



The European Agricultural Fund  
for Rural Development:  
Europe investing in rural areas

# Stopping infection and preventing disease



**This document describes the fundamentals, and explains how infection can be stopped and diseases prevented. It includes measures for preventing infection from reaching the herd, and for reducing its spread on the farm. In addition, it gives recommendations that can be used in day-to-day work to maintain a healthy environment for the animals. A healthy environment for animals is also a healthy workplace for people.**

## Introduction

In Sweden, we have a uniquely good status regarding diseases that spread between animals. Many diseases that are common in other countries are rare or completely absent here. This has been brought about by a sustained and painstaking effort to systematically eradicate certain very costly diseases, such as bovine leukosis, brucellosis and bovine viral diarrhoea (BVD). We also have a good status regarding diseases that can spread between animals and humans, known as zoonoses. The incidence of salmonella, for example, is extremely low in Swedish livestock farming. In Sweden, the authorities guarantee food is salmonella-free.

Since 1988, there has been a law in Sweden that governs how animals are to be kept and cared for: the Animal Welfare Act. It states that "Animals shall be treated well and protected from unnecessary suffering and illness". This means the animal owner is obliged to give their animals good care and, as far as possible, prevent them from getting sick. It also means that sick animals are to be treated and given additional care to prevent unnecessary suffering. An important way to prevent disease is to prevent infection.

### Animal health affects the enterprise

Animal health has a major impact on the enterprise's finances. Disease incurs direct costs in the form of veterinary consultations, testing and treatments. In addition, sick animals require more care and they disrupt flows in routines. This means more time spent working in the cattle barn. When animals are affected so severely that they die or are destroyed on the farm, removing the fallen stock incurs costs and the slaughter income is lost.

Sick animals also incur indirect costs for the enterprise through lost income. This is obvious for milk producers, because they cannot supply milk to the dairy while the cow is being treated. The income from milk is lost throughout the drug's withdrawal period. Other losses are less obvious, but sick animals are less productive than expected: their growth is poor, their fertility is impaired and their milk production is reduced in the long term. Prolonged illness among the animals can have far-reaching consequences for the enterprise's growth potential.

According to calculations carried out under Swedish conditions, the cost of sick animals is 30 öre (1 öre = SEK 0.01) per kilo of milk for a normal herd. Costs for farms with good animal health and high animal welfare (the best 10%) are only half that, i.e. 15 öre per kilo. The worst farms can have costs of over 100 öre per kilo of milk. The graphic comes from Kokontrollen, the Swedish online reporting system for milk production. It illustrates the distribution of costs for all herds in the programme. When a farm wants to see how they are doing, the indicator points to a figure in öre/kg ECM calculated from

### Extract from Sweden's Animal Welfare Act

#### Fundamental provisions concerning how animals are to be kept and cared for

**2 §** Animals shall be treated well and protected against unnecessary suffering and illness.

**3 §** Animals shall be given sufficient feed and water and sufficient supervision. The feed and water shall be of good quality and appropriate for the species.

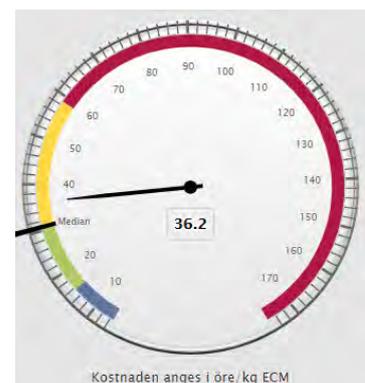
Stalls and other animal housing (...) shall provide the animals with sufficient space and protection. Stalls and other animal housing shall be kept clean.

**4 §** Animals shall be kept and cared for in a good animal environment and in a way that promotes their health and enables them to behave naturally.

**5 §** Animals must not be overworked.

Nor must they be beaten or driven with implements that might easily hurt or otherwise harm the animal.

