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METHODOLOGY FOR ANALYSING PATHWAYS OF INTRODUCTION AND SPREAD OF INFECTIOUS DISEASES

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METHODOLOGY FOR ANALYSING PATHWAYS OF INTRODUCTION AND SPREAD OF INFECTIOUS DISEASES

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I. Aim of the Methodology

The aim of this methodology is to provide livestock farmers with a practical approach to identifying and assessing pathways by which the causative agents of serious infectious animal diseases (Foot-and-mouth disease (FMD), African swine fever (ASF) and Highly pathogenic avian influenza (HPAI)) may be introduced into and spread within livestock holdings. It enables the identification and verification of critical control points, assessment of the exposure of susceptible animals, evaluation of preventive barriers and their actual effectiveness, and the design of preventive measures, followed by an assessment of residual risk after measures intended to reduce the potential introduction of pathogenic microorganisms into livestock holdings have been implemented.

II. Description of the Methodology

II.1. Introduction

Biosecurity is a fundamental component of preventing the introduction and subsequent spread of serious infectious diseases in livestock holdings. Its importance cannot be reduced to a collection of individual preventive measures or merely checking whether such measures formally exist. What matters is the ability to identify actual pathways through which a pathogen could enter a holding and subsequently spread within it, determine where those pathways can be effectively interrupted, and assess the actual effectiveness of preventive barriers under the specific operating conditions of livestock holdings.

This approach reflects the broader understanding of biosecurity as a system for analysing and managing biological risks. The FAO (2007) describes biosecurity as a strategic and integrated approach to risk analysis and management and, in the context of animal health, links it to the prevention and control of emerging and existing diseases throughout animal production chains.

The present methodology is designed as a broadly applicable tool for analysing biosecurity on livestock holdings. Its principles can be applied to the assessment of various serious infectious diseases. They are illustrated in particular using foot-and-mouth disease (FMD), African swine fever (ASF) and highly pathogenic avian influenza (HPAI). These diseases differ in the biological characteristics of their causative agents, the range of susceptible species, pathogen survival in the environment and the relative importance of individual transmission pathways. These differences make it possible to test the general applicability of the proposed analytical approach.

The common starting point is not an assumption that the same transmission pathways exist for every disease or that they have the same epidemiological significance. Rather, it is the method of analysis. For each disease assessed and each individual holding, the key question is whether a continuous connection could arise between a potential source of the pathogen and a susceptible animal, and whether that pathway is effectively interrupted at any of its critical points.

The following basic sequence is therefore used for practical assessment:

POTENTIAL PATHOGEN SOURCE → ENTRY PATHWAY → CRITICAL CONTROL POINT (CCP) → EXPOSURE OF SUSCEPTIBLE ANIMALS → PREVENTIVE BARRIER → BARRIER EFFECTIVENESS → RESIDUAL RISK

A potential source must not be confused with a transmission pathway

For practical biosecurity assessment, it is essential to distinguish between a potential source of a pathogen and the pathway by which the pathogen could reach a susceptible animal from that source.

The mere presence of a source in the vicinity of a holding does not mean that an effective transmission pathway exists. This principle is particularly clear in the case of ASF. The presence of infected wild boar in a region may generate infection pressure, but does not, in itself, identify the mechanism by which African swine fever virus (ASFV) could cross the boundary of a particular holding. Such a connection may arise directly or through people, vehicles, footwear, clothing, tools, equipment, feed, water or technological systems.

Similarly, for ASF, WOAH (2024) identifies direct contact with infected domestic or wild pigs, ingestion of contaminated material, and contact with contaminated objects such as clothing, footwear or vehicles.

The same principle applies to HPAI. Wild birds in the vicinity of a holding represent a potential source of infection, but poultry may be exposed through various direct and indirect pathways. In addition to the movement of infected birds and the role of wild birds, WOAH identifies contaminated feed, water and equipment; contaminated footwear, vehicles and equipment may also contribute to spread between farms.

For FMD, the range of biologically possible pathways is similarly broad. WOAH (2024) identifies, among others, the introduction of infected animals, contaminated transport vehicles and premises, feed and water, contaminated clothing, footwear and equipment, and, under suitable conditions, the dispersal of infectious aerosols by air currents.

One of the fundamental principles of the methodology follows from this:

The presence of a potential source or risk factor is not, in itself, evidence that an actual transmission pathway exists.

Transmission pathways are not isolated corridors

The individual pathways by which pathogens enter and spread cannot be considered mutually independent. Under real operating conditions, they may intersect, branch, form successive links or share common critical control points.

In the case of ASF, it is explicitly recognised that individual pathways do not operate in isolation and that their significance may be influenced by a combination of several risk factors.

For example, a contaminated external environment may be linked to vehicle movements; a vehicle may contaminate a route within the holding; and contaminated material may then be carried mechanically from that route into animal housing on footwear, tools or machinery. What constituted one pathway at the beginning of the chain may therefore become the source of another link in the transmission chain.

Likewise, a potentially contaminated environment may affect several pathways simultaneously, including water, feed, the movement of people and vehicles, or tools in use. Conversely, a single appropriately positioned and genuinely effective barrier may, under certain conditions, interrupt several connected pathways.
The methodology therefore asks not only:

“Is this pathway present?”but, above all:
“What is this pathway connected to, where does it originate, where does it lead, and where can it actually be interrupted?”

Critical control point and preventive barrier

Identifying a transmission pathway does not, in itself, determine the appropriate preventive measure. First, a critical control point (CCP) must be identified: a specific point or section of the transmission chain at which the pathway can be effectively interrupted or substantially restricted.

Only in relation to a specific CCP can the suitability of a preventive barrier be assessed.

This principle avoids the mechanical compilation of universal lists of measures without reference to the actual conditions on a holding. The same measure may be a decisive barrier on one holding, merely a supporting measure on another, and have no effect at all on a particular transmission pathway on a third.

For example, ASF surveillance identified entry to the premises and movements between epidemiologically separate operating areas as critical points for people. For vehicles, critical points included entry to the premises, vehicle routes, and loading and unloading areas. For feed, origin, transport, storage and distribution were considered critical.

The existence of a barrier does not demonstrate its effectiveness

A key premise of the methodology is the clear distinction between the existence of a preventive measure and its actual ability to interrupt a particular transmission pathway.

A barrier may have been formally introduced, yet its effectiveness may be limited by unsuitable positioning, design, operating arrangements, failure to follow established procedures, inadequate cleaning and disinfection, or other operational factors.

It is therefore not sufficient to ask:

“Does the holding have this barrier?”

The next questions must be:

“Is it positioned at the correct critical control point?”

“Does it interrupt this particular transmission pathway?”

“Is it used correctly?”

“Is its effectiveness verified?”

“What happens if it fails?”

This approach is also consistent with the findings of ASF surveillance: a preventive barrier is effective only if it is positioned at the correct critical control point and actually interrupts the relevant ASFV transmission pathway under real operating conditions.

Residual risk

Even an effective preventive barrier does not necessarily eliminate risk completely. Its implementation must therefore be followed by an assessment of residual risk, namely the risk that remains after the measure has been introduced and is functioning in practice.

This step is particularly important where several parallel or successive pathways exist. Interrupting one pathway may not prevent animal exposure if another remains open, or if the failure of one decisive barrier creates an uninterrupted connection between the source and susceptible animals.

The resulting risk therefore cannot be inferred solely from the presence of a single risk factor. It must also be considered in relation to the combined effects of infection pressure, the likelihood of exposure, the frequency and nature of contacts, and the presence and actual effectiveness of preventive barriers. Individual factors may also interact.

Uncertainty is part of the assessment

Biosecurity analysis often takes place when not all the information needed for an unequivocal decision is available. Missing information must therefore not automatically be replaced by assumptions. Throughout the assessment, the following distinctions must be maintained:

I KNOW → I ASSUME → I DO NOT KNOW → I NEED TO FIND OUT

The question:
"Do I have sufficient information to assess this part of the pathway responsibly?"
is therefore not another link in the basic sequence, but a cross-cutting check that applies to the entire assessment system.

If essential information is missing, the outcome of the analysis should not be a forced allocation of risk to a particular category, but identification of the information that needs to be obtained. Only then should the assessment continue.

From general measures to a holding-specific biosecurity system

The proposed approach is not intended to establish a single universal ranking of transmission pathways applicable to all holdings. Such an approach would disregard differences between pathogens, current infection pressure, husbandry systems, operating arrangements and barrier effectiveness. The results of epidemiological surveillance on livestock holdings explicitly show that no universal ranking of introduction pathways can be established for every holding.

The purpose of the methodology is therefore to enable farmers or specialist personnel to examine a particular operating situation systematically, identify relevant introduction and spread pathways, their interconnections and critical control points, and subsequently assess the presence and actual effectiveness of preventive barriers.

The outcome of such an assessment should not merely be a statement that a particular pathway presents a low, medium or high risk. It should provide a basis for deciding:

WHERE intervention is needed → WHY at that point → WHICH barrier to use → HOW to verify its effectiveness → WHAT risk remains after implementation.

In this way, general biosecurity principles are translated into a set of specific, interconnected and verifiable measures reflecting the actual conditions of individual holdings.

II.2. Methodology

II.2.1. Fundamental principles of the methodology

II.2.1.1. The livestock holding as a system of interconnected components

A livestock holding is not a collection of isolated checklist items. People, animals, vehicles, feed, water, technological systems and other operational components may be interconnected. The assessment must therefore consider the particular holding, its layout and its actual operating practices.

II.2.1.2. A potential source is not the same as a transmission pathway

Three questions guide the assessment: WHERE could the pathogen originate? BY WHICH ROUTE AND MEANS could it be transmitted? TO WHERE, that is, to which susceptible animals, could it reach? The existence of a possible pathway does not mean that transmission has actually occurred.

II.2.1.3. Nine analytical categories

For initial orientation, nine categories are used: animals of the same species; wild animals; people; vehicles; feed; drinking water; technological systems; tools and husbandry and veterinary equipment; and air. These categories help identify possible pathways; they do not imply that the same level of risk should automatically be assigned to each.

II.2.1.4. An individual pathway and its branching

A single pathway may branch, and several pathways may converge. The livestock keeper records operational connections that could genuinely occur, including those involving shared sections. The pre-drawn connections in the Spider Diagrams are merely prompts for verification.

II.2.1.5. Critical control points and preventive barriers

The aim is to identify a point at which a possible transmission pathway can be effectively interrupted. The assessment establishes which barrier is present, which pathway it is intended to interrupt and whether it is appropriate for that pathway and pathogen.

II.2.1.6. Barrier effectiveness and the possibility of bypassing barriers

The presence of a barrier is not evidence of its effectiveness. Even an effective barrier does not rule out the possibility that a pathogen may exploit another operational connection. Barrier use is therefore verified under routine operating conditions, while potential bypass routes and related branches are also examined.

II.2.1.7. Descriptive records and subsequent decisions

An unknown piece of information does not automatically constitute a deficiency. The following are recorded: POSSIBLE PATHWAY; INFORMATION REQUIRED; VERIFICATION / CHANGE REQUIRED. These are not numerical risk categories. For every necessary action, the assessment specifies what will be verified or changed and who is responsible.

II.2.1.8. Ongoing reassessment

Following implementation of a measure, it is verified whether the pathway originally assessed and its other connections have changed. The assessment is repeated following a significant operational change, a new finding or a change in the epidemiological situation.

