement of a disease, should it be infectious. This will help not only determine its source but also provide a means by which other flock owners could be notified if there has been contact with your farm.
- Other – other activities such as weather observations, construction, cleaning activity, feed changes, and predators can provide clues to underlying stressors that might precipitate a disease.

Early recognition of a disease problem is an important first step to resolving that problem. Being observant, knowing your birds, and keeping good records are all essential tools that will enhance your ability to achieve that first step.

Clinical Signs in Poultry

Once past the early stages of illness, birds may show overt signs of illness. Often the earliest sign observed is a dead bird, but other signs may start to appear. The specific signs in poultry, like in people, will depend upon the body system that is affected.

Infectious Laryngotracheitis (ILT)

Respiratory signs may be audible or visible. Listening carefully to the flock can reveal signs such as rattling or gurgling sounds, indicating fluid in the respiratory tract, or cough or sneeze-like sounds (referred to as a "snick") indicating irritation to the upper part of the respiratory tract. Individual birds may show obvious signs of respiratory distress, with mouths open and necks extended.

Watch for unusual exudate from eyes or nasal openings, or swelling around the face and eyes, indicating possible early upper respiratory infection.

Diseases of the intestinal tract can cause diarrhea and some illnesses can cause blood in the droppings. Birds with such illness will generally appear to be listless and depressed. The feathers may be fluffed up and the wings drooping.

Mycoplasma gallisepticum (MG)

Infectious coryza

Some diseases are more chronic and the birds will waste away over time. With their feathers, this isn't always evident until the condition is very advanced. This is why it is important to check the birds' condition periodically, making sure that they are in good body condition. Such birds can often be recognized as their combs shrink and dry up.

Lameness or paralysis are signs of other important poultry diseases. Any such signs, especially if in more than one bird, should be investigated.

Marek's Disease

Bumblefoot

While poultry are very effective at hiding their illness, careful observation of your flock will reveal sick individuals and good records will allow you to measure flock health. Once you recognize what is normal, it becomes much easier to detect abnormal.

Responding to Disease

I think my birds are sick, what do I do?

Dr. Bruce Hunter, Ashley Whiteman, Dr. Babak Sanei, Al Dam and Dr. Teresa Cereno
University of Guelph and Ontario Ministry of Agriculture, Food, and Rural Affairs

You should always be monitoring your birds for any signs of sickness. If problems are noticed early, there is a better chance for successful treatment and lower bird mortality or production loss. This is described in further detail in the Biosecurity Principle 2 factsheet (2.3).

Every animal owner should establish a relationship with a veterinarian for consultation and diagnostic services. Under the *Veterinary Act*, a legitimate veterinarian-client-patient relationship (VCPR) is required for your veterinarian to legally dispense drugs and other medications. This is very important when you encounter a disease problem that would necessitate treatment or any further action that may involve government regulations.

Scabs on the face and comb of this chicken are consistent with Avian Pox virus infection.

Veterinarians are educated and trained to diagnose and treat animal diseases. Many practicing veterinarians do not specialize in poultry medicine/diagnostics. Nevertheless, they should be able to quickly diagnose most common avian problems and send appropriate tissue samples to the Animal Health Centre at the Abbotsford Agriculture Centre for further testing if necessary. A veterinarian at the Animal Health Centre will report back to your veterinarian with the results. Your veterinarian will then provide you with an interpretation of these laboratory results as well as make recommendations on medication, vaccination, and possible changes in bird management to treat and prevent the further spread of disease.

Submitting samples to your Veterinarian or to the Animal Health Centre (AHC)

When submitting samples, select specimens and/or freshly dead carcasses that are representative of the problem. Whenever possible, make sure that they have not been treated with antibiotics. Call ahead so the veterinarian or laboratory knows that you will be submitting samples and to determine what information is required so that your submission can be analyzed as quickly as possible.

Head tilts and neck twisting are signs of problems with the nervous system.

Obtaining useful/accurate results from your veterinarian or the Animal Health Centre (AHC) requires good samples and a complete history. Submission forms for the AHC require standard information like the species, breed, age, sex, weight of the bird(s), flock statistics and relevant bird/flock history. A summary of management practices, recent medications, vaccinations and clinical symptoms are all helpful. An AHC submission form can be found on-line at:
http://www.agf.gov.bc.ca/ahc/Avian%20Submission%20Final-%20FillableFinal.pdf

Below is a more detailed list of information that will help in the diagnosis and resolution of your problem. Good background information will increase the chances of a more accurate and rapid diagnosis. This is information that should be readily available as part of your regular record keeping.

History of the Problem

Where possible list dates of onset and/or duration.

Leg problems or paralysis can cause difficulty with mobility.

- General abnormalities – sudden death, morbidity (the number of clinically sick birds), droopiness, depression, lack of appetite, ruffled feathers, abnormal color of wattles and combs, dehydration, loss of feathers, etc.
- Respiratory system – sound of fluid mucus in the airways (rales), gasping, coughing, swelling of areas around eyes, inflamed sinuses, watery eyes, nasal exudates, etc.
- Digestive system – loose droppings, diarrhea, abnormal color of feces, big belly, etc.
- Nervous system – head shaking, neck twisting, abnormal extension of legs, circling, etc.
- Skin and musculoskeletal system – scratches, abnormal discoloration, lumps, lameness, scaly legs, twisted legs, abnormal back curvature, etc.
- Reproductive system – drop in egg production, poor egg quality: thin shell, abnormal shape, color, and size, etc.

Flock Description and History

- Size of the flock/Number of birds at risk.
- Number (or %) sick.
- Number (or %) dead (distinguish natural deaths vs. culls).
- New bird arrivals? Where did they come from; their medication/vaccination history?
- Are there other species on farm? How much contact is there with these other species and the birds?
- Have the birds been to a show or race recently?
- Have they been moved from one barn/loft to another recently?
- Have they had normal molting and brooding behaviour?

Swollen face or eyes. Possible respiratory problems.

Management Practices – Feed and Water

- What type of feed – any recent changes in feed or feed supplier?
- Are there any feed additives?
- What is the source of water (city, well, surface, cistern, etc.) and any recent changes in the source?
- Is the drinking water treated or has the treatment changed? (i.e. filtered, chlorinated, etc.).
- Any changes in the watering system (i.e. from troughs to nipple drinkers)?
- Any water additives used (i.e. apple cider vinegar, vitamin packs, antibiotics, etc)?

Pendulous or distended crop.

Management Practices – Housing

- Access to outside.
- Access to open water.
- Access to wildlife (mainly wild bird populations).
- Cage or housing system.
- Litter/bedding materials, (type of bedding, changes, source).
- Other: ventilation problems, weather or temperature changes, abnormal noise, electrical surges, blackout, recent use of insecticides and/or herbicides, etc.

Caring for animals is difficult and every type of animal operation, whether this is a large animal farm, a commercial poultry operation, or a hobby farm should have a health program and access to a licensed veterinarian for consultation and diagnostic services.

TAKE HOME MESSAGE

- *Develop a relationship with your local veterinarian before health problems arise.*
- *Be proactive and develop a health care program for your birds.*
- *When birds are sick be sure to carefully select representative samples for submission.*
- *Provide a complete and detailed history of the problem.*
- *Seek assistance as soon as a problem is identified.*

Foreign Animal Disease

What is a FAD?

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University of Guelph and Ontario Ministry of Agriculture, Food, and Rural Affairs

A Foreign Animal Disease, (FAD), is an important, transmissible disease believed to be absent or not native to Canada. Some of these diseases are of such importance to human or animal health or to the Canadian economy that animal owners, veterinarians and laboratories are required to immediately report the presence of these conditions to a district veterinarian from the Canadian Food Inspection Agency (CFIA). These diseases known as reportable diseases are outlined in the Health of Animals Act and Regulations (http://laws.justice.gc.ca/en/H-3.3/fulltoc.html). Examples of FAD's include: Highly Pathogenic Avian Influenza (HPAI), Bovine Spongiform Encephalopathy (BSE), and Foot and Mouth Disease (FMD).

The Office International des Epizooties (OIE) http://www.oie.int/eng/en_index.htm is an intergovernmental organization responsible for the International Health Code and for the Manual of Standards for Diagnostic Tests and Vaccines. It sets the sanitary standards for the World Trade Organization and defines HPAI and Newcastle Disease as "reportable" diseases, which means that any identification of these diseases requires reporting it worldwide. OIE has also recommended response and control strategies to be used in the face of an HPAI outbreak. These include surveillance and early detection, rapid culling or depopulation, compensation, improved biosecurity, and vaccinations (when appropriate).

Reportable Diseases

In avian species, the following diseases are reportable:

- Notifiable Avian Influenza – (H5 or H7 Type)
- Exotic Newcastle Disease (END)
- Fowl Typhoid (*Salmonella Typhoid*)
- Pullorum Disease (*Salmonella pullorum*)

With confirmation of one of these diseases, CFIA will immediately institute control and eradication measures to protect other Canadian livestock and poultry producers as well as export markets. CFIA pays compensation for birds that are ordered destroyed during an FAD outbreak.

In addition to Reportable Diseases there are other diseases that occur in Canada that are of sufficient importance to be designated as Immediately Notifiable or Annually Notifiable diseases. A complete list can be found on the Canadian Food Inspection Agency website http://www.inspection.gc.ca/english/anima/disemala/guidee.shtml

Symptoms such as swollen eyes and respiratory difficulties can occur with AI.

Neurological symptoms (neck twisting) from END.

Relevance of a FAD

Each of the diseases listed above share a number of characteristics. They are all: highly contagious, easily transmissible, capable of causing high death losses, severe production losses and can potentially cripple the Canadian export market. For example the Highly Pathogenic Avian Influenza, (HPAI), strains H5 and H7 outbreaks in poultry can cause 90-100% mortality. The HPAI outbreak (H5N2) in British Columbia in 2004 resulted in 18.9 million birds destroyed, severe international trade restrictions and economic losses exceeding $370 million at the farm gate and $850 million retail. Avian Influenza poses an additional threat in that it is capable of causing serious disease and even death in people. Failure to act responsibly when a FAD is diagnosed can result in disaster, not only for your own business, but also for the bird industry in general.

SUGGESTED REFERENCES

Movement Control Following Confirmation of Highly Pathogenic Avian Influenza: (HPAI) in a Flock
http://www.poultryindustrycouncil.ca/factsheets/fs_144.pdf

CFIA definition and description of Foreign Animal Diseases
http://www.inspection.gc.ca/english/anima/heasan/man/avmmva/avmmva_mod12e.shtml
http://www.inspection.gc.ca/english/anima/heasan/fad/privete.shtml

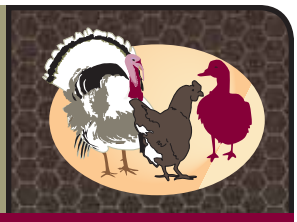
List and definition of Notifiable Diseases
http://www.inspection.gc.ca/english/anima/disemala/guidee.shtml

Reportable Diseases Regulations
http://laws.justice.gc.ca/en/H-3.3/SOR-91-2/index.html

Health of Animals Act: Compensation for Destroyed Animals Regulations
http://laws.justice.gc.ca/en/H-3.3/SOR-2000-233/index.html

TAKE HOME MESSAGE

- *FAD's are extremely important.*
- *Bird owners/producers should make every effort to develop an effective on farm health management and biosecurity programs to reduce the risk of a FAD, (or any disease), from entering their farm. Every producer should be prepared to cooperate with the Federal authorities in the event of an emergency.*
- *Every poultry group/association/club should work together to develop biosecurity programs and Emergency Response Plans. If you have an effective biosecurity program in place and a FAD is diagnosed, CFIA may consider not eradicating your flock.*



Self-Quarantine Protocol for Small Farm Flocks

Prepared by Dr. Victoria Bowes, Avian Pathologist
BC Ministry of Agriculture

What to do if you suspect an infectious disease is affecting your flock.

BACKGROUND: Upon the ***suspicion*** of an infectious disease in a small poultry flock, these are a set of guidelines that are to be enacted by the owner. The intention of this protocol is to limit the spread of disease between birds and, most importantly, the spread of disease off the farm into other groups of susceptible poultry.

SITUATION

You have observed an **unexplained***:*

- *onset of clinical signs of disease*
- *increase in mortality,*
- *change in production parameters such as feed/water consumption or egg production/ shell quality etc.*

ACTION PLAN

1) GET AN ANSWER:

a) If new birds have been recently introduced to your flock, check with the supplier for previous health records or other indications of disease in related birds. This may not be possible depending on the source of birds, which is why it is extremely important to acquire birds from a **reputable and traceable source**.

b) Call your poultry health advisor (vet, feed company, hatchery etc) with a complete description of the problem including time of onset, duration, whether things are getting worse or resolving over time. Offer your suspicions as to what you think the problem might be.

c) Provide representative birds and/or samples for **diagnostic investigation**:

i) call in your veterinarian to do on-farm necropsy and sampling techniques

ii) take or send birds and/or samples to the Vet Lab in Abbotsford (M-F, 9-4); *(For flocks <100 birds the subsidized necropsy fee is $10.00)*

Animal Health Centre
Abbotsford Agricultural Centre
1767 Angus Campbell Rd
Abbotsford, BC V3G 2M3
604-556-3003
1-800-661-9903

2) WHILE YOU WAIT:

a) Follow the advice of the poultry health advisor which may involve interim treatment of the flock based upon the disease suspected.

b) Review and list the on-farm visitors and bird movements in the previous 10 days.

c) Immediately, if possible, segregate affected birds in a "hospital pen" that is isolated from the unaffected birds. Provide protection, supplemental heat, clean fresh water and nutritional support as needed. Treat if appropriate.

d) Immediately adopt enhanced biosecurity protocols for the unaffected birds. Attend to unaffected birds first. Change clothing & footwear between groups.

e) As birds become affected, move them to the hospital pen.

f) Immediately restrict access to the bird areas for all *unnecessary traffic*.

g) Follow strict personal biosecurity procedures for leaving the farm (e.g. use non-farm clothing, footwear and vehicle).

h) **Postpone movements of any birds on or off the farm.**

i) Dispose of dead birds in an approved method: on-farm is preferable, composting or incineration is recommended. Treat as infectious material.

Important Note: *There are only 4 federal (pathogenic NDV and AI and* ***Salmonella pullorum*** *and* ***gallinarum****) and only 2 provincial (ILT and MG in turkeys) "reportable" diseases. All other diseases are "unregulated" and are a private issue between you and your veterinarian. Your confidentiality will be respected.*

3) WHEN A DIAGNOSIS IS CONFIRMED:

a) In the unlikely event that the diagnosis confirms a "federally reportable" disease, the CFIA will have been informed at the same time you were (this is a legal requirement). Prepare records and notes for review.

b) In the case of a "reportable" disease, follow the directions and recommendations of the regulatory agency but don't hesitate to ask questions.

c) Modify or initiate treatment of flock as appropriate.

d) **Enhanced on-farm biosecurity procedures** should be followed for at least 10-14 days following the end of treatment or resolution of clinical signs.

e) Optional but recommended: Enhanced biosecurity signs posted at gates indicating that an infectious disease has been diagnosed and access is restricted.

4) GETTING BACK TO NORMAL:

a) Continue to monitor for disease reoccurrence in the same or subsequent flocks; watch for clinical signs, submit follow-up samples.

b) Record the event in the production records with as much detail as possible.

c) Return to regular biosecurity measures.

d) The regular on-farm cleaning & disinfection procedures for the affected areas should be enhanced.

Self-Quarantine Checklist

An addendum to the Producer Self-Quarantine Protocol

When you suspect an infectious disease on your farm…

- ❑ Immediately call your veterinarian. Date/time called _____.

  Notes:

  _____

  _____

  _____

- ❑ Provide diagnostic specimens. Reference: **Diagnostic Submission Protocol**

  Date/time submitted _____.

  Reference/Submission#_____.

  Estimated time/date of prelim results _____.

  Disease Suspected _____.

  Notes:

  _____

  _____

  _____

- ❑ Review and implement the **Producer Self-Quarantine Protocol**
- ❑ Call all visitors and services expected to visit your farm in the next 5 days and either postpone or arrange end-of-day delivery with enhanced vehicle disinfection. Reference: **Emergency Contact List**

  Who Called/Time Contacted:

  _____

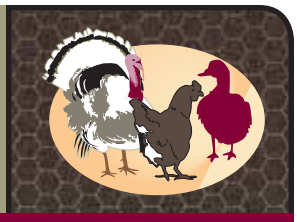
  _____

  _____

- ❑ Gather together all relevant production data and flock records for review.
- ❑ If requested, provide copies of the last 10 days of entries into the **Visitor Log**

Signs that cannot be ignored

1. ↑ *Mortality >3% in 1 week*
2. ↑ *Mortality >0.5% in 24 hours*
3. ↓ *Production >5% in 1 week*
4. ↓ *Feed or water consumption >20% in 1 week*



Understanding Antibiotics

Dr. Bruce Hunter, Ashley Whiteman, Dr. Babak Sanei, and Al Dam
University of Guelph and Ontario Ministry of Agriculture, Food, and Rural Affairs

An antibiotic is a drug generally used to treat infections caused by bacteria. Originally, an antibiotic was a substance produced by one microorganism that selectively inhibits the growth of another. For example, in 1926, Alexander Fleming discovered penicillin, a substance produced by fungi that appeared able to inhibit bacterial growth. Synthetic antibiotics, usually chemically related to natural antibiotics, have since been produced that accomplish comparable tasks.

Despite all of our efforts to keep our birds healthy through good husbandry practices and good biosecurity, it is inevitable that at some point a disease problem will occur on your farm. When this happens many producers immediately begin to medicate their birds with an antibiotic in the hope that this will restore the birds to a healthy state. Very often the drug choice is inappropriate and depending on the cause of the disease, for example a disease caused by a virus, the use of an antibiotic may not be warranted at all. Antibiotic misuse is leading to increasingly more stringent controls on over-the-counter antibiotic sales. Antibiotics have an important place in maintaining bird health, but they must be used carefully and judiciously.

Producers are encouraged to take the livestock medicine education program offered by the University of Guelph, Ridgetown Campus that fosters the safe use and handling of medicines on farm (www.ontariolivestockmed.com).

Improper use of antibiotics in livestock has been linked to drug resistance in pathogens affecting humans and the development of "Super bugs". Human health concerns are driving new regulations on antibiotic use in livestock throughout the world. This problem is not restricted to commercial livestock, but is also a significant problem in back yard flocks, non–regulated poultry industries, our pets and even misuse of drugs in human medicine.

Bird producers should be aware of a number of important facts about the use of antibiotics:

1. Antibiotics are not effective against viruses, fungi, external or internal parasites. They are only effective against bacterial pathogens.

2. Every bacterial pathogen has a different sensitivity pattern to antibiotics, i.e. not every antibiotic is effective against all pathogens. The proper antibiotic has to be carefully chosen and this should be based on having first obtained an accurate diagnosis so that you know exactly what you are attempting to treat. A diagnostic laboratory can run antibiotic sensitivity panels on bacteria isolated from sick or dead birds. These sensitivity panels are the key to choosing the correct antibiotic for the problem. Consult your veterinarian to get a correct diagnosis and directions on the choice and proper route of administration of the antibiotic.

3. Using the proper dose and duration of treatment is critical. In order to be effective, critical target levels of the antibiotic have to be attained and maintained for a sufficient time to control the pathogen. If appropriate and consistent levels of antibiotic are not achieved it will be ineffective in treating the problem. Always give a full course of antibiotic treatment.

4 Bacteria can develop resistance to any antibiotic. This is usually the result of improper use of antibiotics. For example, using an ineffective antibiotic (i.e. the organism is not sensitive to it); by using too low a dose (i.e. below the therapeutic level); using the drug repeatedly at low levels; or by treating for too short a period of time. Antibiotic drug resistance and how it develops is a complicated story, but once drug resistance develops it can be transferred from one type of bacteria to another via gene swapping. Drug resistance problems can build up on your farm over time. If this happens then that class of antibiotic will no longer be an effective treatment option on your farm.

5 Zoonotic organisms (i.e. ones that can be transferred directly from animals to people) like Salmonella may cause significant human health problems. If these bacteria have also developed drug resistance, treatment options for humans become more limited.

6 Antibiotic resistance is becoming a larger and larger issue in human medicine with the development of "Super Bugs" that are resistant to multiple antibiotics. There are already "Super Bugs" in Canada that are resistant to all currently available and registered antibiotics for use in people. Woe to the person that becomes infected with these organisms. Pressure from Health Canada is increasing to regulate drug use in livestock production.

7 All antibiotics have an expiry date. Using old, outdated antibiotics will not effectively treat or control disease.

8 Antibiotics can be destroyed by heat and sunlight. Some require refrigeration. Improper storage of antibiotics renders them ineffective.

9 Antibiotic residues (either the parent drug or metabolites of that drug) will accumulate in the meat or eggs of medicated birds. Each antibiotic has a scientifically established withdrawal time (length of time for drug residues to disappear in meat or eggs after the drug has been removed) before the meat or eggs can be consumed. These withdrawal periods must be adhered to. Many people have drug allergies and residues are a serious concern. Drug residues in food also lead to drug resistance as discussed above.

10 The route of administration of antibiotics is critical. Some drugs must be injected, others can be used in the feed or water systems. Syringes and needles must be sterile. Many diseases are transmitted from bird to bird during the treatment if dirty equipment is used or if needles are not changed between animals. Many drugs are not soluble enough in water to remain dissolved and will precipitate out in the water. Some drugs have a bitter taste and birds will refuse to eat the medicated feed or drink the medicated water. Most water soluble drugs are destroyed by water bio-films or high mineral content in the water. Dosing birds in their water requires that you know the daily water consumption of your flock to calculate an accurate drug dose.

11 Antibiotics are used to kill bacteria. We should not be surprised that antibiotics can also be toxic to the birds if used at levels that are too high or used in the wrong age of bird. For example: tetracyclines used in young birds can cause bone development problems; chloramphenicol causes abnormal blood cell development in young, growing birds; sulfa drugs can cause serious kidney damage if used at too high a dose or in birds that are dehydrated.

12 A number of antibiotics and antimicrobial agents (including wormers and booster packs etc.) can be purchased at local farm supply stores. Farmers often medicate their animals themselves without knowing the diagnosis or the appropriate treatment. The misuse of antibiotics either by using the incorrect drug or using the wrong levels is extremely common in livestock farms in Ontario.

13 The sale of antibiotics is controlled. Certain antibiotics at certain dosage levels have been cleared for use in livestock feeds for growth promotion or prevention of target diseases and can be added by the feed mill. Using antibiotics at a dosage level higher than these accepted levels (i.e. using treatment or therapeutic levels) requires a prescription from your veterinarian.

14 Using drugs "off-label", i.e. using it in ways that are different from the claim on the label of the bottle, must be done carefully as most drugs have never been tested in species other than chickens or turkeys. There are significant differences in how drugs are metabolized and therefore they have different toxicity levels and withdrawal times between species. The use of drugs off label should be done under veterinary supervision only.

Conclusion

Based on the facts listed above, bird owners should be extremely careful on how antibiotics are chosen and administered to their birds. Antibiotics should be used only when necessary so they maintain their effectiveness.

Antibiotics should never be your "first line of defense". Good husbandry, good biosecurity, rapid and accurate disease diagnosis and a solid disease prevention program is more effective in controlling disease than using antibiotics.

In certain provinces like Quebec, all drugs used in livestock require a veterinary prescription. This has not yet occurred in Ontario. Bird producers are strongly encouraged to seek the advice of their veterinarian when deciding on when and how to use antibiotics. There is strong national and international pressure to ban the routine use of antibiotics for growth promotion and disease prevention in commercial livestock production.

Controls on antibiotic availability and sales will tighten over the next few years. Establish a relationship with your local veterinarian ... it will prove to be an asset in keeping your birds healthy.

SUGGESTED REFERENCES

Antibiotic / Probiotic Trends and Transitions in the Poultry Industry
http://www.thepoultrysite.com/articles/706/antibiotic-probiotic-trends-and-transitions-in-the-poultry-industry

Responsible Disposal of Unwanted Medicines and Sharps:
http://www.omafra.gov.on.ca/english/livestock/animalcare/amr/facts/05-051.htm

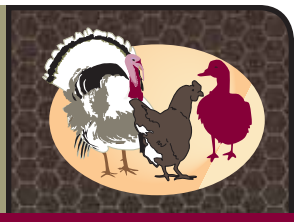
Feed Medications:
http://www.poultryindustrycouncil.ca/compendium-feed_meds.html

Water Medications:
http://www.poultryindustrycouncil.ca/compendium-water_medications.html

Antimicrobial Resistance:
http://www.poultryindustrycouncil.ca/compendium-antimicrobial.html

Antimicrobial Resistance in Agriculture:
http://www.omafra.gov.on.ca/english/livestock/animalcare/amr/facts/04-081.htm

**Mention of trade names is not an endorsement for the products.*



Introduction to Biosecurity

Biosecurity

What is Biosecurity?

There is a myriad of microorganisms and parasites that are constantly looking for a host to infect. Some of these organisms, or pathogens, can cause serious disease in poultry. The results of these diseases, such as Infectious Laryngotracheitis (ILT), Avian Influenza (AI), or Mycoplasma gallisepticum (MG) include suffering of affected birds, loss of production, and mortality. But, before disease can happen, these disease-causing organisms must get into the flock, therefore, it is wise strategy to take measure to prevent their introduction into a flock. Biosecurity is a collection of procedures and rules that, when followed properly, will keep susceptible flocks protected from infectious pathogens.

How complicated is it?

Most elements of biosecurity are common sense, especially when the mechanism of disease transmission is understood. Fundamentally, a flock owner needs only to critically examine their own flock and premises and identify the places in which a pathogen might enter. Once those points are identified, it is an easy matter to put procedures in place to prevent the breach.

Of course, all the rules in the world can be activated, but if the procedures are not properly executed, nothing will be gained. It is therefore important that everyone involved is committed to the process.

What steps are involved?

There are many guides and articles being developed on biosecurity that will provide a good reference to establishing a plan. However, the main elements include:

1. **Access management** — reducing the risk of a pathogen from being carried into (or out of) your farm and your bird holding area (barn, coop, or pasture). Some examples could include:
   - » Restrict entry of people and vehicles — parking vehicles outside the bird area
   - » Strict rules for visitors about hand washing and clean clothing and footwear before entering the bird area
   - » Do not share equipment with other bird owners
   - » Make sure that vehicles that must enter your bird area are clean
2. **Health management** — measures taken to ensure good health and might include:
   - » Purchase chicks, poults, or pullets from sources with known good health status that can produce health records
   - » Vaccinate against prevailing diseases

- » Have good records of health issues and keep diagnostic reports for mortalities
- » Avoid introducing new stock into existing flocks, but if doing this, have a secure isolation area to quarantine new birds for 30 days

3 **Operational management** — general management to support the health and well-being of your birds:

- » Secure buildings with good air management
- » Well-balanced, nutritious diet
- » Good quality water
- » Clean feeding and watering equipment
- » Good mortality management
- » Good manure management
- » Good cleaning and disinfection practices

4 **Know and understand the procedures**

- » Stay up to date on management and health issues
- » Make sure everyone involved with the flock knows and understands the procedures and their rationale

How can you measure biosecurity?

Successful biosecurity practices are very difficult, if not impossible to measure. Production may be improved if certain diseases are eliminated and kept out, but this can only be effectively measured in very large flocks. While one can easily observe absence of disease, it is impossible to know that you have saved your flock from a disease by practicing good biosecurity. So, it comes down to trusting that you are doing the best for the health of your flock.

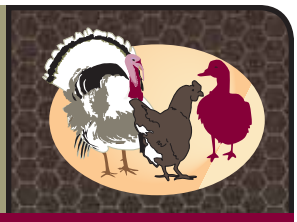
The articles following in this section will cover some of the key areas of biosecurity. The Canadian Food Inspection Agency (CFIA) has published a Biosecurity Standard that provides goals that can apply to poultry flocks of any size. The Standard can be found on-line at the following link:

http://www.inspection.gc.ca/english/anima/biosec/aviafse.shtml

The guide that accompanies that Standard contains a wealth of information and tips on achieving good biosecurity. The Guide can be found in Appendix 1 of this manual.

More information on biosecurity can be found at the following websites:

Canadian Poultry Magazine Guide to Biosecurity:
http://www.canadianpoultrymag.com/images/stories/bio2009.pdf



Producer Self-Assessment Guide

"Vigilance should be constant"

General Principles of Biosecurity

The term "biosecurity" refers to an overall program that uses a combination of physical barriers (things) and directed actions (people) in a specific way that should prevent the introduction of, or limit the spread of , infectious disease causing agents (bacteria and viruses) into a group of susceptible poultry. *Inadequate biosecurity at any level is an industry-wide concern.*

Biosecurity encompasses 3 basic components:

1) **Prevention.** The principle of **preventing the introduction** of a disease agent. Strict physical isolation of barns and birds from potential disease agents. Once the flock or farm is contaminated, the owner of a poultry facility is faced with the challenge and increased costs associated with cleaning and disinfection as well as the potential reliance on vaccines and medications in subsequent flocks.

2) **Containment.** If infected, the steps are in place to **prevent the spread** of an infectious agent by interrupting the disease transmission cycle. This is where application of routine and responsive **sanitation** procedures for personnel and equipment are vital. *The overwhelmingly most common cause of disease spread among farms is contaminated equipment and people.*

   Another aspect of containment includes rapid *diagnostic support and effective communication* between producer, veterinarian and scheduled services such as feed delivery and egg pick-up. Each producer should put in place a set of guidelines for "self-quarantine" that can be referred to during the interim of suspicion and confirmation of a disease problem.

3) **Bird Health.** Optimizing bird health **promotes immunity**, which in turn reduces the amounts of disease causing organisms in the birds environment should an infection occur. Early recognition of a disease problem can be accomplished through daily record-keeping of mortality, feed and water consumption as well as through observational instinct. Minimizing stress promotes optimal bird health and ultimate productivity.

How to Use This Guide

This Guide allows the producer or farm manager the opportunity to assess their current level of on-farm biosecurity. This is a private document entirely for your own personal use. Your answers will provide you with an idea of where there are areas of weakness that require attention or practices that fall below current industry standards. You should develop a plan to address those specific areas that need improvement.

Biosecurity measures that score "Unacceptable" are considered to fall below the minimum standards set out by the industry and will require immediate corrective action because not only your farm but the entire industry is at increased risk of an infectious disease outbreak. Optimal or "Ideal" biosecurity practices, as outlined in the Guide, are to be considered the "gold standard" that producers should aspire to. Remember, your entire biosecurity program is only as good as its weakest point.

Simply read the question and circle the response that best fits your current biosecurity practices. Each response is rated as **Unacceptable**, **Questionable**, **Adequate**, or **Ideal**.

Developing an On-Farm Biosecurity Program

THINK ISOLATION: a defensive fortress, an island.

Using the information provided in this guide and from other available resources, each producer should develop a written and reviewed farm-specific BIOSECURITY PROGRAM. Enhanced biosecurity measures will have an initial cost to implement but this should be viewed as a long term investment in future profitability.

The general approach to developing a workable on-farm biosecurity plan is to systematically identify potential disease risk factors (either physical barriers or an activity a person does) and to formulate a protocol that can reasonably reduce that specific risk. Some risks don't lend themselves to complete elimination and therefore these risks need to be managed appropriately with "work-around" protocols. Each farm is unique and although a recognized compromise, exceptions may have to made to the general recommendations to work around specific insurmountable obstacles. Remember, a biosecurity plan not only protects your investment, it is essential to the long term sustainability of the poultry industry.

Once you have defined your On-Farm BIOSECURITY PROGRAM, practice the **NO EXCEPTIONS** rule. It is the producer who has the ultimate responsibility to refuse entry to any person, vehicle or equipment that is visibly unclean. Choose to do business with people and organizations that have established and display high standards for biosecurity.

It's Easy....

