

# An online risk-based biosecurity scoring system for pig farms

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[www.biocheck.ugent.be](http://www.biocheck.ugent.be)

The Biocheck.UGent risk-based biosecurity scoring system is a freely available online tool that allows users to assess the biosecurity level of pig and broiler herds in a quantitative and objective manner. The scoring system is based on a science-based questionnaire that can be filled in online and which provides immediate and detailed feedback on the biosecurity situation of the herd. This scoring system is completely free and independent. Furthermore, the website ([www.biocheck.ugent.be](http://www.biocheck.ugent.be)) offers an extensive review of information concerning biosecurity and biosecurity measures on pig and poultry farms.

## BIOSECURITY ISSUES

In intensive animal production, every disease outbreak has a major impact on health, welfare, zootechnical performance and profitability, either for the individual farmer (endemic diseases) or the entire sector (epidemic diseases). It is therefore of great importance to prevent disease outbreaks, rather than to cure them. An additional challenge is that, because of the increasing development of antimicrobial resistance in veterinary and human medicine, this prevention should not be achieved through an increased prophylactic use of antimicrobials. As a result, biosecurity, defined as all measures taken to prevent both the introduction and the spread of infectious agents on the farm, is of key importance in the concept of animal disease prevention.

“Biosecurity” on pig farms comprises all measures taken to minimise the risk of the introduction and the spread of infectious agents, thus keeping pigs healthy. By taking measures, pig farmers try to protect their animals against diseases in the best possible way, because even with excellent management it is impossible to achieve zero risk of disease outbreaks.

When explaining biosecurity, a distinction is made between external and internal biosecurity. External biosecurity has to do with farms keeping in touch with the outside world and trying to prevent disease-causing agents from entering or leaving farms. Internal biosecurity comprises measures which combat the spread of disease on farms.

### Which routes of disease transmission are the most important ones?

It is far from easy to make a ranking of the relative importance of the various transmission routes. This results from the frequent shortage of knowledge of the quantitative importance of various transmission routes on

the one hand and, on the other hand, from the variety of pathogens (also called disease-causing agents or germs), even within the categories themselves. For example, each pathogen has a different chance of survival in the environment (sensitive to temperature, drought, pH, etc.), as a result of which they can spread more or less efficiently one way or another.

## ASSESSING BIOSECURITY RISKS

When discussing or implementing biosecurity measures, it is often asked whether all that work and energy is really necessary since there is only a slight chance of a disease spreading. When answering this question, it is not just important to assess the chance of the disease being brought in through a certain route but also to look at how often a risk occurs. In other words, how often the potential transmission route occurs.

The following formula can be used to assess the combined risk, ie. the chance of transmission multiplied by the frequency, with  $p$  being the chance of disease transmission per risk occurrence and  $n$  being the number of times this risk occurs:  $p = 1-(1-p)^n$ .

If you assume that the chance of a particular transmission route of actually transmitting the disease is only one chance in a thousand, but you know that this route occurs 50 times a year (each week, for example), then the chance of disease transmission at the end of the year is 4.88% ( $=1-(1-0.001)^{50}$ ), which is already a significant risk.

## EXTERNAL BIOSECURITY

### Purchasing policy: Disease transmission from animal to animal

Direct contact between infected animals and animals susceptible to diseases is the most effective way of transmitting an infectious agent (Amass and Baysinger, 2006). Infected pigs excrete disease-causing germs through all kinds of excretions and secretions such as saliva, manure, urine, semen, etc. The disease-causing agent could be transmitted to susceptible pigs through direct contact with these excretions and secretions or through nose-to-nose contact.

### Avoid buying animals

Since direct contact between animals is the most effective way of transmitting a disease, it is advisable to restrict the number of new animals to a minimum. Here, a completely closed herd is most favourable because,

in such a system, live animals from outside the system are never brought in, thus limiting the chance of disease introduction. Bringing new animals to the farm over and over again also enables infectious agents already present on farms to maintain themselves through circulation among new animals, which are susceptible to diseases. The higher the number of animals brought to the farm, the greater the risk.