II.2.1.9. Technical sequence for assessing a possible transmission pathway

Potential source of the pathogen

↓

Possible pathway of introduction or spread

↓

Critical control point (CCP)

↓

Exposure of susceptible animals

↓

Preventive barrier

↓

Actual effectiveness of the barrier

↓

Residual risk

Proceed from the potential source of infection to an assessment of what may remain a potential point of risk for pathogen introduction or spread even after preventive measures have been implemented. At every stage, consider the specific circumstances of your holding. Remember that one pathway may branch and that an effective barrier may be bypassed through another pathway.

II.2.2. Nine potential pathways for pathogen introduction and spread

Pathogens responsible for serious infectious diseases may enter livestock holdings and subsequently spread between individual epidemiological units through various direct and indirect pathways. For practical biosecurity assessment, these possibilities can usefully be divided into nine main groups: animals of the same species, wild animals, people, vehicles, feed, drinking water, technological systems, tools and animal husbandry and veterinary equipment, and air.

This classification provides an analytical framework rather than a universal ranking of the importance of individual pathways. The relative importance of each pathway depends on the biological characteristics of the pathogen, current infection pressure, the nature and frequency of contacts, operational organisation, exposure of susceptible animals, and the presence and actual effectiveness of preventive barriers.

The interconnections between pathways by which infectious agents may enter a holding must also be assessed. One pathway may lead into another; a single object may mechanically connect several epidemiological units; and one critical point may simultaneously affect several pathways.

II.2.2.1. Animals of the same species

Characteristics: Movement of an infected or contaminated susceptible animal is one of the most direct ways of establishing a link between a pathogen source and a susceptible population. Its importance is not confined to purchasing animals. Returning animals, movements between farms and operational units, loading, unloading, shared housing and other contacts must also be considered.

FMD: Direct transmission between susceptible animals is of fundamental biological importance. WOAH (2024) states that newly introduced infected animals may provide a route for the spread of FMDV; the virus may be present in various secretions and excretions of infected animals.

ASF: Experimental studies confirm efficient transmission of ASFV through direct contact between pigs. In our surveillance, the reception of animals, loading and unloading, and movements between epidemiological units were identified as particularly important critical points. WOAH (2024) also identifies direct contact with infected domestic or wild pigs as a route of ASFV transmission.

HPAI: Movements of infected birds can introduce the virus directly into a susceptible flock. WOAH identifies movements of infected birds among the factors contributing to the spread of avian influenza and recommends preventing the introduction of birds of unknown disease status.

Possible connections: An animal may simultaneously contaminate a vehicle, transport compartment, bedding, tools, people and technological equipment. Animal movement may therefore create several secondary pathways.

Points to verify on the individual holding: origin and health status of incoming animals; frequency and organisation of movements; loading and unloading locations; separation of groups; quarantine arrangements, where relevant; potential for direct or indirect contact between epidemiological units; and barrier effectiveness during reception and movement.

II.2.2.2. Wild animals

Characteristics: Wild animals may be a potential source of pathogens, but their mere presence near a holding does not establish a transmission pathway. The decisive factor is whether a direct or indirect connection exists between the wild animal population, the environment and susceptible livestock.

FMD: The importance of this pathway must be assessed according to the wild animal species concerned, the epidemiological situation and the actual potential for contact or indirect transmission into the holding. The mere presence of susceptible wild animals nearby must not automatically be treated as evidence of a specific introduction pathway.

ASF: Under European conditions, circulation of ASFV in wild boar populations is of fundamental importance. However, our work also emphasises that the occurrence of ASFV in wild boar in a region does not establish the mechanism by which the virus enters a particular holding. The source must be distinguished from the pathway crossing the farm boundary.

HPAI: Wild birds, particularly waterbirds, play an important role in the ecology of avian influenza viruses. Transmission to poultry may occur through direct or indirect exposure; contamination of the environment, water or other materials may be important.

Possible connections: wild animal → environment → human footwear; wild bird → water → drinking-water supply; wild boar → contaminated soil → vehicle wheels; wild animal → feed or storage area → susceptible animal.

Points to verify on the individual holding: wild animal species and their occurrence; current disease situation; potential for direct contact; access to feed and water; access to outdoor runs and operational areas; potential contamination of access routes, stores and equipment; and the actual effectiveness of fencing, netting and other barriers.

II.2.2.3. People

Characteristics: A person need not be a biological source of a pathogen to create an effective transmission pathway. Infectious material may be carried mechanically on footwear, clothing or hands, or via equipment in use.

FMD: WOAH (2024) lists contaminated clothing, footwear and equipment among recognised routes of spread.

ASF: Our work emphasises the role of people in mechanical transmission and identifies entry to the premises and movement between epidemiologically separated operational areas as particularly important critical points. A case–control study by Boklund et al. (2008) associated visits by professional personnel with ASF occurrence on small holdings; this finding supports the need to assess the movement of people as part of a comprehensive risk system.

HPAI: Movement of people may transfer contaminated material between the external environment, farms and individual poultry houses. WOAH therefore recommends strict control of access by people and highlights the possibility of transmission via contaminated footwear.

Possible connections: person ↔ footwear ↔ vehicle ↔ tools ↔ technological systems ↔ animals. A person may thus provide a mechanical link between several otherwise separate pathways.

Points to verify on the individual holding: who enters; where they come from; where they move; whether they cross boundaries between epidemiological units; changing clothes and footwear; the hygiene entry procedure; movements of visitors and external personnel; equipment use; and compliance with procedures in everyday operations, rather than merely their formal existence.

II.2.2.4. Vehicles

Characteristics: A vehicle may connect the external environment with the farm premises, or different operational areas, via its wheels, undercarriage, load compartment, cab, equipment and occupants.

FMD: WOAH explicitly identifies contaminated livestock transport vehicles among the routes by which FMDV may spread.

ASF: In the surveillance, critical control points included entry to the premises, vehicle routes, and loading and unloading areas. WOAH includes contaminated vehicles among the fomites capable of transmitting ASFV.

HPAI: WOAH highlights between-farm transmission via contaminated vehicles and recommends strict control of vehicle access to flocks.

Possible connections: vehicle → access route → footwear → stable for animals; vehicle → loading area → animal; feed delivery vehicle → feed; service vehicle → technician → technological systems.

Points to verify on the individual holding: whether vehicle entry is necessary; previous vehicle movements; clean and dirty routes; loading and unloading; contact with staff and animals; cleaning and disinfection procedures; structural areas that are difficult to clean and disinfect; and actual compliance with operating procedures.

II.2.2.5. Feed

Characteristics: Feed must be assessed as an entire chain, from the origin of raw materials through production and transport to storage and distribution on the farm. The biological possibility of transmission does not, in itself, establish the practical likelihood of contamination of a particular feed.

FMD: WOAH identifies contaminated hay and feed among the materials that may contribute to the spread of foot-and-mouth disease (FMD).

ASF: Infection with ASFV via ingestion has been demonstrated experimentally. Niederwerder et al. (2019) demonstrated infection following natural consumption of the virus in both liquid and plant-based feed. However, our work rightly emphasises that experimental evidence of oral infection must not be equated with the likelihood of contamination of routinely used feed on a particular farm.

HPAI: Contaminated feed is among the possible indirect routes of exposure for poultry, particularly where wild birds can access it or contamination occurs during storage and distribution.

Possible links: wild animal → feed store; vehicle → feed silo; technological system → distribution between poultry houses; person or tools → secondary contamination.

To verify on the individual farm: origin of feed; transport; unloading procedures; storage; protection against wild animals; distribution; interconnections between feeding systems; potential for secondary contamination.

II.2.2.6. Drinking water

Characteristics: The significance of water depends primarily on its actual source, the potential for contamination and the means of conveyance, storage and distribution up to the point at which animals drink it. A satisfactory water test result at one sampling point does not necessarily reflect the condition of the entire system.

FMD: WOAH identifies contaminated water among the materials that may contribute to the spread of FMDV.

ASF: In the surveillance study, the significance of water differed between categories of farms; the decisive factors were the actual water source, the potential for contamination and its distribution. Experimental data on oral infection support the biological possibility of exposure, but do not automatically establish that ordinary drinking water represents a significant pathway on a particular farm.

HPAI: Contaminated water is a recognised route of exposure for birds; contact between the water source and wild waterbirds or a contaminated environment may be particularly important.

Possible links: wild birds → surface water → storage tank → drinker; contaminated environment → open water source; biofilm in pipework → persistence of contamination; technological system → distribution to multiple units.

To verify on the individual farm: actual source; protection of the source; open tanks and wells; water treatment; storage tanks; condition of distribution pipework; dead legs and biofilm; cleaning and disinfection; sampling location and whether it represents the water actually consumed by the animals.

II.2.2.7. Technological systems

Characteristics: A technological system becomes a potential pathway particularly when it physically connects areas that should remain separate for biosecurity purposes. It may transfer contaminated material or create a shared flow between epidemiological units.

FMD: Its significance must be assessed in relation to the specific design and whether the system permits mechanical or other connections between groups of animals or between the external and internal environments.

ASF: Our surveillance study assessed technological systems specifically in terms of their potential to transfer contaminated material mechanically between epidemiological units.

HPAI: On poultry farms, relevant examples may include feeding systems, egg collection, manure removal, ventilation and other systems connecting a poultry house with the external environment or linking several operational areas.

Possible links: feed → conveyor → poultry house; manure → belt → external environment; maintenance worker → technological system → several stables for animals; air → ventilation system → internal environment.

To verify on the individual farm: which areas the system connects; direction of material movement; potential for back-contamination; shared components; maintenance and repairs; cleanability; cleaning and disinfection; shutdowns; physical barriers and actual operating procedures.

II.2.2.8. Tools, husbandry and veterinary equipment

Characteristics: Portable items may mechanically cross boundaries that are closed to animals or other transmission pathways. Risk arises particularly when they are shared between stables, poultry houses, groups of animals or farms.

FMD: WOAH identifies contaminated equipment among the pathways for the spread of FMDV.

ASF: In our surveillance study, tools, husbandry and veterinary equipment and instruments presented a high level of risk in all four farm categories; their movement between stables, animal groups or holdings was the critical point. A more recent European case–control study also identified sharing equipment between farms as a factor associated with a higher risk of ASF introduction.

HPAI: WOAH notes that the virus may be carried on farm equipment and transferred between farms by contaminated equipment.

Possible links: person → instrument → animal; vehicle → tools → stables for animals; outdoor environment → shovel → feed; veterinary instrument → several groups of animals.

To verify on the individual farm: ownership of the item; where it has been used; between which units it is moved; whether dedicated tools are available; procedures for cleaning, washing, disinfection or sterilisation, as appropriate to the item; hygienic storage following decontamination.

II.2.2.9. Air

Characteristics: The airborne pathway requires particularly careful assessment. The biological possibility of aerosol transmission must not automatically be equated with a high practical significance of this pathway in every operational setting. Assessment must consider the pathogen, source, quantity of infectious material released, distance, meteorological conditions, density of susceptible animals and ventilation arrangements.

FMD: Airborne transmission of FMDV is well established biologically. WOAH lists infectious aerosols and their dispersal by air currents from an infected holding among the pathways for the spread of FMDV.

ASF: In our surveillance study, the airborne pathway was assessed as low risk in all farm categories. Nevertheless, experimental transmission of ASFV by aerosols between infected and susceptible pigs has

been demonstrated. The low assessment therefore indicates low relative importance under the conditions of the farms studied, not the biological impossibility of transmission.

HPAI: For HPAI, the airborne pathway must be assessed in the specific context of the source, distance, wind direction, particle characteristics and ventilation. It is especially important not to infer causation solely from the geographical proximity of two holdings.