**9 §** If an animal is sick, injured or in some other way shows signs of illness in its behaviour, the animal shall promptly be given the appropriate treatment, if necessary by a veterinarian, or other measures taken, unless the disease or injury is so severe that the animal must be destroyed immediately.



the farm's statistics on fertility, animal health and mortality. The example shows a farm with a cost of 36.2 öre/kg ECM. This is therefore just over 6 öre more than the median herd. Based on the farm's production of 700,000 kg ECM/year, improvement to the median would correspond to SEK 43,400. This indicates the farm's financial headroom for working more hours or investing to reduce ill health and improve the welfare of the animals.

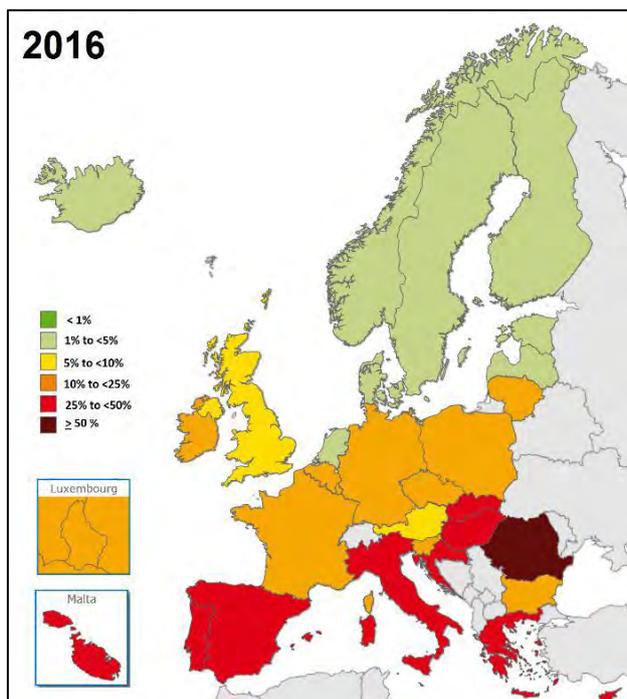
## Healthy animals do not need antibiotics

Many infectious diseases caused by bacteria are treated with antibiotics to enable the animals to recover. Bacteria can develop resistance to the antibiotic being used. The treatment then no longer works, and resistant bacteria can spread from the animal where resistance arose to other animals and to humans. The risk of bacteria developing resistance increases if the total amount of antibiotics used throughout society, for both animals and humans, is high. Another risk factor is the use of antibiotics that are not targeted specifically to the bacterium being countered. If the antibiotic targets many different types of bacteria, it makes it possible for many more bacterial species to develop resistance. Antibiotic resistance in bacteria is a growing problem worldwide, and threatens human health in many countries. It jeopardises the treatment of infections in people where antibiotics are necessary. Healthcare depends on effective antibiotics for operations and transplants, for example.

One example of a bacterium found in both humans and animals, and that has developed broad resistance, is *Staphylococcus aureus* (*S. aureus*). This bacterium occurs normally on the skin, but can cause serious illness in humans if it takes hold in wounds, for example. The illustration below shows the prevalence of resistance to the antibiotic methicillin in *S. aureus* that caused human disease (termed MRSA) in 2016. As can be seen from the illustration, resistance in this bacterium was extremely unusual in Sweden.

### Antibiotic resistance

The word antibiotic comes from the Greek *anti* bios, which means *against life*. Antibiotics are substances that damage bacteria but rarely affect other cells in the body. Many antibiotics are natural substances formed by moulds or bacteria. However, bacteria have protective mechanisms and can sometimes defend themselves against antibiotics. While protective mechanisms vary, in essence genes in the bacteria's genome gives them properties enabling them to survive. We call this resistance, i.e. the bacterium is resistant to an antibiotic. Resistance can occur in the genomes of individual bacteria and then spread to other bacteria in the environment. The part of the genome that often carries antibiotic resistance spreads very readily between bacteria and adapts very easily to different species of bacteria. The resistance is then transmitted by heredity to future generations of bacteria. Some bacteria have acquired resistance to many different types of antibiotics, and are termed multi-resistant.