It is known that direct transmission from animal to animal is the most effective way of transmitting diseases. It is important to realise that the number of animals which are brought to the farm, and the frequency with which this happens, play a major role because they both increase the chance of disease introduction.

### Limit the number of farms of origin

If animals are bought, then the number of farms of origin should be limited to a minimum. Preferably, animals always come from one and the same farm. Several studies have pointed out that buying animals from more than one farm entails a greater risk of introduction of disease-causing agents, including *Mycoplasma hyopneumoniae*, *Actinobacillus pleuropneumoniae* (Hege et al, 2002) and *Salmonella* (Lo Fo Wong et al, 2004). Animals and semen always have to be bought from farms having the same or a higher sanitary status. This way, the chance of disease introduction is limited as much as possible since these farms have a “disease-free” status for a number of diseases.

### Quarantine is of primary importance

A quarantine period gives a farmer the time to observe new animals and identify symptoms before animals enter the existing population and can thus infect the entire population. Furthermore, a quarantine period gives farmers the opportunity to test animals for certain disease-causing agents. This is important for identifying subclinical disease carriers and assessing to what extent new animals are resistant to infectious agents present on the farm. Decisions on adaptation and vaccination can be taken on the basis of serological data.

### Livestock transport and disease spread

Because lorry drivers drive from one farm to another, they can spread disease-causing agents. Epidemiological field studies have pointed out contaminated livestock lorries as the focus of infection for many disease-causing agents, including classical swine fever (CSF; Fritzscheier et al, 2000), *Mycoplasma hyopneumoniae* (Hege et al, 2002), *Actinobacillus pleuropneumoniae* (Fussing et al, 1998, and Hege et al, 2002), *Brachyspira hyodysenteriae* (Windsor and Simmons, 1981) and *Salmonella* (Rajkowski et al, 1998). Livestock should only be transported by lorries or other transportation which is “thoroughly cleaned and, if necessary, disinfected” and this means having to “remove the dead animals, the contaminated stable litter and the excrement as soon as possible”. Cleaning and disinfecting lorries when using them for livestock transportation

between different farms and after having unloaded pigs at the slaughterhouse plays a major role in biosecurity. If all of this is properly carried out, it definitely serves a useful purpose (Rajkowski et al, 1998).

### Feed and water and the spread of disease

In the past a number of *Salmonella* outbreaks were reported that could be linked to the feed of the pigs. In those cases it was mostly the exotic *Salmonella* variant, which was imported via specific raw produce. Nevertheless, their frequency of occurrence is limited. In many countries (eg. Belgium) it is prohibited to feed animal by-products. It should therefore be avoided. The feeding of swill has caused a number of important epidemics (eg. CSF) in the past.

The pigs’ drinking-water quality often leaves much to be desired. The water is often pumped from a well and temporarily stored in a tank, after which pipes supply the entire farm with water. In the well as well as in the tank and the pipes the water could be contaminated. Germs can easily be spread to many animals via water. Regular examination of the drinking-water quality and regular cleaning of the pipes is therefore definitely necessary.

### Disease transfer from humans to animals and vice versa

As it has been frequently noted that germs can transfer from human beings to animals and vice versa, the number of visitors to the stables must always be reduced to the necessary. The transmission of germs is subdivided into mechanical (main type) and biological transmission. Human beings can act as a mechanical vector if they have been in contact with infected animals and subsequently switch to susceptible animals without taking any measures.

This type of transmission has been proven through experiments for several germs, among which are the transmissible gastroenteritis virus (TGV; Alvarez et al, 2001), *Escherichia coli* (Amass et al, 2003) and classical swine flu (Ribbens et al, 2007) and happens mainly through leftovers of excreta from infected animals on footwear and clothing.