1 IDENTIFY THE RISK

2 MANAGE THE RISK

Terminology Used in the Guide

Unacceptable – Based on current knowledge, this breach of biosecurity puts your flock is at an extremely high risk of disease introduction. This practice requires immediate corrective attention since it also puts the general poultry industry at increased risk of in infectious disease outbreak.

All practices deemed "unacceptable" have been reviewed by the Poultry Committee and are considered to be below the minimum standards set for the industry.

Questionable – Based on current knowledge, this biosecurity practice puts your flock at risk for disease introduction depending on your unique situation. Consultation with your poultry veterinarian is recommended to determine if your biosecurity protocols in these areas should be or can be changed to better protect your flock and the rest of the industry.

Adequate – Based on current knowledge, your farm has reasonable biosecurity practices in place to prevent introduction of disease. However, there is room for improvement and you may consider consultation with your poultry veterinarian to review these practices and assess the value of making changes to further safeguard your flocks.

Ideal – Based on current knowledge, these biosecurity practices are outstanding and you have reduced the risk of introducing infectious disease into your flock. This is the "gold standard" and efforts should be directed toward improving the biosecurity practices that score in the previous categories to meet this level.

The following self-assessment checklist was inspired by The Biosecurity Guide for Pork Producers.

1) Farm Location

a) What is the proximity of your farm site to the nearest unrelated poultry operation:

i) Less than 400 meters _____Questionable

ii) 400 meters to less than 2 km _____Adequate

iii) 2 km or greater _____Ideal

b) What is the proximity of your farm site to a public road:

i) Less than 50 meters _____Questionable

ii) 50 to 100 meters _____Adequate

iii) Greater than 100 meters _____Ideal

c) Have you made an effort to familiarize yourself with the location of neighboring backyard poultry flocks?

i) No _____Unacceptable

ii) Yes _____Ideal

d) I routinely meet with my neighbours who own poultry to discuss poultry health issues, including local area disease risks and response plans:

i) Never _____Questionable

ii) Sometimes _____Adequate

iii) Routinely _____Ideal

e) How many backyard poultry flocks are you aware of within 1km of your farm:

i) Greater than 10 _____Questionable

ii) Between 1 and 9 _____Questionable

iii) None _____Adequate

f) How close is the nearest body of water (stream, pond, slough) to your barn(s):

i) Less than 50 meters _____Questionable

ii) Between 50 and 250 meters _____Questionable

iii) Greater than 250 meters _____Adequate

2) Access deterrents

a) No biosecurity or information signs at entrance _____Unacceptable

b) Biosecurity sign is readable from the road _____Adequate

c) Biosecurity signs are posted at the gates of all access points onto the farm ____Ideal

d) There is no vehicle disinfection station on the farm _____Unacceptable

e) There is a freshly stocked vehicle disinfection station at the gate _____Ideal

2) Access deterrents (cont'd)

f) No perimeter fence _____Questionable

g) No gated driveway _____*Ultra Unacceptable

h) Driveway is gated and not locked _____Questionable

i) Driveway is gated and always kept locked _____Adequate

j) Perimeter fence exists and driveway is gated and always kept locked _____Ideal

k) There is no clearly identified designated visitor parking area _____Unacceptable

l) Visitor parking area <30 meters from barn(s) _____Questionable

m) Visitor parking is outside the farm perimeter or "control area" _____Ideal

n) Driveway is dedicated to the barn area and separate from the residence _____Ideal

o) An occupied dwelling exists on the site _____Ideal

p) Farm buildings are not secured with locks _____Unacceptable

q) Driveways are designed for one-way traffic flow _____Ideal

r) Driveways are

   i) dirt _____Unacceptable

   ii) gravel _____Adequate

   iii) paved, no potholes _____Ideal

3) Barn Layout

a) Barns are less than 15 meters apart _____Questionable

b) Barns were built with prevailing wind and other poultry facilities in mind _____Ideal

c) Feed is delivered to the barn (s) away from the fan exhaust _____Adequate

d) Barns vent into adjacent barn intakes _____Questionable

4) Building Entryways

a) Have clearly defined, visible and maintained "clean" and "dirty" areas _____Adequate

b) Entryways (workrooms) are never cleaned and disinfected _____Unacceptable

c) Entryways are routinely cleaned and disinfected _____Adequate

d) Hand wash stations are conveniently located at entry/exit _____Ideal

e) Entryways are routinely disinfected (refer to specific farm protocol) _____Adequate

f) Entryways are uncluttered, swept daily, clean and always kept dry _____Ideal

g) Entryways that have footbaths/footmats with disinfectant are:

   i) changed less than once per week _____Unacceptable

   ii) changed weekly _____Questionable

iii) changed daily or with visible soiling _____Adequate

iv) changed daily or with visible soiling and is located under cover from sun/rain _____Ideal

h) Each farm has its own set of:

i) clean and routinely laundered personal work clothing and footwear _____Adequate

ii) additional clean and routinely laundered farm outerwear and footwear _____Ideal

iii) one-time use disposable coverall and boot covers _____Ideal

iv) each **barn** has its own designated outerwear and footwear _____Ultra Ideal

v) designated outerwear is NOT available _____Unacceptable

5) Pest Control programs

a) What's a pest control program? _____Unacceptable

b) A written rodent control program is maintained by the producer:

i) occasionally or as required _____Unacceptable

ii) routinely, at least weekly, according to written protocol _____Ideal

c) There is untrimmed vegetation or debris within 3 meters of barn(s) _____Unacceptable

d) There is an active fly and beetle control program:

i) seasonally _____Adequate

ii) routinely, year round, according to written protocol _____Ideal

e) Birds have access to inside of barns or feed storage _____Unacceptable

f) Dogs, cats, or wildlife have access to inside of barns or feed storage _____Unacceptable

g) Feed spills are cleaned up immediately _____Ideal

h) Feed storage containers and delivery systems are not water-proof _____Unacceptable

Rodents, feral animals and birds can be sources of pathogens for poultry. Wild birds can transmit *Avian Influenza*, *Mycoplasma gallisepticum* (MG) and *Northern Fowl Mites*, and rodents can be carriers of *Fowl Cholera* and *Salmonella sp*.

Note: Outdoor production units cannot always control bird, pet, rodent, or wildlife access to poultry or poultry feed. Depending on location, producers with outdoor facilities should be aware of the need to be more cautious and more observant.

6) Truck Traffic (Feed, Egg Collection etc)

a) Service truck is dirty on arrival and is allowed entry _____Unacceptable

b) Service trucks are washed & sanitized before entering and leaving farm _____Ideal

c) Service trucks are greeted and inspected at the gate by a producer that enforces biosecurity protocols_____Ideal

d) Driver wears clean company coveralls and new disposable booties or rubber pull-ons on each delivery _____Adequate

e) Feed driver enters poultry barns during deliveries _____Unacceptable

f) Feed driver and truck has clear, clean and dry access to feed bins _____Ideal

g) Feed driver and truck has to negotiate through mud and/or debris to access feed bins _____Unacceptable

h) Feed is delivered from a HAACCP mill_____Ideal

Note: Producers should reject visibly dirty trucks and require them to be washed and disinfected prior to entering past the farm gate.

Vehicles can potentially transmit poultry pathogens when manure containing disease agents is adhered to tires or the vehicle frame. The majority of poultry pathogens are spread by contaminated vehicles and the movement of people.

7) Tools and equipment

a) Small tools are brought onto the farm without cleaning and disinfection _____Questionable

b) Equipment is brought onto the farm without cleaning and disinfection _____Unacceptable

c) All tools are cleaned and disinfected before being brought onto the farm _____Ideal

d) All tools and equipment are cleaned and disinfected when moving between farm buildings _____Ideal

e) Tools and equipment are cleaned and disinfected before they leave the farm _____Ideal

f) Farm maintains its own sets of tools and equipment for repairs as much as possible _____Ideal

8) Cleaning and disinfection

a) On-farm biosecurity protocols are not enforced for catching & vaccinating crews _____Unacceptable

b) Producer does not over see the clean-out procedure to finish _____Questionable

c) All birds are removed from barn before cleaning and disinfection _____Ideal

d) Barns are cleaned and disinfected in a 3 step process (litter removal, wash & disinfection) before new birds are placed _____Adequate

e) Medicators and dispensers are cleaned and disinfected after each use _____Adequate

f) Ceiling, walls, flooring, and equipment are all cleaned and disinfected between flocks _____Ideal

g) Soap and hot water are used to remove all visible organic material before disinfectant is applied _____Ideal

h) There is a minimum of 10 days "downtime" between flock placements _____Adequate

i) There is a minimum of 21 days "downtime" between flock placements _____Ideal

j) Disinfectants are selected at random or "on sale" _____Questionable

k) Disinfectants are selected based on label claims _____Adequate

l) How would your grandmother rate your farms overall level of cleanliness:

i) You're not going anywhere until that's cleaned up properly _____Unacceptable

ii) Not bad, but try again _____Questionable

iii) Pass without the flying colours _____Adequate

iv) We're serving Sunday dinner on these floors, I'm so proud _____Ideal

The key to proper cleaning and disinfection is to first remove all visible manure from the room and equipment within that room. Hot water and detergents can make this job easier. Disinfection should occur only after all visible manure has been removed. Manure and organic debris can interfere with the effectiveness of some disinfectants. The diseases on your farm and the hardness of your water can also affect disinfectant efficacy. Paying attention to label claims for dilution and contact times and working with your veterinarian to check which disinfectant will work best in your situation and will help optimize disinfectant efficacy on your farm.

9) Water sanitation

a) Water quality is checked by a reputable laboratory:

i) sometimes, if I remember _____Unacceptable

ii) yearly _____Adequate

iii) Twice yearly _____Ideal

b) Water lines are sanitized between flocks _____Adequate

c) Water lines are sanitized between flocks and during production _____Ideal

d) There are no in-line water filters _____Questionable

e) Water filters are changed routinely based on written protocol _____Adequate

10) Supply and Product Deliveries

a) Delivery person observes all trucking and visitor biosecurity protocols _____Adequate

b) Delivery person sets packages in a designated location away from the barn ___Adequate

c) Producer greets deliveries and ensures biosecurity protocol is followed _____Ideal

11) Employee concerns

a) Employees have routine contact with other poultry species without following a written biosecurity protocol _____Unacceptable

b) Following contact with other questionable poultry species, employees have a minimum 24 hour "away time" requirement before re-entering the farm _____Ideal

c) It is explained to employees the consequences of coming in contact with off-farm poultry _____Adequate

d) Employees do repair work on other farms without following a written biosecurity protocol _____Unacceptable

e) Contractual employment agreement outlines biosecurity expectations _____Ideal

f) Biosecurity training is provided for employees _____Adequate

g) Annual biosecurity training is a mandatory condition of employment _____Ideal

h) Catching crews and vaccinators are greeted at the gate, directed to a designated parking area and provided with protective clothing and footwear _____Ideal

i) There is a designated clean and comfortable area for catching and vaccinating crews to assemble, take breaks and avoid returning to vehicles _____Ideal

12) Visitor concerns

a) "No Visitor" policy for non-essential visitors _____Ideal

b) Visitors are required to phone ahead and are greeted at the locked gate _____Ideal

c) Visitors wear clothing they have brought with them _____Unacceptable

d) Visitors must wash hands and wear farm provided clothing and footwear ____Adequate

e) Visitors must shower-in, shower-out and wear farm provided clothing _____Ideal

f) Visitor logs are kept, ALL visitors must sign-in:

   i) sometimes _____Unacceptable

   ii) always insisted upon and enforced _____Ideal

g) Visitors must park vehicles in a designated area _____Adequate

h) Visitors are not allowed to bring vehicles inside perimeter fence _____Ideal

13) Multi-farm management

a) Personnel move between farms without following a specific multi-farm management biosecurity protocol _____Unacceptable

b) Move between farms but change into disposable or dedicated outerwear at each site as outlined in the on-farm biosecurity protocol _____Adequate

c) Work only in single farm isolation, no contact with other poultry at any time _____Ideal

14) Flock Health Management

a) All-in all-out management is not practiced _____Questionable

b) Each barn is capable of all-in all-out management _____Adequate

c) All-in all-out management is strictly practiced _____Ideal

d) There are more than one species of bird on the farm _____Questionable

e) Birds are acquired from sources that DO NOT engage in a health program _____Unacceptable

f) Mortality is collected and recorded daily _____Adequate

g) Excess mortality or unexplained clinical signs are investigated within 24 hours _____Ideal

h) Excess mortality or unexplained production changes are not routinely investigated _____Unacceptable

i) The local Vet Lab is used when needed:

   i) submitted by the producer _____Ideal

   ii) submitted by a service rep _____Adequate

   iii) never needed _____Unacceptable

j) There is active flock health monitoring through serology _____Adequate

k) I routinely analyze my mortality records, production data and feed/water consumption rate for signs of problems _____Ideal

l) Vaccination protocols are:

   i) "routine" and unwritten _____Unacceptable

   ii) administered or overseen by the producer_____Adequate

m) Vaccines are not stored or handled according to label requirements _____Unacceptable

n) Medication or vaccine brand name, serial number, date, storage conditions, application and expiry date are part of the written health record _____Ideal

o) Movement of birds on and off the farm is a component of the health records _____Ideal

p) There is NO pre-written "self-quarantine" protocol enacted upon the 1st suspicion of disease _____Unacceptable

q) I do not have an emergency after-hours phone number contact list_____Unacceptable

r) I have immediate access to the advice of a poultry health professional _____Adequate

s) I do not have a written vaccination or disease prevention program _____Unacceptable

t) My vaccination and disease prevention programs are a result of veterinary consultation _____Adequate

u) The written vaccination and disease prevention program is continually being updated as new information becomes available _____Ideal

15) Continuing education

a) I take every opportunity to attend industry meetings and educational seminars to keep updated on new developments in disease control _____Ideal

16) Carcass disposal/ Manure management

a) How far is your dead bird disposal or compost site from your barn(s)?

i) Less than 15 meters _____Questionable

ii) Between 15 and 100 meters _____Adequate

iii) Greater then 100 meters _____ Ideal

b) Carcasses are disposed of in a timely (<24hr) & appropriate manner as outlined in the on-farm biosecurity protocol _____Ideal

c) Carcasses are kept in an enclosure that prevents access by scavengers, pets, rodents or wildlife _____Adequate

d) Manure is composted or covered & stored >30 days before leaving farm _____Ideal

e) Manure transporters observe all trucking biosecurity protocols _____Ideal

f) Farm equipment used to haul manure is NOT cleaned and disinfected prior to reentering the farm _____ Questionable

g) Employees wear coveralls and boots designated for hauling manure and do not resume farm duties until they have washed their hands and/or showered, and are wearing clean clothing and boots _____Ideal

Thank you for taking the time to evaluate your current level of biosecurity. Hopefully it was able to provide insight into those areas that require corrective action.

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Food Safety for Small Flock Owners

How to Reduce the Risk of Food-borne Illness from Your Own Birds

Bill Cox, DVM
Poultry Extension Veterinarian
Animal Health Branch
BC Ministry of Agriculture

Introduction

Owning your own chickens and enjoying the fresh eggs they produce can be most rewarding.

Eggs, an excellent source of nutrients including protein, vitamins, and minerals, have often been described as the perfect food. Although the risk is very small, eggs can occasionally be a source of food-borne illness, particularly Salmonella. Fortunately there are ways in which the risk of infection can be lowered even more, and possibly even eliminated.

How Salmonella Infects Chickens

All chickens are susceptible to infection with Salmonella, even hens in small flocks. Most Salmonellae, however, will not cause illness in chickens, instead residing in the intestine as a normal inhabitant. Salmonella in the intestine can contaminate the outside and, in some cases the inside, of the egg, therefore posing a risk to the consumer.

Most Salmonella bacteria are transmitted from one bird to another by the oral-fecal route; in other words, a bird that is not infected can acquire the bacteria from contact with droppings from an infected bird. The newly acquired bacteria will thrive in the intestine of the new host hen.

Some specific types of Salmonella, such as Salmonella Enteritidis (SE), can spread to the reproductive tract of the hen, infecting the ovary, the oviduct, or both. From the reproductive tract, SE can contaminate the inside of the hen's egg and from there infect a human consuming that egg (if undercooked) or spread directly to the offspring of the infected hen.

How Salmonella Spreads

Salmonella can spread quite readily from bird to bird and, with a little help, from flock to flock. The bacteria can enter a flock through a number of routes, including other chickens, rodents, birds, and people. Once contaminated, manure and barn dust, are an important source of the bacteria for susceptible chickens in the flock.

Some Salmonellae, such as SE, can transmit from hen to offspring directly through the egg. This is a particularly efficient way in which to spread the disease around. Only a few chicks

from an infected flock may be, themselves, infected, but that will be enough to introduce the organism into a flock, as it colonizes the intestinal tract and sheds in the droppings.

Many types of Salmonella, and especially SE, can live in the intestine of rodents and especially mice. Salmonella is shed in the droppings of these pests, contaminating environment and feed. This makes mice or rats an important reservoir that will spread the organism to each new flock placed on the farm. They can also facilitate its spread to neighbouring farms through migration.

New introductions into a susceptible flock are another effective way of spreading Salmonella. Because Salmonella very rarely causes illness in birds, even a period of quarantine for new birds will not be effective in preventing infection of the existing flock. Once the infected bird is mixed with the susceptible ones, the organism will spread readily from bird to bird. Additionally, stress can induce shedding of Salmonella by already colonized chickens, multiplying the amount of Salmonella in the environment.

Wild birds, particularly pigeons and small songbirds such as sparrows, can also carry various strains of Salmonella; so, if such birds are allowed access to the flock's environment, and especially to the feed, then the pathogen can be readily spread into the poultry. Wild birds may also carry Salmonellae mechanically from one flock to another.

Humans can be a major contributor to the spread of Salmonella. Contaminated manure can readily stick to shoes, hands, equipment, or vehicles in sufficient volume to allow its introduction into a flock of susceptible birds. Once a small amount of bacteria is introduced, it can spread readily throughout the flock.

What Salmonella Can Do to Chickens

Most types of Salmonella do not affect the life, growth or productivity of chickens, which makes it very difficult to determine its presence. However, some types can cause disease or production loss. For example, recent strains of SE have caused significant illness and death in young broiler chickens.

How to Control or Prevent Infection with Salmonella

A number of strategies can be taken to reduce the risk of Salmonella infection in the flock. The focus should be on first preventing its entry into the flock, second, preventing carry-over into the next flock, should it get in, and third, reducing the risk of consuming contaminated eggs. Paying attention to the following steps will significantly reduce the risk of Salmonella contamination of the flock and eggs.

- Only purchase chicks or pullets from sources that are known to be free of Salmonella in general or at least Salmonella Enteritidis (SE)
- If introducing birds into a flock, make sure the source flock has been tested and shown to be free of Salmonella
- Ensure a healthy colonization of the young chick's intestinal tract – administration of probiotics can help this
- Ensure optimum management and husbandry to minimize stress
- Start and maintain a strict rodent control program

- Start and maintain a strict fly and darkling beetle control program
- Restrict visitors to your farm. All visitors should be required to do the following:
  - » have had no recent previous contact with poultry
  - » wash hands well
  - » wear clean farm-specific coveralls and boots when entering the bird holding area
- Remove manure from the farm before introduction of a new flock or store it securely at least 100 metres from the bird area.
- Carry out a thorough cleaning and disinfection prior to introduction of a new flock
- Consider having the flock or environment tested for the presence of Salmonella.

Proper Handling of Eggs

While many steps can be taken at the bird level to prevent Salmonella or at least significantly reduce the risk of infection, other important steps can be followed when handling eggs:

- Make sure that the hens have adequate nest box space and that the nest boxes are kept clean.
- Gather eggs twice daily; collect eggs early in the morning as most are laid by 10:00 am.
- Collect eggs into clean trays or containers. Make sure they are cleaned and sanitized after each use. Do not reuse cardboard trays.
- Eggs for consumption should be clean and free of manure, dirt, or feathers.
- Floor eggs, especially those laid in litter or wet ground should be discarded.
- Cracked eggs should be discarded. The risk of contamination of the egg by bacteria is up to 100 times higher in cracked than intact eggs.
- Consider candling the eggs; candling will highlight eggs with small cracks, allowing the selection of only the best eggs. See the following section for a description of candling.
- Refrigerate eggs as soon after collection as possible and keep them refrigerated.

Cleaning Eggs

- Do not cool the eggs rapidly before they are cleaned; this will cause the interior to contract, pulling contamination into the egg through pores on the surface.
- If washing slightly dirtied eggs, make sure the wash water is 10° warmer than the egg temperature; colder water causes the egg interior to shrink, drawing bacteria through the shell and into the interior.
- Dry and cool eggs quickly after washing; store at less than 10°C.

Candling Eggs

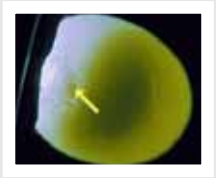
Candling eggs is done to see the inside of the egg and details of the shell. For table eggs, it is done to identify interior abnormalities, such as blood spots and meat spots, and to visualize the integrity of the shell, allowing the removal of small cracks.

Commercially available and home-made candlers

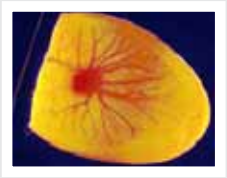
The procedure is quite simple – a concentrated light is shone on the egg and the shell and contents examined. Commercial candling units are available, but a homemade device can easily be constructed. All that is required is a dark room, a box with a bright light inside and a hole about 1 inch in diameter over which the egg is placed.

With the light in the candling box on and the room light out, hold the large end of the egg against the hole so that the interior of the egg is lit up. In this way, the interior can be visualized. Also cracks not visible under regular light will be seen and, by squeezing the egg slightly, the crack will widen. By giving the egg a quick turn against the light, the interior contents will move, giving some information about the quality of the interior; for example, if the white is too runny, the interior motion will be faster than normal.

It is useful to practice candling eggs to gain confidence in interpreting what is seen. Start with store bought white eggs and crack a few open if anything suspicious is seen. Brown eggs will be more difficult to visualize at first, but with a bit of practice, it will be easy to sort out the substandard eggs.



Candled egg highlighting cracks; the yolk is the dark shadow in the centre



Candled egg showing a very early embryo

How to prevent transmission of Salmonella from eggs to people

A number of common-sense steps can be taken to prevent illness, even if an egg consumed is contaminated:

- Store eggs in the refrigerator at <10°C
- Thoroughly cook eggs for consumption, including the yolk
- Wash hands after handling eggs or chicken
- Wash hands after handling your birds
- Use only pasteurized eggs for raw-egg foods such as egg nog or mayonnaise
- Immediately wash and sanitize all surfaces on which eggs or chicken have been prepared before preparing other foods

Important Poultry Diseases

Intervet International BV, The Netherlands

Foreword

We first published the "Important Poultry Diseases" in 1972 and, ever since, it has remained the most sought after of all our publications.

However, in the intervening years new causes of disease such as chicken anemia virus and pneumovirus were identified. Therefore, Intervet Research teams developed new vaccines to combat the changed pattern of diseases. Many of these are inactivated vaccines, in either single or combined form, resulting in new vaccination programmes. We have, therefore, produced this fourth edition of the handbook to cover these developments. It is intended as a pocket reference book for people working with poultry. It is not highly academic as it is written from a practical angle to assist with every day problems in the field.

Intervet Research continues to co-operate with the poultry industry, worldwide, to stay ahead of disease problems.

The farmer who uses an Intervet vaccine can do so knowing that it is the best product available.

For detailed information on any of our products contact the local Intervet representative or

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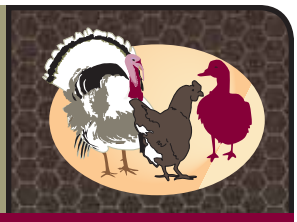


INFECTIOUS RESPIRATORY DISEASES

- *Chronic Respiratory Disease (CRD)*
- *Coryza*
- *Aspergillosis*
- *Newcastle Disease (ND)*
- *Infectious Bronchitis (IB)*
- *Infectious Laryngotracheitis (ILT)*
- *Avian Influenza*
- *Turkey Rhinotracheitis/Swollen Head Syndrome*

Chronic respiratory Disease (CRD) (Airsacculitis)

Cause

The underlying cause of CRD is *Mycoplasma gallisepticum* (Mg). The condition is frequently triggered by respiratory viruses such as ND and IB and subsequently complicated by bacterial invasion. The main agents involved in the infection are *Mycoplasma gallisepticum* and *E. coli*. Stress caused by moving the birds, by debeaking or other operations or other unfavorable conditions e.g. cold or bad ventilation, make the birds more susceptible.

Transmission

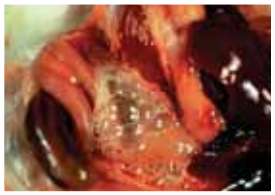
The main problem is that parent birds infected with *Mycoplasma gallisepticum* can transmit the organism through the egg to their offspring. In addition, infection can occur by contact or by airborne dust or droplets. The incubation period varies from 4 days to 3 weeks.

Species affected

Chickens and turkeys.

Clinical signs

Young chickens (broiler chicks or layer pullets) will show respiratory distress. The birds frequently show a lack of appetite, decreased weight gain and increased feed conversion ratios. In adult birds the most common symptoms are sneezing, coughing and general signs of respiratory congestion. In laying birds a drop of egg production between 20–30% can occur. CRD does not normally cause an alarming number of deaths. The effect is more of a chronic nature causing reduced weight gain and feed conversion ratios in broilers and lower egg production in breeders and layers. In this way the overall economic loss can be very great in broilers but less dramatic in breeders and layers.



Airsacculitis.

Internal lesions

A reddish inflamed trachea and/or cheesy exudate in airsacs, especially in complicated cases (e.g. with secondary *E. coli* infections) are observed. In mild Mg infections the only lesion might be slight mucus in trachea and a cloudy or light froth in the airsacs.

Turkeys with Mg infection usually have swollen sinuses under the eyes.

Diagnosis

Diagnosis of Mg infection can be made by blood testing of chickens, post-mortem examination and ultimately by isolating the causative Mg organism from tracheas or airsacs of affected birds.

Differential diagnosis

Respiratory virus infection (Newcastle disease or infectious bronchitis) with secondary infection (*E. coli*, etc.) can give similar lesions.

Treatment

Treatment of Mg-infected chickens or turkeys with suitable antibiotics or chemotherapeutics has been found to be of economic value. However, control by medication or vaccination and eradication of Mg infections has been by far the most effective method of combating the disease. Fertile eggs from infected birds can be treated with antibiotics such as tylosin to eliminate the *Mycoplasma gallisepticum* organisms. Methods used are the injection of fertile eggs or egg dipping. Blood serum testing of breeder chickens for Mg antibodies has become a routine to test flocks for a Mg infection.

Pericarditis, peritonitis and perihepatitis is frequently observed in birds with CRD.

Infectious Coryza

Cause

The bacterium causing this disease is *Hemophilus paragallinarum*.

Transmission

The disease spreads from bird to bird and flock to flock by contact and airborne infected dust particles and via the drinking water. Spread by equipment and personnel has also been reported. The incubation period varies from 1 to 3 days.

Species affected

Chickens appear to be the only natural hosts of *H. paragallinarum*.

Clinical signs

The main signs of the disease are inflammation of eyes and nose with foul-smelling discharges, conjunctivitis, sneezing and facial swellings. Feed and water intake is reduced, leading to loss of weight. Egg production in laying birds will drop. Mortality will vary with the virulence of the infection but is generally low.

Diagnosis

A field infection produces similar symptoms to chronic respiratory disease, a diagnosis is difficult to establish. The most certain diagnosis may be obtained by the isolation of the organism from the sinus or airsac exudate from affected birds. This procedure must be carried out in the laboratory.

Treatment and control

Treatment with antibiotics can be given to subdue clinical infection, but eradication and prevention are the most desirable means of control of coryza. Vaccines have been developed, but are only used in areas where the disease is endemic and cannot be eradicated.

Typical facial edema.

Aspergillosis (Fungal Pneumonia)

Cause

The disease is caused by a fungus, *Aspergillus fumigatus*.

Transmission

Transmission is by inhalation of fungus spores from contaminated litter (e.g. wood shavings) or contaminated feed. Hatcheries may also contribute to infection of chicks.

Species affected

Young chicks are very susceptible, older chickens are more resistant to infection. Turkey poults, pheasant chicks, quail chicks, ducklings, and goslings may also become infected.

Clinical signs

Infected chicks are depressed and thirsty. Gasping and rapid breathing ("pump handle breathing") can be observed. Mortality is variable, from 5 to 50%. Gross lesions involve the lungs and airsacs primarily. Yellow-white pinpoint lesions can be found. Sometimes all body cavities are filled with small yellow-green granular fungus growth.

Gross lesions of the lungs.

Diagnosis

The presence of *Aspergillus fumigatus* can be identified microscopically or sometimes even with the naked eye in the air passages of the lungs, in the airsacs or in lesions of the abdominal cavity.

Treatment and control

There is no treatment for aspergillosis. Affected chicks should be removed and destroyed. Strict hygiene in breeder and hatchery management is necessary. Choice of litter material is important so that no spore-bearing wood shavings are used.

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.

Infectious Bronchitis (IB)

Cause

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

Respiratory symptoms of IB in chickens.

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.

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.

Misshapen, shellless and normal eggs.

Infectious Laryngotracheitis (ILT)

Haemorrhagic lesions in trachea.

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.

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.

Some birds show symptoms of gasping with the head extended and the beak open.

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.

Avian Influenza

Cause

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

Influenza in turkeys.

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

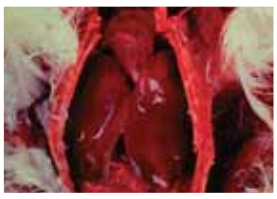
Turkeys and ducks are mainly affected but chickens, geese, and wild birds can also be infected.

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.

Pneumovirus Infections (Turkey Rhinotracheitis/Swollen Head Syndrome)

Cause

The disease is caused by a pneumovirus.

Young turkey with conjunctivitis and sinusitis.

Transmission

The virus may be transmitted horizontally by contaminated water, personnel and equipment as well as from bird to bird.

Species affected

Turkeys and chickens.

Clinical signs and lesions

In young turkeys sneezing. Rales and nasal discharge, conjunctivitis, swelling of the infraorbital and submandibular sinuses can be seen. In laying flocks a drop in production may occur along with respiratory distress. Morbidity is high whereas mortality may vary being usually higher in young poults. In chickens the pneumovirus may be involved in the so called "swollen head syndrome" (SHS). In such cases affected chickens may show swelling of the periorbital and infraorbital sinuses, torticollis, cerebral disorientation and depression. Marked egg production losses can be associated with SHS. At necropsy the lesions seen may vary due to other microorganisms that may complicate the original picture. In cases of SHS apart from oedema in the head also purulent or caseous subcutaneous exudate can be found. Rhinitis, tracheitis and sinusitis are frequently noted in both chicken and turkeys, hence also the name turkey rhinotracheitis (TRT). Poliserositis affecting the air sacs and pericardium may be due to secondary infections (*E. coli*). The kidneys may be swollen and congested as well as the lungs which may show a fibrinous exudate in the pleural cavity.

Swollen head syndrome.

Diagnosis

The diagnosis based only on clinical signs is difficult to establish since other agents may be involved. The most certain diagnosis may be obtained by the isolation of the organism from nasal secretions or tissue scraped from the sinus of affected birds. Antibodies can be detected by several serological methods such as the VN test, IFT and ELISA.

Treatment and control

Treatment with antibiotics can be given to control secondary bacterial infections. The use of vaccines should be the best approach to control the disease.

NEOPLASTIC DISEASES

- *Lympoid Leucosis*
- *Marek's Disease*

Lymphoid Leucosis (LL, Big Liver Disease, Visceral Leucosis)

Cause

Lymphoid leucosis (LL) is caused by a retro (leuco) virus.