*Staphylococcus aureus*: percentage of invasive isolates with resistance to methicillin, (MRSA), EU/EEA, 2016.

Summary of the latest data on antibiotic resistance in the European Union.

Sweden's resistance status is good, mainly due to targeted treatment and the low use of antibiotics. One significant difference from many other countries is that antibiotics must be prescribed by a doctor or a veterinarian. Another is that adding antibiotics to animal feed as growth promoters was banned in Sweden in 1986. To preserve the status, some antibiotics are now banned for use in animals. The most important thing owners can do to stop bacteria becoming resistant is to prevent their animals from becoming ill in the first place. Healthy animals simply do not need antibiotics.

## Stop infection at the border

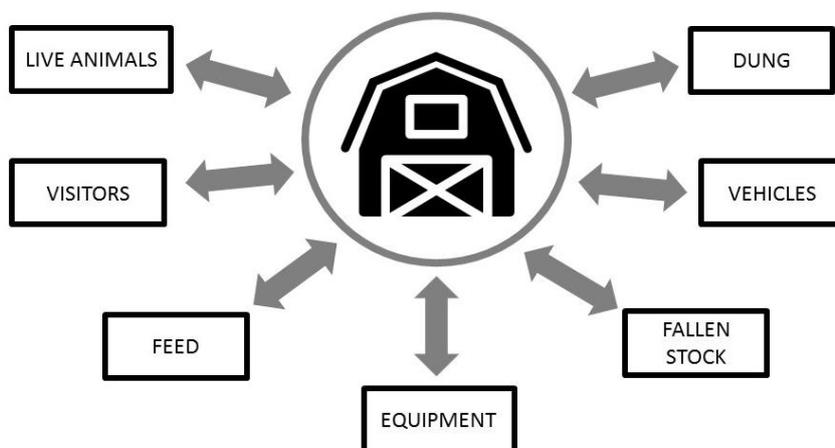
We want to stop infectious diseases from around the world entering Sweden. There are therefore virtually **no imports of live animals to Swedish farms**. If necessary, new genetic material can be introduced into the population via imported semen or embryos.

People too can carry infections across national borders. These may be bacterial infections such as salmonella and tuberculosis, which are spread between humans and animals, often via people who are not themselves ill. They may also be viruses that only infect animals but can be carried over long distances by a person. Foot-and-mouth disease is an example of such a virus. It can be found in the nasal cavities of people that have been in contact with affected animals. Because of these risks, Sweden's farmers have got together and agreed a few simple rules. A person that has been in contact with livestock in another country must wait **48 hours** before being in contact with animals in Sweden. If the person was in an area with foot-and-mouth disease, the period is extended to **5 days**.



## Stop infection entering the farm

Infectious diseases still occur among cattle in Sweden, of course. Common examples are ringworm (a fungal skin infection), digital dermatitis (a bacterial hoof disease), *S. aureus* (bacteria that cause mastitis) and various viruses that cause coughing and diarrhoea. Infectious agents can enter or exit the farm in many ways (see diagram below). With well thought-out strategies, the farm can be protected from infections. The same strategies also reduce the risk of spreading any infections on to other farms.



## Buying animals

The biggest risk of acquiring new infections is when animals are purchased for the herd. The new animals carry the bacterial flora of their original herd and can also carry viruses and parasites.

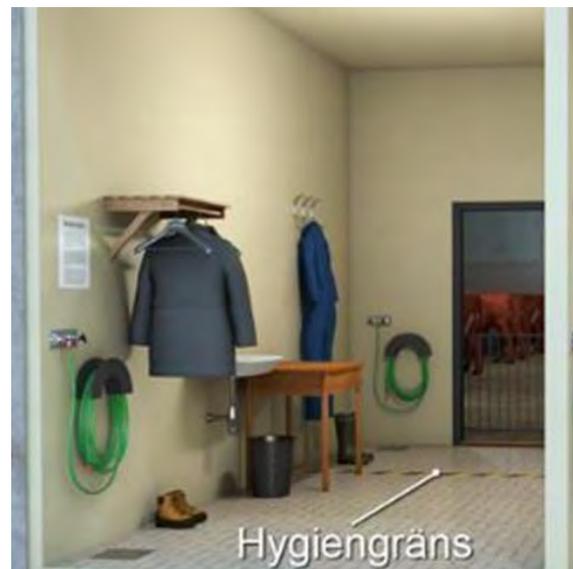
The best way to protect the herd is therefore to maintain high fertility among the cows and a high survival rate for calves. This provides an ongoing internal supply of new animals, avoiding the need to buy them.