Possible links: infected farm → aerosol/dust → ventilation air intake → poultry house; contaminated dust → surfaces → tools or people → secondary mechanical transmission. Ventilation technology may therefore form part of the airborne pathway.

To verify on the individual farm: presence and nature of a potential source; distance; orientation of buildings; prevailing and current wind direction; terrain; ventilation air inlets and outlets; filtration; density of susceptible animals; potential transfer of contaminated dust and other particles.

II.2.2.10. Common principle for assessing the nine pathways

Analysis of the individual pathways shows that none can be assessed solely on the basis of its presence. The same object may be a significant link in a transmission chain on one farm but not on another. Likewise, a pathway for which transmission is biologically possible may not present a significant residual risk under specific operational and epidemiological conditions.

Each of the nine pathways should therefore be assessed using a common algorithm in the following part of the methodology:

POTENTIAL SOURCE

↓

IS THERE A REAL PATHWAY OF INTRODUCTION?

↓

WHERE IS THE CCP?

↓

CAN SUSCEPTIBLE ANIMALS BE EXPOSED?

↓

WHICH PREVENTIVE BARRIER INTERRUPTS THE PATHWAY?

↓

DOES IT WORK UNDER ACTUAL OPERATING CONDITIONS?

↓

WHAT RESIDUAL RISK REMAINS?

And throughout the assessment:

DO I HAVE SUFFICIENT INFORMATION TO MAKE THIS DECISION?

If not:

DO NOT ASSESS → IDENTIFY THE MISSING INFORMATION → VERIFY IT → ONLY THEN PROCEED.

II.2.3. Practical procedure for farm self-assessment

The aim of the first assessment is not to identify every risk on your farm.

Follow Worksheets 1–7 (Annex B). During the first assessment, you do not have to identify every possible pathway. What matters is to describe at least one specific possible pathway, or part of one, and record what you need to establish.

1. Define what you are assessing (Worksheet 1):
Record the farm, or part of the farm, being assessed and the disease or pathogen concerned. As you assess it, ask: WHERE FROM? → BY WHICH ROUTE AND VIA WHAT? → TO WHERE? Distinguish what you know from what you merely assume.

2. Review all nine categories (Worksheet 2):
For each category, select YES, DO NOT KNOW or NO. YES indicates a specific reason for further assessment; DO NOT KNOW means that information must be obtained; NO means that you currently have no specific reason to proceed. A NO response is not evidence of zero risk.

3. Construct a possible pathway (Worksheet 3):
Without graphical prompts, describe the pathway from a potential source through actual operational connections to susceptible animals. State whether you are describing the entire pathway or only part of it, and what remains unverified.

4. Ask supplementary questions (Worksheet 4):
Begin with questions relating to the initial category and continue with others as necessary. Consider the actual movement of animals, people, vehicles and materials, and operational interconnections. For air, require specific supporting evidence; failure to identify another pathway is not evidence of airborne transmission.

5. Check for overlooked links (Worksheet 5):
Only at this stage should you use the relevant pathway-specific Spider Diagram from Annex C. A connecting line is a prompt for investigation, not confirmation of an existing pathway. Move to another Spider Diagram only if a specific link is identified; do not repeat an already verified section.

6. Identify where the pathway can be interrupted (Worksheet 6):
First verify whether the pathway is genuinely possible on the farm. Consider whether an undesirable connection can be eliminated. If a barrier is needed, identify where to intervene, its suitability and its actual effectiveness during routine operations. Also verify whether another branch could bypass it.

7. Record the outcome and next steps (Worksheet 7):
Record the POSSIBLE PATHWAY, what you NEED TO FIND OUT and what you NEED TO VERIFY / CHANGE. Specify who will carry out each task, by when, and how the effectiveness of the measure will be verified. These records are not numerical risk grades.

8. Reassess related transmission pathways and their interconnections:
A new finding or measure may also change other parts of the farm network. Return to the relevant worksheets, examine the affected branches and do not complete again those sections that have already been verified and remain unchanged.

II.2.4. How to use the worksheets and annexes

Follow the eight steps in Section II.2. The first seven steps each have a corresponding worksheet in Annex B. The eighth step involves returning only to records affected by a new finding or an implemented measure.

Worksheet 1 → Define the farm and disease for which potential introduction and spread are being assessed; Worksheet 2 → nine categories; Worksheet 3 → possible pathway; Worksheet 4 → supplementary questions; Worksheet 5 → check links using Spider Diagrams; Worksheet 6 → interrupt the pathway and verify barriers; Worksheet 7 → findings, tasks and their verification.

Seven accompanying working pages in Annex C support the individual worksheets.

Nine pathway-specific Spider Diagrams are used to examine related categories

Use the final Spider Diagrams of the nine pathways for an overall check of possible links. They illustrate potential interconnections among the nine pathways by which agents of serious infectious diseases may be transmitted on farms. They do not show the magnitude of risk, probability of transmission or direction of transmission. Neither line thickness nor line type indicates the importance or severity of a link. The absence of a connecting line does not mean that a link cannot exist on a particular farm.

Use the graphical aids only after making your own assessment; connecting lines do not constitute evidence of transmission or of the magnitude of risk.

II.2.5. Validation of the system for analysing pathways of pathogen introduction and spread on livestock farms

The applicability of the system for analysing pathways of pathogen introduction and spread on livestock farms was evaluated when processing the results of epidemiological surveillance conducted on a total of 108 livestock farms, comprising 45 cattle farms, 34 pig farms and 29 poultry farms of different sizes. The representation of farms in the study population (45 large-scale farms, 32 medium-sized farms, 19 small-scale farms and 12 organic farms) was determined with reference to their proportional representation in the structure of livestock farming in the Czech Republic.

The epidemiological surveillance focused on assessing relationships between potential sources of agents of serious infectious diseases, the possible routes by which they could cross farm boundaries and the conditions permitting their subsequent spread within farm premises. The overall evaluation identified nine principal pathways of potential pathogen introduction and subsequent spread.

Animals of the same species provide a direct epidemiological link between holdings. The significance of this pathway is influenced by the origin and health status of the animals, the number of source holdings, the method of transport and the possibility of quarantining newly arrived animals.

For wild animals, the decisive factor is the possibility of direct contact with livestock or indirect contact via feed, water, bedding and the farm environment. The significance of this pathway may increase particularly in systems allowing animals access to outdoor runs and in pasture-based farming.

People and vehicles create mobile connections between the external environment and the holding, as well as between different operational areas. From a biosecurity perspective, not only the frequency of their entry is important, but also their previous contacts, movements within the premises and compliance with hygiene protocols.

For feed and water, the decisive factors are their origin, transport, storage and distribution, including the possibility of secondary contamination.

Technological systems, tools, husbandry and veterinary equipment may permit the mechanical transfer of infectious agents between groups of animals or different operational areas.

Unlike the preceding pathways, the significance of the airborne route is strongly dependent on the biological properties of the particular pathogen, its concentration, distance and environmental conditions. Its general assessment must therefore take account of pathogen-specific characteristics.

The results showed that neither farm size nor identification of a potential source alone is sufficient for a practical assessment of biosecurity. The nature and frequency of epidemiologically relevant contacts, and the presence and effectiveness of preventive barriers, play a major role. The key is to identify the point at which a preventive measure can substantially reduce the likelihood of pathogen introduction or subsequent spread. On this basis, the following general model was formulated:

SOURCE → PATHWAY → CRITICAL CONTROL POINT → PREVENTIVE BARRIER → EFFECTIVENESS CHECK → RESIDUAL RISK.

For practical application of the surveillance findings, it therefore appears appropriate to link the empirically observed frequency of risk factors with the epidemiological significance of the relevant pathway. A semi-quantitative assessment may subsequently make it possible to present complex information in an accessible form for prioritising preventive measures.

II.3. Conclusions and recommendations for practice

Biosecurity is one of the fundamental components of preventing the introduction and subsequent spread of infectious disease agents, including those causing serious infectious diseases, on livestock farms. The present methodology is designed as a generally applicable tool for analysing the level of biosecurity on livestock farms.

The practical biosecurity assessment procedure comprises eight interrelated steps that enable livestock keepers to systematically identify potential pathways for the introduction and spread of agents causing serious infectious diseases, assess whether these pathways are interrupted by preventive measures, and verify the actual effectiveness of those measures. The procedure is neither a one-off inspection nor merely the completion of a checklist of biosecurity requirements. It is based on understanding the specific holding, its operational interconnections and potential transmission pathways. The practical procedure enables livestock keepers to systematically identify and assess potential pathways for the introduction and spread of agents causing serious infectious diseases under the particular conditions of their holding.

The livestock keeper first defines the holding, or part of it, to be assessed and identifies the diseases and potential sources to be considered. Using nine analytical categories, the keeper examines the principal operational areas, then independently maps specific potential transmission pathways and, where necessary, uses supplementary questions and schematic “Spiders of Potential Connections”. For identified pathways, the keeper locates critical control points, determines the presence and actual effectiveness of preventive barriers, and decides whether further information must be obtained, measures verified or operational procedures changed.

Findings are recorded descriptively in the worksheets. The methodology does not require numerical risk calculation or the assignment of a single overall risk level to the entire holding.

The practical assessment is conducted in eight consecutive, interrelated steps. The procedure is repeatable and allows a return to earlier steps whenever a new finding affects any previous conclusion.

The practical benefit for livestock keepers lies in their ability to independently identify potential pathways of disease introduction and spread, determine critical control points, verify the actual effectiveness of preventive barriers and decide on necessary measures, taking residual risk into account.

After completing the worksheets, follow each identified potential pathway through to an assessment of whether, and by what route, transmission could continue despite existing preventive measures. The outcome should be your own decision on what to do next, rather than merely a completed form.

1. What I have established

For each potential pathway, record the source, introduction or spread, critical control point, potential exposure of susceptible animals and associated operational connections. Distinguish verified findings from assumptions and information that still needs to be obtained.

2. What protects me and what may remain unaddressed

Specify the preventive barrier, how you verified its actual effectiveness and whether transmission could bypass it via another pathway. At this stage, describe residual risk in words: what may remain a potential pathway of introduction or spread even after the measures have been implemented.

3. What I can do

Classify the proposed measures according to feasibility: (a) what I can change immediately in working procedures and the organisation of the holding; (b) what requires time, preparation or financial resources; and (c) what is currently impracticable and where I must seek another solution. If a barrier cannot be introduced, consider eliminating the undesirable operational connection or interrupting the pathway at another point.

4. How I will know whether the change works

For the selected measure, determine who will implement it, when and how its effectiveness will be verified. Then revisit only the affected pathways and related branches.

5. When to seek expert advice

Only after completing your own assessment may you discuss your conclusions and outstanding questions with a specialist. The specialist will review the validity of your conclusions with you, draw attention to any connections that may have been overlooked and recommend what else needs to be established. Consultation does not replace your own self-assessment.

Working output of the self-assessment

For each pathway assessed, you should have a brief record of: what is possible and verified; where transmission can be interrupted; which barrier exists and whether it works; what may remain unaddressed; what you will change immediately, later or by other means; and what you still need to establish. We will verify this proposed output on the basis of the sequence of Worksheets 1–7.

What follows the self-assessment

Following self-assessment, the livestock keeper may, if desired, consult a biosecurity specialist about their assessment of the holding's biosecurity level.

III. Comparison of the novelty of the procedures

The methodology presents entirely new, experimentally supported findings on the basis of which procedures have been developed and verified that enable livestock keepers to identify and assess potential pathways for the introduction and spread of agents causing serious infectious diseases under the specific conditions of a holding. These procedures encompass the interconnections between pathways, critical control points, preventive barriers and their actual effectiveness, as well as the development of a set of mutually reinforcing preventive measures to reduce the potential risk of introducing agents causing serious infectious diseases into the holding and their subsequent spread within the farm premises, thereby providing an important basis for maintaining and progressively improving the health status of the animals kept.