Transmission

The lymphoid leucosis virus appears to be transmitted through eggs. However, horizontal transmission at a young age may occur. Infected breeders can be detected by testing hatching eggs and cloacal swabs for the presence of the virus. In this manner eradication of lymphoid leucosis will be possible.

Clinical signs

Visceral tumors are the main feature of lymphoid leucosis. They can be found in liver, spleen, kidneys, and bursa of birds that are in general older than 25 weeks. In affected layer flocks a lower egg production can be observed.

Osteopetrosis is lymphoid leucosis of the bones of legs and wings which become enlarged, but is quite rare. Affected birds have bowed, thickened legs. Lymphoid leucosis can also occur as blood leucosis. Such erythroid and/or myeloid leucemias are also quite rare.

Affected birds are listless, pale, and are wasting away. Because of the tumours, LL may be confused with Marek's disease, but in LL the nervous system is never involved (no paralysis). LL generally causes birds to weaken, lose weight and eventually die. Histopathological examination is essential for a proper diagnosis.

"J" Virus

Recently, within the known subgroup of exogenous LL viruses (A, B, C and D), a new subgroup denominated "J" has emerged. The new "J" virus shows tropism for cells of the myelomonocytic series, causing tumors, which are identified by histopathology as being myelocytomas. The virus has tropism for meat-type birds. The tumors caused by this virus are normally seen from sexual maturity onward and are frequently located on the surface of bones such as the junction of the ribs, sternum, pelvis, mandible and skull and may be also found in visceral organs.

Treatment and control

No treatment is known. The best control method is the laboratory detection of infected breeders. Breeding leucosis-free offspring from leucosis-free breeders can eventually lead to eradication of the disease.

Lymphoid Leucosis (big liver).

Right: normal

Left: affected

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.

MD leg paralysis.

Species affected

The domestic fowl.

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.

The paralysis is caused by lesions and enlargements of the affected nerves. The picture shows an enlargement of a sciatic nerve.

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.

Tumors may be observed in the ovaries. In the acute form visceral tumours are most common.

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.

AVIAN ADENOVIRAL DISEASES

- *Inclusion Body Hepatitis (Hydropericardium-Hepatitis Syndrome)*
- *Egg Drop Syndrome 1976 (EDS '76)*

Affected chickens have mottled livers, pale bone marrow and sometimes gangrenous dermatitis can be seen.

Inclusion Body Hepatitis (Hydropericardium-Hepatitis Syndrome)

Cause

The disease is caused by an avian adenovirus (for example the Tipton strain) and is usually simultaneously accompanied by other immunosuppressive diseases such as infectious bursal disease or infectious anaemia. There are 12 known serotypes of avian adenoviruses that may be involved in the development of this disease.

Transmission

Egg transmission is an important factor. Horizontal transmission from bird to bird by contact with droppings. Once the bird becomes immune, the virus can no longer be isolated from the droppings.

Species affected

Chickens, turkeys and pheasants and possibly other birds can be affected by avian adenovirus.

Clinical signs

Chickens with inclusion body hepatitis are affected at usually 5 to 7 weeks of age. The birds are listless, with ruffled feathers. Mortality is usually quite severe, up to 25% in the first 10 days of the disease.

Internal lesions

Affected chickens have mottled livers, many with pinpoint necrotic and haemorrhagic spots. Pale bone marrow and, in some cases in presence of infectious anemia, gangrenous dermatitis can be seen. Kidneys are pale and swollen. The spleen is usually quite small (atrophy).

If Gumboro disease (infectious bursal disease) has been present in the birds, even if subclinical, the bursa of Fabricius will be very small (atrophic). Such chickens are immune-suppressed and usually have more severe cases of inclusion body hepatitis and/or infectious anaemia. Mature birds do not have clinical signs of adenovirus infection, they only start showing antibodies in their blood.

Hydropericardium-Hepatitis Syndrome

HHS was reported for the first time in 1987 in Pakistan and was referred to as "Angara disease". The disease has meanwhile been reported from several other countries, including

India and countries in the Middle East and Latin America. Hydropericardium-hepatitis syndrome is caused by a virus belonging to the family of the fowl adenoviruses (FAV). Despite of the diversity in the geographical distribution of the disease, in all areas the infection is caused by a virus belonging to FAV serotype 4. There are three features which underline that this condition is a new disease, different from the known IBH. IBH and hydropericardium accompany this syndrome. Once outbreaks of HHS occur, it remains a problem for the poultry industry. And while IBH is shown to be caused by strains belonging to various FAV serotypes, HHS is, contrary to this, caused by FAV serotype 4. The infected flocks show high mortality rates and beside the lesions typical for IBH, a marked hydropericarditis is found in the affected birds.

Diagnosis

Typical mottled livers with pinpoint lesions, pale bone marrow and kidneys, small spleen and bursa are good indications of the disease. In the case of HHS the typical lesion (hydropericardium) is also found. Histological examination (intranuclear inclusion bodies) of liver and/or virus isolation are helpful means of diagnosis.

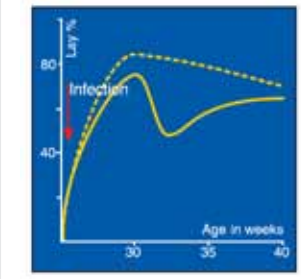
Treatment and control

No treatment exists. Antibiotics can be used to prevent secondary bacterial infection and possible gangrenous dermatitis. The best method of control is to ensure adequate immunity against other immune suppressive diseases (e.g. infectious bursal disease). Chickens may be vaccinated s.c. during the first two weeks of life with an inactivated oil-emulsion vaccine.

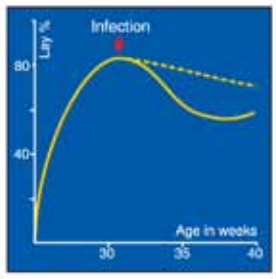
Egg Drop Syndrome 1976 (EDS '76)

Cause

The disease is caused by an avian adenovirus (strain BC14, virus 127), the EDS virus does not belong to any of the 12 fowl adenoviruses.



Non-peaking effect of early EDS '76 infection.



Egg drop by infection during lay.

Transmission

The virus is transmitted through the egg to a few birds in a flock, these birds carry the virus until the flock comes into lay at which time they begin to excrete virus and infect birds kept in the same house. Horizontal spread through infected litter can and does occur once a flock shows the disease but it seems that the virus is not very infectious or the level of virus excretion is low.

Species affected

Only chickens are susceptible to clinical disease due to EDS virus; however, the virus is widespread in ducks but does not cause any problems.

Clinical signs

EDS '76 affects only layers and breeders at the start of or during their egg production. Affected flocks show a failure to reach peak egg production or a drop in egg production accompanied by an inferior eggshell quality and in the case of brown eggs, a loss of shell color. Affected birds may also appear to be anaemic, may show a transient diarrhoea and sometimes the food intake may be reduced. No increased mortality or other symptoms are observed.

Internal lesions

No specific internal lesions have been observed.

Diagnosis

Clinical signs provide the diagnosis for EDS '76. Virus isolation and antibody tests can confirm this.

Differential diagnosis

Infectious bronchitis and to a lesser extent Newcastle disease and infectious laryngotracheitis will have to be considered. Proper diagnostic tests such as the antibody tests will eliminate doubt.

Treatment and control

There is no treatment against egg drop syndrome 1976. Vaccination with an inactivated vaccine before point of lay is the only available, effective method for the control of EDS '76.

Misformed and soft shelled eggs.

MISCELLANEOUS VIRAL DISEASES

- *Fowl Pox*
- *Avian Encephalomyelitis*
- *Infectious Bursal Disease*
- *Reovirus Infectious*
- *Malabsorption Syndrome*
- *Infectious Anaemia*

Fowl Pox (Avian Pox, Avian Diphtheria)

Cause

Fowl pox is caused by a pox virus.

Fowl pox lesions on the head and appendages.

Transmission

Introduction of infected or "carrier" birds in a susceptible flock will cause an outbreak by direct contact and water or feed transmission. Mosquitoes and other flying insects can also transmit the virus from bird to bird and also transmit the disease to nearby flocks. The incubation period varies from 4 to 20 days.

Species, affected

Chickens, turkeys, pheasants and pigeons can be affected by different fowl pox virus strains.

Clinical signs

The lesions of fowl pox can be external (mainly on the head) or internal ("wet pox") in the mouth, oesophagus and/or trachea, they can also be found on other parts of the body (skin of legs, cloaca etc.). The lesions on the head, combs, and wattles are usually wart-like in appearance, yellow to dark brown in color. The internal lesions in the mouth, oesophagus and/or trachea are yellow-white and cheesy in appearance. Affected birds will be depressed, lack appetite and when "wet pox" is present they breath laboriously.

Mortality

Mortality is variable, from a low 1 to 2%, when slight head lesions are present, to over 40% when the diphtheritic form ("wet pox") is more prevalent. Reduced egg production can be observed in laying birds, this will return to normal in a few weeks.

Diagnosis

Wart like lesions of the head particularly of the comb and around the eyes or yellow cheesy lesions of the mucous membranes of the nasal and buccal cavities are suggestive of fowl pox. A definitive diagnosis can be made in a diagnostical laboratory by histological examination (inclusion bodies) or virus isolation in embryonated chicken eggs.

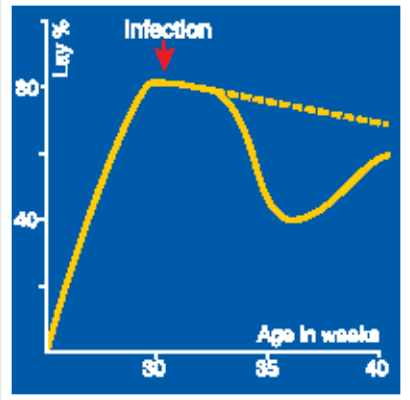
Treatment and control

It is difficult to treat affected birds. Treatment of local lesions with disinfectant and/or removal of the diphtheritic membranes from the throat to improve respiration has been practised. Preventive vaccination using a live vaccine is by far the most successful control method. Even when an outbreak of fowl pox has been diagnosed, it is advisable to vaccinate the flock immediately to stop further spread of the infection.

Avian Encephalomyelitis (AE) or Epedemic Tremor

Cause

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



Effect of AE on egg production.

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.

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%.

AE infected young chickens

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.

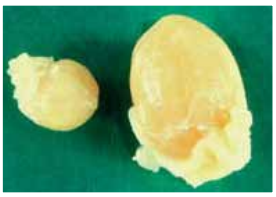
Treatment and control

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.

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.



Normal (right) and affected bursa three days post infection.

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.

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 to 10% 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.

IBD infected chicken (right).

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.

Reovirus Infections

Cause

Reovirus infections, also know as viral arthritis/tenosynovitis is caused by an avian reovirus.

Transmission

The virus may be transmitted by droppings from bird to bird. Egg transmission is also a factor when breeder flocks become infected during egg production. Reovirus is a common inhabitant of the intestines of birds and not all strains are pathogenic.

VA infected birds have malpositioned feathers.

Species affected

Chickens, turkeys and possibly pheasants are natural hosts.

Clinical signs

The first signs of reovirus infection are usually observed in broiler breeder chickens between 6 and 10 weeks of age. The birds are reluctant to walk and when forced up have a painful, trembling gait. A distinct swelling of the tendons of the shanks and also above the hock joint can be observed. Affected birds have malpositioned feathers, especially on the wings.

Internal lesions

The hock joint may be somewhat swollen, but usually not as severely as with *Mycoplasma synoviae* or Staphylococcus infections. Upon opening the legs the tendons usually appear discolored, brown or blood-tinged, with straw coloured fluid between them.

Ruptured tendons may occur and, in older broiler breeders (29-30 weeks old), one may feel a hard scarry knot in the tendon above the hock joint. When the infection is complicated by Ms or Staphylococcus the fluid may appear yellow and creamy. In commercial egg-laying breeds of chickens, the disease is not as common as in broiler breeders and broilers.

Swollen tendons.

Diagnosis

Leg problems in broilers or broiler breeders associated with swelling of shank tendons or tendons above the hock joint sometimes accompanied by ruptured tendons, are indicative of reovirus infections. A positive blood test with the agar gel precipitation (AGP) test is of some value as an indication of exposure to reovirus, but does not constitute proof of diagnosis. Histopathological examination of affected tissues and isolation of virus from such tissues are needed for a definite diagnosis.

Treatment and control

Reovirus infection cannot be treated successfully, but antibodies are of help in preventing secondary bacterial infections, particularly Staphylococcal infections.

Vaccination of broiler breeders with certain live and inactivated vaccines to ensure maternal immunity in their offspring appears to be of benefit to the birds themselves.

Malabsorption Syndrome

This complex disease has been reported under various names such as helicopter disease, femoral head necrosis, brittle bone disease, infectious proventriculitis, pale bird syndrome, running disease and stunting disease.

Cause

The malabsorption syndrome appears to be a disease complex involving avian Reoviruses and other viral and bacterial agents which may affect the digestive system resulting in nutritional and deficiency signs and lesions.

Transmission

Only circumstantial evidence is present at the moment to indicate that the causal organism(s) may be vertically transmitted. Horizontal transmission also seems to play a role on infected sites.

Species affected

Chickens and possibly turkeys.

Clinical signs

The disease is mainly observed in broiler flocks. Many affected broiler flocks have a history of diarrhoea, beginning as early as a few days of age and lasting until 10-14 days of age. Light or dark brown, foamy droppings can be found with undigested food particles. Several affected broilers in a flock may exhibit malpositioned feathers, especially on the wings. Early rickets with extreme paleness of legs and heads can be observed.

Encephalomalacia is also regularly found. At a later age (5-6 weeks) osteoporosis becomes clinically evident, frequently unilateral causing the birds to limp. Later an important effect is the delayed growth of the affected birds. Mortality is variable and in general as low as 4%.

Diagnosis

The clinical disease is characterized by one or more of the following lesions: enteritis with watery brown and foaming contents and the presence of undigested food in the intestine. Mucosal and submucosal proventricular lesions. Pancreatic inflammatory infiltration with degenerative changes have been found. Osteoporosis and osteomyelitis, femoral head necrosis whereby the bone of the epiphysis of the femur is unusually soft. Since the causal agent may differ it is difficult to base a diagnose on virus isolation or serology.

Treatment and control

Treatment is impossible, vaccination against reovirus in the breeders helps to reduce problems in the progency. Strict hygienic and sanitary measures will reduce the incidence of the disease.

Infectious Anaemia

Cause

Infectious anaemia is caused by a very resistant small virus known as CAV (Chicken Anaemia Virus).

Transmission

The major mode of transmission of infectious anemia is vertical transmission from infected breeder hens. Horizontal transmission from bird to bird or by infected equipment, clothing, etc. is also possible.

Clinical signs and lesions

CAV causes a syndrome in young chicks up to approximately 3 weeks of age. Adult birds may get infected but will not develop clinical signs. The disease is characterized by increased mortality and anaemia associated with atrophy of the haematopoietic tissues in the bone marrow. Subcutaneous and intramuscular haemorrhages can be found accompanied with atrophy of the lymphoid system. Affected birds may show focal skin lesions (also known as blue wing disease). Mortality rates vary from 20% to 70%. Affected flocks will show poor growth reflected in economic losses.

A marked difference in size and growth retardation is observed between healthy (left) and infected (right) birds.

Diagnosis

The diagnosis can be based on the clinical signs and pathological findings in affected birds. Blood serum testing for specific CAV antibodies can be carried out (IFT, VN, ELISA). Virus isolation is also possible but it is time-consuming and expensive.

Treatment and control

No treatment is available for infectious anaemia. Maternally derived antibodies can offer protection. The induction of high maternal immunity in the progency by vaccinating breeders is the best approach to successful CAV control.

MISCELLANEOUS BACTERIAL DISEASES

- *Infectious Synovitis*
- *Fowl Cholera*
- *Salmonella pullorum Disease and Fowl Typhoid*

Infectious Synovitis

Cause

This disease is caused by *Mycoplasma synoviae* (Ms).

Swollen hock-joint.

Transmission

The major mode of transmission of Ms is vertical (egg) transmission from Ms-infected breeder hens. Horizontal transmission from bird to bird and by infected equipment, clothing, shoes, egg boxes and other fomites.

Clinical signs and gross lesions

Vary from asymptomatic infection to mild respiratory signs, airsacculitis and synovitis, an inflammatory swelling of the joints of legs and wings and inflammation of the sternal bursa ("breast blisters"). Creamy exudate in joints extending into tendon tissues is indicative. Airsacculitis with frothy to cheesy exudates in the airsacs can be found, especially if secondary infection with *E. coli* is present.

Diagnosis

Blood serum testing for specific Ms antibodies with Ms antigen and the findings of specific lesions are indicative of Ms infections. Isolation of the causative Ms organisms is decisive for diagnosis.

Differential diagnosis

Staphylococcus arthritis can also cause swollen joints with a creamy exudate sometimes extending into the tendon sheaths. Reovirus infection can also cause swelling of joints and tendon sheaths, but the exudate is more watery or blood-tinged, unless secondary Staphylococcus infections occur.

Treatment and control

Ms infections can be treated with antibiotics with variable degrees or success (tetracycline, erythromycin, tylosin, tiamulin). However, control of Ms has been largely successful by blood testing of breeder chickens and elimination of positive Ms reactors.

Fowl Cholera (Pasteurellosis)

Fowl cholera.

Cause

Fowl cholera is caused by a bacterium: *Pasteurella multocida* (several serotypes).

Transmission

Transmission of fowl cholera is mainly from bird to bird by water or feed contamination. Rodents (rats and mice) also appear to play a role in contamination of water and feed with *Pasteurella multocida*.

Species affected

Chickens, turkeys, game birds and other bird species are susceptible.

Clinical signs

Affected birds are depressed and have decreased appetite. Egg production will drop 5-15% and mortality will be high in acute fowl cholera. Birds that die from acute fowl cholera frequently have bluish combs and wattles. Chronic fowl cholera will not cause high mortality, although there will be an increase in deaths. Swollen wattles is a feature of chronic fowl cholera.

Internal lesions

Gross lesions in acute cases are mainly internal haemorrhage and congestion of liver, spleen and kidneys. In chronic fowl cholera cheesy exudates can be found between the intestines, and on liver and heart.

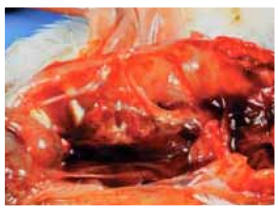
Treatment and control

Treatment with appropriate antibiotics or chemotherapeutics can be successful in halting mortality and restoring egg production. However chronic carrier birds have been found in flocks of chickens after treatment. If clinical fowl cholera with mortality reappears in such flocks, one must treat again. Rodent control is also very important to prevent reintroduction of the infection. Vaccines, both inactivated bacterins as well as live vaccines are available.

Pullorum Disease and Fowl Typhoid

Cause

Pullorum disease is caused by a bacterium, *Salmonella pullorum*. Fowl typhoid is caused by *Salmonella gallinarum*, which is related to, but not identical to, *S. pullorum*.



S. pullorum infected internal organs.

Transmission

Pullorum can be transmitted by infected (carrier) breeder hens through their eggs. Chicks that hatch from such infected eggs will have typical pullorum disease (white diarrhoea) and high mortality. Infected chicks can also infect other chicks via droppings. Fowl typhoid is more a disease of adult chickens, with high mortality and morbidity. Horizontal transmission is important with fowl typhoid through infected droppings, dead bird carcasses, and infected clothing, shoes, utensils and other fomites.

Species affected

Chickens, pheasants, ducks, geese and guinea fowl can contract both pullorum and fowl typhoid.

Clinical signs

Pullorum in chicks causes typical white bacillary diarrhoea, with pasted cloacas and high mortality. Infected adult breeders do not have clinical signs of the disease but have internal lesions in the ovary (miss-shaped, dark coloured follicles). Fowl typhoid in adult chickens causes listlessness and sulfur-coloured diarrhoea. The birds have generalized infection with swollen livers, spleens, and kidneys and haemorrhages in such tissues. Mortality is usually high: 25 to 60%.

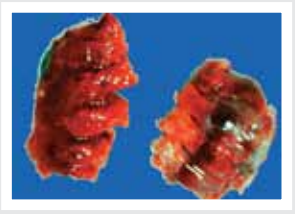
Treatment and control

Treatment of pullorum disease will not bring about a cure and is undesirable from a standpoint of eradication. It is far more practical to control the disease by elimination of infected carrier breeder hens. Blood testing of breeder chickens by the serum plate or tube agglutination test with suitable *S. pullorum* antigen will detect infected carrier birds which can then be culled. Such control measures will stop the incidence of egg-transmitted pullorum disease. If hatching eggs from tested pullorum-free breeders are kept free from contamination through infected eggs from infected breeders or through contaminated equipment, chickens can remain after treatment. The best control method is eradication of infected birds. Breeder flocks should be blood tested with antigen for typhoid. The typhoid carriers can then be eliminated. Vaccination for fowl typhoid with a special *S. gallinarum* (9R strain) has been practiced in several countries, but it should be discouraged in breeders when an eradication programme is in operation.

Ornithobacterium rhinotracheale (OR) Infection

Cause

Ornithobacterium rhinotracheale is a gram-negative rod responsible for causing infections in chickens and turkeys of all ages.



Pneumonic lungs caused by OR infection.

Transmission

Horizontal transmission from bird to bird and by infected fomites. Infected breeder hens may transmit the disease agent vertically to their offspring.

Clinical signs and gross lesions:

OR may cause a respiratory disease in turkeys, usually between 2-6 and 12-20 weeks of age. The birds may show respiratory disease with watery eyes and swelling of the sinus infraorbitalis. Broilers may also show respiratory signs after infection at around 4 weeks of age. A severe purulent pneumonia, accompanied by airsacculitis and pericarditis may be found in broilers as well as in turkeys. Affected birds also show growth retardation. Concomitant viral infections may intensify the severity of the lesions.

Diagnosis

Blood serum testing using a commercially available ELISA for the detection of specific antibodies against OR and the finding of specific lesions are indicative of OR infection. Isolation of the organism and its biochemical determination may be attempted but care should be taken that these are carried out using appropriate methods in order to avoid unreliable results. Differential diagnose with bacteria causing similar disease patterns is recommended (*E. coli*, *P. multocida*, MG).

Treatment and control

OR infections may be treated with broad -spectrum antibiotics with variable degrees of success. An inactivated vaccine for broiler breeders and turkey poults is available.

INFECTIOUS VIRAL DISEASES OF DUCKS

- *Duck Hepatitis*
- *Duck Plague*

Duck Virus Hepatitis

Cause

Duck virus hepatitis is caused by a picornavirus. It is possible that there are more serotypes.

Transmission

The disease can spread rapidly to all susceptible ducklings in the flock via faeces. The incubation period varies from around 24 hours to a few days.

Species affected

Ducklings under 6 weeks of age are susceptible.

Clinical signs

The disease has a very short course, with all affected birds dying within a few days. Signs, if seen at all, may include somnolence and convulsions, followed by quick death. Mortality up to 95%.

Signs may include somnolence and convulsions, followed by quick death.

Internal lesions

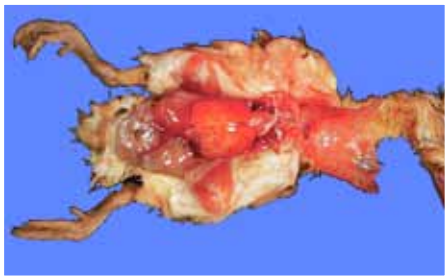
Principal lesions found in the liver, showing fatty degeneration, yellowish and with many small or bigger haemorrhages.

Diagnosis

Sudden death in small ducklings is highly suggestive. Virus isolation can confirm this diagnosis.

Treatment and control

Serum therapy is possible. Strict isolation during the first 4-5 weeks can prevent infection. Ducklings can be protected by maternal antibodies. To provide for this, parent stock has to be vaccinated, preferably twice. This will protect the progeny for two weeks, and mitigate infection afterwards. Ducks without maternal antibodies should be vaccinated at day old.



Principal lesions found in the liver, showing fatty degeneration, yellowish and with many small or bigger haemorrhages.

Duck Plague (Duck Virus Enteritis)

Cause

Duck plague is caused by a herpes virus. Only one serotype is known. There is a difference in virulence between strains.

During the disease vascular damage, tissue haemorrhages, digestive mucosal eruptions, lesions of lymphoid organs as well as degenerative changes in parenchymatous organs can occur.

Transmission

Duck plague virus is excreted by affected birds through faeces and other body discharges. Via soiled drinking water, contaminated pound water or open water other birds are infected.

Species affected

Ducks, geese and swans, of all ages.

Clinical signs

High mortality up to 100%, sometimes sudden death. Droopy appearance, slow movements with hanging wings. Birds show bloody nasal discharges and conjunctivitis, diarrhoea and they may make a hoarse noise. The birds are very thirsty. Birds often die in a rather characteristic position, with the neck twisted downwards, sidewards or backwards. In laying flocks egg production may drop 50% or more.

Internal lesions

Haemorrhagic enteritis, haemorrhagic or pseudo-membranic pharingitis, oesophagitis and cloacitis, haemorrhagic ovaritis.

Diagnosis

The gross lesions are rather characteristic for duck plague. Virus isolation and neutralization confirm the diagnosis to distinguish the disease from avian cholera (*Pasteurella multocida*) or duck hepatitis.

Treatment and control

There is no treatment known. Prevention should include clean drinking water and keeping wild, free-flying waterfowl away. Vaccination with adapted strains can provide a reliable protection. Even in an infected flock emergency vaccination can limit the damage, due to an interference phenomenon between the vaccine virus and the field virus.

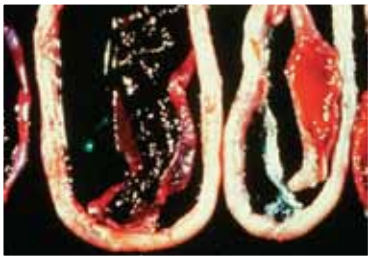
PARASITIC DISEASES

- *Coccidiosis*
- *Endoparasites*
- *Blackhead*

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*.



Eimeria tenella.

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*.

E. acervulina

May affect birds of any age.

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 shriveled 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

May affect birds of any age.

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

May affect birds of any age.

E. maxima is less pathogenic than *E. acervulina*, necatrix and brunetti, mortality is generally low. Diarrhoea, 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, grayish, brownish or pinkish in color.

E. necatrix

Mainly in chickens up to 4 months of age.

Eimeria necatrix.

E. necatrix is very pathogenic. Infection with *E. necatrix* 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 coccidia 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.

Tape worms, usually 7 to 10 cm long, consisting of may small segments.

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.

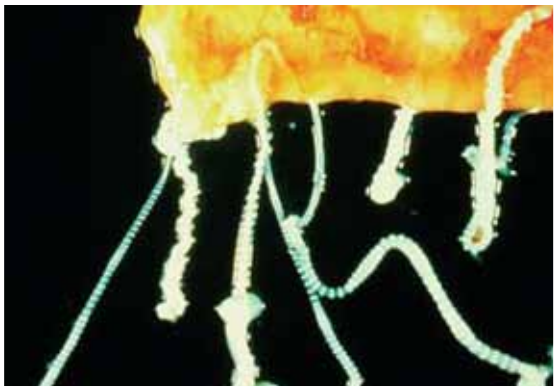
Roundworms.

Hairworms.

Vaccination to prevent coccidiosis is also possible

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.



Tapeworms.

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.

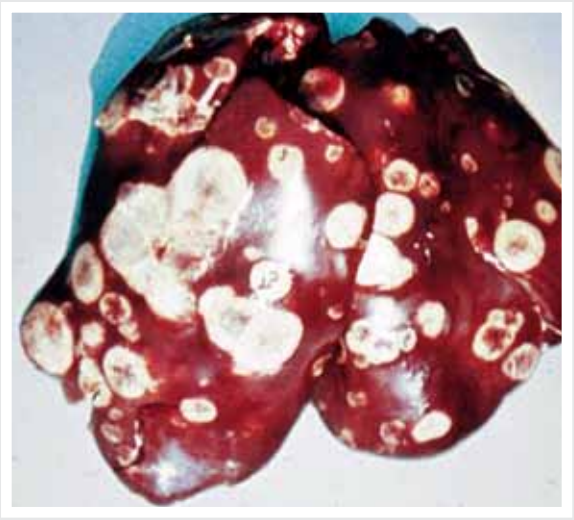
Blackhead (Histomoniasis, Enterohepatitis)

Cause

A protozoan parasite, *Histomonas meleagridis*.

Transmission

Direct transmission by infected water, feed, or droppings has been proved. Indirect transmission by infected eggs of the caecal worm. *Heterakis gallinarum*, is also a major factor. Raising turkeys and chickens on wire and indoors decreases the incidence of blackhead.



Necrotic liver infected by Histomonas meleagridis.

Species affected

Chickens, turkeys, and peafowl are natural hosts to blackhead infection.

Clinical signs

Affected birds are depressed, stand or sit with ruffled feathers, and have yellowish diarrhoea. Darkening of head parts, especially in turkeys, gave the name to the disease (blackhead). Gross lesions include circular necrotic areas in livers with a crater-like center and cheesy cores in the caeca. Blackhead can cause high mortality, particularly in young turkey poults, but the disease can also affect older birds. In chickens the mortality from blackhead infection is usually lower, young chickens being the most susceptible.

Treatment and control Treatment with protozoan chemotherapeutics is usually effective. Such drugs can also be given at preventive levels in turkeys starter and grower feed. Growing turkeys on wire and indoors can reduce the incidence of blackhead to a large extent, but even so, strict hygiene and elimination of caecal worms are important control measures.

SOME IMPORTANT VITAMIN DEFICIENCY DISEASES

- *Riboflavin*
- *Vitamin E*
- *Vitamin D_3*

Riboflavin (Vitamin B_2) Deficiency (Curly Toe Disease)

Clinical signs

Young chicks, as early as 1-week-old, exhibit curling of the toes, inability to walk and sometimes diarrhoea.

Treatment and control

Administering vitamin B preparations brings a rapid cure. Only in advanced cases will birds be dehydrated and emaciated, requiring further treatment. It is important to ensure adequate vitamin B levels not only in starter and grower diets, but also in the diet of parent breeders.

Curly toe caused by riboflavin deficiency.

Vitamin E Deficiency (Crazy Chick Disease, Encephalomalacia)

Clinical signs and gross lesions

Vitamin E deficiency in chickens affects the brain, causing degeneration, oedema and haemorrhage, especially in the small brain (cerebellum). Affected young chicks appear unable to walk, they fall on their sides or stand with their heads between their legs. The cerebellum shows gross swelling, with yellow or brown discoloration and pinpoint haemorrhages may be observed. Encephalomalacia can also be found in mature chickens.

Brain lesions caused by vitamin E deficiency.

Treatment and control

Adequate levels of vitamin E and selenium in the diet of chickens and their parent breeders is of prime importance. Treatment of affected birds with vitamin E preparations (alpha-tocopherol) is effective if the condition is not too far advanced.

Vitamin D_3 Deficiency (Rickets, "Rubber Legs")

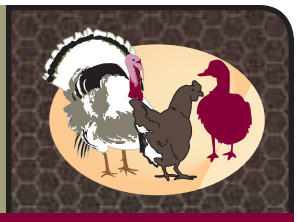
Clinical signs and gross lesions

Young chickens, 2 to 5 weeks of age, with vitamin D_3 deficiency are unable to stand and have very soft, pliable, legs and beaks. The rib joints are swollen like beads and curved inward, the breastbone often twisted. In layer chickens, vitamin D_3 deficiency causes soft-shelled eggs and a drop in production.

Rubber legs.

Treatment and control

Vitamin D_3 can be given as treatment, usually in combination with calcium and phosphorus.