However, if animals must be bought (e.g. to help expand the herd), the risk can be minimised by complying with the recommendations that have been issued. These are available at [www.vxa.se](http://www.vxa.se) under Säker Livdjurshandel (in Swedish).

## People

Temporary visitors to the farm pose a risk of infection. People that travel between herds and have close contact with animals, such as veterinarians and inseminators, risk carrying infection from farm to farm. These people are well informed about the various infectious diseases and are aware of the risks. They have established hygiene routines that reduce the risk of spreading infection. A good way to further reduce the risk of these people introducing infection is for the farm to **provide clean, full protective clothing and boots for visitors to use.**

The picture shows a hygiene sluice for visitors. Note that there is a hygiene lock, protective clothing to borrow, a clean table for equipment and a wash basin for hand hygiene.



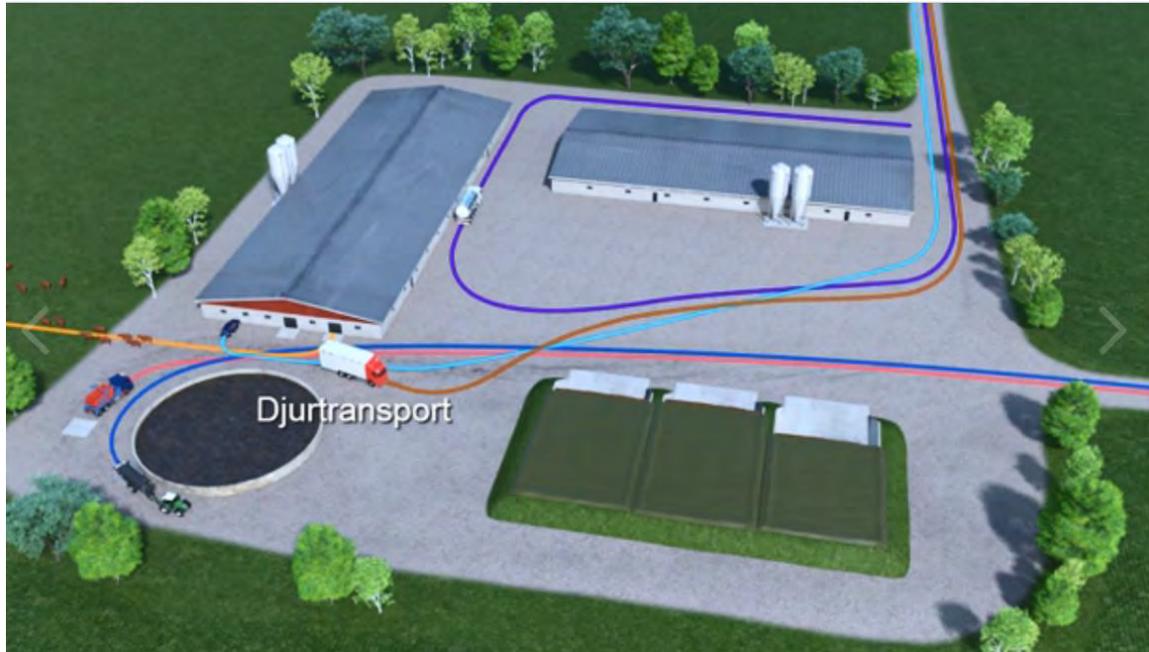
Animal transporters also move between farms and have direct contact with animals. With clear signage about who to contact when they arrive, they need not enter the cattle barn. If the farm's workers unload the animals, the risk of infection falls considerably.