IV. Description of the application of the certified methodology

The methodology is intended primarily for all livestock keepers in the Czech Republic, livestock breeders' associations, public administration authorities through the Ministry of Agriculture and the State Veterinary Administration, as well as private veterinary surgeons, regional information centres, agricultural advisers, the professional community and others interested in the subject. The content of the methodology is also intended for inclusion in the syllabuses of Czech - and English-language study programmes and in Czech- and English-language teaching materials for secondary vocational schools and universities specialising in veterinary and agricultural subjects.

V. Economic aspects

On the basis of a qualified expert estimate, adherence to good livestock husbandry practices, animal health programmes and biosecurity principles can be expected to improve animal health on cattle, pig and poultry farms and subsequently reduce expenditure on veterinary care and medicines by at least 10%.

The anticipated economic benefits are calculated from the average annual costs of veterinary care and medicines on dairy cattle, finishing pig, laying hen and broiler farms, assuming a 10% reduction in these costs.

Cattle farming: On a farm with capacity for 500 dairy cows, where annual veterinary care and medicine costs range from CZK 1,250,000 to CZK 2,500,000, the estimated annual saving is CZK 125,000–250,000.

Pig farming: On a farm with a breeding herd of 100 sows and an annual output of 3,000 finished pigs, where annual veterinary care and medicine costs amount to CZK 250,000–450,000, the estimated annual saving is CZK 25,000–45,000.

Laying hen farming: In a poultry house with capacity for 30,000 laying hens, where annual veterinary care and medicine costs range from CZK 240,000 to CZK 450,000, the estimated annual saving is CZK 24,000–45,000.

Broiler farming: In a poultry house with capacity for 30,000 broilers over six production cycles per year, i.e. an annual output of 180,000 chickens, where annual veterinary care and medicine costs amount to CZK 126,000–216,000, the estimated annual saving is CZK 12,600–21,600.

Pullet and laying hen farming by a user of the methodology: On a farm with capacity for 230,000 pullets and 65,000 laying hens, annual veterinary care and medicine costs for pullets range from CZK 460,000 to CZK 1,035,000, representing an estimated annual saving of CZK 46,000–103,500. For laying hens, annual veterinary care and medicine costs amount to CZK 130,000–235,000, corresponding to an estimated annual saving of CZK 13,000–23,500. The total estimated annual saving for the pullet and laying hen operation is therefore CZK 59,000–127,000.

VI. Annexes

Annex A – Glossary of terminology for livestock keepers

Annex B – Worksheets 1–7

The seven worksheets guide you step by step through an independent assessment of potential pathways for the introduction and spread of infectious disease agents under the specific conditions of your holding.

Annex C – Working pages 1–7

Contains seven consecutive working pages, nine specific Spider diagrams and the final Nine-Pathway Spider diagram.

Annex D Graphical aids – Specific Spider diagrams 1–9 – Final Spider diagrams 1–2

Contains nine specific Spider diagrams and two final Spider diagrams covering the nine potential pathways for the introduction and spread of infectious disease agents on livestock farms.

How to use the annexes

First, consider the potential transmission pathways on your holding and record your findings in Worksheets 1–7.

Only then use the graphical aids (Spider diagrams) to examine other possible connections that you may have overlooked in your own assessment.

Remember: The connecting lines in the Spider diagrams represent potential connections that need to be examined. They do not, in themselves, demonstrate the existence of a transmission pathway or the magnitude of risk.

Appendix A – Glossary of Terms for Livestock Farmers

Consult this glossary if you encounter an unfamiliar term when using the methodology or worksheets.

Biosecurity

Principles, measures and rules intended to prevent the introduction of infectious disease into a livestock farm and its spread within the farm.

External and internal biosecurity

External biosecurity prevents the introduction of infection from outside the farm. Internal biosecurity limits its spread between animals and different parts of the farm. The two are interrelated.

System under assessment

The entire farm or a clearly defined part of it being assessed, such as a livestock building, poultry house or group of animals. The scope of the assessment must be clear.

Epidemiological unit

A group of animals or part of a farm assessed together for a particular disease based on contacts, environment and husbandry practices. It need not correspond to a single building.

Biosecurity boundary

A location or operational interface at which rules governing entry, movement or handling change, such as the entrance to a livestock building. Simply designating a boundary does not mean that it is protected.

Disease agent (pathogen)

A biological agent (e.g. a virus or bacterium) capable of causing infectious disease in susceptible animals.

When assessing potential pathways of its introduction and spread, particular consideration must be given to the mode of transmission, shedding by infected organisms, ability to survive in the environment and conditions under which susceptible animals may become infected.

Susceptible animals

Animals that may become infected with the pathogen under certain conditions; this does not in itself mean that they have been exposed to infection.

Potential source of a pathogen

An animal, environment or other possible source from which the pathogen could spread. The term "potential" does not mean that the pathogen has actually been detected.

During assessment, a potential source of the pathogen must be distinguished from intermediaries that may subsequently carry it. Depending on the circumstances, a contaminated object, material or environment may form part of a transmission pathway or constitute a secondary source of contamination.

Analytical category

One of nine areas used to identify potential pathways systematically: animals of the same species; wildlife; people; vehicles; feed; drinking water; technological systems; tools and equipment; and air. A category does not in itself constitute a complete transmission pathway.

Transmission mechanism

The means by which a pathogen may pass from its source to an animal, for example through direct contact or contaminated material. This depends on the particular pathogen.

Operational link

An actual connection between activities, people, areas, objects or technological systems. Not every such connection permits transmission of the disease under assessment.

Potential pathway of introduction or spread

A sequence of links through which, under the prevailing conditions, a pathogen could pass from a potential source to susceptible animals.

It may involve several successive activities, intermediaries or operational areas, and may branch or connect with other pathways.

The mere presence of a potential source, risk factor or operational link does not establish the existence of a complete transmission pathway. The pathway must be biologically plausible and operationally feasible on the farm concerned. Describing it is not evidence that transmission has occurred.

Transmission branch

A section of a potential pathway that diverges from or joins another pathway. Several branches may pass through the same location or use the same equipment.

Exposure of susceptible animals

A situation in which animals could come into contact with a pathogen. Exposure does not necessarily mean that infection has occurred.

Critical control point (CCP)

A location, operational interface or activity along a potential transmission pathway at which targeted measures can interrupt or substantially reduce pathogen transmission. A CCP identifies where intervention is possible; a preventive barrier is the specific measure applied at that point. Sometimes eliminating an undesirable operational link is more effective than adding another barrier.

Preventive barrier

A specific organisational, operational, technical or hygiene measure intended to interrupt or substantially reduce transmission. An example is a separate hygienic entry point with a footwear change and enforced personnel movement procedures, ideally incorporating a hygiene barrier system.

The mere existence of a barrier does not demonstrate its effectiveness. What matters is its suitability for the pathogen and transmission mechanism concerned, correct positioning, technical condition, actual use and the possibility of bypassing it.

Functionality of a preventive barrier

The ability of a particular barrier to perform its intended protective function under actual farm conditions. This depends on its suitability for the disease concerned, its location and technical condition, and whether it is used correctly in routine operations.

Bypassing a barrier

An alternative potential pathway by which a pathogen may continue beyond the barrier being assessed. A barrier may function correctly yet still be bypassed, for example through an uncontrolled side entrance to a livestock building, movement of equipment between farm areas or another unprotected contact.

Verification of a measure's effectiveness

Determining whether a measure actually works, for example by observing routine operations or checking its technical condition or records. An assumption alone is insufficient.

Farm-specific network

The set of potential pathways and their branches that may interconnect on a particular farm. A change in one part may affect other pathways.

Assumption

A statement or working proposition that may be scientifically justified but has not yet been verified on the particular farm.

An assumption must not be treated as an established fact during the assessment.

Verified information, assumptions and missing information

A fact or item of information whose accuracy has been adequately checked for the purposes of the assessment. An assumption is a proposition that has not yet been verified.

Missing information

Information needed to assess a potential transmission pathway or the effectiveness of a measure but unavailable at the time of assessment.

Missing information does not demonstrate either a deficiency or the proper functioning of a barrier. It indicates that further investigation is required.

Reassessment of the affected farm network

Re-examination of potential pathways and transmission branches whose significance, operational links or opportunities for interruption may have changed as a result of new findings, operational changes or an implemented measure.

Reassessment covers not only the part directly affected but also other related pathways and branches.

The assessment returns to the step whose conclusion is affected by the new finding.

Spider diagram of potential links

A visual aid for identifying connections that may have been overlooked. A connecting line means “investigate”; it is not evidence of an existing pathway, the direction of transmission or the magnitude of risk. It is used only after the farmer has undertaken their own assessment.

Farm self-assessment

An initial independent assessment of the farm by its operator. The findings provide a basis for subsequent joint work with a specialist.

Risk level

A verbal or numerical expression of the level of risk based on predefined assessment criteria. Its interpretation depends on the method used and the available scientific evidence. In version 1.0, farmers do not need to calculate a score or assign a single number to the whole farm. The entries “POTENTIAL PATHWAY”, “NEED TO FIND OUT” and “NEED TO VERIFY / CHANGE” are not risk levels.

Residual risk

The risk remaining after preventive measures and their actual effectiveness have been taken into account; its expert determination forms part of the subsequent assessment with a specialist.

Appendix B – Worksheets 1–7

WORKSHEET 1 | WHAT YOU WILL DO

The aim is not to identify every risk on your farm during the first assessment.

You will select potential pathways of pathogen introduction or spread. For those requiring investigation, try to describe how the pathogen could reach your animals.

FROM WHERE? → BY WHICH ROUTE AND VIA WHAT? → TO WHERE?

DO I KNOW THIS, OR AM I ONLY ASSUMING IT?

I DO NOT KNOW → I NEED TO FIND OUT.

The first assessment need not be exhaustive. Try to identify at least one specific potential pathway of disease introduction or spread, or part of such a pathway. Also record what you need to find out, verify or change.

First review all nine categories and try to construct a specific potential pathway independently. Use the supplementary questions and the spider diagram of potential links only afterwards.

Which farm / part of the farm am I assessing today?

.....

Which disease or pathogen am I assessing today?

.....

WORKSHEET 2 | RAPID PATHWAY SCREENING

First review all nine categories in turn. For each, mark YES, DO NOT KNOW or NO. Only then select the specific potential pathway you will assess further.

IS THERE ANYTHING IN THIS CATEGORY THAT I NEED TO ASSESS FURTHER?

YES = I have a specific reason | DO NOT KNOW = I need to obtain information | NO = I currently have no specific reason

CATEGORY	QUESTIONS	YES / DO NOT KNOW / NO
Animals of the same species	Are animals introduced or moved between groups or farms?	.....
Wildlife	What could wild animals contaminate in or around the farm?	.....
People	Who arrives from other locations, and where do they then go?	.....
Vehicles	Which vehicles arrive, and what do they connect?	.....
Feed	What route does feed take from delivery to the animal?	.....
Drinking water	What happens to water between its source and the drinker?	.....
Technological systems	Which parts of the farm are connected by the systems in use?	.....
Tools, husbandry and veterinary equipment	What is used in more than one group, livestock building or farm?	.....
Air	Is there a specific reason to investigate airborne transmission?	.....

BEFORE ANSWERING NO: Have I assessed the entire potential pathway of the pathogen, or only part of it?