Blackhead (Histomoniasis) in Turkeys

Blackhead is the common name for the disease caused by a protozoan (single-celled) parasite called *Histomonas meleagridis*. It is probably more accurately called "Histomoniasis" because the appearance of dark skin around the head (cyanosis), giving the disease its name, is actually a rare clinical sign. The parasite can affect other gallinaceous (chicken-like) birds besides turkeys including chickens, pheasants, partridge, and pea-fowl. But it is the turkey that suffers from the most serious expression of the illness.

Clinical Signs

The first signs seen in an infected flock may just be a sudden rise in mortality. However, early infection with *Histomonas meleagridis* will cause the bird to appear lethargic, with drooping head and wings, a very non-specific observation. Feed consumption may be reduced, leading to weight loss. A very distinctive sign in the live bird is the appearance of sulphur-yellow droppings caused as a result of damage to the liver. Any time signs such as these are seen in live birds, a sample of sick birds should be submitted to a poultry veterinarian or to the Animal Health Laboratory for diagnosis.

Signs:

- *Lethargic, drooping wings, head*
- *Reduced feed consumption*
- *Sulfur-yellow droppings*

Post-mortem:

- *Thickened cecal pouches with yellow cores*
- *Enlarged liver with target-like lesions*

Post-Mortem Observations

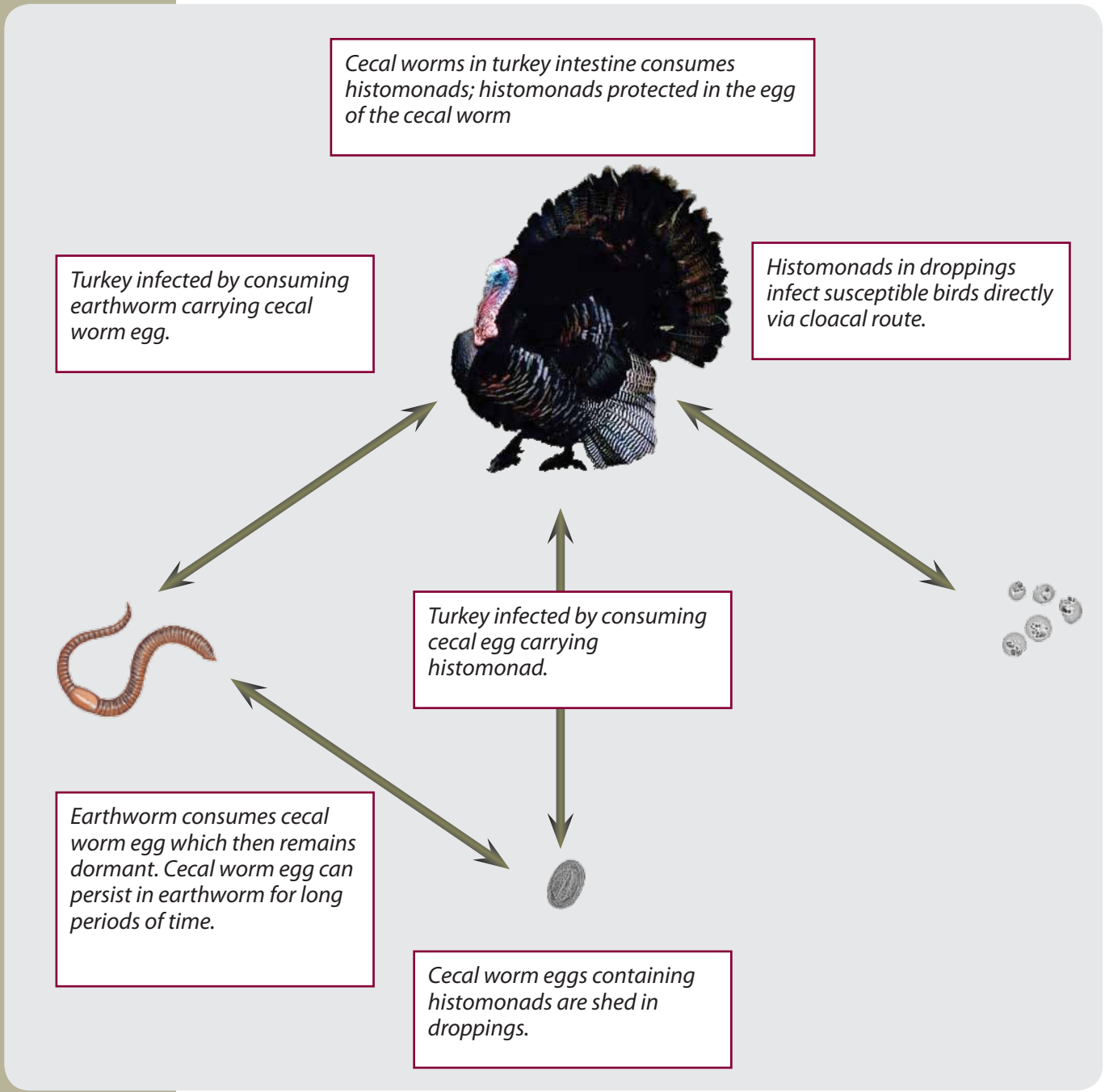
The classical lesions associated with Histomoniasis are thickened cecal pouches containing yellowish, firm cores, and enlarged livers spotted with target-like lesions representing areas of necrosis, or cell death. While the gross lesions are usually diagnostic, it is important to confirm the diagnosis and rule out similar appearing diseases such as salmonellosis and coccidiosis. This is especially important early in the progression of the disease. To improve the accuracy of the diagnosis, it is useful to submit very fresh dead birds for post mortem examination.

Life Cycle of *Histomonas meleagridis*

Histomonas meleagridis has a complex life cycle that is illustrated on the following page. When understood, the difficulty in managing around this disease becomes evident.

The histomonad itself will not survive well in the environment and will die within a short time. Its ability to penetrate and remain viable within the egg of the cecal worm, however, gives the parasite an enormous survival advantage. Added protection is given when contaminated cecal worm eggs are consumed by earthworms. Fields that have been populated with infected turkeys or other birds, can remain contaminated for years. This is particularly important if chickens had previously occupied the premises because they are

likely to have only very mild infections but will still shed histomonad-containing cecal worm eggs.



Life cycle of *Histomonas Meleagridis*

Treatment of Histomoniasis

Unfortunately, there is nothing currently available for the treatment of Blackhead in food-producing birds.

Prevention and Control of Histomoniasis

The first and best control method is to avoid exposing turkeys to *Histomonas meleagridis*. As simple as this statement is, the reality is that to accomplish control of Blackhead requires a multilayered approach.

The first level of control is to exclude earthworms from the birds' diet. Housing birds inside on a concrete floor will significantly reduce the likelihood of turkeys gaining access to earthworms. It is important, however, to make sure that water from the outside cannot gain entry into the barn, even in small amounts, as this will facilitate the movement of earthworms into the barn. Even a small opening that remains moist will allow the entry of earthworms.

If birds are to be housed on dirt floors or outdoors, ensure that the ground has not been previously inhabited by chickens or turkeys. Previous exposure of the ground to chickens or turkeys that have been infected can result in contamination that can remain active for years. Also ensure that the ground is well drained to discourage earthworms.

The next level of control is to eliminate or reduce the cecal worm parasite. Thorough cleaning of the barn between flocks will reduce the amount of contamination carried over by infected cecal worms. However, it is impossible to be sure that the worm is eliminated. A targeted worming program that is designed to prevent any cecal worms from reaching maturity should be considered if dealing with a high risk situation.

The final level of control, when faced with a very high risk of challenge, is to attack the parasite directly. Because the organism dies quickly when in the environment away from the turkey host or the cecal worm and earthworm vehicles, the only method of control is in the bird itself. Only one product, nitarsone, is available for control of blackhead. This product is included in the feed and must be given prior to any exposure to the parasite. It is important to understand that nitarsone is effective only as a preventative and cannot be used as a treatment.

Finally, make sure that good biosecurity is followed to prevent the entry of blackhead from other farms. Because the parasite itself is so fragile, the greatest risk of infection comes with the cecal worm, specifically cecal worm eggs, which can be easily carried by manure and manure-contaminated equipment and shoes. Blackhead can easily be prevented through routine biosecurity practices.

Treatment:

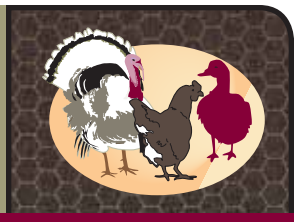
- *None*

Prevention

- *Prevent earthworms from accessing turkey holding area*
- *Do not run turkeys on range that has previously held chickens*
- *Well drained range or dirt floor area*
- *Control cecal worms*
- *Preventative in-feed medication if high risk*
- *Maintain good biosecurity practices*

Summary

Blackhead is a disease caused by a single-celled parasite that infects the turkey's intestine and liver, causing serious illness and death. Its complex life-cycle makes the parasite a challenge to control once it gets into a premises. Control requires good biosecurity and an effective worming program aimed at the cecal worm.



Identification and Treatment of Common Lice and Mites

BRIGID MCCREA, Graduate Research Assistant, Poultry Science Department, Auburn University, JOAN S. JEFFREY, former Extension Poultry Veterinarian, University of California at Davis, RALPH A. ERNST, Extension Poultry Specialist, University of California at Davis and ALEC C. GERRY, Assistant Veterinary Entomologist and Extension Specialist, University of California at Riverside

To simplify information, some trade names of products have been used. No endorsement of named products is intended, nor is criticism implied of similar products that are not mentioned.

Lice and mites are common pests of poultry where they feed on the blood, feathers, skin or scales of the bird. Heavy infestations of these pests on poultry can result in poor health, reduced growth and egg production, and even death. Identification of the lice or mite pest is important to selecting an appropriate treatment regimen.

Common Poultry Lice

Lice are small (most between 1 to 6 mm in length), wingless, straw colored insects with a somewhat flattened appearance and a generally elongated abdomen (last body segment). All poultry lice have chewing mouthparts and feed on dry skin scales, scab tissue, feather parts, and can feed on blood when skin or feather quills are punctured. Lice are commonly found on both the skin and feathers and can move from one bird to another when birds are kept in close contact. Eggs (nits) are usually attached to the feathers. Lice are ectoparasites and spend their entire life on an animal host. Lice are generally host specific, meaning that they can feed on only one or a few closely related species of animal host. Poultry lice cannot survive on humans or on our domestic pets. In fact, poultry lice will generally complete their entire life cycle from egg to adult on a single bird, and will die in a few days to a week if separated from their host. Lice numbers on poultry tend to be greatest during the autumn and winter.

Poultry lice are not known to transmit any avian pathogens, although some wild bird lice are suspected of transmitting pathogens to their hosts. Parasitism with lice frequently accompanies poor health due to other causes, and is especially harmful to young birds in which high numbers of lice may cause sleep disruption. Effective host self grooming is an important means of reducing lice. Lice populations are generally higher on birds with beak injuries or on those that have had their beaks trimmed. Molting greatly reduces lice populations and severe problems with lice can be reduced through forced molting and rapid removal of egg laden feathers from the facility.

The two most common species of lice affecting California poultry are the chicken body louse (*Menacanthus stramineus*) and the shaft louse (*Menapon gallinae*). Adult chicken body lice measure 3-3.5 mm in length while adult shaft lice measure about 2 mm in length. Adult chicken body lice are most prevalent around the sparsely feathered vent, breast, and thigh regions. Eggs of the chicken body louse are cemented in clusters to the base of

feathers especially around the vent while eggs of the shaft louse are cemented individually at the base of the feather shaft or along the feather barb in the breast and thigh regions. Eggs of both species require 4-7 days to hatch and then 10-15 days to become adult lice. Adult lice can lay from 50-300 eggs in their 3 week lifespan.

Birds should be examined for lice at least twice per month. Examination for lice involves spreading the feathers in the vent, breast, and thigh region to look for egg clusters or feeding adults at the base of the feathers. The presence of a few lice per bird, or the presence of egg clusters indicates the need for treatment. Chemical treatment, if required, should be performed at 10 to 14 day intervals until control is achieved. Lice eggs are resistant to insecticides, so a single insecticide treatment may fail to provide control as lice protected within their egg shell will hatch after the insecticide is no longer active. By treating at 7-10 day intervals, the generation of lice that survived the previous chemical treatment while in the protected egg stage will be killed by the subsequent treatment before they are able to lay additional eggs.

Figures 1 (left) and 2 (right). Egg clusters of the chicken body louse on base of vent feathers. Each egg is less than 1 mm long.

Photos by: Nancy Hinkle (University of Georgia) (Figure 1) and Brad Mullens (University of California at Riverside) (Figure 2).

Common Poultry Mites

Mites are very small (just visible without magnification) and may appear like moving dark specks. While mites are wingless like lice, their body shape differs greatly from lice. In addition to their much smaller size, mites have a generally rounded body shape and lack an obvious body segmentation. Also, adult mites have eight legs while adult lice have only six. Mites are not as host specific as lice and may parasitize many animal species. Some mite species spend their entire life on a single bird, while others are found on the bird only during active feeding periods, retreating to nearby protected locations after feeding. Like lice, mite numbers generally increase during the winter months and decrease in the summer months.

Chicken mite or red poultry mite (*Dermanyssus gallinae*) is a blood sucking mite that generally feeds on poultry during the night. During the day they may be found hiding throughout the poultry house, especially in cracks and crevices of surrounding woodwork, under clods of dirt or manure, or in nests. This habit of leaving the host after nighttime

feeding is diagnostic for this species of mite. Chicken mites appear red (following a blood meal) to black in color, and can often be found clustered together in the environment surrounding the birds. Usually you must inspect your birds at night to find them on the skin. Due to their need to find daytime hiding places, chicken mites are generally not a pest in cage layer operations, but can be quite problematic in breeder operations or other operations where fowl are maintained on litter or have nest boxes. Chicken mites have a broad host range and are often associated with a number of wild birds in addition to poultry.

This mite can complete its life cycle in as little as 7 days. Adult females lay eggs in small groups in the environment surrounding their avian host. Eggs hatch in approximately 2 days, and the larvae molt in 1 to 2 days without feeding. All other life stages of this mite feed on blood. Adult chicken mites can survive starvation up to 34 weeks allowing them to survive periods where nests or poultry houses are unoccupied. This makes treatment of the entire poultry facility imperative to controlling this pest.

Because chicken mites feed at night, poultry workers are rarely bitten during the workday. However, workers entering into infested poultry houses at night will be readily bitten. These bites may be painful, cause irritation and itchiness, and may result in small red skin lesions.

Northern fowl mite (*Ornithonyssus sylviarum*) is a blood sucking mite that can be found on poultry both day and night. This mite is commonly found infesting birds in commercial egg-laying facilities throughout California and is arguably the most important external parasite of caged poultry in the State.

Figure 3. Scanning Electron Micrograph (SEM) of a northern fowl mite. The scale shows this unfed mite to be slightly less than 1 mm long.

Photo by: Jeb Owen (University of California at Riverside).

Heavy infestations of northern fowl mite are especially costly when birds are beginning to lay eggs. Northern fowl mites appear red to black in color, like chicken mites, but can be distinguished by their daytime presence on poultry, poultry eggs and cage structures. Heavy infestations of northern fowl mite on poultry can result in blackened feathers due to the accumulation of dried blood and excretions, often near the vent, with scabbed and cracked skin around the vent. Eggs and mites are commonly found under the wings, next to the soft feathers of the body, in the feathers above and below the vent, in the beard and crest (on breeds that have them), and on feathers that are high on the legs. Use of a bright flashlight when examining birds for mites will stimulate the mites to move around and make them easier to see. Younger birds generally have greater numbers of mites than older birds. Northern fowl mites have a broad host range and are often associated with a number of wild birds in addition to domestic fowl.

This mite can complete its life cycle in less than 7 days and includes only one blood feeding stage other than the adult mite. Adult mites lay white or off-white eggs in bundles on the fluff surrounding the feather shaft. If this pest is present, all birds in the flock should be treated twice on a 5-7 day interval. Adult northern fowl mite can only survive starvation for up to 2-3 weeks, thus removal of poultry from an infested facility for over 3 weeks will result in control.

Figure 4. Northern fowl mites feeding on poultry.

Photo by Brad Mullens (University of California at Riverside).

Because northern fowl mite is active during the day, poultry workers will often complain of picking up mites while handling eggs or birds during the day. These mites will only occasionally bite humans causing small red skin lesions and intense itching. More importantly, northern fowl mites cause annoyance and concern to poultry workers and their presence may result in the reluctance of poultry workers to continue working. Many poultry workers wrap their forearms with double sided tape or spread a Vaseline-like gel on their forearms to capture mites traveling up their arms when handling mite infested birds, eggs, or cage structures.

Scaly leg mite (*Knemidocoptes mutans*) is a very small mite with an oval shaped body and extremely short legs. The mite's entire life cycle is spent burrowing in the unfeathered, scaled skin of the feet and shanks or occasionally the cere and beak. Individual birds contract the mites through prolonged direct contact with other birds and infested surroundings. Older birds are most commonly affected. It is uncommon to find these mites on birds in commercial operations because commercial poultry are generally young and because they rarely have direct contact with older birds infested with this mite. These mites are too small to see without a microscope and often the first indication of parasitism is a brittle, flaky, or powdery appearance to the bird's legs. This appearance may progress to the formation of lesions or scabs, to lumpy, crusty, proliferative masses, and finally to deformation of the shank and crippling. Suspect lesions on the feet and shank of the bird can be scraped from the leg, placed into a small vial and shipped to a veterinary facility for microscopic examination to determine if these mites are present.

In addition to the treatments listed below for chicken mites, affected birds should be isolated or culled. For small numbers of birds, scaly leg mites can be treated by direct application of an oil based product such as petroleum jelly, a 50:50 kerosene and cooking oil mix or Blue Ribbon (a mixture of plant oils and camphor in a canola oil extract). While wearing gloves, apply the treatment to the entire affected area daily for at least

Figure 5 (left) and 6 (right). Feather blackening and scabbing, a result of feeding by northern fowl mites.

Photos by Brad Mullens (University of California at Riverside) (Figure 5) and Nancy Hinkle (University of Georgia) (Figure 6).

2 weeks. After letting the treatment soften the dead scales, gentle scraping or rubbing will help remove the dead scales and mites. Removal of dead scales by soaking the legs in warm soapy water before treatment has been reported to improve treatment results.

Treatment for Lice and Mites

Insecticides for treating lice and mites are available as dusts, wettable powders, liquid sprays, and resin strips. Dusts and sprays should be applied directly to birds. When applying insecticide to individual birds, part the bird's feathers so that the dust or spray reaches the skin. For multiple bird application use a liquid spray with enough spray pressure to penetrate the feathers and reach the skin. Be sure to spray the birds from below as well as above to get the best insecticide coverage. To control chicken mites, insecticide sprays should also be applied to litter, bedding and building structures to kill mites that are hiding in the surrounding environment. When treating building structures, a liquid spray is recommended so that the insecticide will penetrate small cracks and crevices. For poultry kept on litter, a dusting box (24" × 36" × 4") containing insecticidal dust can be used for periodic treatment of birds (limit to one treatment every 4 weeks). Insecticidal resin strips placed into poultry cages or nest boxes can provide continuous control of lice and mites. Insecticidal resin strips should be placed near food and water sources or roosting sites so that birds will have daily contact with the strips. Use insecticidal resin strips only during months when lice and mite populations would be expected to be high in order to delay the development of insecticide resistance and preserve the usefulness of these products. When applying insecticides, always carefully follow the label directions provided with the insecticide and any withdrawal periods required before slaughter.

Insecticides approved for eliminating lice and mites from poultry and poultry facilities include pyrethrins, synthetic pyrethroids, organophosphates, and a single carbamate (carbaryl or Sevin dust). Pyrethrins and synthetic pyrethroids are generally effective products and have a very low mammalian toxicity. Also, pyrethrins and synthetic pyrethroids are a good choice for use in a chemical rotation program because they are chemically unrelated to the organophosphate and carbamate insecticides traditionally used for mite and lice control. Rotating the type of insecticide used will slow the development of insecticide resistance. Northern fowl mite is known to be resistant to carbaryl and to malathion in some parts of California.

For small numbers of birds, Carbaryl dust offers an easy and low cost treatment option for control of lice and mites. Carbaryl is available in a shaker can that provides easy application of the product to individual birds. Shaker cans containing Carbaryl can be purchased at most livestock, garden or hardware stores. One pound of Carbaryl dust should treat at least 20 chickens.

When treating a flock or a poultry house, the entire flock or house should be treated simultaneously to ensure that rapid re-infestation of treated birds does not occur. Following treatment, it is important to prevent wild birds or other poultry from contacting your treated flock and causing a new infestation.

Note

**Read and follow product labels carefully for target pest information, compatibility of the treatment with other management practices and for precautions to avoid contamination of feed, water, meat or eggs.*

Ascites in Broiler Chickens

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Animal Health Centre,
BC Ministry of Agriculture and Lands

Ascites is a common cause of mortality in broiler chickens, especially during the cooler months of the year. While we recognize this condition as a frequent occurrence associated with fast-growing birds, much can be done to minimize its impact on the flock.

Ascites in broiler chickens showing enlarged, bluish coloured abdomen.

The Cause of Ascites

The term "ascites" actually refers to the fluid accumulated in the abdominal cavity (or "waterbelly") as a consequence of heart failure. The disease is more scientifically known as pulmonary hypertension syndrome and this disease may or may not actually end up as ascites. In fact, some birds that might be recognized in the barn as flippers may actually be mortalities that are the result of pulmonary hypertension, occurring very acutely.

Pulmonary hypertension happens when the heart is unable to push sufficient blood through the lungs (pulmonary), thereby significantly increasing the blood pressure (hypertension). Broiler chickens, by the nature of their ability to consume large quantities of feed and grow very rapidly, have an extremely high demand for oxygen. Generally, the bird's cardiovascular system can accommodate this demand, with the heart efficiently pushing blood through the lungs, where oxygen exchange occurs. When there is an increased demand for oxygen, the heart essentially pushes the blood through the lungs harder to increase the amount of oxygen available to the bird's metabolism. Because the lung volume and cardiovascular volume within the lung tissue is fixed, there comes a point at which the lung can no longer accommodate any more blood being supplied by the heart. This is the starting point for heart failure.

Broiler chickens with ascites.

When the point of heart failure is reached, it is probably easier to imagine the outcome by using water through a hose as an analogy. If water is being pumped through a 2-inch hose into a 1-inch hose, as long as the water pressure is kept low, everything will flow efficiently. If the water volume through the 2-inch hose is increased so that the 1-inch hose can no longer accommodate it, the water pressure will rise. If the connections are very strong, you can see the larger hose expand and stretch to try to adjust to the increased pressure and ultimately, the

smaller hose will stretch in diameter as well. If the connections are not tight, water will leak out and, the higher the pressure, the more leakage will occur.

A similar, though more complex, situation will also occur in the chicken's circulatory system. The blood pressure will back up from the lungs, through the heart, back to the liver and abdominal viscera. The heart will enlarge due to both pressure and, with time, hypertrophy of the muscles due to the hard pumping activity (exactly the way in which skeletal muscles will enlarge in weight lifters as they "pump iron"). Further upstream, the blood vessels will also enlarge, causing the liver to swell and blood vessels on the intestines to become prominent. Because blood vessels are also quite leaky, fluid will leak out and that is the source of all the extra "water" seen in the abdomen of affected birds.

Exposed abdomen of chicken showing ascites fluid

What Increases Oxygen Demand in Broiler Chickens?

Healthy, fast-growing broiler chickens are efficiently utilizing all available oxygen to convert feed to bone and muscle while at the same time maintaining optimum body temperature and body function. While there is undoubtedly room for responding to some increased demand, some birds can be on the edge and will tip over into heart failure with any increase in demand. The more demand that is imposed on the flock, however, the more cases of clinical ascites we are likely to see.

Maintaining optimum body temperature is one of the more oxygen-demanding functions attended to by the bird. The theoretical thermo-neutral air temperature for fully feathered chickens is 75°F (24°C), the temperature at which the bird needs not use energy to either create heat or cool down. As the temperature varies from this point, the bird's body must respond, using energy and therefore consuming oxygen. While both excessive and insufficient air temperatures increase oxygen demand, the greatest need is with low temperatures.

In an experiment conducted in Alberta, small groups of birds were held at set temperatures according to industry guidelines, or at the same average temperatures but fluctuating the temperatures by only 3° C on each side of the average. The birds were then followed through a complete grow out and measured for the occurrence of ascites as well as the heart-specific characteristics of pulmonary hypertension, including heart weight, right ventricular weight, and ratio of right ventricular weight to total heart weight, of surviving birds at the end of the grow out. The birds exposed to fluctuating temperatures had significantly more mortalities due to ascites as well as significantly higher average heart weights. This study nicely demonstrates the impact of cool temperatures on the cardiovascular system of broiler chickens.

Air quality also has an impact on the cardiovascular system of broiler chickens. The lungs are capable of extracting only as much oxygen from air as is available. Also, if carbon dioxide concentrations are excessive, it will inhibit the lung's ability to absorb oxygen, as the other half of the job is to eliminate carbon dioxide from the blood. In general, air quality, which includes dustiness and ammonia, both of which can interfere with respiratory function.

To demonstrate the effect of poor air quality on the incidence of ascites, a study was done in which PLT was added to the litter of pens of broiler chickens and the litter ammonia, atmospheric ammonia, and mortality due to ascites measured and compared with pens of birds not on PLT-treated litter. Atmospheric ammonia was significantly reduced with the PLT treatment and, consequently, mortality due to ascites was reduced from 2.1% to 0.3%. Total mortalities were 5.2% on treated litter and 6.7% on untreated litter, with the difference being due entirely to ascites.

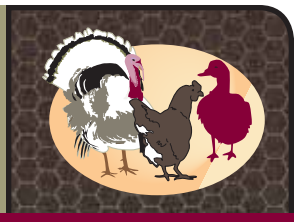
Stress is yet another mechanism by which the oxygen demand can be elevated. Studies done on the effect of thyroid hormones on the incidence of ascites of chickens also showed that birds with ascites exhibited a significant stress response, as measured by blood cortisol concentrations.

How can Ascites be Minimized?

There is no doubt that a rapidly growing bird is susceptible to developing ascites. However, given what we can learn from research and the examples given above, there are a few things that can be done to minimize the incidence of ascites in a flock:

- Maintain a consistent temperature in the barn and keep it at the guidelines recommended for the bird.
- Keep air quality optimum by moving air regularly and efficiently. In the colder months, it is better to add heat and keep the air moving than to shut down vents or reduce airflow in an effort to conserve heat.
- Keep litter moisture low; wet litter encourages ammonia production.
- If reusing litter or if the barn has a reoccurring problem with ammonia, consider using a litter treatment.
- Reduce stress in the flock. While we don't know all the stressors that can affect chickens, we can address those that are obvious. Keep densities optimum. Make sure feed is always available and that there is adequate feed and water space. Reduce light variation and keep light levels at reasonable intensities. Walk the barns often and carefully; continued exposure of the birds to humans will allow them to become accustomed to your presence. Rushing through the barn and making sudden gestures will spook the birds and add to their stress level.

Many of the details that, when ignored, can help to precipitate ascites may seem obvious. But it is easy to let them go, even to a minor degree. All these small details can add up to result in a problem. Continued attention to the details, with a consistent application of your Best Management Practices will go a long way to reducing the problem of ascites and maximize returns.



Cannibalism: Prevention and Treatment

Phillip J. Clauer, Poultry Extension Specialist, Animal and Poultry Sciences
Virginia Polytechnic Institute and State University

Cannibalism in fowl is a costly and vicious habit that poultry producers can not afford to ignore. It may occur at any age among all breeds, strains and sexes of fowl.

Cannibalism usually occurs when the birds are stressed by a poor management practice. Once becoming stressed, one bird begins picking the feathers, comb, toes or vent of another bird. Once an open wound or blood is visible on the bird, the vicious habit of cannibalism can spread rapidly through the entire flock. If you notice the problem soon after it begins, cannibalism can be held in check. However, if the problem is allowed to get out of hand it can be very costly. Cannibalism will lower the birds value due to torn and damaged flesh, poor feathering and can result in high death losses. Once this habit gets out of hand it is difficult to eliminate.

Since there are numerous reasons for outbreaks of cannibalism, it is important that cannibalism control be a part of your management program.

Cannibalism is usually caused by one or more of these conditions:

1 **Overcrowding:** Chicks should be allowed:
1/4 sq. ft./bird for first 2 weeks
1/2 sq. ft./bird for 3-8 weeks
1 sq. ft./bird from 8 to 16 weeks of age
1.5 sq. ft./bird from 16 weeks on

With game birds, double the above recommendations. With pheasants, allow 25 to 30 sq. ft./bird after 12 weeks of age or use pick prevention devices.

2 **Excessive heat:** When the birds become uncomfortably hot they can become extremely cannibalistic. Be sure to adjust the brooding temperature as the young fowl get older.

Brood young fowl at 95°F. for the first week and then decrease the temperature 5°F. per week, until you reach 70°F. or the outside temperature. The temperature should be measured at the height of the birds back directly under the heat source. Do not heat the entire brooding facility to the recommended temperature.

3 **Excessive light:** Extremely bright light or excessively long periods of light will cause birds to become hostile toward one another. Never use white light bulbs larger than 40 watts to broodfowl. If larger bulbs are required for heat, use red or infra-red bulbs.

In birds 12 weeks of age or older, use 15 or 25 watt bulbs above feeding and watering areas.

Don't light fowl more than 16 hours per day. Constant light can be stressful to the birds.

4 **Absence of feed or water or a shortage of feeder and waterer space:** If the birds have to fight for food and water, or if the birds are always hungry they will increase pecking. Be sure that birds have free access to water and feed at all times.

5 **Unbalanced diets:** Extremely high energy and low fiber diets cause the birds to be extra active and aggressive. Feed lacking protein and other nutrients, particularly Methionine, will also cause birds to pick feathers. Make sure you feed a diet balanced appropriately for the age and types of fowl you are raising.

6 **Mixing of different types and colors of fowl:** Mixing different ages of fowl or fowl with different traits promotes pecking by disrupting the flocks normal pecking order. Never brood different species of birds together. Don't brood feathered leg fowl, crested fowl or bearded fowl with fowl without these traits. Curiosity can also start pecking.

7 **Abrupt changes in environment or management practices:** If you plan to move young birds to a new location, it is best to move some of their feeders and waterers with them in order to help them adapt. When you change over to larger feeders and waterers it is helpful to leave the smaller equipment in the pen for a few days to help during the change.

8 **Brightly lit nests or shortage of nesting boxes:** Don't place bright lights near the nesting areas. Also, allow 1 nest for every 5 hens. Vent pecking by layers is also a common problem.

9 **Allowing cripples, injured or dead birds to remain in a flock:** Fowl will pick on cripples or dead birds in their pens because of the social order and curiosity. Once pecking starts it can quickly develop into a vicious habit.

10 **Slow feathering birds are most prone to cannibalism:** Take extra precautions with slow feathering birds. Most cannibalism occurs during father growth in young fowl. Birds with slow feathering have immature tender feathers exposed for longer periods of time leaving them open to damage from pecking. Don't raise slow feathering birds with other fowl.

Additional preventive measures include:

1 Allow the birds to use up their energy in an enclosed outside run. This will keep the birds busy and allow them to peck greens, ground and insects instead of other birds.

2 Give the birds a large handful of fresh greens like clover grass or weeds, each day. This increases the fiber in the birds diet. High fiber diets keep the birds crop full and makes the birds more content.

3 Use of mechanical devices in aggressive birds like game birds is advisable.

4 Finally, beak trimming is used in most commercial laying flocks. Trim the beak by remove of the top beak and about 1/3 of the lower beak providing a square tip. This makes it difficult for the birds to harm each other. However, beak trimming should be done by someone experienced in proper trimming.

Treatment for a cannibalism outbreak:

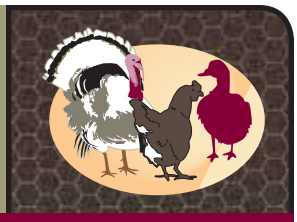
Since cannibalism can be caused by several conditions, you may not be able to determine the exact cause of the problem. However, stress no matter how slight, is usually the main factor.