The chance of biological transmission between human beings and pigs exists for germs that can infect human beings as well as pigs, such as the H1N1 influenza virus. Transmission of the H1N1 influenza virus from pigs to human beings has been noted (Wentworth et al, 1997), as well as the transmission from human beings to pigs. Recently a lot of attention has been paid to the biological transmission of methicillin-resistant *Staphylococcus aureus* (MRSA) ST398. Pigs as well as human beings can be subclinical vectors of that “pig strain”. Mutual transmission through direct contact has been generally accepted (Huijsdens et al, 2006). Up to now biological transmission from human beings to pigs has been regarded as unimportant and therefore no specific measures have been described.

### Clothing and boots

When visitors enter the farm it is always necessary that they put on clean clothes and farm-specific footwear. That way excreta (manure, saliva, etc.) from other animals are prevented from transferring through clothing.

It is therefore important to provide enough clean clothing in the hygiene lock for visitors' use.

### Vermin and bird control

Rodents could be important for the biological as well as for the mechanical transmission of germs (Amass and Baysinger, 2006). This should be kept in mind with regard to the spread of germs within the farm, but also between neighbouring farms. It has been clearly demonstrated that rodents are an important vector (Joens, 1980) for pig dysenteriae (*Brachyspira hyodysenteriae*).

In order to limit problems with vermin as much as possible, it should be controlled systematically, possibly with the help of specialised companies.

## INTERNAL BIOSECURITY

### Management of diseases

Returning piglets to younger age groups is very risky. The animals lag behind in growth and development for a reason. There is a big chance that their immune system is weakened and that they are incapable of surviving infections. Transferring a piglet to a younger age group will bring a likely carrier of germs to a susceptible population. When the pig farmer decides the piglet will never become a profitable fattening pig, euthanasia is a better choice than letting it run around among its litter as a permanent infection source.

### Sickbay

Clinically diseased animals have to be isolated, in order to prevent other animals from exposure to pathogens through nose contact and infected excretions and secretions. It is strongly advised not to move them to separate pens or a corridor in the section, but to isolate the animals in a closed sickbay. Carcasses form a source of contamination as well (eg. for *Salmonella* [Lettellier et al, 1999]), and should therefore be removed from the stable as soon as possible.

### Vaccination

A stable immunity prevents continuous circulation of pathogens. For closed farms, it is easier to preserve this stable situation than for farms who import animals (Amass and Baysinger, 2006). In case of import, the farmer should take care of the provision of appropriate vaccines and adaptation to farm-specific germs during the quarantine period. Vaccination does not only protect the vaccinated animals against clinical symptoms, it also aims to suppress the transmission of germs.

### All-in/all-out

The all-in/all-out (AI/AO) principle helps to prevent cross-contamination between consecutive production rounds

and makes it possible to clean and disinfect the stables between different production rounds. Applying the AI/AO principle strictly is probably the most important measure to break the infection cycle from old to young (Clark et al, 1991, mentioned in Maes et al, 2008).

### Keeping age groups together

An AI/AO system in which the same piglets are moved as a group during the various production phases is preferable to mixing the groups at the transition from one compartment to the other (Maes et al, 2008). When the nursery requires bigger groups than the size of the litter in the farrowing house, it would be better to put two or three litters together rather than sorting all the weaned piglets in terms of their size in the nursery. There are significantly better production results when the litters are kept together, from the farrowing house till the fattening unit (Anonymous, 2008).

### Age and sensitivity

It is widely known that there is an important connection between the age of the animals and their sensitivity to certain pathogens. On the one hand, this has to do with the presence of certain receptors (places where germs can attach themselves) that are present at a specific time, and, on the other hand, with the disappearance of maternal immunity after some time (protection of the piglets via antibodies present in the mother's milk). That is why it is so important to separate the different age groups as much as possible. It is certainly not recommended to place older animals (who themselves are often immune to certain diseases but still carry the germs) together with younger animals (returning) or placing a group of younger animals in a stable with several older animals.