NO does not mean zero risk. It means only that you currently have no specific reason to investigate the pathway in greater detail.

For DO NOT KNOW responses, I need to find out:

.....

WORKSHEET 3 | CONSTRUCT A POTENTIAL PATHWAY

Start where the infectious agent may be present and try to describe how it could reach your animals.

WHERE FROM? → BY WHICH ROUTE AND MEANS? → WHERE TO?

My initial assessment – without prompts:

.....

.....

.....

.....

.....

HAVE I DESCRIBED THE ENTIRE POTENTIAL PATHWAY TO THE ANIMALS, OR ONLY PART OF IT?

DO I KNOW THAT THE OPERATIONAL LINKS DESCRIBED ACTUALLY EXIST, OR AM I ONLY ASSUMING THAT THEY DO?

I NEED TO FIND OUT:

.....

.....

.....

WORKSHEET 4 | ADDITIONAL QUESTIONS

After independently constructing a potential pathway, use these additional questions to check whether you have overlooked any important link. Start with the questions for the initial category and, where necessary, continue with those for other categories through which the pathway may pass. Preventive measures will be assessed later.

ANIMALS OF THE SAME SPECIES — Where do they come from? Where are they kept on arrival? Do they move into contact with other animals?

WILDLIFE — What might they have contaminated? Who or what subsequently comes into contact with it?

PEOPLE — Where has the person been previously? By what means could they transfer infectious material? Where do they go next?

VEHICLES — Which routes does the vehicle take and where does it stop? What or who moves on from the vehicle?

FEED — What happens to feed between the silo/silage clamp and the animal? Can contact also occur after the vehicle has arrived?

DRINKING WATER — Source → treatment, if any → storage tank → distribution system → drinker → animal. Where could the infectious agent enter the system?

TECHNOLOGICAL SYSTEMS — What does the system connect? What moves through it? Who operates or handles it?

TOOLS, HUSBANDRY AND VETERINARY EQUIPMENT — Where was the item previously? What did it come into contact with? Where will it be used next?

AIR — Where is the potential source? How far away is it? What lies between it and the animals? What specific evidence is available?

"WE HAVE NOT IDENTIFIED ANOTHER PATHWAY" IS NOT EVIDENCE OF AIRBORNE TRANSMISSION.

Terminological note: A vector is a living organism; a contaminated object or material may act as a vehicle for transmission but is not a vector.

WORKSHEET 5 | SPIDER DIAGRAM OF POTENTIAL LINKS – EXTENDING A POTENTIAL PATHWAY

After independently constructing a potential pathway and considering the additional questions, examine the Spider Diagram of Potential Links for the relevant category. Consider whether it helps you identify further possible links that you have not yet recorded.

IS THERE ANYTHING YOU OVERLOOKED IN YOUR INITIAL ASSESSMENT?

A connecting line means "investigate a possible link". It does not mean that the link actually exists on your farm or poses a risk.

HAVE I IDENTIFIED ANOTHER POSSIBLE LINK?

YES → I will record the possible link and verify whether it actually exists on my farm and could form part of the pathway being assessed.

DON'T KNOW → I will record what I need to find out.

NO → I will not pursue it further.

What additional link did the Spider Diagram help me identify?

.....

.....

.....

.....

If you identify a specific link to another pathway, continue with its Spider Diagram from that point only. Do not complete again any section already investigated.

Do not move on to another Spider Diagram merely because pathways are interconnected in general.

WORKSHEET 6 | WHERE CAN THE PATHWAY BE INTERRUPTED?

First verify whether the pathway described is genuinely possible on the farm concerned. Only then consider preventive measures.

DOES THIS BRANCH OR ITS KEY OPERATIONAL LINK NEED TO EXIST AT ALL?

.....

WHERE CAN THE POTENTIAL PATHWAY BE INTERRUPTED, AND WHERE AM I ALREADY PREVENTING ITS CONTINUATION?

.....

WHAT PREVENTIVE MEASURE DO I USE AT THIS POINT, OR WHAT MEASURE IS MISSING?

.....

DOES IT ACTUALLY WORK UNDER ROUTINE OPERATING CONDITIONS?

.....

WHAT DO I ACTUALLY KNOW ABOUT THE EFFECTIVENESS OF THE MEASURE, AND WHAT DO I STILL NEED TO VERIFY?

.....

THE EXISTENCE OF A MEASURE DOES NOT MEAN THAT IT ACTUALLY WORKS.

HAVE I ADDRESSED THE ENTIRE POTENTIAL PATHWAY, OR ONLY PART OF IT?

.....

COULD THE INFECTIOUS AGENT CONTINUE ALONG ANOTHER PATHWAY WITHOUT PASSING THROUGH THIS PREVENTIVE MEASURE?

.....

Example: Does the vehicle need to enter the farm at all? Does the item need to be moved between these locations?

WORKSHEET 7 | MY SPECIFIC FINDINGS

POTENTIAL PATHWAY:

.....

.....

.....

I NEED TO FIND OUT:

.....

.....

COULD THE INFECTIOUS AGENT STILL REACH SUSCEPTIBLE ANIMALS DESPITE THE EXISTING PREVENTIVE MEASURES?
WHAT DO I KNOW ABOUT THIS, AND WHAT DO I NEED TO VERIFY?

.....

.....

I NEED TO VERIFY / CHANGE:

.....

.....

WHO WILL ENSURE THIS IS DONE, AND BY WHEN?

.....

HOW AND WHEN WILL I VERIFY THAT THE MEASURE ACTUALLY WORKS?

.....

If you have identified another potential pathway, or if a measure implemented has affected other parts of the farm, return to the relevant worksheets and reassess the affected pathways and links. Sections already verified and unchanged need not be completed again.

The first assessment need not be exhaustive. What matters is recording what you have established and what you still need to verify or change.

Annex C – Working Pages 1–7

PAGE 1 | WHAT YOU WILL DO

The aim is not to identify every risk on your farm during the first assessment.

You will select potential pathways by which an infectious agent could spread. For those requiring investigation, try to describe how the agent could reach your animals.

WHERE FROM? → BY WHICH ROUTE AND MEANS? → WHERE TO?
DO I KNOW THIS, OR AM I ONLY ASSUMING IT?
DON'T KNOW → I NEED TO FIND OUT.

The first assessment need not be exhaustive. It is useful if you identify at least one specific potential pathway, or part of one, and know what you need to find out, verify or change.

Work independently first. Use the prompts and Spider Diagram only when you get stuck or have completed your initial assessment.

Which farm / part of the farm am I assessing today?

_____

_____

PAGE 2 | QUICK SELECTION OF PATHWAYS

DO I NEED TO INVESTIGATE THIS PATHWAY NOW?

YES = I have a specific reason | DON'T KNOW = I need further information | NO = I currently have no specific reason

PATHWAY	INITIAL QUESTION	YES / DON'T KNOW / NO
Animals of the same species	Are animals introduced or moved between groups or farms?	_____
Wildlife	What might wildlife contaminate in or around the farm?	_____
People	Who arrives from elsewhere, and where do they subsequently go?	_____
Vehicles	Which vehicles arrive, and what do they connect?	_____
Feed	How does feed move from delivery to the animal?	_____
Drinking water	What happens to water between the source and the drinker?	_____
Technological systems	Which parts of the farm are connected by the systems in use?	_____
Tools and equipment	What is used in more than one group, building or farm?	_____
Air	Is there a specific reason to investigate airborne transmission?	_____

Before selecting the initial pathway for assessment, work through all nine rows listed.

BEFORE ANSWERING NO: Have I assessed the entire potential pathway of the infectious agent, or only part of it?

NO does not mean zero risk. It means only that you currently have no specific reason to investigate the pathway in greater detail.

For DON'T KNOW responses, I need to find out:

_____

PAGE 3 | CONSTRUCT A POTENTIAL PATHWAY

Start where the infectious agent may be present and try to trace a route to your animals.

WHERE FROM? → BY WHICH ROUTE AND MEANS? → WHERE TO?

My initial assessment – without prompts:

_____

_____

_____

_____

HAVE I DESCRIBED THE ENTIRE POTENTIAL PATHWAY TO THE ANIMALS, OR ONLY PART OF IT?

DO I KNOW THAT THIS IS WHAT ACTUALLY HAPPENS, OR AM I ONLY ASSUMING IT?

I NEED TO FIND OUT:

_____

_____

PAGE 4 | PROMPTS IF YOU GET STUCK

Use only the questions for the pathway you are currently investigating. This page helps you complete the pathway, not identify preventive measures.

ANIMALS OF THE SAME SPECIES — Where do they come from? Where are they kept on arrival? Do they move into contact with other animals?

WILDLIFE — What might they have contaminated? Who or what subsequently comes into contact with it?

PEOPLE — Where has the person been previously? By what means could they transfer infectious material? Where do they go next?

VEHICLES — Which routes does the vehicle take and where does it stop? What or who moves on from the vehicle?

FEED — What happens to feed between the silo/silage clamp and the animal? Can contact also occur after the vehicle has arrived?

DRINKING WATER — Source → treatment, if any → storage tank → distribution system → drinker → animal. Where could the infectious agent enter the system?

TECHNOLOGICAL SYSTEMS — What does the system connect? What moves through it? Who operates or handles it?

TOOLS AND EQUIPMENT — Where was the item previously? What did it come into contact with? Where will it be used next?

AIR — Where is the potential source? How far away is it? What lies between it and the animals? What specific evidence is available?

“WE HAVE NOT IDENTIFIED ANOTHER PATHWAY” IS NOT EVIDENCE OF AIRBORNE TRANSMISSION.

PAGE 5 | SPIDER DIAGRAM – PROMPTS FOR IDENTIFYING LINKS

First construct a potential pathway for the infectious agent yourself. Only then consult the relevant specific Spider Diagram.

IS THERE ANYTHING YOU OVERLOOKED IN YOUR INITIAL ASSESSMENT?

A connecting line means “investigate a possible link”. It does not mean that the link actually exists on your farm or poses a risk.

HAVE I IDENTIFIED ANOTHER POSSIBLE LINK?

YES → I will add it to the potential pathway.

DON’T KNOW → I will record what I need to find out.

NO → I will not pursue it further.

What additional link did the Spider Diagram help me identify?

_____

_____

_____

If you identify a specific link to another pathway, continue with its Spider Diagram from that point only. Do not complete again any section already investigated.

Do not move on to another Spider Diagram merely because pathways are interconnected in general.

PAGE 6 | WHERE CAN THE PATHWAY BE INTERRUPTED?

First verify whether the pathway described is genuinely possible on the farm concerned.
Only then consider preventive measures.

DOES THIS BRANCH OR ITS KEY OPERATIONAL LINK NEED TO EXIST AT ALL?

_____

WHERE AM I ALREADY PREVENTING ITS CONTINUATION?

_____

WHAT AM I USING TO PREVENT IT AT THIS POINT?

_____

DOES IT ACTUALLY WORK UNDER ROUTINE OPERATING CONDITIONS?

_____

WHAT DO I ACTUALLY KNOW ABOUT THE EFFECTIVENESS OF THE MEASURE, AND WHAT DO I STILL NEED TO VERIFY?

_____

HAVE I ADDRESSED THE ENTIRE POTENTIAL PATHWAY, OR ONLY PART OF IT?

_____

COULD THE INFECTIOUS AGENT CONTINUE ALONG ANOTHER PATHWAY WITHOUT PASSING THROUGH THIS MEASURE?

_____

Example: Does the vehicle need to enter the farm at all? Does the item need to be moved between these locations?

THE EXISTENCE OF A MEASURE DOES NOT MEAN THAT IT ACTUALLY WORKS.