Other visitors, not normally in contact with agriculture, pose a different kind of risk. Examples include various tradespeople, as well as children's playmates. They are often less well informed, which means they obviously do not take responsibility for protecting animals and themselves against infection. Always inform visitors about washing their hands thoroughly before and after contact with animals or being in the cattle barn. Help young children do it properly. This not only protects the animals from the people's infections but also the people from the animals'. Another important thing to remember is to **never offer unpasteurised milk**. It contains high levels of bacteria from the cows' immediate environment. People that have not been in that environment previously have no protection against these bacteria. Some of the bacteria (e.g. some E. coli bacteria) can cause serious disease in people.

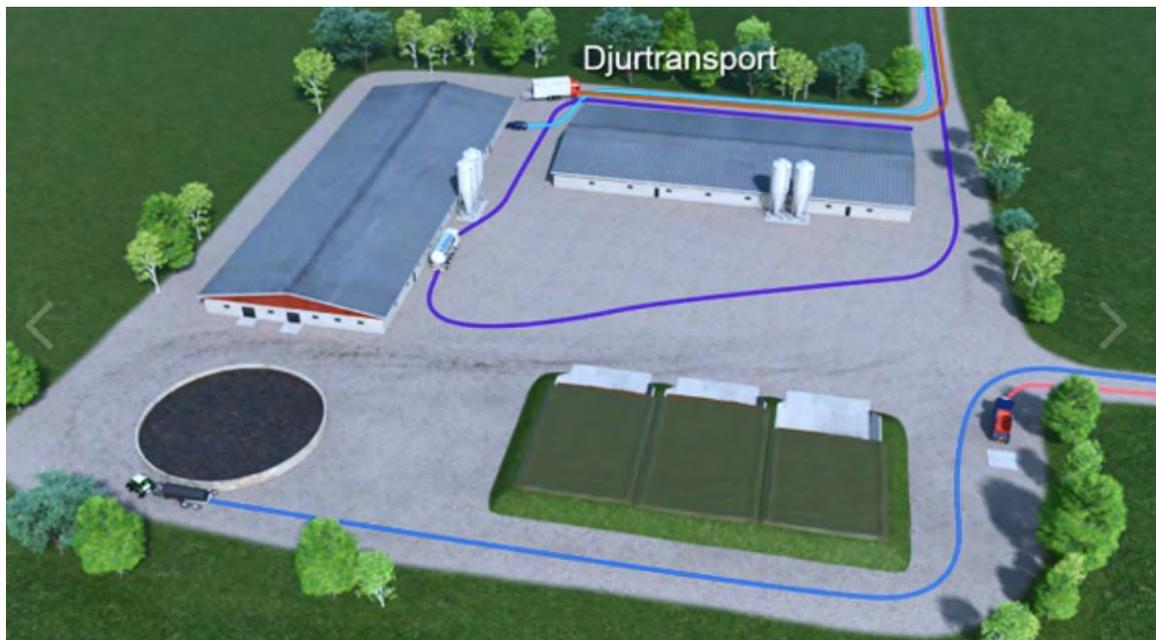
## Vehicles

Vehicles can pose a risk of spreading indirect infection, mainly because dung can adhere to tyres and wheel arches and so be carried between farms. The infection can then be spread to animals on the

farm, for example on mobile feeders via tractors and mixer trolleys. If the farm has well-designed and clearly indicated routes, crossings between its internal traffic and transport from outside can be avoided. Fallen stock collection trucks pose a special risk because the animals they carry have been sick. The risk of infection is obvious, and it is therefore recommended to locate the fallen stock area at the outer edge of the farm.



**Example of poorly planned routes:** Here, the farmyard is crossed by visiting traffic such as the slaughter transporter (red), fallen stock trucks (pink) and visitors (light blue). The manure barrel (blue) also crosses the farmyard, past the entrance to the silo bunkers.