1. Try to correct any practices which may have lead to cannibalism.
2. Darkening the facilities by using red bulbs.
3. Remove any badly injured birds.
4. Applying an "anti-peck" ointment or pine tar on any damaged birds usually stops pecking.
5. Lower the pen temperature a bit if possible.

Don't take chances!

Make the cannibalism control part of your management program and you will save a great deal of time and money.

Reviewed by Audrey McElroy, associate professor, Animal and Poultry Sciences



Factors Affecting Egg Production in Backyard Chicken Flocks

J.P. Jacob, H.R. Wilson, R.D. Miles, G. D. Butcher, and F.B. Mather
University of Florida, Institute of Food and Agricultural Sciences Extension

The laying cycle of a chicken flock usually covers a span of about 12 months. Egg production begins when the birds reach about 18-22 weeks of age, depending on the breed and season. Flock production rises sharply and reaches a peak of about 90%, 6-8 weeks later. Production then gradually declines to about 65% after 12 months of lay. A typical production curve for a laying flock, showing changes in the level of egg production and in egg weight, over time, is given in Figure 1.

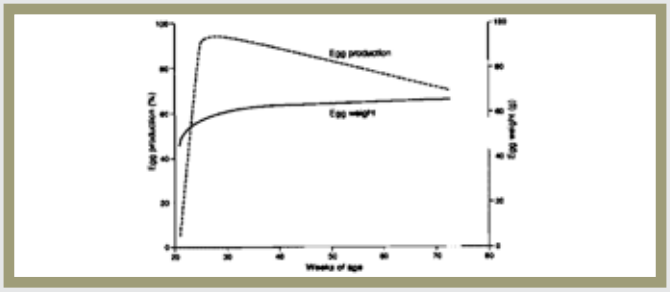


Figure 1.

There are many factors that can adversely affect egg production. Unraveling the cause of a sudden drop in egg production requires a thorough investigation into the history of the flock. Egg production can be affected by such factors as feed consumption (quality and quantity), water intake, intensity and duration of light received, parasite infestation, disease, and numerous management and environmental factors.

Noninfectious Causes

Aging Hens

Chickens can live for many years and continue to lay eggs for many of these years. However, after two or three years many hens significantly decline in productivity (see Figure 2). This varies greatly from bird to bird. Good layers will lay for about 50 to 60 weeks and then have a rest period called a molt. Poorer layers and older hens will molt more often and lay less consistently. See Table 1.

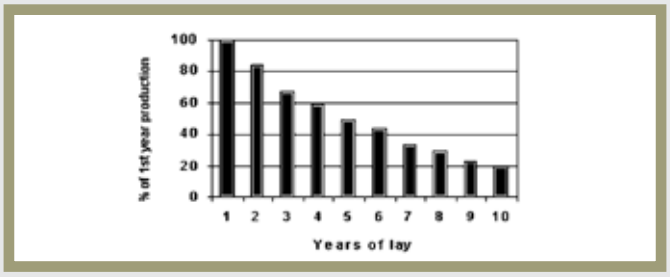


Figure 2.

Improper Nutrition

Laying chickens require a completely balanced diet to sustain maximum egg production over time. Inadequate nutrition can cause hens to stop laying. Inadequate levels of energy, protein or calcium can cause a drop in egg production. This is why it is so important to supply laying hens with a constant supply of nutritionally balanced layer food. Feeding whole grains, scratch feeds and table scraps will cause the birds diet to become imbalanced and inadequate.

Many times these imbalances can cause other problems like oviductal prolapse. Prolapse may occur when the bird is too fat and/or an egg is too large and the bird's reproductive tract is expelled with the egg. Prolapse usually causes permanent damage to the hen and is fatal in many cases.

Omission Of Feed Ingredients

Salt

Animals have an innate desire to consume salt. Feeding a salt-deficient diet will lead to increased feather pecking and a decline in egg production.

Most animal feeds will contain added salt, usually in the form of sodium chloride. Iodine is rarely added as a separate ingredient. Instead, iodized salt is routinely used. Cobalt iodized salt is often used in diets for swine and ruminants, and this can also be used without any problems for poultry. This type of salt is usually blue.

Sodium is an essential nutrient, playing a major role in maintaining body fluid volume, blood pH, and proper osmotic relationships. A continuously low intake of salt can cause a loss of appetite. Sodium deficiencies adversely affect utilization of dietary protein and energy,and interfere with reproductive performance.

Chlorine is also an essential nutrient. Hydrogen chloride (7C8) released from the true stomach(preconstruct) is important in digestion. Chlorine also plays a role in maintaining osmotic balance in body fluids. Birds deficient in chlorine are more nervous, showing increased sensitivity to sudden noise.

Calcium

The egg shell is composed primarily of calcium carbonate. The pullet's requirement for calcium is relatively low during the growing period, but when the first eggs are produced, the need is increased at least four times, with practically all of the increase being used for the production of eggshells. Inadequate calcium consumption will result in decreased egg production and lower egg shell quality.

Hens store calcium in medullary bone, a specialized bone capable of rapid calcium turnover. As calcium stores are depleted, bones become brittle. In severe cases, hens are unable to stand. The condition is known as caged-layer fatigue. Birds on the ground or on litter floors recycle calcium and phosphorus through consumption of feces, and do not have caged-layer fatigue.

Calcium can be supplied in the diet as either ground limestone or oyster shell. Particle size affects calcium availability. Usually the larger the particle size, the longer the particle will be retained in the upper digestive tract. This means that the larger particles of the calcium source are released more slowly, and this may be important for the continuity of shell formation, especially in the dark period when birds do not ordinarily eat.

Periodically, dolomitic limestone is offered to the feed industry. However, dolomitic limestone(which is used in the steel industry) should never be used in poultry diets. Dolomitic limestone contains at least 10% magnesium, and this complexes with calcium or competes with calcium for absorption sites in the intestines. The consequence of feeding dolomitic limestone is induced calcium deficiency.

Young birds should not be fed a high calcium layer diet because the calcium/phosphorus ratio will be unbalanced, resulting in increased morbidity or mortality.

Vitamin D

Vitamin D is required for normal calcium absorption and utilization. If inadequate levels of vitamin D are fed, induced calcium deficiency quickly results and egg production decreases.

Feed grade vitamin D comes in two forms, D_2 and D_3. In most animals, both are equally potent. In birds, however, D_3 is substantially more active than D_2. In poultry diets, therefore, vitamin D must be supplied in the form of D_3.

Protein

Dietary requirements for protein are actually requirements for the amino acids that constitute the protein. There are 22 amino acids in body proteins, and all are physiologically essential. Poultry cannot synthesize some of these, or cannot synthesize them rapidly enough to meet the metabolic requirement. Therefore, these amino acids must be supplied in the diet. Amino acid requirements vary considerably according to the productive state (i.e., growing, laying eggs, etc.), age, type, breed, and strain. Methionine is the amino acid most often deficient in laying rations.

When pullets begin laying, there is an increase in protein, vitamin and mineral requirements per day due to deposition in the egg. If dietary protein is too low or the amino acid requirements are not met, poor egg production and hatchability will occur.

Fat

Dietary fat is a source of energy and of linoleic acid, an essential fatty acid. A deficiency of linoleic acid will adversely affect egg production. Dietary fats also serve as "carriers"of fat-soluble vitamins, and some fat is necessary for absorption of vitamins. In fact, impairment of the absorption of fat-soluble vitamins (A, D, E, and K) is the most serious consequence of a dietary deficiency of fat.

Toxicoses

Salt

Although the salt requirement of birds is relatively low, adequate levels are essential, and excessive amounts are highly toxic and reduce egg production. Birds require a sensitive balance between necessary and toxic levels of salt. See Table 1.

Excess dietary salt intake readily causes wet droppings and wet litter. Several feed ingredients,such as fish meal, corn gluten meal, meat meal, whey and sunflower meal contain high levels of sodium. When such ingredients are used, the level of supplemental salt (NaCl) in the diet must be reduced.

Phosphorus

The nutritional role of phosphorus is closely related to that of calcium. Both are constituents of bone. The ratio of dietary calcium to phosphorus affects the absorption of both these elements;an excess of either one impedes absorption and can reduce egg production, shell quality and/or hatchability.

In addition to its function in bone, phosphorus plays a primary role in carbohydrate metabolism,is active in fat metabolism, and helps to regulate the acid-base balance of the body.

Vitamin D

Excess vitamin D_3 leads to increased calcium absorption resulting in hypercalcemia which may reduce egg production. Most animal species appear to be able to tolerate 10 times their vitamin D_3 requirement for long periods of time. For short-periods of time, poultry can

tolerate up to 100 times their requirement. An excess of vitamin D_3 in the diet, therefore, is unlikely.

Mycotoxins

Molds can produce mycotoxins which adversely affect egg production and general health. They can interfere with the absorption or metabolism of certain nutrients, depending on the particular mycotoxin. Apparent calcium and/or vitamin D_3 deficiencies can occur when mycotoxin contaminated feeds are given to laying hens. In addition,some have hormonal effects which can cause a decline in egg production.

The major mycotoxin of concern with corn is aflatoxin, produced by the mold *Aspergillus flavus*. The mold infects corn both in the field and in storage. Aflatoxin fluoresces under ultraviolet light, so its presence can be detected by examining grain under "black light". Other mycotoxins sometimes associated with corn and other grains are zearalenone (F-2 toxin), ochratoxin, T-2 toxin, vomitoxin, and citrinin. More than 300 mycotoxins have been identified.

Botulism

Botulism is an acute intoxication caused by consumption of a neurotoxin produced by the bacterium *Clostridium botulinum*. It commonly occurs when birds consume decomposing carcasses, spoiled feed or other decaying organic materials. Ponds and other stagnant water sources are often areas of decaying materials that may contain this toxin.

Other toxins

Numerous plants are toxic to varying degrees if plant parts or seeds are consumed by the bird. Production, hatchability, growth, and livability may be reduced. Examples of these plants include crotalaria, nightshade, coffeeweed, cotton seeds, chick peas, vetches, and many ornamentals. Other potential causes of problems include pesticides, herbicides, disinfectants, fertilizers,drugs, antibiotics, and other chemicals, including oils and antifreeze.

Anticoccidials

Anticoccidials (to prevent coccidiosis) are commonly used in diets for replacement pullets,meat birds and young breeding stock that are reared on litter floors. Anticoccidials are not given to commercial laying hens.

Nicarbazin

Nicarbazin is an anticoccidial drug that reduces reproductive performance when it's inadvertently added to layer or breeder diets at normal anticoccidial levels. The yolk membranes are weakened,resulting in mottling of the yolk. Nicarbazin fed to brown-egg layers turns their eggshells white within 48 hours, although this is completely reversible when the product is withdrawn from the feed. Even low levels of nicarbazin can cause some loss in shell color, mottling of egg yolks (see Fact Sheet PS-24, "Egg Quality"), and a decline in hatchability.

Monensin

Monensin has been the most successful of the anticoccidials. Monensin, and other ionophoreanticoccidials, have an adverse effect on egg production when used in conjunction with low protein diets.

Management Mistakes

Out of feed

If hens are out of feed for several hours, a decline in egg production will probably occur. The amount of decline will be related to the time without feed. Be sure that all the birds have access to an adequate supply of a complete feed which meets all their nutritional requirements.

Feed stored on the farm longer than two weeks may become moldy. If feed becomes wet it should be discarded. In addition, vitamin potency decreases with prolonged storage.

Out of water

Water is often taken for granted, and yet it is probably the most essential nutrient. Water is by far the single constituent of the body, and, in general, represents about 70% of total body weight. Access to water is very important, and a lack of water for several hours will probably cause a decline in egg production. Hens are more sensitive to a lack of water than a lack of feed.

The amount of water needed depends on environmental temperature and relative humidity, diet composition, and rate of egg production. It has been generally assumed that birds drink approximately twice as much water as the amount of feed consumed on a weight basis, but water intake varies greatly, especially in hot weather.

Inadequate day length

Hens need about 14 hours of day length to maintain egg production. The intensity of light should be sufficient to allow a person to read newsprint at bird level. The decreasing day length during the Fall and shorter day lengths in the Winter would be expected to cause a severe decline,or even cessation, in egg production unless supplemental light is provided. When production ceases, the birds may also undergo a feather molt. Hens exposed to only natural light would be expected to resume egg production in the Spring.

High house temperatures

High environmental temperatures pose severe problems for all types of poultry.
Feed consumption,egg production, egg size, and hatchability are all adversely affected under conditions of severe heat stress. Shade, ventilation, and a plentiful supply of cool water help reduce the adverse effects of heat stress.

Ectoparasites

An ectoparasite is a parasitic organism that feeds on the exterior of the body of the host.

Northern fowl mite

The northern fowl mite (*Ornithonyssus sylviarum*) is the most common of the poultry mites. Refer to the publication PS-10, ("Common Continuous External Parasites of Poultry"), for information on identification and control of Northern fowl mites.

Northern fowl mites are blood suckers and are irritating to poultry. Anemia occurs in heavily parasitized birds, reducing feed efficiency, egg production, and ability to withstand and overcome diseases.

Lice

Several species of chewing lice may be found on chickens, especially those in small flocks or on range. Refer to publication PS-10, ("Common Continuous External Parasites of Poultry"),for information on identification and control of lice.

Chicken lice feed on dry scales, feathers, or scabs on the skin. As lice crawl over the bird,their mouth parts and sharp claws scratch the skin. The constant irritation causes the bird to become nervous and behave abnormally, causing a general unthriftiness and unkempt appearance in the bird. Egg production in infested flocks may drop as much as 10%, although some heavy infestations have caused egg production to fall as much as 20%.

Fleas

Stick-tight fleas are sometimes a severe problem in home flocks and may be difficult to prevent or eradicate. The adult female flea attaches to the skin around the face and head, causing severe irritation and, in some cases, blindness. Refer to publication PS-10, ("Common Continuous External Parasites of Poultry"), for information on identification and control of stick-tight fleas.

Endoparasites

An endoparasite is a parasite that lives and feeds inside the host animal. Heavy infestations of endoparasites can cause unthriftiness, poor feed efficiency, poor growth,reduced egg production, and mortality in severe infestations. Infected birds may also be more susceptible to various diseases and stresses.

Nematodes

Nematodes, or roundworms, are elongated, cylindrical, unsegmented endoparasites. There are many species of roundworms, each tending to infect a specific area of the gastrointestinal tract. Refer to publication PS-18, ("Nematode Parasites of Poultry"), for identification and control of nematodes.

Tapeworms

Tapeworms (cestodes) are white or yellowish ribbon-like segmented flat worms. They vary in size from 0.17 to 12 inches in length. Although tapeworms do not produce extensive lesions or damage to the intestines, they are nutritional competitors. A cestode does not digest its own food. Instead, it anchors itself to the inner wall of the bird's intestines, letting its segmented body dangle in the flow of digested material, absorbing nutrients before they can be utilized by the host. A variety of commercially available anthelmintics will effectively and safely eliminate both nematodes and cestodes from poultry.

Diseases

Fowl Pox

Fowl pox is a viral disease of chickens characterized by scab-like lesions on the skin of the unfeathered body parts and/or on diphtheritic (wet) membranes lining the mouth or air passages. Infection with the fowl pox virus will cause the chickens to have poor growth, poor feed conversion and a precipitous fall in egg production. Fowl pox may affect any age bird. It is transmitted by direct contact with an infected chicken or by mosquitos. Table 2.

For more information on fowl pox, refer to publication VM66, "Prevention and Control of Fowl Pox in Backyard Chicken Flocks".

Coccidiosis

Coccidiosis is a protozoan disease characterized by enteritis and diarrhea in poultry. Unlike the organisms which cause many other poultry diseases, coccidia are almost universally found wherever chickens are raised. Coccidiosis outbreaks vary from very mild to severe infections. See Table 2.

Individual strains of cocci attack birds differently, resulting in diverse symptoms. The overall symptoms may be one or more of the following: bloody droppings, high mortality, general droopiness,emaciation, a marked drop in feed consumption, diarrhea and a drop in egg production in layers.

It is common to add a coccidiostate in the feed of broilers. In addition, live vaccines are currently available.

Infectious bronchitis

Infectious bronchitis is a highly contagious respiratory disease. The disease is caused by a virus which is moderately resistant, but can be destroyed by many common disinfectants.

Infectious bronchitis occurs only in chickens (Infectious bronchitis is different from Quail bronchitis which affects Bobwhite Quail). All ages of chickens are susceptible to infectious bronchitis. In laying hens it is characterized by respiratory signs (gasping, sneezing, coughing)and a marked decrease in egg production. Egg quality is also adversely affected. Low egg quality and shell irregularities (soft-shelled or mis-shapened) may persist long after an outbreak. Chickens that have had infectious bronchitis, especially during the first week of life, may never be good layers.

There is no effective treatment for infectious bronchitis, although broad spectrum antibiotics for 3 to 5 days may aid in controlling secondary bacterial infections. Vaccines can be used for prevention, but they are only effective if they contain the right serotypes of virus for a given area. Infectious bronchitis vaccine is often combined with Newcastle vaccine in the same vial.

Newcastle disease

Newcastle disease is caused by a virus. The viruses vary in pathogenicity and are classified as lentogenic (mildly virulent), mesogenic (moderately virulent), and velogenic (markedly virulent).

Newcastle disease is characterized by a sudden onset and rapid spread through the flock. In adult laying hens clinical signs can include depression, loss of appetite, decreased water consumption, and a dramatic decline in egg production. Production may drop to zero. Newcastle disease runs its course in 10 to 14 days, but the hens do not come back into full production for 5 to 6 weeks.

There is no treatment for Newcastle disease. Antibiotics can be given for 3 to 5 days to prevent secondary bacterial infections. Chickens and turkeys can be immunized against Newcastle disease by vaccination.

Avian influenza

Avian influenza is a viral disease affecting the respiratory, digestive and/or nervous systems of many species of birds. Avian influenza viruses are classified based on severity of disease,ranging from apathogenic to highly pathogenic. The mildly pathogenic form

produces listlessness,respiratory signs (sneezing, coughing), and diarrhea. The level of mortality is usually low. The highly pathogenic form of avian influenza produces facial swelling, cyanosis, and dehydration with respiratory distress. Dark red/white spots (cyanosis/ischemia) develop on the legs and combs of chicks. Mortality can range from low to near 100%. The decrease in egg production is related to the severity of the disease and can be severe.

There is no specific treatment for avian influenza. Recovery is rather spontaneous. Birds slaughtered 7 days after infection often have no significant increase in condemnations.

Infected flocks will be quarantined by the State. Quarantine is continued until the flock is depopulated. The course of the disease is 10 to 14 days, but recovered birds continue to shed the avian influenza virus in feces for 3 or 4 weeks. Eggs from layers are safe to eat, but the shell should be wash and sanitized. The poultry litter or manure should be commensurations application to cultivated lands.

For more information on avian influenza refer to publication PS-38, "Avian Influenza in Poultry".

Avian encephalomyelitis

Avian encephalomyelitis (epidemic tremors) is a viral disease usually affecting young poultry. It is characterized by incoordination and tremors, especially of the head and neck in chicks,and elevated mortality levels. Chicks that recover may later develop cataracts after sexual maturity. In affected hens, decreases in egg production and hatchability are noted.

Laying hens seldom show clinical signs when infection is going through the flock. However,good production records often reveal a slight drop in egg production (5 to 20%) lasting no more than two weeks. In breeding flocks, a corresponding decrease in hatchability is also noted.

There is no effective treatment. All replacement breeder and layer pullets should be immunized.

Mycoplasma gallisepticum infection

Mycoplasma gallisepticum infection (chronic respiratory disease, PPLO infection, airsacculitis, MG) is characterized by respiratory distress (coughing, sneezing, snicks, rales, discharge from eyes and nose).Feed consumption and egg production decline in laying hens. Mortality is usually low but there may be many unthrifty birds.

The organism may be present in a flock and cause no disease until triggered by stress, e.g.,changes in housing, management, nutrition, or weather.

Many broad spectrum antibiotics have been used for treatment and will suppress losses. However,relapses often occur when treatment is discontinued. Most antibiotics are given in feed or water, preferably in water. Tylosine and tetracyclines have been used extensively for treatment. Injectable antibiotics may be more effective if the disease is advanced and if the flock is small enough to be treated individually. FDA withdrawal periods for respective medications used must be strictly observed to avoid residual chemicals in the eggs and meat. Live and inactivated vaccines also are commonly used to reduce the adverse effects of the disease.

Fowl cholera

Fowl cholera is an infectious bacterial disease of poultry. With an acute outbreak, sudden unexpected deaths occur in the flock. Laying hens may be found dead on the nest.

Sick birds show anorexia, depression, cyanosis, rales, discharge from eyes and nose, white watery or green mucoid diarrhea, and egg production is decreased.

As fowl cholera becomes chronic, chickens develop abscessed wattles and swelling of joints and foot pads. Cheesy pus may accumulate in the sinuses under the eyes.

Flocks can be treated with a sulfa drug. Sulfa drugs are not FDA approved for use in pullets older than 14 weeks or for commercial laying hens. Sulfa drugs cause residues in meat and eggs. Prolonged use of sulfa drugs is toxic and causes a decrease in production in laying hens. Antibiotics can be used, but require higher levels and longer medication to stop the outbreak.

Where fowl cholera is endemic, live and/or inactivated vaccines are recommended. Do not start vaccinating for fowl cholera until it becomes a problem on the farm and a diagnosis is confirmed.

Infectious coryza

Coryza is a respiratory disease of chickens. Common clinical signs include swelling and puffiness around the face and wattles, a thick sticky discharge with a characteristic offensive odor from the nostrils, labored breathing, and rales. There is a drop in feed and water consumption as well as egg production.

Sulfadimethoxine (Albon) is the preferred treatment for infectious coryza. If Albon fails or is not available, sulfamethazine, sulfamerazine, or erythromycin (Gallimycin) can be used as alternative treatments. The sulfa drugs are not FDA approved for pullets older than 14 weeks or for commercial laying hens.

A vaccine for infectious coryza is available. It is given subcutaneously (under the skin)on the back of the neck. Chicks are usually vaccinated four times, starting at 5 weeks of age (i.e., at 5, 9, 15, and 19 weeks with at least 4 weeks between injections). Vaccinate again at 10 months of age and twice yearly thereafter.

Other Problems To Consider

There are a variety of other problems which can cause an apparent drop in egg production. They include:

1. Predators and snakes consuming the eggs.
2. Egg-eating by hens in the flock.
3. Excessive egg breakage.
4. Hens which are able to run free hiding the eggs instead of laying in nests.

Summary

There are numerous factors which may adversely affect egg production in backyard chicken flocks. If a drop in egg production occurs, investigate the cause by answering questions that follow also refer to Table 1 and Table 2, sick and recently dead birds to a state diagnostic lab, and/or consult with your County Extension Agent or a veterinarian.

1. How old are the birds?
2. How much feed are the birds consuming daily?
3. Has the level of feed consumption changed lately?
4. Has there been a change in the type of feed used?
5. Is the feed moldy?
6. How much light do the birds receive daily? Has it changed?
7. What is the light source?
8. What is the condition of the poultry houses?
9. Are the birds getting enough clean water?
10. What is the condition of the birds?
11. How active are the birds?
12. What is shell quality like?
13. What is interior egg quality like?
14. Are there any signs of disease?
15. Are the birds crowded?
16. Are there any signs of parasites?
17. Do the birds have access to different plants?
18. Have any pesticides or herbicides been used in the area?

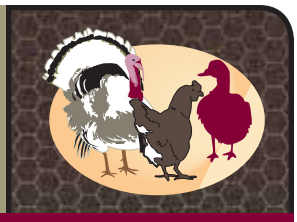
Table 1.

Table 1. Non-infectious causes of reduced egg production.	
CAUSES OF DECLINE	**SIGNS/SYMPTOMS**
OMISSION OF INGREDIENTS	
Salt	Nervous flock, increased pecking, feathers in digestive tract
Calcium	Birds down in cages, increased incidence of shell-less eggs
Vitamin D_3	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 D_3	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

Table 2.

Table 2.
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 unfeathered 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 – dramatic drop in egg production – decreased shell quality – increased mortality Acute form: – respiratory distress – twisted neck
Avian influenza	Mildly pathogenic form: – listlessness – sneezing, coughing – diarrhea Highly pathogenic form: – facial swelling – dark red/white spots on legs and combs – 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



Suggested References

Textbooks

Commercial Chicken Production Manual 4th Edition

Mack O. North and Donald D. Bell
Chapman and Hall Publishing

This textbook is oriented toward commercial production, but most of the concepts can be applicable to small flocks, just on a smaller scale. The information is a bit outdated (1994), but the fundamentals are still valid.

Pigeon Health and Disease

David C. Tudor
Iowa State University Press,
Ames, Iowa.

Online References

Duck Research Laboratory,

Cornell University:

http://www.duckhealth.com/housmngt.html

This site provides some good information on management, feeding, and health care of ducks.

Broiler Chicken Management Guide

Ross Broilers

http://www.aviagen.com/pdf/Ross_NA/BroilerManagementGuide.htm

Provides detailed specifications and requirements for broiler chicken strains, as well as production targets.

Turkey Management Guide

Hybrid Turkeys

http://www.hybridturkeys.com/index.html

Commercial Production guides and technical information for turkeys.

Layer Management Guide

Hyline Layers

http://www.hyline.com/userdocs/library/Brown_Eng_indd.pdf

NRC Nutrient Requirements of Poultry

9th Edition

http://www.nap.edu/openbook.php?record_id=2114&page=R1

Poultry Industry Council

http://www.poultryindustrycouncil.ca/

This site has a variety of information regarding poultry and poultry production. The site is updated routinely as new information or new reports are published.

Keeping your Birds Healthy

http://www.agbiosecurity.ca/healthybirds/aspx/public/index.aspx

Keeping your Birds Healthy is a collaborative effort between the University of Guelph (Ontario) and the Ontario Ministry of Agriculture, Food, and Rural Affairs. It is an excellent source of information for all poultry owners but is aimed at small flock owners. A wide range of topics are covered.

Compendium of Medicating Ingredients Brochures

http://www.inspection.gc.ca/english/anima/feebet/mib/mibtoce.shtml

This CFIA webpage has an easily searchable listing of all medications that can be included in livestock or poultry feeds, including indications, cautions, and withdrawals. Any use outside of those published here, including combinations, requires a veterinary prescription.

CFIA National Biosecurity Standard

Standard: http://www.inspection.gc.ca/english/anima/biosec/aviafrme.shtml

Guide: http://www.inspection.gc.ca/english/anima/biosec/stdnore.shtml

Poultry Breeds

Description of breeds of poultry: http://139.78.104.1/breeds/poultry/

Selecting a breed of chicken: http://www.ces.purdue.edu/extmedia/AS/AS-518.pdf

Merck Veterinary Manual:

http://www.merckvetmanual.com/mvm/index.jsp?cfile=htm/bc/toc_200000.htm

University Websites of Interest

Kansas State University Agricultural Experiment Station and Cooperative Extension Service
http://www.ksre.ksu.edu/library/DesktopDefault.aspx?tabid=16

North Carolina Cooperative Extension Services:
http://www.ces.ncsu.edu/depts/poulsci/tech_manuals/small_flock_resources.html

University of California Agriculture and Natural Resources Publications:
http://ucanr.org/freepubs/freepubsub.cfm?cat=33

University of Florida Institute of Food and Agricultural Sciences Extension:
http://edis.ifas.ufl.edu/topic_poultry

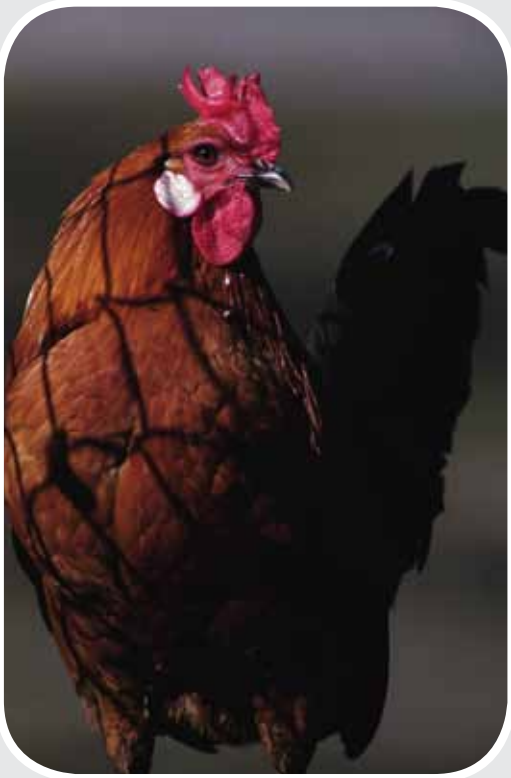
University of Kentucky College of Agriculture:
http://www.ca.uky.edu/smallflocks/factsheets.html

University of Georgia Cooperative Extension:
http://www.poultry.uga.edu/extension/index.htm

Utah State University Extension:
http://extension.usu.edu/htm/agriculture/poultry

Virginia Cooperative Extension:
http://pubs.ext.vt.edu/category/poultry.html

CFIA Biosecurity Guide



Canadian Food Inspection Agency | Agence canadienne d'inspection des aliments

General Producer Guide

National Avian

On-Farm Biosecurity Standard

Canada

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About this document

Who is this document for?

This *General Producer Guide* has been developed as an information resource for the *National Avian On-Farm Biosecurity Standard* to assist poultry producers with the development of biosecurity plans for their farming operations. Biosecurity planning and implementation reduces the risk of infectious disease transfer within and among poultry flocks. Enhancing your farm's biosecurity protects both individual and industry-wide economic interests. Further, it reduces the risk to public health that may result from certain poultry diseases.

The *General Producer Guide* and the *National Avian On-Farm Biosecurity Standard* form the basis of a comprehensive program designed to provide applicable guidance for owners or managers across all the poultry sectors in Canada. This Guide has been developed as a tool for all people and businesses that handle and keep poultry, including large scale supply-managed producers, backyard flock owners, and other domestic bird keepers. It provides guidance to producers on how to achieve the Target Outcomes of the *National Avian On-Farm Biosecurity Standard*.

The Standard and the associated Producer Guide are designed both to support the development of farm-specific biosecurity protocols for sectors that do not participate in a provincial association or On-Farm Food Safety (OFFS) program – such as the non-regulated commercial and non-commercial sectors – and to complement and enhance existing on-farm programs. The OFFS programs, developed by industry, formally address many elements of biosecurity and will be the primary avenue for implementation, where applicable.

This Guide is based on clear, scientifically justified principles. It details a range of measures that could be implemented to prevent disease-causing agents from entering or leaving a premises that houses poultry.

Why is biosecurity important?

There is no formal definition for the word "biosecurity," but it has become the accepted term used to describe the measures needed to protect against the introduction and spread of diseases.

It is in the best interest of poultry keepers to ensure that they are aware of the risks and that they implement procedures to limit the chances of disease developing or spreading. When a bird is infected with a pathogenic organism, there may or may not be obvious signs of clinical disease. Nevertheless, this pathogen can be reproduced in the bird's body, which then sheds the organism into the environment through body excretions, including feces, urates from the kidneys, and aerosols from the respiratory system. The organisms contained in these excretions contaminate the surfaces in the surrounding environment, which then carry the infection to the next bird. If another bird becomes infected and the pathogens are in sufficient quantity to overcome a susceptible bird's immune system, the bird becomes infected and the cycle continues. As the pathogenic organism passes through more and more birds, its numbers in the environment multiply rapidly.

Additionally, pathogenic organisms can change over time to become more or less capable of causing disease. Circulating unchecked within a flock or between flocks of different generations, organisms have greater opportunity to undergo genetic alterations, and thus potentially cause more significant disease in poultry or other animal species, including humans.