PAGE 7 | MY SPECIFIC FINDINGS

POTENTIAL PATHWAY:

_____

_____

_____

I NEED TO FIND OUT:

_____

_____

_____

I NEED TO VERIFY / CHANGE:

_____

_____

_____

HAS THE PROPOSED / IMPLEMENTED MEASURE BEEN VERIFIED? YES / NO / NOT VERIFIED / NOT APPLICABLE

How, and with what result? _____

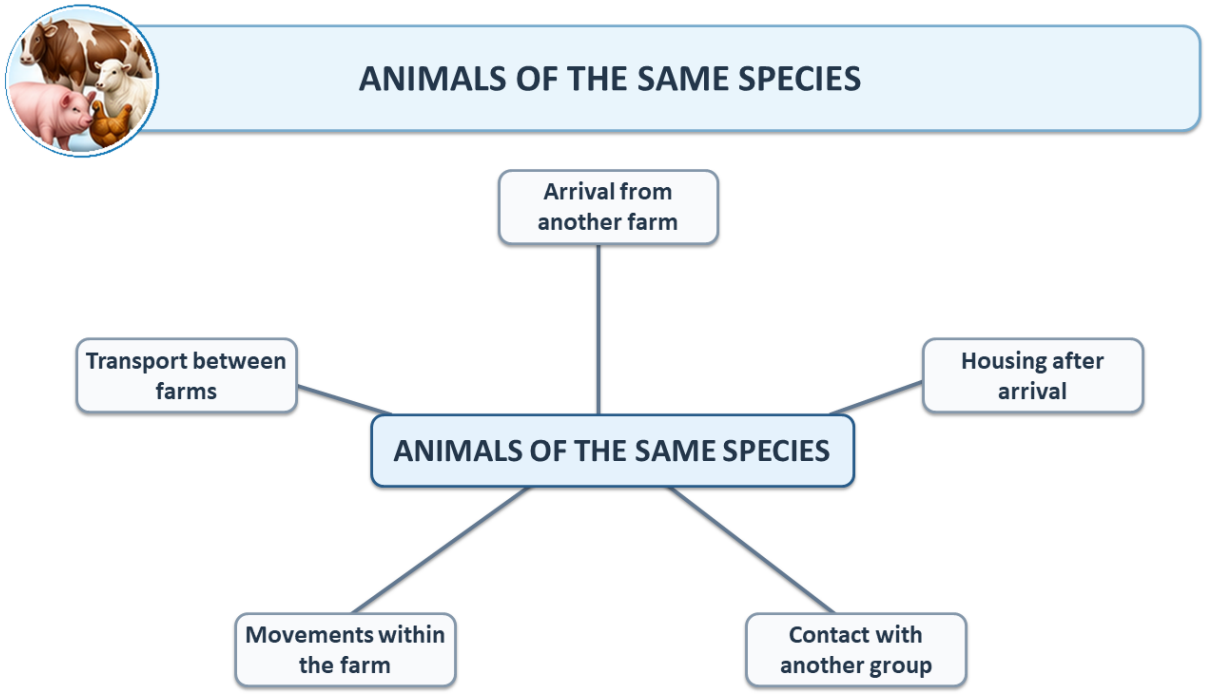
If you have identified another potential pathway, repeat the procedure for that pathway only. Do not complete again sections already described.

The first assessment need not be exhaustive. It is useful if you have identified a specific potential pathway, or part of one, and know what you need to find out, verify or change.

Appendix D: Graphical aids – Specific Spider Diagrams 1–9 – Final Spider Diagrams 1–2

SPECIFIC SPIDER DIAGRAM 1/9 | ANIMALS OF THE SAME SPECIES

Use only after completing your own assessment. A pre-drawn connecting line indicates a potential link to be investigated. It does not confirm the existence of an operational link on a particular farm or the transmission of a pathogen.



CHECK QUESTIONS – select only those you need:

1. Are animals of the same species brought in from another farm?

2. Where do they come from, and where are they housed on arrival?

3. Do they subsequently come into contact with other animals?

4. Are they moved between livestock buildings or groups?

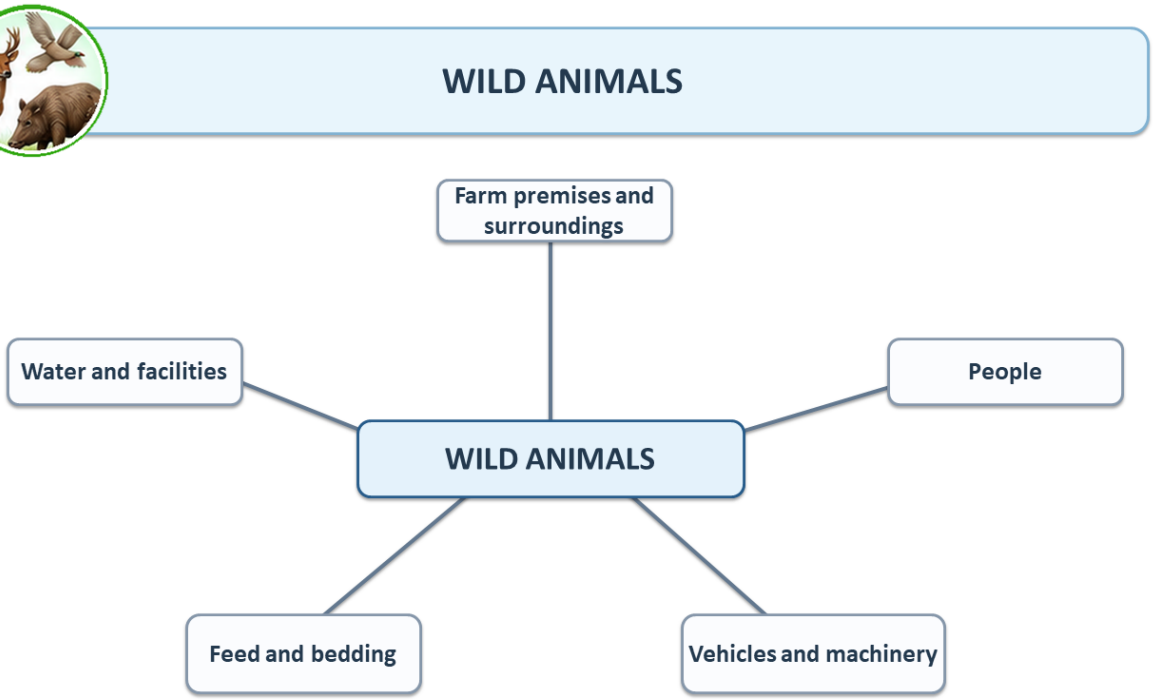
5. Are they transported between several farms within the same livestock enterprise?

HAVE I IDENTIFIED A LINK I PREVIOUSLY OVERLOOKED? YES / DON'T KNOW / NO

I will add / I need to establish: _____

SPECIFIC SPIDER DIAGRAM 2/9 | WILD ANIMALS

Use this diagram only after making your own assessment. A pre-drawn connecting line indicates a possibility that needs to be investigated. It does not confirm the existence of an operational link on a particular farm or the transmission of a pathogen.



CHECK QUESTIONS – select only those you need:

1. What could wild animals contaminate on the farm premises or in the surrounding area?

2. Who or what might subsequently come into contact with it?

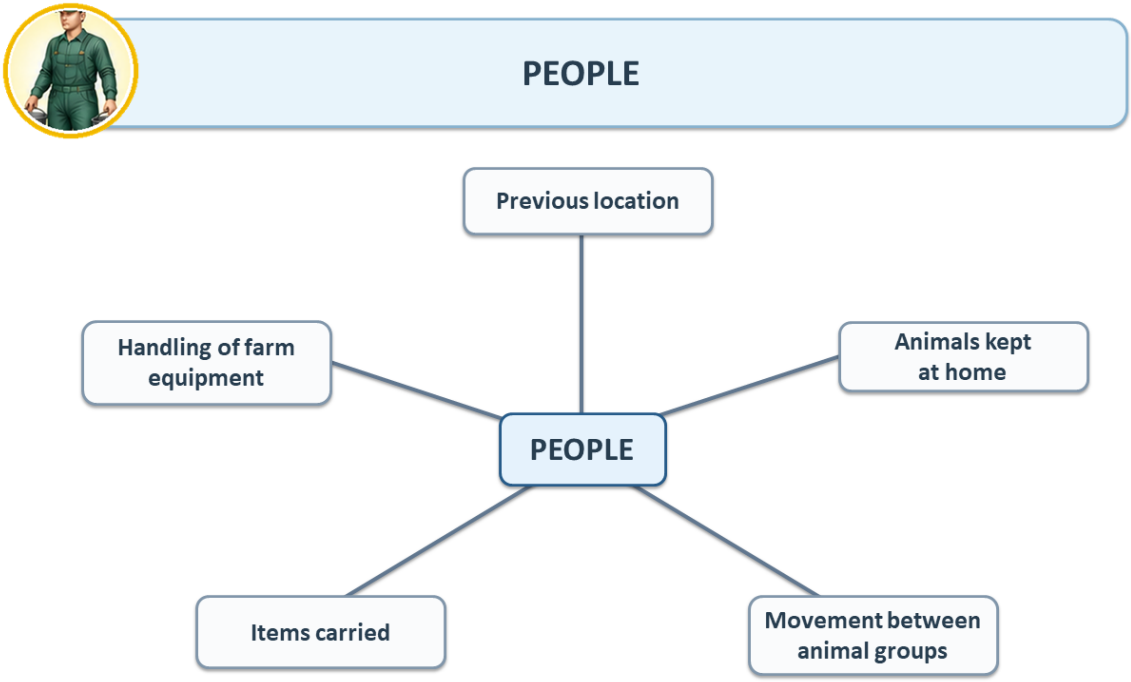
3. Could this contact subsequently lead to exposure of your animals?

HAVE I IDENTIFIED A LINK I HAD OVERLOOKED? YES / DON'T KNOW / NO

I will add / need to find out: _____

SPECIFIC SPIDER DIAGRAM 3/9 | PEOPLE

Use only after making your own initial assessment. A pre-drawn connecting line indicates a possible link that needs to be investigated. It does not confirm the existence of an operational link on a particular farm or the transmission of a pathogen.