**Example of a well-designed flow for vehicles on the farm.** The fallen stock area is located at the outer edge (see the lower right corner). Access for visitors and loading for slaughter transport have been moved to the far end of the farmyard. In this way, these vehicles that present a risk do not cross the farmyard. The manure barrel has also been rerouted to avoid crossing the feed traffic.

## Contact between farms

**Each farm has its own unique infection status. This means contact between farms that are close to each other also poses a risk of infection.** Contact between farms can take many forms, for example cooperative working and jointly owned machines or equipment.

The advice is to always clean machines and equipment between farms. This applies especially to equipment and machinery with direct animal contact, such as livestock trailers and chutes. High-pressure washing and **allowing to dry** before use on the next farm can significantly reduce the risk of infection. Manure barrels are emptied and washed down thoroughly.

People pose a risk here, too. **Remember not to visit someone else's farmyard in the clothes and boots you have been wearing while working with your own animals.**

The grazing season poses a risk of infection between animals. The best way to protect your animals is to keep fences in good repair to keep your animals in and others' animals out.

## Stop infection within the farm

Each farm has its own spectrum of infectious agents. Animals born on the farm have better adapted immune systems than do animals bought in. Older animals carry more infections and have a more developed immune system than younger animals. Limiting infections and keeping animals healthy requires well-established routines that are regularly followed up. Infections are not spread randomly. Many infectious agents are spread in similar ways. That means multiple infection pathways can be broken using the same routines.

### Infection pathways

Breaking infection pathways prevents the spread of disease. The infection pathway is the route an infectious agent takes from an infected animal to a susceptible one. The most common infection pathway is physical contact between animals. Infectious agents can enter the susceptible animal in various ways, for example through mucous membranes in the mouth and nasal cavities, via the teat duct and via broken skin. The more animals living under the same roof, the more potential infection pathways there are. Large herds therefore make it easier for infections to take a hold and spread.

### Infection pressure

The term **infection pressure** is used to describe **how infectious** the animal's environment is. A high infection pressure means there is a high number of infectious agents. The infectious agent may be a virus, a bacterium or a parasite.

When an animal becomes ill, the infectious agent multiplies in the animal and is secreted in large quantities into the environment (see illustration). Because infectious agents are excreted via faeces and bodily fluids, they accumulate in bedding and on equipment. The surrounding air can also carry infections, especially various viruses. The more animals that are sick, the higher the infection pressure.

The infection pressure can also build up over time, and increases even more if there is high density or a high turnover of animals. **Infections accumulate in certain locations in the farmyard, such as in sick pens.** More effort is required here to keep the infection pressure low.

## Secretion of infectious agents



### The **animal's resistance**

Many factors determine how severely the animal is affected when exposed to an infectious agent. There is always a struggle between the animal's resistance and the infectious agent.

Susceptibility to an infection depends on whether the animal has immunity, among other things. When an animal has had an infection, it acquires immunity to the infectious agent by forming what are known as antibodies. The antibodies, and therefore the immunity, may persist for a short or long period. **Calves do not have antibodies at birth, and depend completely on receiving colostrum during their first hours of life.** The colostrum is obtained from the first milking after calving. It contains large amounts of antibodies from the cow's immune system. During the first 24 hours, the calf's intestine is able to absorb the antibodies, which then protect the calf during its first 6-8 weeks of life. The calf's own immune system develops gradually when it encounters various infectious agents in the environment. Vaccination is a way of conferring immunity to a specific infectious agent. In Sweden, the main use of vaccines is against ringworm. Other cattle vaccination programmes are used, but they are currently uncommon.

Not all infectious agents lead to disease in the animal, because some can be killed off by the immune system. This is more likely if the infection dose (the amount of infectious agent to which the animal is exposed) is low and the animal has good resistance. The lower the animal's resistance, the smaller the infection dose required to make the animal ill. Younger individuals are generally more susceptible than older ones. Stress increases the animal's susceptibility. **Common stress factors include movement, overcrowding, change of feed and calving. Among calves, under-feeding and/or cold and draughts are common causes of increased susceptibility.** Well thought-out routines can often reduce animals' stress and hence strengthen their resistance.