Because pathogenic organisms are microscopic, they are invisible to the naked eye. Despite this, they can be found in large numbers in visible material, such as dust, water droplets suspended in the air, and fecal contamination. A dust particle can contain an infective dose. In fact, such a small amount of contaminated material may be hidden on equipment, clothing, footwear, or even hands, allowing the disease to be carried from one flock to another.

Past disease outbreaks, both in Canada and overseas, clearly demonstrate the serious impact that avian diseases can have on business, individual livelihoods, and local communities. The impact may range from the destruction of tens of thousands of birds, to the cancellation of shows or sporting events. The period during which emergency controls are in place may vary depending on how rapidly a disease can be successfully controlled.

Some diseases, known as zoonoses, can infect both poultry and humans. Good biosecurity is therefore an important element in preventing human illnesses.

Those who keep poultry must share responsibility for protecting their business or hobby by reducing the risks associated with the spread of diseases.

Practising good biosecurity has clear benefits as follows:

- healthy birds
- minimized potential for significant costs and losses in revenue
- protection of human health
- unrestricted movement of birds
- protection of other industries, such as feed suppliers
- protection of export markets

How should this document be used?

The *General Producer Guide* has been organized to follow the organization of the Standard document. It is divided into three sections (the same as in the Standard), representing the foundations of a smoothly operating biosecurity system:

1. **Access Management**
2. **Animal Management**
3. **Operational Management**

In each section, each Target Outcome of the Standard is followed by current information on a variety of biosecurity-related practices as examples of the measures that producers can implement to meet the target outcome. The Guide demonstrates the flexibility required for a variable and complex poultry industry. It is not a full and complete listing of all examples that can be used to meet the Target Outcomes. Many examples relate to large commercial-scale industry, but also apply to other sectors. Optimal or highly effective biosecurity measures are provided in text boxes labelled "Ideally." They represent an ideal for those producers who wish to

implement more rigorous biosecurity measures. Other guides, with more sector-specific producer guidance, may be developed in the future.

Biosecurity is best achieved when all of the foundations and their components are in place and are being managed properly. Weak building blocks or poorly implemented biosecurity measures provide a route by which disease might enter the flock or remain undetected within the flock.

All keepers of poultry should focus on achieving a level of control in every component on their property. For those new to the concept of biosecurity, those with limited resources or where it is not practical or applicable to fully achieve all target outcomes, the Guide provides examples of measures to take to mitigate the risks on a day-to-day basis.

A Glossary at the end of the document provides definitions of terms used. There are also a number of annexes, one of which is a self-audit checklist. This checklist can be used to quickly record the Target Outcomes that are being effectively controlled and those that need further action on your premises.

National Avian On-Farm Biosecurity Standard: **General Producer Guide**

This document provides producer guidance on meeting Target Outcomes of the *National Avian On-Farm Biosecurity Standard*. These general guidance notes were developed with significant contributions from representatives of the various poultry sectors. They are not a full and complete listing of all methods that can be used to meet the Target Outcomes but do include some existing beneficial practices and other examples to facilitate meeting the Target Outcomes, while providing the flexibility required for a variable and complex poultry industry.

Some specific examples may be presented in boxes. Additional guidelines, in the "Ideally" boxes, may be more difficult and/or expensive procedures to implement, but will improve your biosecurity program. You should consider implementing these additional procedures – especially in scenarios of increased risk (i.e. a disease challenge in the area).

Section 1 Access Management

1.1 Designation of Zones

1.1.1	***Target Outcome***
Recognizable zones and access points are in place.	

1.1.1	**Producer Guidance**

Zones and access points may be defined as follows:

Controlled access zone (CAZ): The area of land and buildings constituting the poultry-production area of the premises that is accessible through a securable controlled access point.

Restricted access zone (RAZ): An area inside the CAZ that is used, or intended to be used, to house poultry, including semi-confined and range production, and where personnel and equipment access is more restricted than in the CAZ. Within the RAZ, the unrestricted movement of people, birds, and equipment may occur. The RAZ is sometimes referred to as the "production area" or "restricted area" (RA) in other poultry production documents and guides.

Controlled access point (CAP): A visually defined entry point(s) through which workers, equipment, feed trucks, etc. will enter the CAZ and/or the RAZ.

The CAZ

Recommendations for establishing a CAZ

- Draw, in the initial design phase, a map of your property.
- Ensure that, when deciding on boundaries, the CAZ is large enough to provide a functional buffer zone around the poultry housing units, but remains small enough to allow traffic that is not directly involved with poultry production to travel around the CAZ (not through the CAZ).
- Include all buildings and structures used directly in the production of poultry.
- Note: The shape and size of the CAZ will vary among sites.
- Require personnel and equipment to pass through an appropriate primary CAP when entering or exiting the CAZ.
- Exclude personal residences and non-applicable structures (machine shops and storage sheds, etc.) if they are not used for production equipment and materials. This allows visitors who access a personal residence and personnel who need to enter unrelated machine shops and storage facilities to do so without entering the CAZ.
- Park unnecessary vehicles outside the CAZ.

The RAZ

Recommendations for establishing a RAZ

- Establish the area that is housing the poultry as a RAZ.
- Recognize that the barn entrance to the RAZ is the last line of defence in preventing the entry or exit of disease-causing organisms. Ideally, the RAZ is a physical enclosure that segregates the birds from the external environment and possible exposure to disease agents from outside. A RAZ that includes outside areas (outside pens, laneways for vehicles or equipment, etc.) is at a higher risk for exposure to disease.
- Consider facility operations and your areas of concern regarding internal spread of disease-causing agents when designing a RAZ. Everything within a RAZ can be considered of equal risk status, because of unrestricted movement of people, birds, and equipment within this zone.
- Applies normally to an individual barn, a compartment or floor within a barn, a series of connecting barns for birds that are raised indoors, or an enclosed outdoor area where birds are raised.
- Consider each barn as a separate RAZ in a multi-barn site. Within a single CAZ, having biosecurity procedures among barns is a good practice for reducing the possibility of spreading disease-causing agents from barn to barn.
- Note that, for barns with more than one floor, for barns which are physically joined by a common anteroom, or for barns that contain multi-aged flocks, a single RAZ or several separate internal RAZs may be appropriate. If rooms,

compartments, or floors of the barn share a common air space – that is, wall dividers do not extend fully to the ceiling, and/or ventilation is shared – creating separate RAZs may be of little value in preventing disease transmission.

- Establish a visually defined entrance, requiring all necessary traffic, human or otherwise, to pass through an appropriate primary CAP. This includes a transition area or anteroom where the biosecurity procedures can occur for movement between the CAZ and RAZ.

- Note: For some production methods and premises configurations, multiple RAZs may not be operationally feasible. Options, including collective RAZs, are detailed in the diagrams below, with the following understanding:

    - If multiple buildings and/or ranges operate without restrictions on movements between the buildings/ranges, at least one RAZ should exist around the entire complex with entry and exit controls.

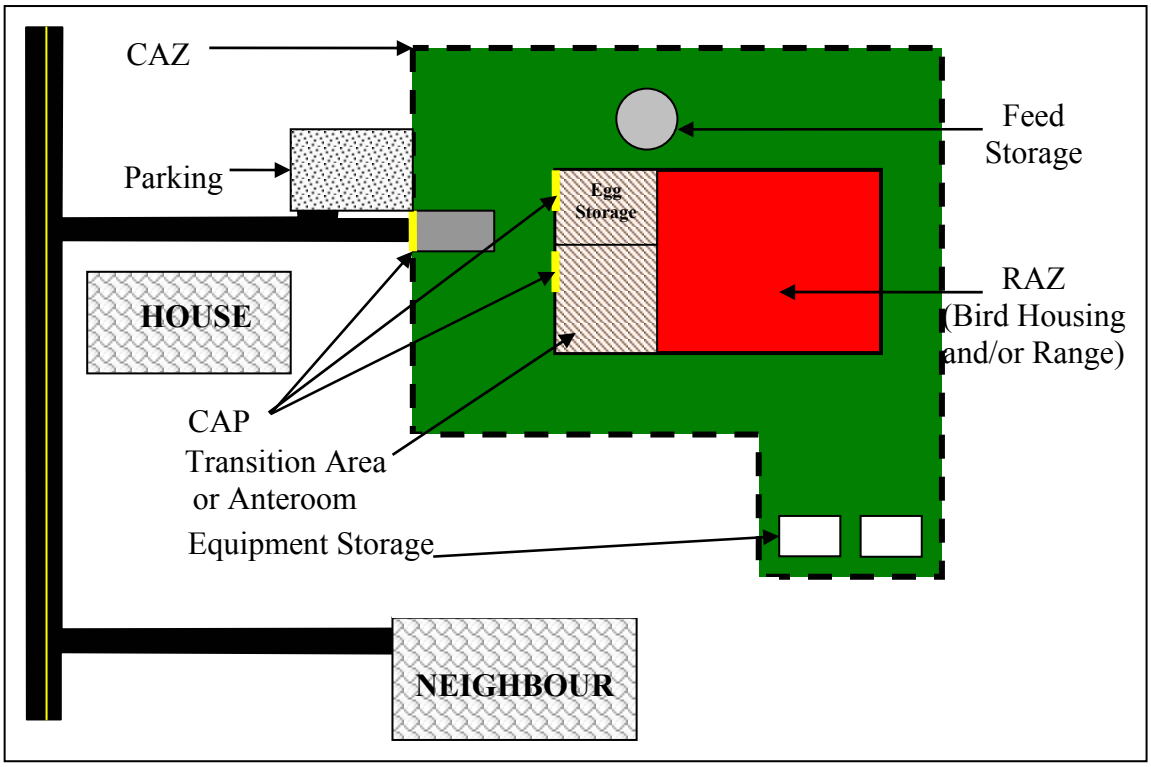
    - This option would be **less effective in reducing the possibility of disease spread into/out of the complex, and has no controls to reduce the risk of disease spread within the complex.**

- Have your veterinarian or local association help configure a RAZ that would be defined in such a way that is practical, while at the same time, minimize the possibility of disease introduction or spread.

- Ensure that the people who enter your premises are not sick, have not been in contact with sick poultry, livestock, pets and/or people, especially those exhibiting clinical signs related to influenza virus.

The three concepts depicted below provide options for laying out these zones, though other scenarios may better fit your operation.

Concept 1 *One controlled access zone with one restricted access zone*

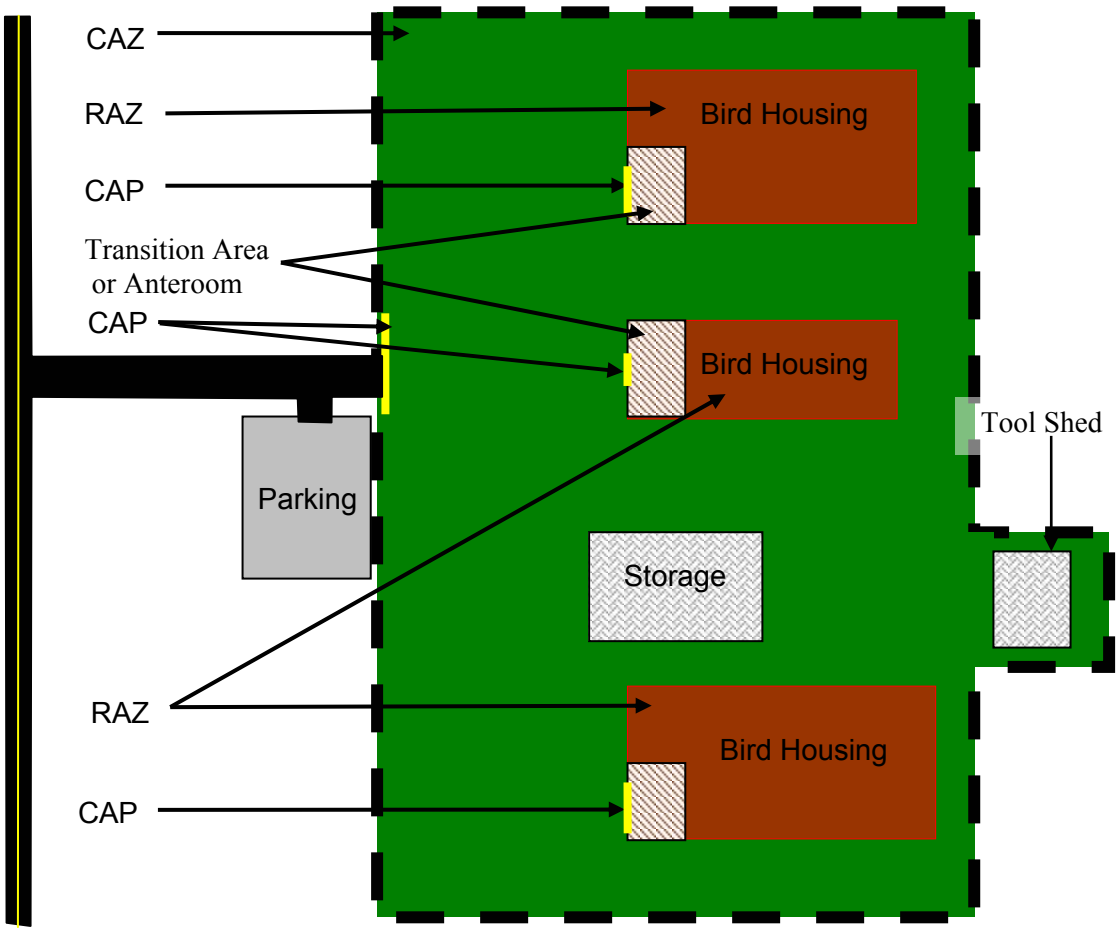


CAZ = controlled access zone RAZ = restricted access zone CAP = controlled access point

A CAZ and a RAZ for a simple farm site, comprised of only one barn and/or range and limited outbuildings, can be easily established. The CAZ incorporates all the farming activities, whereas the RAZ is the barn and/or range. A CAP provides access to each zone, and parking outside of the CAZ limits the volume and frequency of traffic movement.

A transition area at the front of the barn allows room for people who work on the premises to perform boot and clothing changes, hand washing, and other tasks. It may also provide room for dry storage or egg collection activities, depending on the needs of the farm site. For egg production, egg pickup personnel can access the egg storage room via the anteroom or through a separate exterior door.

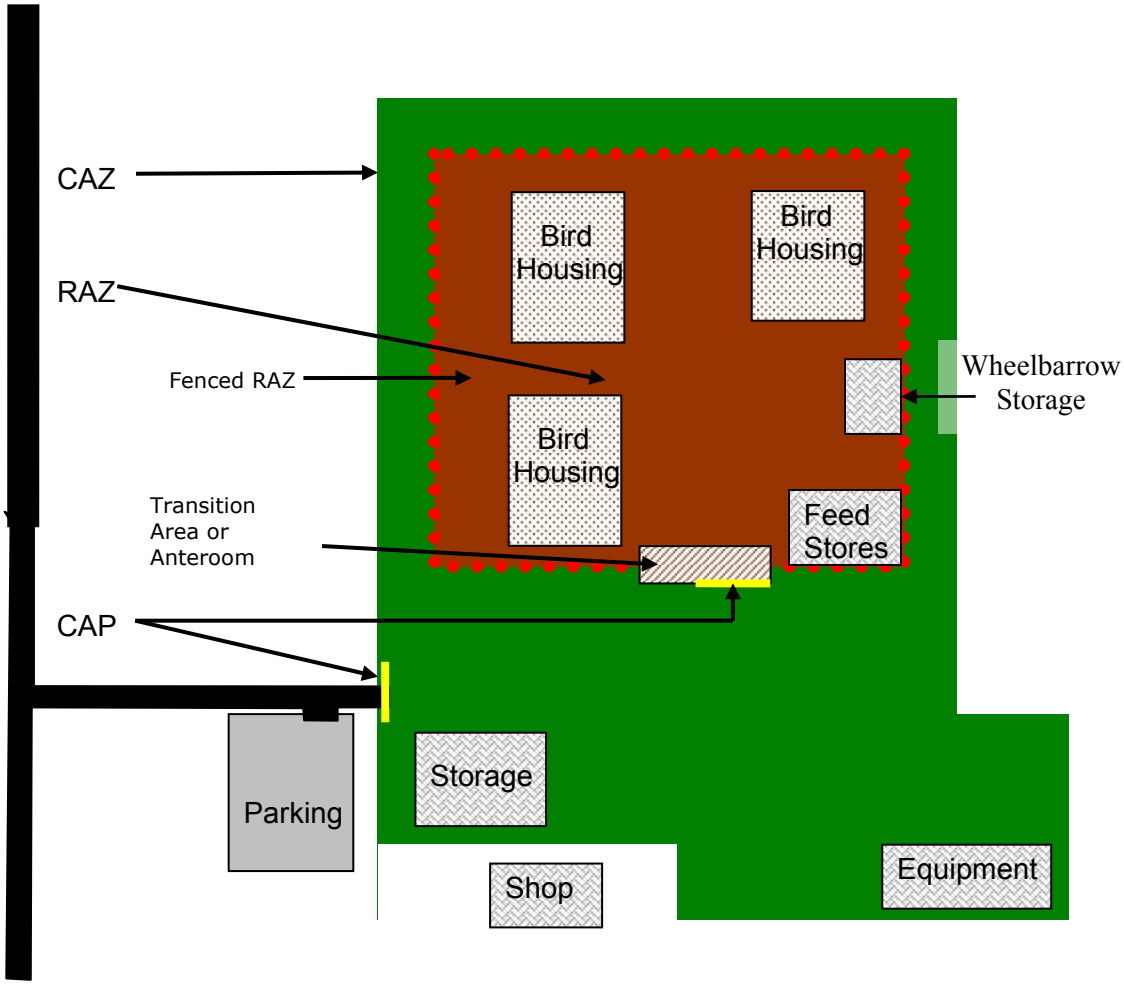
Concept 2 *One controlled access zone with multiple restricted access zones*



CAZ = controlled access zone RAZ = restricted access zone CAP = controlled access point

A larger and more complicated farm site may contain multiple barns, along with equipment and storage buildings. A separate RAZ and CAP have been established for each barn. Transition areas within the barn allow personnel to apply appropriate sanitary measures. One CAP provides access to the single CAZ. Parking is established outside the CAZ to reduce unnecessary traffic movements within the CAZ.

Concept 3 *One controlled access zone with a restricted access zone, containing multiple buildings and/or ranges*



CAZ = controlled access zone RAZ = restricted access zone CAP = controlled access point

A more complex farm site may contain multiple barns and/or ranges, along with equipment and storage buildings. One RAZ, as in this example, is not ideal for disease control; however, if the operation includes common equipment and personnel who are moving unrestricted among buildings, one RAZ, including all buildings and the area inside in which unrestricted movement occurs, may be the only alternative. In this setup, control of disease spread into and out of the complex is less effective than if each barn was a separate RAZ. Further, there is no control of disease spread between the barns. All barns would be of equal biosecurity status (i.e. as if they were all one barn). Entry into the RAZ is controlled by a CAP. This could be an anteroom setup for personnel and with cleaning and disinfecting capabilities for larger equipment. One CAP provides access to the single CAZ. Parking is established outside the CAZ to reduce unnecessary traffic movements within the CAZ.

1.1.2	*Target Outcome*
Visual indicators are in place to define the controlled access zone (CAZ) and the restricted access zone (RAZ).	

1.1.2	Producer Guidance

Recommendations for demarcating the CAZ

- Visually define the entrance (i.e. the CAP). This can be accomplished with signage and visual markers.

Ideally:

- The boundary of the CAZ would be readily distinguishable.
- Boundaries, such as the edge of a cultivated field, driveway, roadway, or the property edge, are used if possible. Boundaries might be distinguished by one or more of the following:
  - landscaping (grass cutting, gravel, pathways);
  - tree lines, posts, or other visual markers;
  - fencing;
  - signage.

Recommendations for demarcating the RAZ

- Establish a readily visible boundary. Typically, this would constitute the walls of the housing unit, but could be fencing or other physical barriers if the RAZ were to include more than the structure that is housing animals.
- Visually define the entrance (i.e. the CAP). This can be accomplished with signage and visual markers.

1.2 Entry, Movement, Exit Controls

1.2.1	*Target Outcome*
People who work on the premises are knowledgeable of and understand the importance of and rationale behind the CAZ and the RAZ.	

1.2.1	Producer Guidance

The people who access or work within the zones require a briefing to identify the measures in place regarding access control to the zones and why it is important that they be followed. People who work on the premises should have this covered as part of their training and/or briefing (according to Target Outcomes 3.6.1 and 3.6.2) before starting work. This Guide and the Standards document could be used as training aids. An annual review for people working on the premises would be beneficial.

Individuals who frequent the premises, but do not work within the zones, should understand the importance of avoiding an unintentional compromise of biosecurity. They should know not to enter the zones without being supervised or without having further training. They also need to take responsibility for any accompanying non-essential visitors.

1.2.2	*Target Outcome*
Access to the CAZ and RAZ is controlled by appropriate measures and routine procedures. Tools/equipment/facilities necessary to accomplish the established procedures are available, functional and maintained for their required purpose.	

1.2.2	Producer Guidance

The Controlled Access Points

The purpose of a CAP is to ensure CAZ and RAZ entry and exit is through a place where appropriate procedures can be applied to personnel, vehicles, equipment, and materials that may carry disease-causing agents to minimize disease spread. This may include cleaning and disinfection measures and/or clothing changes. The goal is to reduce pathogen transmission, primarily by mechanical means (common contact), enabling the CAZ and RAZ to be of a higher (more protected) health status than that of the outside environment.

Recommendations for establishing a CAP for the CAZ – physical structures, tools, equipment

- Create one primary CAP to the CAZ.
- Consider both the entrance and the exit as primary access points for premises that have a U-shaped access point, as they see the common flow of traffic on the premises.
- Limit the number of CAPs to ensure adequate maintenance and monitoring.
- Devise a method of blocking the entrance to the CAZ when needed (i.e. in a disease response situation) – a single laneway blocked by a wagon or other obstacle, for example.

Ideally:

- There is a lockable gate, chain, or other device that restricts access of vehicles and people.
- The barrier is kept closed, except when vehicles and personnel are entering or leaving.

- Post effective signage for CAPs (e.g. "Biosecurity is in effect in this area").
  - Signage might also state that permission is required to proceed (with contact information provided) or that staff accompaniment is required.

- It is recommended that signage outside the CAZ inform personnel of the procedures to follow for admittance, and include identification of the parking area.

Ideally:

- The surface of the CAP would be hard, impervious, and easy to clean with a broom, shovel, or pressure washer. Concrete or asphalt is ideal. Crushed rock is preferred over bare earth, but cannot be easily cleaned. Other options could be considered.
- Wash water would run off toward areas that provide natural filtration (grassy areas with vegetation) and would comply with applicable environmental regulations.
- CAPs would be equipped with cleaning and decontamination equipment. This includes materials that are adequate for the effective cleaning and decontamination of vehicular and foot traffic, as necessary. For example:
  - water (preferably hot);
  - equipment to wash hands (sanitizer) and footwear (brushes);
  - paper towels and garbage disposal;
  - dedicated footwear (rubber boots) and outwear (coveralls);
  - equipment or tools to remove caked-on material;
  - pressure washers with the ability to apply detergent and disinfectant (when necessary);
  - equipment to clean the decontamination station.
- CAP equipment (i.e. disinfectant, clothing, etc.) must be protected from the elements. A room, shed, or other structure at the CAP can be used for this purpose. For smaller operations, CAP equipment may be stored in large totes or bins.

Recommendations for movement control at the CAP to the CAZ

- Allow only essential personnel and vehicles to enter the CAZ.
- Ensure that vehicles are visibly clean and free of organic material.
- Take care to ensure that all traffic on the premises drives slowly to avoid disturbing dust.

Ideally, access to/exit from the CAZ would be controlled by the following:

- Supervised entry;
- Agreements with feed, veterinary, and other service providers on entry and premises biosecurity protocols, delivery schedules, etc.;

- Vehicles and/or equipment as follows:
  - For vehicles and equipment that are to remain in the CAZ, it may be sufficient that they are visibly clean and free from organic debris. Washing and disinfecting wheels and wheel wells is still a prudent measure.
  - At most access points, during summer and winter, cleaning may be accomplished with minimal equipment: a broom, shovel, and hand sprayer may be effective for the types of vehicles and dry roadway surfaces encountered. (A review of the frequency, type, cleanliness, and use of the vehicles and equipment entering the farm site would be required to implement this option.)
  - The sharing of equipment between premises and operations is not recommended.
  - Vehicles and equipment that have been directly exposed to poultry and/or manure from other premises will require full cleaning and disinfection. Optimally, this should be performed prior to vehicles and equipment leaving the premises where the exposure occurred to reduce the transmission of disease agents off-site. If this is not feasible, vehicles and equipment should be cleaned at the closest commercial wash station. On arrival at the next premises, minimal cleaning and disinfection would be required.
  - Vehicles and equipment that have visited other premises without direct exposure to poultry and/or manure require contact surfaces (e.g. tires) cleaned and disinfected.
  - Upon detection of serious contagious diseases within the local poultry population, all vehicles and equipment entering the CAZ should be cleaned and disinfected prior to entry and upon exit. When a disease alert has been issued, producers should request guidance on protocols from their veterinarian, poultry board or organization, and provincial or federal governments.

Ideally, all personnel would be required to wear CAZ-specific boots and clothing, or to use disposable coveralls and booties.

- Boot cleaning and/or the wearing of booties may be all that is necessary for visitors who are wearing clean clothing and who are moving through the CAZ directly to a RAZ where clothing and boot changes will be necessary, or who will be in the CAZ for a brief period and have not visited, nor will be visiting, any other agricultural premises that same day.

  Note: All visitors pose a risk to premises for disease carriage, but some visitors pose a higher risk than others. However, without requesting detailed information, risk cannot be adequately assessed. Always consider that visitors may be arriving from or going to other premises.

Recommendations for establishing a CAP for the RAZ – physical structures, tools, equipment

- Ensure that there is one primary CAP to the RAZ. If a secondary CAP is required, ensure it is adequately maintained and monitored.

- Use secure barriers (i.e. locked doors) to ensure the access through CAPs is restricted.
- Install visible signage at all CAPs to a RAZ, stating that it is a biosecurity restricted area, and to avoid entering unless authorized. Signage posted at the entrance should state "No Entry – Biosecurity in Effect," "Permission to Enter Required Past This Point," or wording with a similar meaning.

- Provide a transition area, preferably with an impervious, cleanable floor (e.g. concrete) and a roof, where transition area procedures can be applied to personnel and equipment entering and leaving the RAZ. An anteroom as a transition area is highly recommended.

- Equip the CAPs with RAZ-specific footwear and clothing plus equipment and materials for cleaning and/or decontamination foot traffic (also equipment and vehicles if applicable).

Recommendations for movement control at the CAP to the RAZ

- Limit access to the RAZ to only those individuals required for flock production or to essential visitors who have received instruction in appropriate biosecurity measures.

- Sanitize hands prior to entry and exit, before and after handling poultry, and especially after handling mortalities. Adequate hand sanitization is best accomplished by hand washing with soap and water, or if hands are suitably clean, a hand sanitizer or a pre-packaged alcohol hand wipe.

- Ensure that there is no common footwear contact between the CAZ and the RAZ.
  - Changing into specific barn footwear is ideal. Wearing disposable plastic overshoes is acceptable.
  - If this is not practical, boot dipping in well-maintained footbaths is a less desirable alternative option. (See Annex E for information on footwear sanitation.)

- Clean and disinfect equipment that enters the RAZ.

Note: Annex B provides a detailed set of barn access (entry and exit) procedures for personnel.

Ideally, at the access to/exit from the RAZ:

- Barn doors or range gates would be kept locked;
- The names and dates of essential visitors who enter the RAZ would be recorded; and
- Personnel would put on premises-specific clothing or appropriate protective clothing, such as disposable coveralls.

Additional considerations for personnel and visitors

Ensure those who enter your premises are not sick, and have not been in contact with poultry, livestock, pets, and/or people that are sick, especially those exhibiting clinical signs related to influenza virus.

People who have had **contact with poultry or poultry workers** from other farm sites during the preceding 48 hours need to ensure they have washed (preferably showered) and changed into clean clothing before entering the RAZ where live poultry are kept. Any clothing that is worn off-farm or when visiting other premises **is not acceptable** as premises-specific clothing.

People should not access barns other than the ones in which they are working.

Traffic flow of trucks or equipment should be regulated to limit the proximity of activities to other barns.

Non-essential visitors

People and their equipment that have no requirement to access the CAZ and RAZ include, but are not limited to, guests, friends, and family. If there is no necessity for production purposes, these visitors should not be allowed access into the CAZ and the RAZ.

Essential visitor: Any person who enters the CAZ or RAZ, other than personnel concerned with day-to-day poultry management on the premises.

Biosecurity measures that may be required of essential visitors – such as veterinarians, service and delivery people, suppliers and regulators – may include, but are not limited to the following:

- The owner or manager ensuring that all visitors and personnel entering or leaving the RAZ follow the designated biosecurity rules;
- Wearing RAZ-specific clothing and boots;
- The owner and/or a farm employee accompanying visitors who enter the CAZ and the RAZ (otherwise, the owner and/or farm employee must be confident that the visitor is aware of, and will implement, the farm's biosecurity procedures); and
- Signing and filling out the premises log book (with name, date, time of arrival, and contact information).

Ideally:

A more comprehensive visitor log is the preferred option and may also include the following:

- organization for which the visitor works;
- vehicle licence plate;
- purpose of visit;
- date of last contact with poultry;
- *location of previous premises visited;
- *next premises to be visited.

**These details are particularly important during a disease outbreak. The more information provided, the easier it is to trace movements that are a disease transmission risk.*

Catching crew, vaccination crew, and other comparable service providers

When live poultry remain in the RAZ, biosecurity measures that may be imposed for RAZ access include, but are not limited to the following:

- ensuring adequate equipment cleanliness;
- providing barn-specific equipment;
- all members of the crew wearing clean clothing or disposable cover-ups;
- all members of the crew cleaning and disinfecting boots or wearing disposable booties.

Egg pickup service providers:

- Access the egg storage room, using an exterior door to the location that eggs are stored via the anteroom.
- Clean, sanitize, and dry the equipment that is used for egg storage and transport prior to entry onto the premises.

The producer should strive to minimize the potential cross-contamination between the egg storage room and the rest of the production facility at all times. After eggs are picked up, the producer should ensure that the storage room is kept clean and tidy. The producer can sweep and spot clean areas, if necessary, to ensure that there is no accumulation of dust or egg residue.

Ideally:

- Boot cleaning and disinfection may be all that is necessary for egg pickup service providers moving, for a short period of time, into the egg storage room that is part of the CAZ.

- Washing and disinfecting the egg storage room can take place at the time of annual clean-out or prior to placing new birds. **Note:** For hatching eggs, the Canadian Hatching Egg Quality (CHEQ) Program recommends that egg room floors be cleaned weekly.

Section 2 Animal Health Management

2.1 Animal Introduction/Movement/Removal

2.1.1	Target Outcome

Each placement or removal of poultry is recorded and carried out with appropriate scheduling, isolation or segregation to minimize the introduction or spread of disease.

2.1.1 Producer Guidance

- Schedule movement of poultry to minimize potential exposure to other poultry on the premises.

> **Ideally:**
>
> **All in/all out –** All poultry within a new flock are placed in an empty RAZ within seven days. When the flock is removed from the RAZ, the process is again completed within seven days.
>
> "All in/all out" scheduling should occur, keeping the completion time of poultry arrival and shipment as short as possible, first within each barn and ideally within the entire premises.

- Consider taking additional precautions when "all in/all out" scheduling is not practised, as outlined in the guidance for Target Outcome 2.1.3. Specifically: poultry introduction, movement, and return; multi-species operations; multi-aged operations; inter- and intra-premises movement; and premises unit configurations and isolations.