CHECK QUESTIONS – select only those you need:

1. Where was this person previously?

2. Does this person keep animals at home that are relevant to the disease under assessment?

3. Where does this person move around the farm, and which animals do they come into contact with?

4. What does this person bring with them or carry between locations?

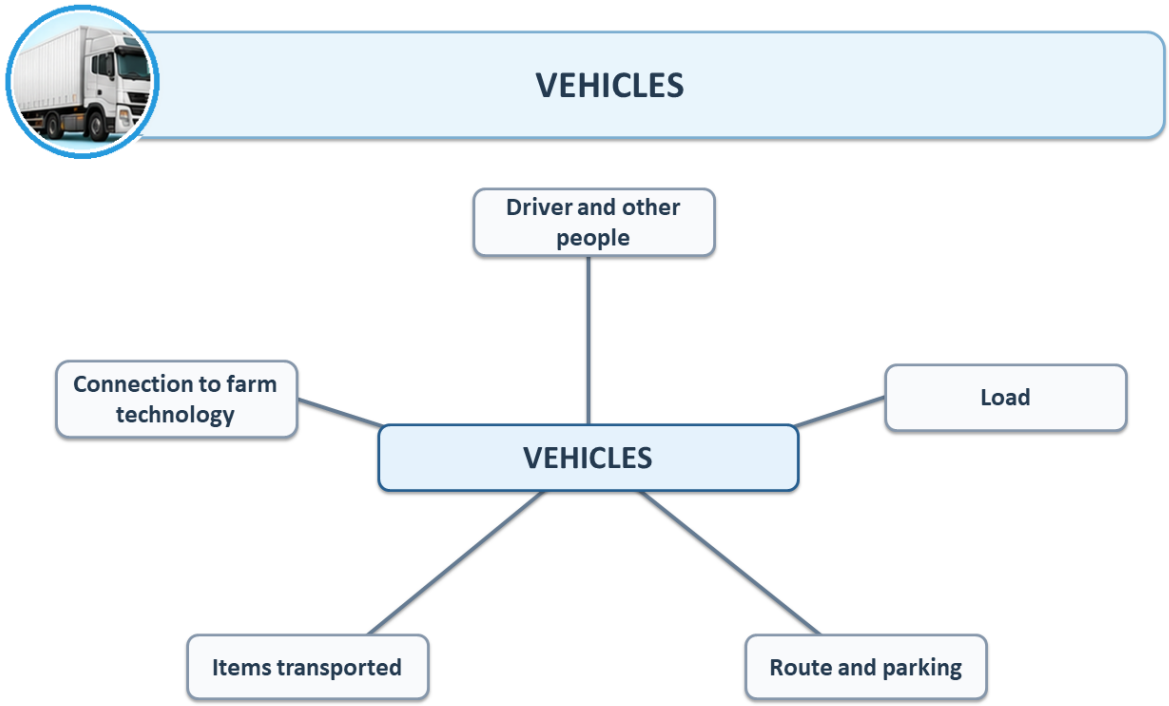
5. Which farm equipment or technological systems does this person handle?

HAVE I IDENTIFIED A LINK I PREVIOUSLY OVERLOOKED? YES / DON'T KNOW / NO

I will add / I need to find out: _____

SPECIFIC SPIDER DIAGRAM 4/9 | VEHICLES

Use this diagram only after conducting your own assessment. A pre-drawn connecting line indicates a possibility that needs to be investigated. It does not confirm the existence of an operational link on a particular farm or the transmission of a pathogen.



CHECK QUESTIONS – select only those you need:

1. Who gets out of the vehicle, and where do they go?

2. What does the vehicle deliver or collect?

3. Which route does it take, and where does it park?

4. What is transferred from the vehicle onto the farm or taken back to the vehicle?

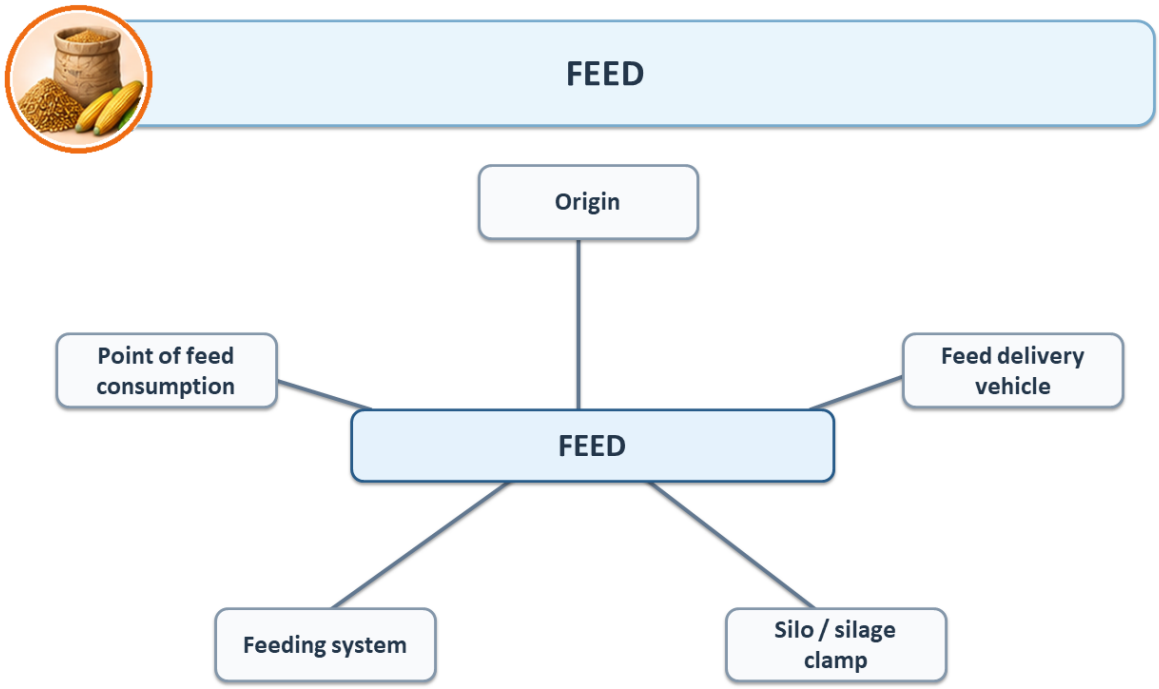
5. Is the vehicle directly connected to the farm's technological systems?

HAVE I IDENTIFIED A LINK THAT I OVERLOOKED? YES / DON'T KNOW / NO

I will add / I need to find out: _____

SPECIFIC SPIDER DIAGRAM 5/9 | FEED

Use only after carrying out your own assessment. A pre-drawn connecting line indicates a potential link that needs to be investigated. It does not confirm that an operational link exists on a particular farm or that transmission of a pathogen has occurred.



CHECK QUESTIONS – select only those you need:

1. Where does the feed originate?

2. How is it transported and received?

3. Where is it stored, and who or what comes into contact with it?

4. What happens to it before it is consumed by an animal?

5. Could the pathogen enter the pathway even after the vehicle has arrived?

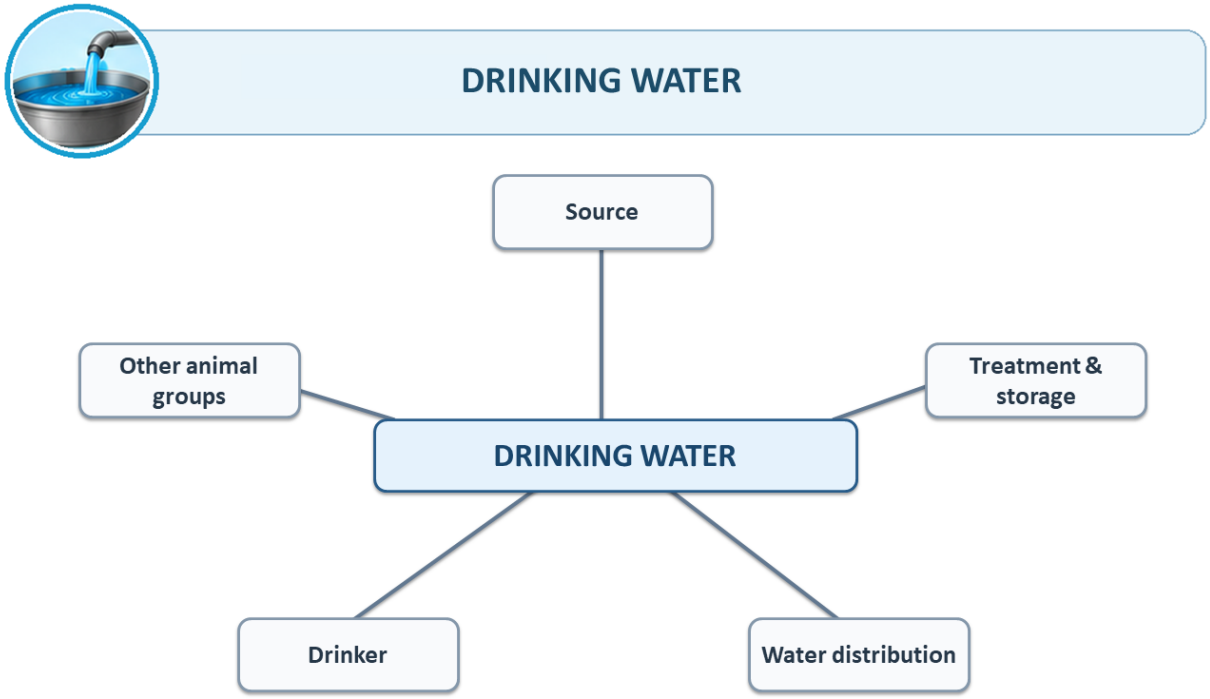
HAVE I IDENTIFIED A LINK I HAD OVERLOOKED? YES / DON'T KNOW / NO

I will add / I need to establish: _____

IMPORTANT: The presence of feed in a potential transmission pathway does not, in itself, mean that the pathogen is transmitted via feed.

SPECIFIC SPIDER DIAGRAM 6/9 | DRINKING WATER

Use only after considering your own farm circumstances. A pre-drawn connecting line indicates a possibility that needs to be investigated. It does not confirm the existence of an operational link on a particular farm or transmission of a pathogen.



CHECK QUESTIONS – select only those you need:

1. Where does the water come from?

2. What happens to the water before it reaches the drinker?

3. Could a pathogen enter the water along the pathway from the source?

4. Could a pathogen enter the system from animals or the environment?

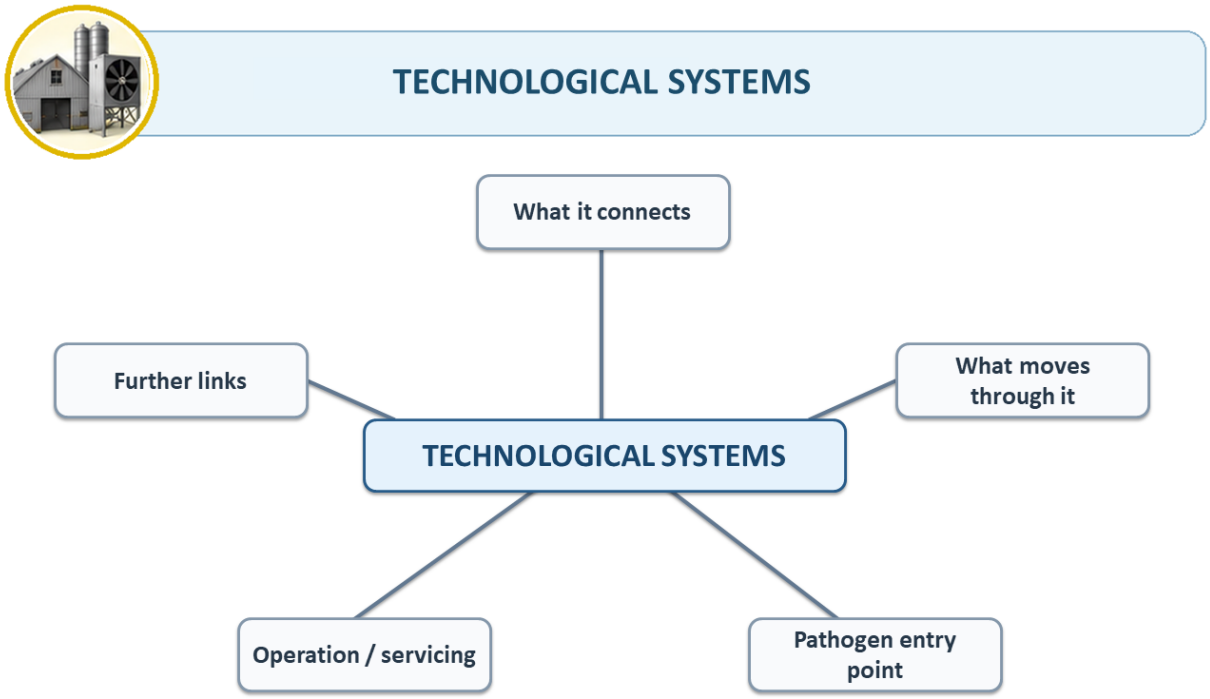
5. Could the system connect several groups of animals?