The period in the calving pen is also important. The calf can be protected from birth through good hygiene in the calving pen, to keep the infection pressure low (no one wants to be born in an infection ward), and by providing its colostrum ration promptly. The law in Sweden states that the calving pen may be used only for that purpose, and not as a sick pen. This is to protect newborn calves, and cows with reduced resistance due to calving.

## Stay one step ahead

There are no shortcuts to keeping animals healthy and preventing diseases. It requires well thought-out routines followed by everyone on the farm. Regular monitoring of work and animal health shows whether the routines are giving the desired result or whether they need changing. Two areas that require a major effort, and are essential for keeping infections in check, are animal grouping and dung management.

### Animal grouping

The best way to protect healthy animals against becoming ill is to prevent infection from getting to them. This is especially obvious for calves and dairy cows. Infections that can cause major problems circulate among both groups. Keeping healthy and infected animals apart breaks the infection pathways.

Calves, for example, are easily affected by viruses and bacteria that cause diarrhoea and/or pneumonia. Immediately after birth, the calf should go into an individual pen. This prevents contact with older disease-carrying animals. When the time comes for calves to be brought together, cohesive groups with a narrow age spread (known as all-in-all-out production) are a good way to prevent disease. Calves that become ill deteriorate very quickly and may die without prompt treatment. Because the course is so rapid, it is important for the keeper to be able to spot signs of ill health at an early stage. The signs may be subtle, but there are some simple things to keep an eye out for. **The earliest sign of disease is that the calf does not finish its milk ration.** If it lives in a group pen, it is not uncommon for it to remain lying down when the other calves get up, for example to eat. If the calf shows such behaviour, it should be examined. It is very probably ill. **A sick calf needs extra care in the form of increased supervision, extra bedding and, ideally, additional heat.**

For dairy cows, grouping is mainly about breaking infection pathways to protect cows with healthy udders from bacteria that cause mastitis. These bacteria can infect either cow-to-cow or from the cow's environment. Streptococci and staphylococci infect directly via contact between animals or indirectly via cubicles, milkers' hands or milking parlour equipment. Cows that become acutely ill from these bacteria are treated with penicillin. The bacteria can also cause mild, chronic mastitis with no visible symptoms. Affected cows are therefore carriers of the bacterium, and being chronically ill they can continue to spread the infection. Both acutely and chronically sick cows can secrete large numbers of bacteria, thereby creating a high infection pressure. Staphylococcus aureus is a particularly stubborn bacterium that cows find it difficult to recover from. Once infected, they are considered carriers for the rest of their lives. In order to deal with infections related to udder health, it is important to know which

## What does Swedish law say?

### Extract from L104 Regulations on cattle husbandry

#### Chapter 2. Management and care

**3 §** Animals shall normally be inspected at least once a day. Newborn, sick or injured animals and animals behaving abnormally shall be attended to more frequently. The same applies to heavily in-calf cows, especially around the time of calving.

**5 §** Calves kept indoors shall be attended to at least twice a day.

**8 §** Animals shall be kept in a satisfactorily clean condition.

#### Chapter 3. Feeding and watering

**4 §** Newborn calves shall receive colostrum as soon as possible, but no later than six hours after birth.

#### Chapter 4. Housing

**1 §** Housing shall be cleaned and dung removed at least once a day (...).  
In continuous production, the stall or stall section shall be cleaned thoroughly at least once a year. In batch production, the stall or stall section shall be cleaned thoroughly before each new batch of animals is brought in.

**2 §** Lying surfaces shall be kept clean and dry (...).

#### Chapter 5. Areas and equipment

**1 §** Animals that need special care shall be able to be dealt with untethered in a nearby area and shall be able to be housed individually (*i.e. sick pen*)..

**2 §** In herds with cows or heifers that are about to calve, calving pens shall be provided ahead of calving.

**3 §** Calving pens (...) shall be designed and used in such a way that they can be cleaned regularly without difficulty and can be disinfected when necessary.