- Source poultry from a hatchery that operates under a disease control program or from flocks that have current health records and no evidence of infectious disease. Flock health, vaccination, and veterinary inspection records should accompany all new poultry brought onto the premises.

- Keep poultry that are introduced or re-introduced into an existing flock separate for a quarantine period before introduction.

- Make available historical records of placement, introduction, and removal, and outline future scheduling. Records should be kept regardless of the shipment and movement practices on the premises.

> **Ideally:**
>
> Records should be kept for a minimum of one year, unless a longer period is specified by provincial or On-Farm Food Safety (OFFS) program requirements.

2.1.2	*Target Outcome*
The downtime between flocks is optimized in each barn.	

2.1.2	Producer Guidance

Definition:

Downtime: The time between flocks starting with a barn being emptied of birds and ending with the placement of new birds. It allows for the natural reduction in numbers of disease-causing micro-organisms within the barn. The effective period can be reduced by cleaning at the beginning of the period.

For each barn or production area, optimize downtime as follows:

- The text box below suggests a minimum downtime after the flock has been removed. It assumes flock removal is followed by dust blow-down and manure cleanout (dry cleaning). The addition of washing and disinfecting to the process may allow for an overall reduced downtime.
- If a reduced downtime period is unavoidable, add washing and disinfection to the process as soon as possible after shipment to allow for maximum downtime after being thoroughly cleaned and dry.
- Cold (particularly freezing temperatures), wet, or seasonal conditions can affect the practicality of washing, disinfection, and downtime. In these situations, slight alterations in routine cleaning and disinfection procedures or other options should be considered to meet production needs without compromising biosecurity. (Annex D provides information on cleaning barns in inclement conditions.)

Ideally:

- Have a downtime of 14 days after the flock has been removed to significantly reduce pathogen load.
- Dry clean after removing the birds, to reduce pathogen load further.
- Add washing and disinfection after dry cleaning to minimize pathogen load and, if necessary, allow for some reduction in the overall downtime (i.e. 7 to 10 days total downtime).
- If manure is not removed, schedule a downtime of at least 21 days. Composting the manure inside the barn or heat-treating by heating the barn (to 105F/40C for two days) will further reduce pathogen load and risk to the next flock.
- Schedule for the entire barn to be empty approximately once a year, with a full cleanout and downtime of 14 days (and if possible, keep the entire premises empty of live poultry for 14 days).

2.1.3	*Target Outcome*
More stringent additional biosecurity measures are implemented either at the barn or premises level where "all in/all out" scheduling and downtime is not practical.	

2.1.3	Producer Guidance

Areas where Target Outcomes 2.1.1 and 2.1.2 will not be met and which present an increased possibility of pathogen introduction:

- multi-age barns;
- multi-species operations;
- returning birds;
- staggered or phased live poultry introduction or removal into an established flock that includes the following:
  - partial flock shipment over a period greater than 7 days (e.g. heavy tom production [turkeys larger than 13.3 kg]);
  - introduction of spiking males into breeding flocks;
  - movement to another barn for further growth or egg production; and
  - proximity to shipping activities.

  Note: Repeated crew or transportation equipment and/or container contacts increase the risk of pathogen introduction to any remaining poultry; therefore, additional precautions are warranted.

The additional biosecurity measures that may be taken in association with moving or introducing poultry may include, but are not limited to the following:

- transporting all poultry that are moved from one barn to another or one flock to another in clean crates;
- ensuring that poultry introductions have equivalent vaccination history (levels) as resident flocks;
- scheduling all activities within the barns or between barns to start with the youngest poultry and to end with the oldest in any barns that contain multiple ages of poultry (with the exception of any quarantined birds, which would be attended last);
- increasing the monitoring of the flock after higher risk procedures (e.g. vaccinations, handling, and returning birds); and
- isolating (a separate RAZ) from resident flocks for 30 days:
  - all new poultry, if not shown to be disease free through participation in a testing or certification program;
  - returning show birds; and

- all poultry that have been treated with a live vaccine.

The biosecurity measures that require extra attention to ensure adequate biosecurity between subsequent flocks may include, but are not limited to the following:

- cleaning or disinfection procedures for personnel and equipment;
- manure movement, handling, storage, and spreading;
- completing all necessary repairs to the barn structure and equipment;
- cleaning floor of transition area, or cleaning barn anteroom, if applicable;
- removing dust and other debris from the barn exterior;
- pest control procedures;
- cleaning and disinfecting the barn after any disease outbreak prior to repopulation; and
- review of flock health, vaccination, and treatment programs with your veterinarian.

Note: Biosecurity measures may be applied to the premises level when there is more than one barn and when each barn is at a different stage of production.

The measures that should be taken to clearly separate each barn into separate isolation units include, but are not limited to the following:

- applying biosecurity measures between barns to enable barn segregation;
- regulating the flow of both pedestrian and vehicular traffic (in direction and/or timing) to provide the best order of operation to reduce possible cross-contamination and proximity to live poultry;
- paying particular attention to manure and mortality handling and route of travel to avoid cross-contamination to other barns still in production; and
- limiting the movement of equipment between barns, and cleaning and disinfecting all equipment that is moving between barns.

2.2 Ongoing Monitoring of Health Status and Response

2.2.1	*Target Outcome*
Individuals who monitor poultry are knowledgeable and experienced in monitoring flock health, the recognition of disease conditions, and timely response protocols.	

2.2.1	Producer Guidance

- People who work on the premises should be sufficiently trained and experienced to recognize sick and underperforming birds.
- People who work on the premises should be suitably trained and briefed to take necessary actions in cases where disease is suspected.
- Training people in the basics of good flock management practices will assist in their recognizing conditions that can predispose or contribute to flock illness. (See Annex D.)

The options for improving skills are as follows:

- attending seminars and/or workshops organized by government, veterinarians, or the poultry industry;
- descriptions and/or photographs of typical symptoms placed in anterooms, restrooms, etc.; and
- supervision by more experienced personnel.

Note: Target Outcome 3.1.1 outlines further guidance on training.

2.2.2	*Target Outcome*
Daily procedures for observation, and culling if necessary, are followed.	

2.2.2	Producer Guidance

- Conduct a walk-through of the barn and/or range area at least once daily, taking note of poultry behaviour and attitude, and the presence of culls or sick birds as follows:
  - In barns, walk along both sides and down the centre, ensuring that you look in corners, nest boxes, and covered areas.
  - In range areas, walking in an "S" or "X" shaped pattern can ensure good coverage of the flock.

  Note: It is ***highly recommended*** that this be done two or more times daily.
- Keep still at various points in the barn to allow the flock to settle, easing the observation of sick birds or unusual behaviour. This will also allow the observer to hear unusual sounds made by poultry with breathing difficulties.

- Ensure that lighting in the barn is adequate to allow all of the flock to be observed clearly.

> **Ideally:**
>
> Flock monitoring should be responsive to increased risk levels, and occur as follows:
>
> - during and after introduction of new stock,
> - following high-risk activities (e.g. visit from vaccination crew);
> - during seasonal or location risk; or
> - during a local outbreak, etc.

2.2.3 Target Outcome

A daily mortality log is maintained for each flock.

2.2.3 Producer Guidance

- Mortalities should be collected daily and the number recorded.
- As a minimum, mortality records should include the total number of dead birds found each day and should include birds that have been culled due to sickness symptoms.

Ideally:

It is recommended that mortality records are maintained as part of a more comprehensive flock health management record, elements of which include but are not limited to the following:

- daily observations of flock condition;
- daily morbidity and mortality counts;
- lists of all vaccines and medications given at the hatchery and the farm;
- lists of all diseases and syndromes that were diagnosed, medicated, or not;
- input and deliveries, including feed, suppliers, and chicks;
- output records (e.g. egg production);
- flock movements;
- feed and water consumption rates; and
- end of flock data.

2.2.4	*Target Outcome*

Unusual morbidity or mortality triggers contact with a veterinarian and disease diagnosis action. Suspicion of diseases that are contagious, of economic importance, or reportable triggers a "disease response plan" that provides guidance to individuals on the appropriate procedures to follow.

2.2.4 Producer Guidance

- Cull and remove from the flock those birds that are showing symptoms of sickness.
- Review feed and water consumption and, if necessary, collect feed and water samples.
- Initiate a call to a veterinarian for any evidence of disease symptoms, sudden rises in mortalities and/or sick birds, or unacceptable drops in feed and/or water consumption or egg production.

Ideally:

A veterinarian should be consulted if any of the following clinical signs are observed:

- loss of appetite;
- decreased egg production, and/or soft or misshapen eggs;
- lack of energy (depressed behaviour);
- diarrhea;
- coughing or sneezing (respiratory distress);
- swelling of tissues around eyes and neck;
- purple wattles and combs;
- abnormal neurological behaviour (muscular tremors, depression, drooping wings, twisting of heads and necks, lack of coordination, complete paralysis. etc.); or
- elevated mortalities.

All farms should:

- use the services of a veterinarian trained in poultry disease diagnosis;

- use the services of a veterinarian who has relevant post-graduate training and who demonstrates a current knowledge and understanding of poultry disease; or
- have access to technical services that are supported by veterinary expertise.

Records should be maintained when the veterinarian provides advice or recommendations on the health and welfare of the birds on the farm.

For example:

- The contact name and number of the veterinarian or veterinary clinic is available.
- The visitor log shows records of veterinary visits.
- The flock sheet, feed, and production records show any medications prescribed to birds.
- Diagnosed infectious or production-related diseases, copies of diagnostic reports, and prescriptions are kept on file, etc.

Disease response plan

- The owner and/or manager should be aware of his or her role in the Provincial Emergency Response Plan. This information may be obtained by contacting your veterinarian or a provincial board office (for supply-managed producers), or by attending an information session on this topic.
- If there is strong evidence of a highly infectious disease, producers should contact their veterinarian. Supply-managed producers should also contact their Provincial Board Office and follow any guidance provided.
- If a contagious disease of economic importance is suspected, enhanced biosecurity protocols should be initiated, and preparations for self-quarantine started. (See Annex C.)

An example of a disease diagnosis action plan:

Suspicious clinical signs or an unacceptable increase in unexplained mortalities is/are detected.
⇩
There is a self-imposed barn or premises isolation or containment (Annex C).
⇩
Access to the premises is restricted.
⇩
A veterinarian is called.
⇩
A contagious disease of economic importance is suspected.
(If a reportable disease is suspected, the veterinarian must notify the Canadian Food Inspection Agency [CFIA]).
⇩

Appropriate samples are collected for lab analysis and confirmation.
⇩
Self-declaration and notification of appropriate officials occur.
⇩
The current visitor log is reviewed for trace-back purposes.

Upon the suspicion of disease of economic importance, a self-quarantine or isolation protocol (Annex C) may include, but is not limited to the following:

- implementing enhanced biosecurity measures between barns and limiting access to the premises (particularly the CAZ);
- limiting movement between barns and off the premises;
- contacting a veterinarian and providing birds or samples, as needed, under veterinary consultation and following any veterinary advice;
- discussing the situation with family members and employees;
- postponing bird movements, vaccinations, etc.;
- reviewing flock health and mortality records;
- reviewing all visitor logs and delivery slips; and
- informing the necessary farm visitors, such as feed delivery, to schedule the affected farm as the last call of the day.

Section 3 Operational Management

3.1 Mortality and Manure Management

3.1.1 Target Outcome

Daily procedures are followed with respect to dead birds, including collection and removal from the production area.

3.1.1 Producer Guidance

Mortality management includes the activities below, all being performed in a biosecure manner:

- prompt collection of mortality;
- removal of mortality from contact with the flock; and
- disposal of mortality (reduced exposure to the flock).

Recognizing that production systems vary greatly, mortality management may occur as one seamless process or in a set of steps as follows:

- Remove dead birds from the production area at least daily. Use rubber or disposable gloves for this activity.

- Conduct the gathering and removal of dead birds separately from other bird or product handling operations.

- Ensure that routine hand-washing takes place, followed by the use of a sanitizer after any handling of mortalities.

- Ensure written instructions are available to staff, detailing procedural steps for mortality management.

- Remove mortalities from the RAZ in covered containers. In some instances, mortalities may be disposed of in the RAZ by way of composting or incineration. (See section 3.1.3 for additional information.)

Examples of acceptable containers include, but are not limited to, the following:

- a pail with a tight-fitting lid;
- empty feed bags;
- plastic bags;
- a labelled, closed cart set aside, specifically for the collection and movement of dead birds, etc.

3.1.2	*Target Outcome*
A dead poultry storage system, which protects the carcasses from scavengers and insects until final disposal, is utilized on the premises.	

3.1.2	Producer Guidance

- In some instances, mortality will be temporarily stored prior to final disposal.
- In mortality storage, the following are preferable:
  - Mortalities should be stored frozen. Mortalities that are not frozen should only be stored for short periods of time.
  - Storage should be located (sited) in a secure location away from the flock, feed, and water sources.
  - Access to the storage location should be controlled (restricted).
  - Storage should be in a manner that does not allow for escape of organic matter or exposure to the environment, and preferably in a sealable container.
  - Storage areas should be kept free of pests, rodents, or other vermin.
- Carcasses should be disposed of as soon as possible.
- Care should be taken to avoid accidental spillage of material from the carcass when in transit to the freezer or from freezer to final disposal site.
- All containers used to collect mortalities should be cleanable or disposable.

3.1.3	*Target Outcome*
Carcass disposal, including any on-farm disposal (incineration, composting and burial), is done in accordance with provincial or municipal guidelines. If a rendering service is utilized then the pickup is performed to minimize any biosecurity risk.	

3.1.3	Producer Guidance

Follow federal, provincial, and municipal rules at all times. They may limit options and placement.

- Avoid disposing carcasses near any food or water sources or poultry housing.
- Maintain biosecurity measures when disposing carcasses.
- Ensure that carcass disposal (no matter what method) takes place outside of the CAZ, with the exception of the collection of carcasses for rendering, freezing, or RAZ composting. (See subsequent sections, "Off-farm rendering" and "On-farm incineration.")
- Ensure, with the exception of off-farm rendering, that disposal sites are contained and demarcated. Some methods include fencing, signage and paint.
- Control access to carcass disposal site or area.

Off-farm rendering

- Store carcasses for rendering in a secure facility, and move to the access point or outside the CAZ when the rendering truck arrives or to a suitable container outside the CAZ for short-term holding, pending render pickup.
- Bring out the carcasses to the truck, upon arrival, in sealed, leak-proof containers.
- Clean and disinfect all containers, used to collect mortalities prior to their return into the CAZ and prior to re-entry into the RAZ.

On-farm incineration

- Keep incinerators clean and well maintained.
- Ensure that complete incineration occurs at every run.
- Avoid exceeding maximum capacity when running the incinerator.
- Do **not** locate newly installed incinerators on the same side of the barn as the air inlets.

Burial

- Cover carcasses with enough soil or other material (in accordance with local regulations) to prevent access from scavengers.
- Ensure that the burial site is in a location that is appropriate to soil type and water table.

Composters

- Design and operate composters, including composting performed in manure piles, in an effective manner. Producers should be aware of variables affecting the composting process that may require adjustment, including nutrient composition, added substrate, temperature, pH, volume (load), placement of carcasses, moisture levels, and the need to turn piles if temperatures are not achieved and sustained. (See Annex J.)
- Monitor temperatures to ensure that composting is working effectively.
- Maintain composters to minimize the attraction of flies, rodents, and other animals.

Note: In rare instances, where flock size, production type, and/or geography limit disposal options and flock disposal occurs inside the RAZ by way of incineration or composting, the disposal system must ensure containment of mortality and separation from the flock in a controlled area.

1. Physically separate the disposal system from the flock in an adjacent room or by a wall or barrier. This prevents exposure of the flock to pathogens in

dust, debris, organic material, secretion, or excretions etc., which may be released during the disposal process.

2. Ensure that the disposal system is the right size for the production type, volume, and mortality rates.

3. Plan for storage and/or access of substrates that may be required for the composting process.

4. Provide sufficient room for cleaning and storage of any dedicated equipment.

5. Ensure that separate mortality disposal systems are present for each RAZ.

6. Pay additional attention to pest management, as mortality can be an attractant for pests (flies, rodents, birds, and scavengers), which can transmit disease to the flock.

7. Recognize that mortality disposal systems inside the RAZ increase the risk of flock exposure to pathogens and require a higher level of management to ensure that disease transmission does not occur.

3.1.4 Target Outcome

Manure is suitably handled and stored to minimize the risk of transferring disease organisms to poultry flocks.

3.1.4 Producer Guidance

- Follow federal, provincial, and municipal rules at all times.
- When manure is stored in a pit under the production area, and live birds are to remain on site, consider this pit area as part of the CAZ. Any movement into the pit area requires biosecurity practices (i.e. change of footwear and clothing).
- Never use manure from an unknown or suspect source on the poultry farm. Avoid bringing any manure onto the farm, regardless of source.

Ideally:

- Manure is stored in a dry location and on a non-porous surface.
- Manure storage areas are controlled. These areas must be considered contaminated by contagious organisms. Limiting access to these areas will reduce disease transmission. They should be located away from barns to prevent transfer back into the barns by people, equipment, vehicles, or weather.
- Manure is composted before its removal from the premises or spreading onto land.

- Raw manure is not applied directly onto land. This is of significant concern if a disease outbreak has occurred recently in the barn.

3.2 Premises, Building, Equipment and Vehicle Sanitation

3.2.1 Target Outcome

A sanitation program is in place that applies to premises, building, equipment and vehicle sanitation.

3.2.1 Producer Guidance

- The basis of the premises biosecurity control measures for buildings, equipment, and vehicle sanitation should be a set of documented procedures that clearly specify the requirements to ensure that the appropriate standards of hygiene are maintained and that risk of contamination is minimized.

- These procedures should be followed at all times, with additional provisions if a disease outbreak occurs, either on the premises or within the region.

    - Always complete cleaning of surfaces before disinfection. Dust, manure, and other debris can act as a barrier and protect pathogens from disinfectants; therefore, cleaning first is essential. In any cleaning situation, if dry cleaning is followed by washing, the efficacy is improved.

    - Use only approved disinfection chemicals, at appropriate dilutions and not date-expired, when cleaning and disinfecting buildings or barns, equipment, and vehicles.

Ideally:

In a disease-response situation, washing and disinfection would become a necessity for all buildings, equipment, and vehicles. Cleaning processes would include vehicles coming onto the premises.

Barns

- Barns that have been emptied should be dry cleaned initially, followed by pressure washing and disinfection.

- Barn entryways, anterooms, egg rooms, and other service areas should be maintained clean and free of debris at all times.

- Barn exteriors, including the areas around fans and their housings, should be kept clean and free of debris.

- Where dirt floors exist, piling and composting of litter in the barn prior to removal, combined with heating the barn to 105F (40C) for two days, would reduce the risk of pathogen carry-over to the next flock. Every effort should be made to keep the rest of the barn clean.

Ideally:

- Surfaces in the barn are impermeable and can be cleaned, pressure washed or steam cleaned, and disinfected. (Disinfection is essential if a barn is being cleaned after a disease outbreak.)
- It is virtually impossible to clean or disinfect dirt floors. These should be avoided in the design of new barns.
- See Annex D for barn cleaning and disinfection in inclement weather.

Equipment

- Equipment should be selected for ease of cleaning.
- All equipment brought into the CAZ from outside should be clean, free from debris, and preferably disinfected. Disinfection is vital if equipment has had previous contact with manure or live birds, or if live birds remain on the premises.
- Equipment that is taken into a clean, disinfected barn should be cleaned and disinfected before entering the barn.
- Equipment moved between barns, within a single CAZ, should be free of visible contamination before being used in another barn.

Ideally:

- Most equipment used during production is dedicated to individual barns.
- Cleaning procedures for equipment and buildings include both dry cleaning and a wet cleaning process.
- Disinfection is performed following wet cleaning.

- Water lines should be flushed under high pressure and disinfected when barns are empty. It is recommended to flush lines on a regular schedule during production.
- Open drinkers in barns and range areas should be cleaned and disinfected regularly and left to dry before being reused.

Vehicles

- Ensure that all vehicles entering the CAZ are visibly clean.
- Clean vehicles that have had previous contact with poultry or manure off-site before entering the CAZ.
- Disinfect high-risk surfaces of vehicles before entry to and on exiting the CAZ. The high-risk areas are wheels, wheel wells, and surfaces that have been in contact with poultry or manure.
- Include the inside footrest area in the cleaning program when the driver or passengers have been to other sites with poultry present.

Ideally, or in response to a disease situation:

A cleaning program for vehicles would include the following:

- the physical removal of debris by washing with detergent and/or high pressure water;
- cleaning of the inside footrest area and steering wheel;
- disinfection of all outer surfaces of the vehicle;
- disinfection of wheel wells and tires before entry to and upon exiting the CAZ;
- appropriate disinfectant contact time before proceeding;
- vehicle washing area (concrete pad or other hard surface) cleaned of debris and disinfected between vehicles; and
- collection and containment of wash water and debris according to local/provincial regulations.

3.3 Facility Maintenance

3.3.1	*Target Outcome*
A program for facility maintenance is in place.	

3.3.1	Producer Guidance

Poultry production areas and equipment should be maintained and kept functioning properly to ensure the best environment for continued health and ease of cleaning.

- Ensure that ventilation, feed, and water systems are functioning correctly.
- Cover feed bins, and keep in good condition.

- Keep storage areas in good condition.
- Keep barn sides, roofs, and doors in good condition.
- Design, maintain, and manage the premises to prevent feeding, shelter, or access for pest species.
- Prevent wild birds and animals from entering the barn, and deter them from range areas. Pay specific attention to restriction of potential access points, such as windows, doors, pipes, walls, attics, vents, inlets, fans, etc.

3.4 Water/Feed/Bedding Management

3.4.1	*Target Outcome*
A water management program is in place to ensure that water is potable and meets local guidelines for poultry consumption.	

3.4.1	Producer Guidance

Water source

- Water provided to poultry should meet local guidelines for poultry consumption.
  - Municipal supplies should be deemed to meet this requirement.
  - Water from other sources should be analyzed yearly for bacterial content and other contaminating substances.
  - More frequent water testing may be required if a previous analysis failed to meet recommended guidelines or if advised by a veterinarian or municipality.

Water storage

When water is stored prior to use by poultry or between flock placements:

- cover the container to prevent contamination;
- ensure that water is appropriately treated; and
- demonstrate that the water meets the minimum guidelines for poultry consumption, as advised by the local authority, by conducting annual laboratory test results.

Water delivery

- Keep water delivery systems clean by routine flushing, descaling, and disinfecting of water lines and drinkers.
- Design and maintain drinkers to prevent contamination of water at the point of use (i.e. ensure that they are not prone to litter or feed contamination).

Water treatment

- Water treatment systems may be installed if the water source is suspect, or as a routine prevention method.
- Surface water sources pose significantly higher risk for introduction of infectious organisms and are not recommended for use without a functioning treatment system.
- At any time a treatment system is in use, it should be well maintained with chemicals used as directed. Chemical usage should be monitored and recorded.

3.4.2	*Target Outcome*
Feed is obtained and stored in a manner that minimizes the risk of contamination by pathogens.	

3.4.2	Producer Guidance

Obtaining feed

- Purchase finished feed from a source that can verify its safe origin, such as feed suppliers that follow established protocols under Hazard Analysis Critical Control Point (HACCP) or FeedAssure™ programs.
- Inform feed suppliers of premises' biosecurity procedures, and confirm their willingness to comply.
- Where practical, check feed condition and verify that it is pest-free on arrival. It is also good practice to keep feed samples, which can be tested if health problems later occur.
- Rotate newly purchased feed appropriately in order to use the oldest feed first.
- Avoid moving feed between farms.
- Take the necessary biosecurity precautions when moving feed from one premises to another. Only feed from the feed bin should be stored or moved off-farm. (Discard any feed within the Restricted Area [i.e. feed pans]). Other biosecurity measures may include the following: examination of feed for contaminates (mould, pests, manure, feces, etc.), examination of the transport vehicle, and personal cleaning and disinfection.

Feed storage

- Store feed in a dry, clean, and secure environment, away from wild birds and animals.
- Cover feed bins.
- Close feed systems.
- Empty feed lines, pans and troughs, boots, and hoppers at cleanout.

- Inspect feed routinely for moisture, spills, and pest activity.
- Quickly clean up and properly dispose of any feed spills.

3.4.3	*Target Outcome*
Bedding is obtained and stored in a manner that minimizes the risk of contamination by pathogens.	

3.4.3	Producer Guidance

- Inform bedding suppliers of premises' biosecurity procedures, and confirm their willingness to comply.
- Where appropriate, check incoming bedding materials on arrival for deterioration or pests, and keep it dry prior to use.

Ideally:

Bedding will be stored in a weatherproof and pest-controlled environment.

3.5 Pest Control Program

3.5.1	*Target Outcome*
An integrated pest control program is present.	

3.5.1	Producer Guidance

An effective integrated control program will ensure that the presence of potentially harmful pests, such as insects, rodents, and wild birds, is kept to a minimum.

General control methods for pests:

- don't attract;
- exclude (seal entry points);
- exterminate (bait or trap); and
- monitor for effectiveness and adjust.

These practices should be backed up by appropriate reduction methods, ongoing monitoring for pest activity, a response plan for signs of increased pest activity, and records of pest control activities, as follows:

- Ensure that the CAZ is free of debris, which might provide shelter for pests.
- Reduce or eliminate any features that could provide shelter, breeding grounds, roosts, nesting sites, or feed sources attractive to rodents and wild birds. For example:
  - nearby standing water;

- spilled feed;
- nearby manure storage;
- unsealed mortality storage;
- open compost; and
- any accumulation of debris or tall vegetation.

♦ Exclude predators and pets from the RAZ.

Rodent-specific points

♦ Maintain a 1m-wide (3 feet) rodent barrier strip – using shale, gravel, bare earth, or extremely short vegetation – around each barn, and ensure that it is free of debris.

♦ If possible, maintain an additional 3.5m (12 feet) zone, outside the rodent barrier strip, free of debris and tall vegetation.

♦ Position bait stations and traps close to barn walls at entry points around the barn perimeter and inside the service area.

♦ Renew or replace rodent baits regularly, according to the manufacturer's instructions.

♦ Ensure that rodenticides are approved, used in accordance with the label, and kept inaccessible to the flock.

Insect-specific points

♦ Position insect traps or electrocuting devices at insect entry points and in areas requiring specific control.

♦ Renew or replace insect-control products and devices regularly, according to manufacturer's instructions.

♦ Ensure that insecticides are approved for use near poultry.

Range-specific points

♦ Keep the range area free of debris that might shelter pests.

♦ Use closed or covered feeders and drinkers where possible. Moving feeders and drinkers regularly will help discourage pests.

♦ Have sufficient covered or roofed space to house all poultry at times of risk (an "enhanced biosecurity state").

> **Ideally:**
>
> The location will house poultry with sufficient space, no droppings will fall from overhead, and no small wild birds or rodents will have access. This could include housing with a solid roof and sides, but other materials, such as weld mesh, windbreak netting, and tarpaulins, are effective.

- Appropriate fencing, deterrent or scaring devices or traps (as per provincial guidelines) may be used for predator control.

  Ideally:

  - Construct fencing such that predators are unable to dig under the fence to gain entry or to climb over the top of the fence.
  - Ensure that the fence is of sufficient mesh size to stop predators from climbing through.

- Some pests may be more problematic in some regions or operations, due to differences in geography, climate, or building structure.
- Additional pests not listed here may require control measures to ensure adequate biosecurity.

3.5.2	*Target Outcome*
Garbage is effectively and safely disposed of.	

3.5.2	Producer Guidance

- Use garbage cans or bins with tight-fitting lids and that are lined inside with plastic bags to reduce odours (attractive to pests and predators) and to help keep the cans or bins clean.
- Provide garbage bins at the access points to the RAZ for disposable clothing and foot coverings.
- Keep garbage storage areas clean and maintained to limit insects, rodents, and scavengers.
- Position long-term garbage storage outside the CAZ.
- Dispose of garbage and household waste regularly, in accordance with provincial and municipal regulations.

3.6 Biosecurity Program and Training

3.6.1	*Target Outcome*
All people working on the premises are knowledgeable of, and understand the rationale behind and importance of, biosecurity and biosecurity protocols.	

3.6.1	Producer Guidance

- Owners or keepers of poultry should ensure that all family and other workers are adequately trained before starting work, and that they have a general understanding of the processes of biosecurity, not just measures related to their own tasks.

- Someone who is properly trained will adopt biosecurity procedures as routine and provide suggestions for improvement. Equally important is ensuring that contractors and visitors abide by the control practices.

- The Standards document and this Guide can be used as reference material for such training. Provincial agriculture extension or poultry industry information seminars and workshops may also be available.

- A record of training should be kept for each worker.

Examples of training include the following:

- attending seminars or workshops;
- working under direct supervision;
- reviewing written instructions, or standard operating procedures (SOPs) –Target Outcome 3.6.2 provides further guidance;
- training using the Standard and this Guide as a template; and
- formal qualifications.

Examples of records include the following:

- title and/or certificate of attendance for seminars, workshops, courses attended;
- individual training records, detailing training given and dates; and
- a signed confirmation from each staff member that SOPs have been read and understood.

3.6.2 Target Outcome

All people working on the premises have reviewed the applicable biosecurity-related instructions as needed, based on their assigned tasks.

3.6.2 Producer Guidance

Development of Standard Operating Procedures

To ensure people understand how to complete their assigned tasks, written instructions or SOPs should be developed. These are step-by-step explanations of how to perform a task from beginning to end.

- SOPs relating to flock health management should be developed with the input of a veterinarian.

Example:

SOPs for mortality handling and disposal should include the following:

- times for daily mortality collection;
- mortality handling procedures, including hand sanitation;
- mortality transfer from the RAZ to storage or disposal site;
- procedures for the removal of birds for off-site disposal; and
- compost procedures, including pest control, time spent at and temperature of the compost site (if composting is disposal method used).

Reviewing SOPs with staff

- Review written instructions annually with staff as re-training or as a reminder to ensure continuous improvement and quality control.
- Provide all farm staff with copies of, or access to, the SOPs.
- Review SOPs prior to new staff starting work.
- When work commences, review SOPs again with the new staff and address any questions.
- Display SOPs or procedures, with accompanying rationale, at the entrance to the RAZ or in employee rest areas.
- Update staff on changes to SOPs.

Ideally:

- SOPs will be reviewed annually for relevance and clarity of content.
- There will be SOPs including, but not limited to, the following:
  - access procedures for CAZ and RAZ;
  - moving between barns;
  - building cleaning and disinfection procedures;
  - vehicle and equipment cleaning and disinfection procedures;
  - the pest control program;
  - flock health monitoring and response;
  - mortality handling;
  - mortality disposal;
  - manure management; and
  - self-quarantine procedures (Annex C).

Glossary

Access point: A visually defined entry point(s) through which all traffic, such as workers, equipment, feed trucks, etc., will enter the CAZ and/or the RAZ.

Additional biosecurity measures: A level of biosecurity to be practised to mitigate situations where recommended practices cannot be followed. For example, where an "all in/all out" system is impossible (as in the case of a multi-age premises), additional biosecurity measures should be practised.

Anteroom: A room or area of a building which immediately precedes the restricted access zone (RAZ), providing a transition area from the controlled access zone (CAZ).

Approved: When used in reference to chemicals, such as rodenticides, it means approved by the appropriate regulatory authority for the specific usage mentioned in the text.

Beneficial practice: A management practice, technique or technology that, when adopted, results in improvement and increased sustainability of the operation.

Biosecurity program: A risk reduction program that conforms to Canadian Food Inspection Agency (CFIA) national standards and which is designed to prevent and control the introduction and spread of pathogens.

Clean: Free of any visible accumulation of organic matter and debris or other residues.

Complex: A collection of buildings and/or outdoor ranges that is or may be used directly for production.