### Cleaning and disinfecting

Cleaning, disinfecting and drying out buildings is very important to keep diseases under control on the pig farm (Amass and Clark, 1999). Pens, feeding troughs and equipment infected through faeces can maintain an infection cycle because new animals keep getting infected, and will consequently secrete the germ and infect their environment. This can happen very quickly, as shown by the fact that pigs, two hours after they were placed in a *Salmonella typhimurium* infected environment, were already infected (Hurd et al, 2001). To break the infection cycle between consecutive litters a thorough cleaning and disinfection of the pens is required. When cleaning, all visible waste needs to be removed because the presence of organic material negatively influences the functioning of antiseptics. Using a detergent before or after cleaning with the pressure washer significantly increased the quality of the cleaning (Corrégé and Dubroca, 2006). Soaking in with a detergent shortened the time needed for the following cleaning.

Disinfection exterminates germs and therefore lowers the general infection pressure that had been built up. Heating the stable at the end of the disinfection will quicken the

drying of the room.

Finally it is important to note that better decontamination can be achieved by emptying and cleaning the faeces prior to cleaning and disinfecting.

### THE BIOCHECK.UGENT SCORING SYSTEM

Despite the recognised importance of biosecurity, it is known from practice and research that there are still serious shortcomings in the application of these preventative measures in farms.

To assist in the objective and quantitative evaluation of the level of biosecurity in animal production (pigs and poultry), and subsequently advise on improvements, the Biocheck.UGent scoring system was developed.

The Biocheck.UGent scoring system is based on an extensive questionnaire composed of relevant and practice-based questions to assess all relevant components of biosecurity. It is subdivided into external biosecurity (all aspects related to the prevention of entry of pathogens into the herd) and internal biosecurity (all aspects related to the prevention of spread of pathogens within the herd). The scoring system is applicable to every type of conventional pig herd (fattening herd, breeding herd, mixed herd, etc.) and broiler herds. The calculation of the score and the accompanying report are adapted to the herd type. The unique aspect of the scoring system is that it takes into account the importance or relevance of various biosecurity measures (not everything carries the same risk), resulting in a risk-based weighted score. This means that you receive many points for implementing very important measures, whereas less important measures only partly influence the overall score. The finer points of the scoring system pertain to these weightings and extensive research was conducted to assign these weightings. In the questionnaire, each question is explained in detail, to ensure that the user is always informed on the purpose of the question and the relevance in reference to the biosecurity.

On the basis of the answers to the questionnaire a score is calculated for the biosecurity situation on the specific farm. For this purpose a score from 0-100 is given both for internal and external biosecurity. The score is provided immediately upon completion of the questionnaire and will be saved for you, so that you can look it up in the future, and if desired compare it with future scores.

#### The report

The result of the questionnaire is presented as a report in which the scores are summarised. The scores for each subcategory (six for external and six for internal biosecurity categories) are provided in more detail as well as the national average in order to provide a comparison to average scores. You will also receive a short feedback on the score. Furthermore, you can click on the different subcategories of the report to receive further information on "how it should be done". Finally, all results are plotted in a graph to facilitate comparisons of the herd situation to the average scores.



**Biosecurity on pig farms comprises all measures taken to minimise the risk of the introduction and spread of infectious agents.**

The biosecurity report can be used as a tool for further herd-specific advice on relevant improvements in biosecurity and management practices.

#### Relevance for animal health

In a recent study by Laanen et al ("Relationship between biosecurity and production/antimicrobial treatment characteristics in pig herds," *The Veterinary Journal* 2013; 198: 508-512), it was demonstrated that pig herds that scored higher on internal and external biosecurity scores (assessed by means of the Biocheck.UGent scoring system) were also the herds that showed better production results as well as lesser antimicrobial use. In a study by Gelaude et al ("Biocheck.UGent: a quantitative tool to measure biosecurity at broiler farms," submitted to *Poultry Science*, 2014) it was demonstrated that the scoring system can be used as a handy tool for herd advice that resulted in a substantial reduction of antimicrobial use in poultry herds without any negative impact on production results.

#### ABOUT BIOCHECK

The Biocheck.UGent website and the accompanying biosecurity scoring system have been developed by the Veterinary Epidemiology Unit of the Faculty of Veterinary Medicine of Ghent University, Belgium.