#### **General advice regarding 2 § of the Swedish Animal Welfare Act**

*Calving pens (...) should be cleaned thoroughly and provided with fresh bedding between each calving.*

*Calving in group pens should be in batches. The group should only contain animals expected to calve within next ten days. In this case, the calving area should be cleaned thoroughly and provided with new bedding between each batch of animals.*

cows are healthy and which are carriers of bacteria. A good way to check udder health is to look at the cell count. Information about this is available in Kokontrollen or other similar management systems. Healthy cows have a cell count below 100,000 cells per millilitre of milk. If the cell count is higher than that, there is a high risk of the cow having bacteria in her udder. To establish which bacteria are present in the udder, a milk sample can be sent for analysis. Udder bacteria can be transferred during milking via milkers' hands or the milking parlour equipment. It is therefore important to milk healthy cows first and the worst infected cows last. Healthy cows should also be housed in a separate group to minimise their risk of being infected by udder bacteria.

## Dung

In cows' natural environment, they move away from their faeces. They cannot do this in the farmyard, however. Instead, dung and urine must be removed from the vicinity of the animals. A large part of farm work involves keeping the environment around the animals clean. **Dung contains billions of bacteria** that are necessary for digestion in the intestine. However, **these bacteria can cause damage if they end up in the wrong place** (e.g. on teats, in wounds or in a calf's navel). If the animals' environment cannot be kept dry and clean, the infection pressure increases and the animals' resistance decreases. **General cleanliness and good hygiene therefore provide good assurance against disease.**

Grazing cows refuse to eat grass growing where a cowpat has been dropped to avoid the infection in the dung. This behaviour – avoiding their own faeces – is deeply rooted in cows and is necessary for keeping themselves healthy. The feeding table, and the entire feed chain, should therefore be kept free of dung. Remember that for the animals in the stall, the feeding table is their dinner plate. The animals' drinking water is also part of the feed chain.

Since infectious agents are present in large quantities in dung and urine, dung should not be transferred from one group to another. Protect young animals in particular from contact with older animals' dung. In addition to spreading infection, dung and urine can affect animals' resistance. Calves and young animals in particular become more susceptible to infections if they cannot keep dry and clean. If it is not dry underfoot, the hoof health of older animals can be severely impaired because dung and urine loosen the hoof horn.



## Routines

**Routines, routines, routines.** Good routines result in a good environment for the animals, minimise farm infections and reduce the risk of animals becoming ill. **A healthy environment for animals is also a healthy workplace for people.** Employees like to know exactly what to do and how. Set routines with regular follow-up have many benefits, and taken together they lay the foundations for a profitable enterprise. The challenge is to do the right thing the right way at the right time.

All farms have their unique routines, adapted to their own conditions. Sometimes the routines have emerged from old habits, and do not give the desired results. Perhaps there is no continuous follow-up. In such cases, a thorough review of the routines can have a major impact on animal health. Veterinarians and other advisers can act as sounding boards in this area. Set routines with a focus on animal health not only lead to healthier animals. They often also result in a better work situation for employees. Work is simply more congenial when the instructions are clear and the animals stay healthy. The enterprise becomes a better employer, making it easier to recruit skilled staff.

## Infectious disease control in practice

In conclusion, there are three short lists of individual routines that are important for achieving good infection protection. All items listed are beneficial for animal health. Many have been mentioned in the text. Some are legal requirements. Others are recommendations.

### Study assignment

Go through the attached lists item by item, and say why they are important. Then say how you do it on the farm where you work. Work on one item at a time. Use this text. Discuss things with your colleagues and the veterinarians you come into contact with. The *Manual for*

*Livestock*

*Keepers within Milk Production* is available at [www.vxa.se](http://www.vxa.se). You can print it out and use it as an additional reference source. You can also look for information online. For Swedish-speakers, more detailed information is available at [www.smittsäkra.se](http://www.smittsäkra.se).

Can you find any improvements for your farm? Present your suggestions for improvements to your employer. Once you have presented your suggestions, the assignment is considered completed.