Controlled access point: A visually defined entry point(s) through which all traffic, such as workers, equipment, feed trucks, etc., will enter the CAZ and/or the RAZ. It includes a transition area where procedures designed to minimize the spread of pathogens can occur.

Controlled access zone (CAZ): The area of land and buildings constituting the poultry production area of the premises that is accessible through a securable controlled access point. It excludes any residence and any other outbuildings that are not directly related to poultry production (e.g. machine sheds, storage sheds, workshops, etc).

Debris: Any material that may be capable of harbouring disease-causing organisms or pests, such as discarded equipment or machinery, manure, dead birds, or parts of dead birds, egg white, egg yolk, egg shells, feathers, and soil.

Disease response plan: A predetermined set of steps that is followed in the case of a significant disease occurrence. This response may be at the premises level by the production people, at the provincial level by the industry or provincial ministry, or at the national level in the case of reportable disease.

Disinfection: The application of a physical or chemical process to a surface for the purpose of destroying or inhibiting the activity of disease-causing micro-organisms.

Disposal (carcasses): Final removal of a bird carcass from the premises (by means of serviced rendering collection, composting, incineration, or burial).

Downtime: A period of time between flocks, starting with a barn being emptied of birds and ending with the placement of new birds. It allows for the natural reduction in numbers of disease-causing micro-organisms within the barn. The effective period can be reduced by cleaning at the beginning of the period.

Endemic diseases: Diseases that are regularly reoccurring or whose causative agent is constantly present with a region or population.

Enhanced biosecurity: At times when a disease outbreak is suspected on the premises or has been identified in the vicinity, additional biosecurity measures may be required, and increased emphasis placed on existing biosecurity procedures.

Essential visitors: Any person required to enter the RAZ, other than personnel concerned with day-to-day poultry production on the premises. Visitors include veterinarians, service and delivery people, suppliers, and regulators.

Exotic diseases: Infectious diseases that normally do not occur in the region, either because they have never been present there or because they were eradicated and then kept out by government control measures or agricultural practices.

Facility: Synonymous with "premises" (see below). May be used to refer to production areas on a premises.

Flock: A group of poultry managed as a distinct population.

Flock area: Area or range that (outdoor) poultry occupy.

Fomite: Any inanimate object or substance capable of carrying infectious organisms. This may include, but is not limited to, equipment, farm vehicles, and articles of clothing or shoes.

Isolation (or "segregation"): The status or practice of a bird, birds, or flock being kept physically separate from others (including direct and indirect contact). Usually performed for sick or returning animals.

Non-essential visitors: People and their equipment who do not require access to the CAZ and RAZ. These include, but are not limited to, guests, friends, and family.

Non-premises vehicles: Vehicles (cars, trucks, tractors, etc.) not owned or operated by the premises and not designated to the premises.

Pathogens: Biological agents, such as a bacteria or virus, that have the potential to cause diseases.

Potable: Suitable for drinking.

Poultry: All birds reared or kept in captivity for breeding, the production of eggs or meat for consumption, for production of other commercial products, for restocking supplies of game birds, or for breeding these categories of birds.

Poultry barn: Any structure that encloses poultry flocks, including sheds, runs, etc.

Premises (facility): A parcel of land with a continuous property boundary and defined by a legal land description or, in its absence, by geo-referenced coordinates, on which or on any part of which poultry are grown, kept, assembled, or disposed of.

Premises vehicles: Vehicles (cars, trucks, tractors, etc.) owned and operated by the premises and primarily designated to the premises.

Producer guidance: Examples and beneficial practices to facilitate achievement of the Standard.

Protocols: Effectively a code of conduct, defined procedure to be followed.

Range: A RAZ, allowing birds to roam freely within the confines of a perimeter.

Rendering: Using an off-farm service for the pickup and disposal of mortalities.

Reportable disease: A disease that must be immediately reported to the CFIA. Reportable diseases in poultry are avian influenza, virulent/exotic Newcastle disease, pullorum disease (*Salmonella pullorum*), and fowl typhoid (*Salmonella gallinarum*). These diseases are sometimes referred to as "foreign animal diseases."

Restricted access zone (RAZ): An area inside the CAZ that is used, or intended to be used, to house poultry, including semi-confined and range production, and where personnel and equipment access is more restricted than within the CAZ. The RAZ is sometimes also referred to as the "production area" or "restricted area" (RA) in other poultry production documents and guides.

Spiking males: Sexually mature male poultry introduced into a breeding flock to maintain fertility by boosting mating frequency.

Standard Operating Procedures (SOPs): Documented procedures based on generally accepted good practices that describe in detail the steps followed to meet an objective (for example, an SOP that details the barn cleaning and disinfection procedure).

Storage (carcasses): Temporary placement of bird carcasses into a sealable, leak-proof container until disposal.

Target outcome: The goal that all keepers of poultry, regardless of the size of their flock, should aim for to protect their flocks from the introduction and spread of avian diseases.

Transition area: An area where biosecurity procedures can occur for movement between the CAZ and the RAZ.

Annexes

Use of annexes

The information in the following annexes is not to be considered an official part of the *General Producer Guide*. The annexes have been provided for reference and example purposes only. The examples provided are not the only way to achieve the outcomes of the Guide; rather, they are intended to illustrate the flexibility and creativity that may be required given production variability.

Producers with any questions or concerns are advised to contact their national, provincial, or territorial boards. For further information, internet links have been provided at the end of each annex.

Annex A: Self-Evaluation Checklist

Section 1 Access Management

	Self Audit √ or X

1.1 Designation of Zones

1.1.1 Recognizable zones and access points are in place.	
1.1.2 Visual indicators are in place to define the controlled access zone (CAZ) and the restricted access zone (RAZ).	

1.2 Entry/Movement/Exit Controls

1.2.1 People who work on the premises are knowledgeable of and understand the importance of and rationale behind the CAZ and the RAZ.	

Section 2 Animal Health Management

2.1 Animal Introduction, Movement, Removal

2.1.1 Each placement or removal of poultry is recorded and carried out with appropriate scheduling, isolation or segregation to minimize the introduction or spread of disease.	
2.1.2 The downtime between flocks is optimized in each barn.	
2.1.3 More stringent additional biosecurity measures are implemented, either at the barn or premises level where "all in/all out" scheduling and downtime is not practical.	

2.2 Ongoing Monitoring of Health Status and Response

2.2.1 Individuals who monitor poultry are knowledgeable and experienced in monitoring flock health, the recognition of disease conditions, and timely response protocols.	
2.2.2 Daily procedures for observation, and culling if necessary, are followed.	
2.2.3 A daily mortality log is maintained for each flock.	
2.2.4 Unusual morbidity or mortality triggers contact with a veterinarian and disease diagnosis action. The suspicion of diseases that are contagious, of economic importance, or reportable triggers a "disease response plan" that provides guidance to individuals on the appropriate procedures to follow.	

Section 3 Operational Management

3.1 Mortality and Manure Management

Mortalities

3.1.1 Daily procedures are followed with respect to dead birds, including collection and removal from the production area.	
3.1.2 A dead poultry storage system, which protects the carcasses from scavengers and insects until final disposal, is utilized on the premises.	

3.1.3 Carcass disposal, including any on-farm disposal (incineration, composting and burial), is done in accordance with provincial or municipal guidelines. If a rendering service is utilized then the pickup is performed to minimize any biosecurity risk.	

Manure Management

3.1.4 Manure is suitably handled and stored to minimize the risk of transferring disease organisms to poultry flocks.	

3.2 Premises, Building, Equipment, and Vehicle Sanitation

3.2.1 A sanitation program is in place that applies to premises, building, equipment and vehicle sanitation.	

3.3 Facility Maintenance

3.3.1 A program for facility maintenance is in place.	

3.4 Water, Feed, Bedding Management

Water

3.4.1 A water management program is in place to ensure that water is potable and meets local guidelines for poultry consumption.	

Feed

3.4.2 Feed is obtained and stored in a manner that minimizes the risk of contamination by pathogens.	

Bedding

3.4.3 Bedding is obtained and stored in a manner that minimizes the risk of contamination by pathogens.	

3.5 Pest Control Program

3.5.1 An integrated pest control program is present.	

Garbage Management

3.5.2 Garbage is effectively and safely disposed.	

3.6 Biosecurity Program and Training

3.6.1 All people working on the premises are knowledgeable of, and understand the rationale behind and importance of, biosecurity and biosecurity protocols.	
3.6.2 All people working on the premises have reviewed the applicable biosecurity-related instructions as needed, based on their assigned tasks.	

Annex B: Sample Standard Operating Procedures – Procedures for Barn Entry and Exit

The following is an example of a set of procedures for minimizing disease carriage while moving personnel in and out of a barn. The process may vary among producers.

Irrespective of the method used, the goal is to create a separation between the internal environment (flock housing area) and the external environment (non-flock housing area).

Procedures for barn entry using an anteroom

- Ensure that outerwear and footwear entering an anteroom are visibly clean.

  (Ensure that premises-designated footwear and outwear worn in the CAZ is free of manure, soil, and organic debris. If not, prior to entering the anteroom, brush off outerwear, and remove soil and other organic material from footwear – use a boot pail with a brush and clean solution of disinfectant – paying particular attention to the tread.)

- Step into the anteroom.

- Remove outerwear (coats, sweaters, coveralls), and store in an area designated for outside clothing.

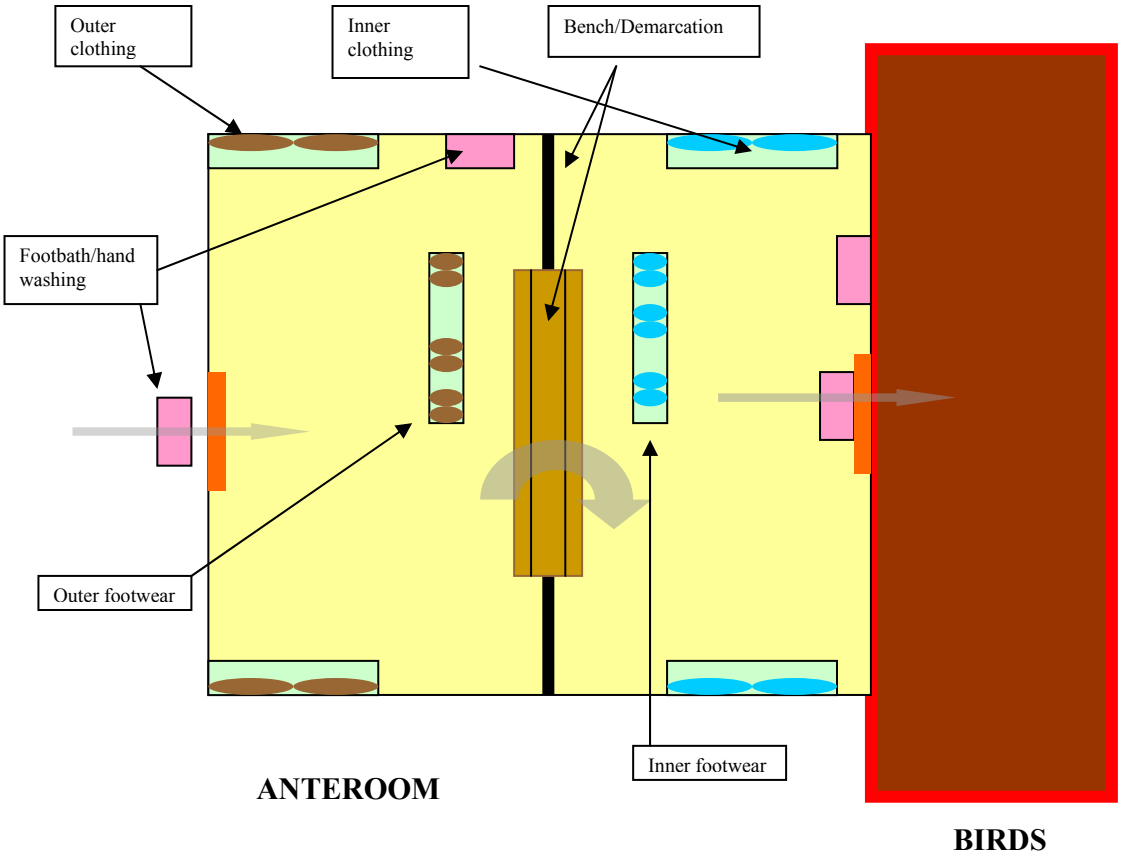
- Wash or sanitize hands.

- **Remove outside footwear**. Step over a demarcation line or barrier (bench, painted line), and **put on designated inside-barn footwear.**
  - In some instances, footwear will be removed, and staff will walk through a corridor or around a partition prior to donning the clean footwear.
  - Benches work well and allow staff to remove outerwear first, sitting on the bench to remove outside footwear, turning 180 degrees to face the barn door access and donning footwear and barn-designated gear.

- Put on barn-designated outerwear – coveralls, headcover, and gloves. (Wash hands again if clean gloves are not used.)

- Step into the bird housing area.

Note: Cleaning and disinfecting barn-designated boots prior to entering the bird housing area will provide an added layer of security, removing any contaminants that may have been carried into the anteroom.



Procedures for barn exit using an anteroom

- Brush or scrape off all organic material from barn-designated footwear before leaving the bird housing area.
- Step into a footbath containing disinfectant, ensuring the outside of the footwear is thoroughly covered by disinfectant, paying particular attention to the tread.
- Wash or sanitize hands, if possible.
- Remove outerwear (while still wearing gloves, if worn), being careful to avoid touching the inside of clothing or coveralls.
- Remove gloves.
- Remove footwear and step over line demarcation on the floor, and put on outside footwear.
    - If a bench is being used, sit down and remove barn-designated footwear, turn 180 degrees, and put on outside-designated footwear.

- If a corridor system is used, walk the length of the corridor and into the clean area before putting on outside-designated footwear.

- Wash or sanitize hands.

- Put on outside clothing, step through a footbath, and depart.

Further information:

New Zealand Poultry Industry – Broiler Biosecurity Manual
http://www.kkgm.gov.tr/TR_06_AI_SV_new/English/Compartmentalisation/07BiosecurityManuals/NZBiosecmanualVersion_1.pdf

BC Agricultural Research and Development Corporation
www.ardcorp.ca

BC Agriculture Council
www.bcac.bc.ca

Canadian Poultry Consultants Ltd.
www.canadianpoultry.ca/biosecurity_at_all_levels.htm

University of Minnesota
www.ansci.umn.edu/poultry/resources/biosecurity.htm

North Carolina College Poultry Science
www.ces.ncsu.edu/depts/poulsci/tech_info.html

The Poultry Site
www.thepoultrysite.com/articles/817/small-flock-biosecurity

Agbiosecurity
www.agbiosecurity.ca/aspx/public/main.aspx

Annex C: Producer Self-Quarantine Protocol

Dr. Victoria Bowes, B.C. Ministry of Agriculture, Food and Fisheries

This protocol presents to the producer a course of action during the suspicion of an infectious disease. This plan is an excellent example of procedure, but other protocols regarding quarantine and infectious disease do exist. It is recommended that all producers are familiar with local or industry-accepted procedures.

Background

Upon the **suspicion** of an infectious disease in a poultry flock, the following set of guidelines should be followed by the producer. The intention of this protocol is to limit the spread of disease between barns and, most importantly, the spread of disease off-farm.

Situation: There has been an ***unexplained***

- increase in mortality;
- change in production parameters, such as feed or water consumption, egg production, or shell quality, etc.; or
- onset of clinical signs of disease.

Action plan

1) Obtain an answer

a) Start your own on-farm investigation. Gather together all relevant documents, including health records of all flocks currently on the farm.

b) Call your veterinarian with a complete description of the problem, including time of onset, duration, and whether things are getting worse or resolving over time. Offer your suspicions as to your thoughts on what the problem might be.

c) Review and provide copies of production and mortality records.

d) Provide representative birds and/or samples for diagnostic investigation:
   i) Call in your veterinarian to do on-farm necropsy and sampling techniques.
   ii) Take birds and/or samples to a local poultry veterinarian and/or to the Vet Lab. (**Note:** there may be special precautions required when moving birds and/or samples off-farm. Consult your veterinarian for proper procedures.)

2) While you wait

a) Follow the advice of your veterinarian, which may involve interim treatment of the flock, based upon the disease suspected.

b) Review and list the on-farm traffic, visitors, and bird movements in the previous 10 days. Refer to visitor log.

c) Immediately adopt enhanced biosecurity protocols. Service unaffected barns first and/or dedicate a specific employee to the affected barn(s).

(**Note:** Enhanced biosecurity protocols should be prepared beforehand, in consultation with your veterinarian.)

d) Immediately restrict on- and off-farm access by locking gates and requiring phone-ahead pre-arrangements for deliveries and pickups. Suspend all unnecessary traffic.

e) Inform all family members and employees of the situation. Request confidentiality until diagnosis is confirmed.

f) Follow strict personal biosecurity procedures for leaving the farm (e.g. non-farm clothing, footwear, and vehicle), especially if meeting with other poultry industry members, even socially.

g) Postpone scheduled vaccinations until a diagnosis is confirmed.

h) Postpone movements of any birds on or off-farm.

i) Dispose of dead or culled birds, using an approved method: on-farm is preferable; composting or incineration is recommended. Treat as infectious material.

j) If there is a **strong suspicion** of a highly infectious disease, such as infectious laryngotracheitis (ILT), pox, avian infectious bronchitis (IBV), or avian influenza (AI), based on the visible lesions found at necropsy but before laboratory confirmation, request that the feed or egg truck make your farm the last stop of the day.

3) When a diagnosis is confirmed

a) If the diagnosis confirms a "reportable" disease, either the CFIA (federal disease) or your producer association (provincial disease), will have been informed at the same time. Follow up. Prepare records and notes for review.

b) In the case of a "reportable" disease, follow the directions and recommendations of the regulatory agency, but do not hesitate to ask questions.

c) Modify or initiate treatment of flock as directed by your poultry veterinarian.

d) Follow enhanced on-farm biosecurity procedures for at least 10 to 14 days following the end of treatment or the resolution of clinical signs.

e) If they have not already been informed, update your service industry representatives and producer groups of the diagnosis and the measures undertaken for containment.

f) If practical, inform neighbouring poultry operations.

g) If appropriate, make provisions for birds moving directly to slaughter, in which case the processor should be informed.

h) Recommended: Post enhanced biosecurity signs at gates, indicating that an infectious disease has been diagnosed and that access is restricted.

4) Getting back to normal

a) Enhance the regular on-farm cleaning and disinfection procedures for the affected barns. Extend clean "downtime" as long as possible.

b) Continue to monitor for disease reoccurrence in the same or subsequent flocks, watch for clinical signs, and submit follow-up samples.

c) Record the event in the production records with as much detail as possible.

d) Return to regular biosecurity measures.

Important note:

Pathogenic Newcastle disease (NDV), avian influenza (AI) and *Salmonella pullorum* & *gallinarum* are federally reportable diseases. The CFIA has developed disease response plans and strategies for these diseases upon their identification in domestic flocks.

The national immediately notifiable diseases are infectious laryngotracheitis (ILT), avian cholera (pasteurellosis), chlamydiosis (psittacosis, ornithosis), duck hepatitis, avian encephalomyelitis, egg drop syndrome (avian adenovirus), goose parvovirus infection (Derzsy's disease), and turkey rhinotracheitis (avian pneumovirus, swollen head syndrome). The CFIA must be notified if these diseases occur; however, limited action is taken, and only with respect to certification of meat product for export to certain countries.

Specific provinces have a list of provincially notifiable diseases that are of significant economic concern, and there may be specific action response plans to the occurrence at the industry level or mandated by the provincial government. The most common ones are infectious laryngotracheitis (ILT) and mycoplasma in breeder birds and turkeys.

All other diseases are "unregulated" and are a private issue between you and your veterinarian. Your confidentiality will be respected, but your cooperation in informing your industry service representatives of a potential infectious disease problem is encouraged and appreciated.

It's the right thing to do!

Further information:

Producer Self Quarantine Policy
www.poultryindustrycouncil.ca/education/factsheets-health.php?subaction=showfull&id=1255894969&archive=&start_from=&ucat=4&

BC Agriculture Council
www.bcac.bc.ca

Annex D: Barn Cleaning and Disinfection in Inclement Weather

Freezing temperatures

- Place additional emphasis on dry cleaning to reduce the time required for wet cleaning.
- Provide supplementary heat to raise barn temperatures to allow wet cleaning and disinfection to occur.
- Focus on critical areas where birds are housed to reduce the volume of water applied: bird contact areas (floors, nest boxes, cages, walls to a height of three feet, feeders, and waterers). Dry clean the ventilation system.
- Add propylene glycol, and use machines capable of heating water, to increase the effectiveness of detergents and disinfectants and to prevent wash and disinfectant solutions from freezing.
- Increase the surface contact time for disinfectants.
- If wet cleaning cannot be performed, thoroughly dry clean the barn, and raise and maintain barn temperatures; this can be effective at inactivating pathogens. The temperature and time required for pathogen inactivation vary for different organisms and should be discussed with your veterinarian.
- Thoroughly drying the barn after any cleaning stage is important for pathogen inactivation.

Cold and wet weather

- Raise barn temperatures.
- Use warm to hot water when using detergents and disinfectants.
- Increase the concentration and surface contact time of the disinfectant. Rain and wet surfaces can significantly reduce the concentration of cleaning and disinfectant solutions.

Additional measures

- Disinfectant fogging, disinfectant foam, fumigation, and steam cleaning are measures that may be employed in adverse weather conditions.
- Steam cleaning can reduce the amount of water required and increases temperature to reduce pathogen load.
- Consult with commercial cleaning companies, disinfectant manufacturers, industry experts, and veterinary professionals on sanitation measures when environmental conditions impair routine cleaning and disinfection.

Annex E: Footwear Sanitation

Footwear sanitation is vital for a strong biosecurity program. As visitors or employees, people can enter a premises and have no physical contact with structures or animals, except for footwear. The process of footwear sanitation, and the best method for your premises, are worth investigating.

Generally, there are three approaches to footwear sanitation: premises-dedicated footwear, disposable foot coverings, and footbaths.

Premises-dedicated footwear

Having several pairs of footwear for employees and visitors is an option. Regardless of the type of footwear, it is important to follow two important guidelines:

1. The footwear does not leave the biosecurity zone to which it is dedicated; and
2. The footwear is sanitized on a routine basis.

Generally, the use of dedicated footwear will require an anteroom process (described in Annex B).

Disposable foot coverings

Disposable foot coverings can be a relatively cheap method of footwear sanitation. Before entering a premises or biosecurity zone, foot covers are placed over footwear. Upon exit from the biosecurity zone, the foot covers are removed and disposed of.

Some advantages to foot covers:

- They are inexpensive.
- The covers never leave the site.
- They are small, lightweight, and compact, making it easy to store them at each biosecurity access point.
- They are quick and easy to use.

Some disadvantages:

- They are easily torn.
- Outside footwear is worn in biosecurity zones.
- They require biosecure disposal.

Some of these disadvantages can be counteracted by cleaning, disinfecting, and drying outside footwear before the coverings are put on.

Footbaths

Note: The use of footbaths is not promoted by On-Farm Food Safety (OFFS) programs, due to the high degree of maintenance required for efficacy and the potential for creating disease reservoirs. It is widely accepted that footbaths are most effective in clean areas and that they should always be used in combination with other preventative actions.

Some advantages to foot baths:

- They are easy to use and inexpensive.
- The optics of having a footbath in front of an entrance encourages its use.
- If used correctly, all surfaces, including deep treads, are exposed to disinfectant.

Some disadvantages:

- They are high maintenance, in that footbaths need to be monitored closely. Disinfectant solutions should be changed routinely and the container cleaned on a regular basis.
- Contact time is required for effective sanitation.
- Depending on the disinfectant used and its concentration, footbaths may be ineffective against all pathogens of concern.
- Some disinfectants are expensive.

If footbaths are the chosen option for your premises, it is important to understand the process required for their effective use. The four steps for footwear sanitation using a footbath are as follows:

1) Remove visible debris from the footwear. This requires the physical removal of dirt, mud, manure, etc., using equipment such as a boot brush. Pay extra attention to treads.

2) Wash footwear with a detergent. This step removes any oils, grease, or bio-films that may be invisible.

3) Apply disinfectant. (This is the process of stepping into the footbath.)

4) Ensure appropriate contact time. To be effective, the disinfectant should be in contact with the surfaces of the footwear for a period of time. Most manufacturers provided this information on the disinfectant's container. Depending on the concentration and pathogen, the time is generally about 10 minutes.

Further information:

University of California – Division of Agriculture and Natural Resources
http://cetuolumne.ucdavis.edu/files/52532.pdf

Annex F: Sample Standard Operating Procedures – Using Footbaths

The following procedure is for use by all persons entering and exiting a biosecurity zone requiring footwear sanitation.

1. Remove visible debris from footwear, using the provided equipment (boot brush).

2. Wash footwear with the water and detergent provided. Pay extra attention to treads.

3. Step into the footbath, completely submersing the footwear for 5 to 10 seconds.

4. Exit the footbath.

5. Wait for (required time as recommended by manufacturer) before proceeding.

Further information:

University of California – Division of Agriculture and Natural Resources
http://cetuolumne.ucdavis.edu/files/52532.pdf

Annex G: Sample Standard Operating Procedures – Footbath Maintenance

Footbaths are to be controlled using the following monitoring schedule:

1. Clean and maintain footbaths every **Thursday** before end of day.

2. Check footbaths daily before start of day.

3. If a footbath requires cleaning or recharging, do so immediately.

The following seven steps are to be carried out as required by the footbath monitoring schedule:

1. Empty the used disinfectant into a bucket.

2. Wash the footbath container with hot soap and water.

3. Empty the used soap and water into the bucket containing the used disinfectant.

4. Rinse.

5. Empty the rinse water into the bucket.

6. Recharge the footbath with fresh disinfectant at the desired concentration.

7. Dispose of the water and used disinfectant in the bucket. (This is site specific, but should occur without crossing biosecurity zones.)

Further information:

University of California – Division of Agriculture and Natural Resources
http://cetuolumne.ucdavis.edu/files/52532.pdf

Annex H: Sample Mortality Log

Several examples can be found in the BC Poultry Reference Guide Appendix
www.kkgm.gov.tr/TR_06_AI_SV_new/English/Compartmentalisation/07BiosecurityManuals/BCManualAppendixAll.pdf

Annex I: Disinfectants

Terminology

"Disinfectants" are chemical compounds applied to inanimate (non-living) objects to destroy or irreversibly inactivate disease-causing organisms.

"Disinfection" refers to the inactivation of disease causing organisms and includes but is not limited to chemicals, heat, and ultraviolet light.

Product regulation

Health Canada regulates the registration of disinfectants in Canada and provides a Drug Identification Number (DIN) prior to their marketing; this number will be listed on the disinfectant container.

Selecting a disinfectant

Disinfectants are evaluated by Health Canada using strict criteria; however, efficacy is determined under controlled laboratory conditions, and the use of disinfectants on a farm site requires that they be used according to the manufacturer's recommendations. Disinfectant selection is based on a variety of factors, including the following:

- the chemical properties of the disinfectant;
- the type(s) of organism targeted for inactivation;
- the cleanliness of materials to be disinfected;
- the composition (e.g. wood, metal, rubber) of the surface to be disinfected;
- the temperature of surfaces and disinfectant;
- contact time;
- concentration;
- application method;
- the presence or use of other chemicals;
- pH;
- characteristics of the water (presence of dissolved solids, degree of contamination);
- environmental considerations (the presence of streams and wildlife); and
- cost.

These factors will affect the likelihood of a disinfectant performing as indicated by the manufacturer.

Choose broad-spectrum disinfectants with minimal toxicity that are easy to apply and that are effective under a variety of environmental conditions.

Disinfectant storage

Disinfectants have different shelf lives, depending on the chemical composition of the product, and often have a "best before" date. Chemicals degrade over time, reducing the effectiveness of the product: this often accelerates after a product has been opened. Use unexpired disinfectants and ensure lids, tops, bags are securely fastened for storage. Store in cool, dry, dark areas or according to manufacturer's recommendations.

Disinfectant application

Disinfectants are most effective when applied to clean, dry surfaces. Organic material (litter, soil, manure, etc.) on equipment, boots, and structures significantly reduces the activity of disinfectants, so these surfaces must be cleaned prior to disinfectant application.

Follow the manufacturer's recommendations for application, paying strict attention to the concentration required and contact time. Some disinfectants require rinsing as their final step. Follow local government regulations regarding the application of disinfectants to ensure compliance with environmental legislation.

Once disinfectants are mixed with water or other chemicals, their shelf life decreases dramatically, so they must be replenished regularly. This may be daily for some products and weekly for others.

Disinfectants used for cleaning boots and other heavily contaminated equipment must be replenished frequently and are only effective if properly applied; boot baths or dips with disinfectants are often heavily contaminated with disease-causing agents, are ineffective, and must be used with caution.

Further information:

Health Canada
www.hc-sc.gc.ca/dhp-mps/prodpharma/applic-demande/guide-ld/disinfect-desinfect/index-eng.php

Centers for Security and Public Health
www.cfsph.iastate.edu/BRM/resources/Disinfectants/Disinfection101Feb2005.pdf

Annex J: Impact of Federal Disease Control and Response Measures – Producer Considerations for Premises Design and Procedures

As mentioned in Annex C, the CFIA has developed disease control and response plans to address detections of federally reportable diseases. The measures applied differ, depending on the disease detected; however, the strategies are generally aimed at eradicating the disease, and restoring Canada's "disease-free" status as quickly as possible.

Premises actions

In most instances, where contagious diseases are detected on a site, the CFIA will declare the entire premises "infected," as per the *Health of Animals Act*. This allows control measures to be applied to all structures, equipment, animals, animal products and by-products etc. to prevent disease transmission off-site. The design of the site and procedures used can affect where and how control measures are applied.

Control measures often include the following:

- movement controls;
- surveillance (testing for disease);
- humane destruction of infected flocks;
- disposal of infected and contaminated carcasses, animal products and by-products, materials and other objects;
- cleaning and disinfection of the infected premises;
- compensation payments; and
- recovery procedures to allow restocking.

The CFIA will conduct epidemiological investigations, which include, but are not limited to, determining the source of infection, determining methods of transmission, and identifying locations where disease may have been transmitted (significant risk contacts).

Premises design

Upon suspicion or detection of a federally reportable disease on a poultry premises, all areas of the premises, equipment, and materials used in raising, caring for or handling poultry, their products and by-products would be deemed "infected" by the CFIA. This includes barns, composting areas, manure storage, vehicles, equipment, etc. Producers should be aware that the locations of structures on their sites will affect control actions taken, as follows.

Location of flock housing

Housing areas (barns, open ranges) located in close proximity to each other on the same legal land description will often be treated under one CFIA declaration of an "infected premises"; disease identified in one housing area will result in disease control measures being applied to all housing areas on the site. Barns or housing areas located on a different premises that have shared equipment, staff, animals, or other potential carriers of disease would also be declared infected, and control measures would be applied.

If a producer can establish that a different but co-owned premises is epidemiologically distinct (with no cross utilization of staff or equipment, no link due to movement of animals, etc.), these sites would be monitored for disease. Reduced control actions may be applied to separate barns on an infected site if there is sufficient physical separation and they are epidemiologically distinct. Flocks which have significant value (breeder flocks, flocks with rare/unique genetics) should be located on a different premises from that of the main flock, and measures employed to ensure there are no epidemiological linkages between them.

Location of compost and manure

Compost and manure are considered as potentially contaminated with disease organisms. Access to areas where they are stored should be controlled. These areas should be located far enough from flock housing areas to eliminate the risk of disease introduction to the flock, and managed to prevent disease release. If central manure and compost sites are used – with the movement of all manure and litter from different barns and/or other sites to one location – the detection of disease in any barn or any site will result in control actions being applied to the central areas.

Note: This information is provided for information purposes only; disease response and control actions vary depending on the nature of the pathogenic agent, the course of an outbreak, and the geographic and demographic location of the outbreak.