HAVE I IDENTIFIED A PREVIOUSLY OVERLOOKED LINK? YES / UNSURE / NO

I will add / need to establish: _____

SPECIFIC SPIDER DIAGRAM 7/9 | TECHNOLOGICAL SYSTEMS

Use this only after considering the situation on your own farm. A pre-drawn connecting line indicates a possibility that needs to be investigated. It does not confirm the existence of an operational link on a particular farm or the transmission of a pathogen.



CHECK QUESTIONS – select only those you need:

1. Which specific technological system are you assessing?

2. What does it actually connect on the farm?

3. What moves through it or is transferred by it?

4. Where could a pathogen enter this pathway?

5. Who operates or handles the system, and where could the pathway continue?

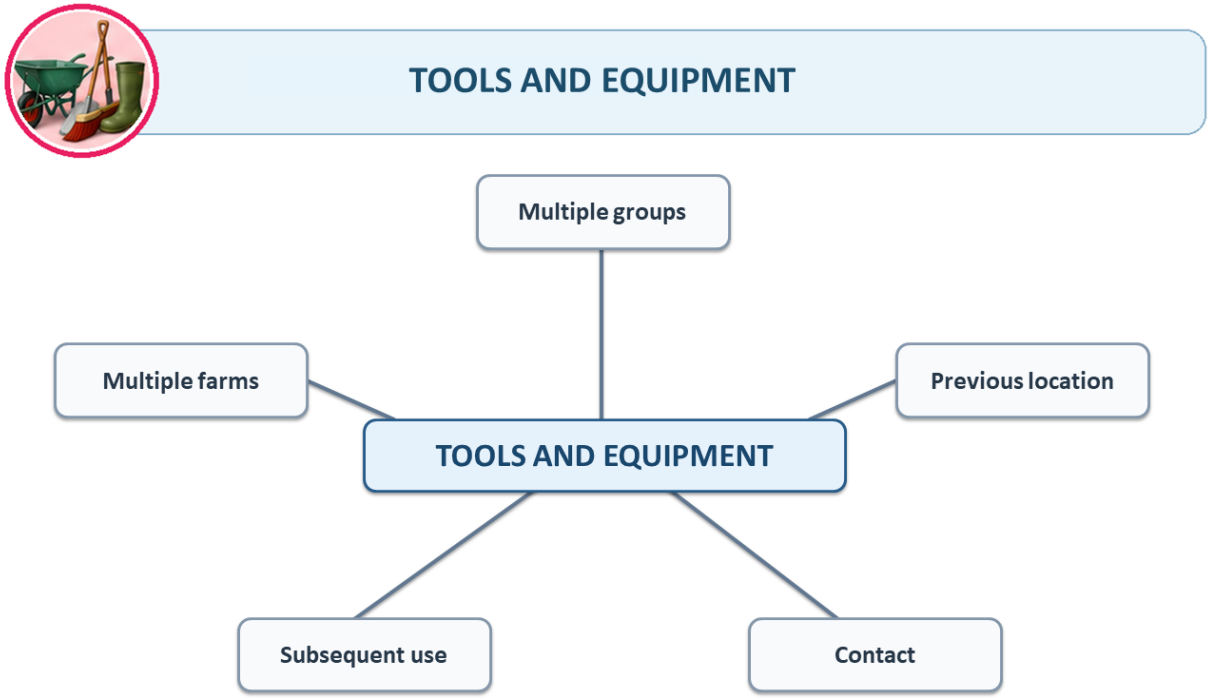
HAVE I IDENTIFIED A PREVIOUSLY OVERLOOKED LINK? YES / UNSURE / NO

Additional information / information to establish:

_____

SPECIFIC SPIDER DIAGRAM 8/9 | TOOLS AND EQUIPMENT

Use only after considering the situation on your own farm. A pre-drawn connecting line indicates a possibility that needs to be investigated. It does not confirm the existence of an operational link on a particular farm or transmission of a pathogen.



CHECK QUESTIONS – select only those you need:

1. What is transferred between groups of animals or livestock buildings?

2. Where was the item previously?

3. What or whom has it come into contact with?

4. Where will it be used next?

5. What is used on more than one farm?

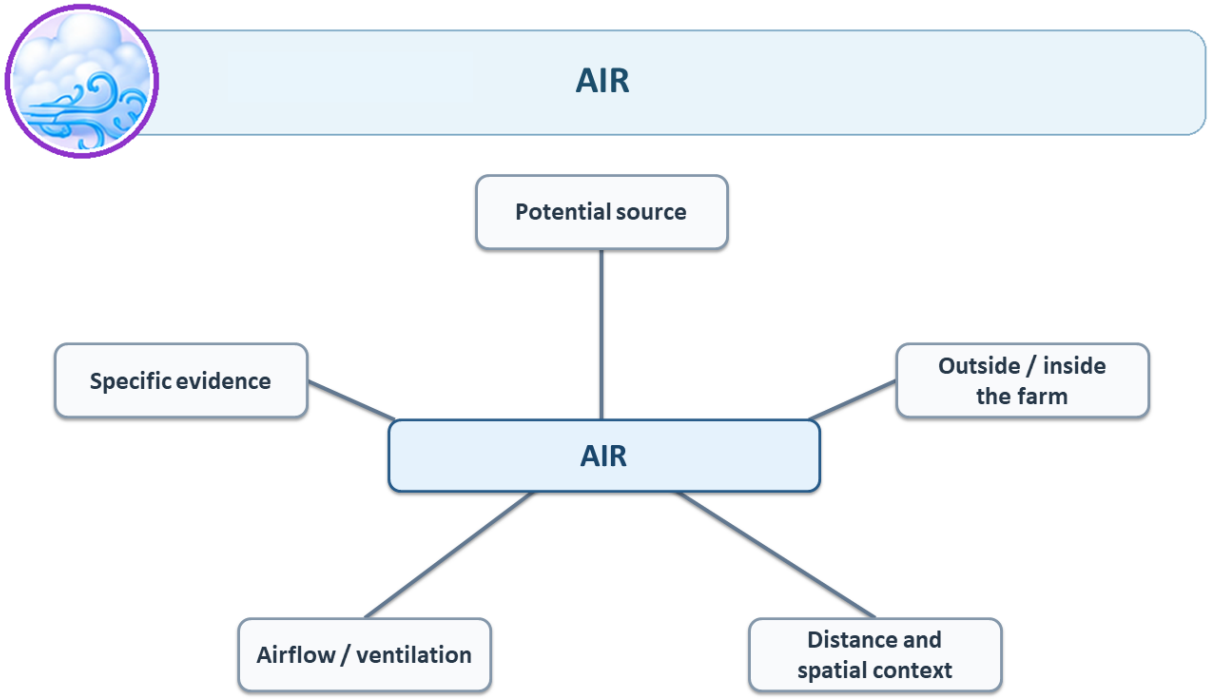
HAVE I IDENTIFIED A PREVIOUSLY OVERLOOKED LINK? YES / UNSURE / NO

Additional information / information to establish:

_____

SPECIFIC SPIDER DIAGRAM 9/9 | AIR

Use only after considering the situation on your own farm. A pre-drawn connecting line indicates a possibility that needs to be investigated. It does not confirm the existence of an operational link on a particular farm or the transmission of a pathogen.



CHECK QUESTIONS – select only those you need:

1. What leads you to assume that this pathway may exist?

2. Is the potential source outside or inside the farm?

3. How far is it from the animals, and what lies between them?

4. By what route could air reach the animals?

5. What do we actually know about this transmission pathway?

HAVE I IDENTIFIED A PREVIOUSLY OVERLOOKED LINK? YES / UNSURE / NO

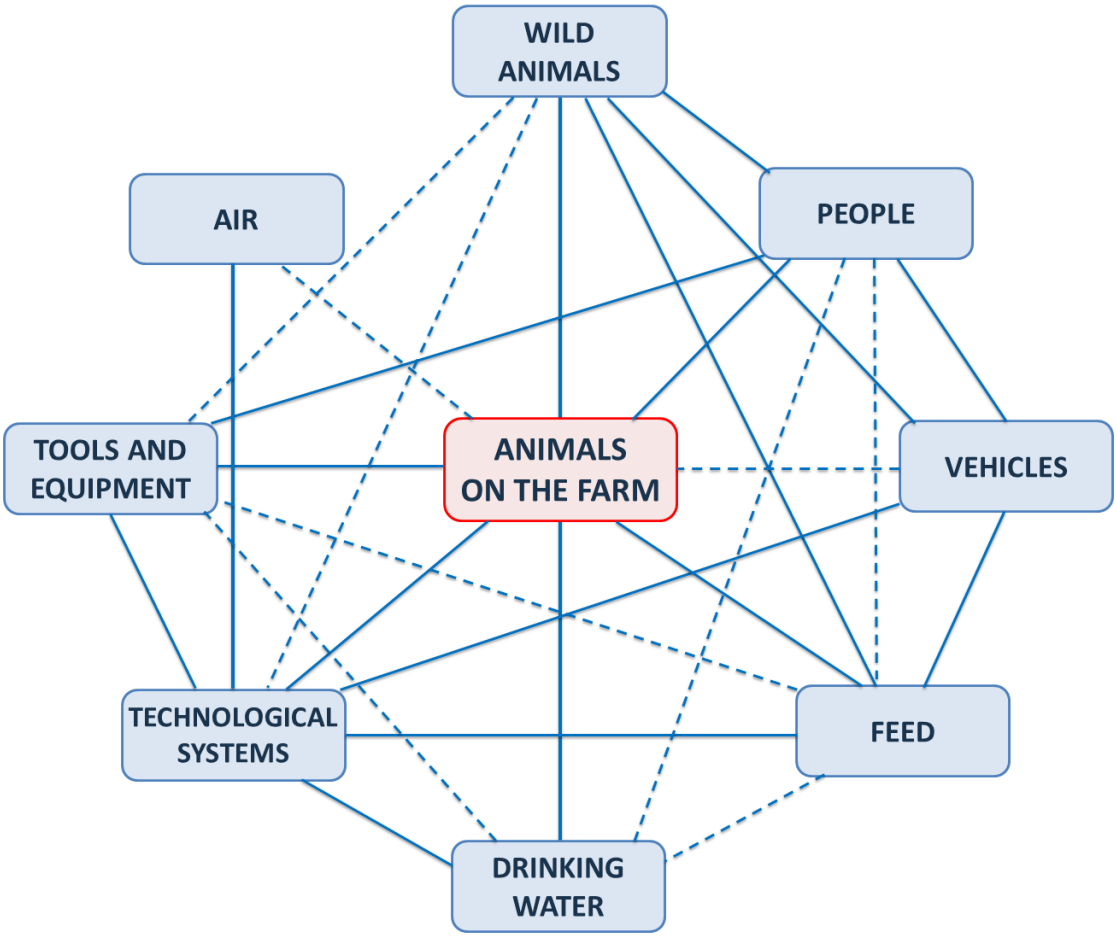
Additional information / information to establish:

_____

"We have not found another pathway" is not evidence of airborne transmission.
UNSURE → expert verification is required.

FINAL SPIDER DIAGRAM – NINE PATHWAYS

Potential interconnections between pathways of transmission of pathogens causing serious infectious diseases on livestock farms



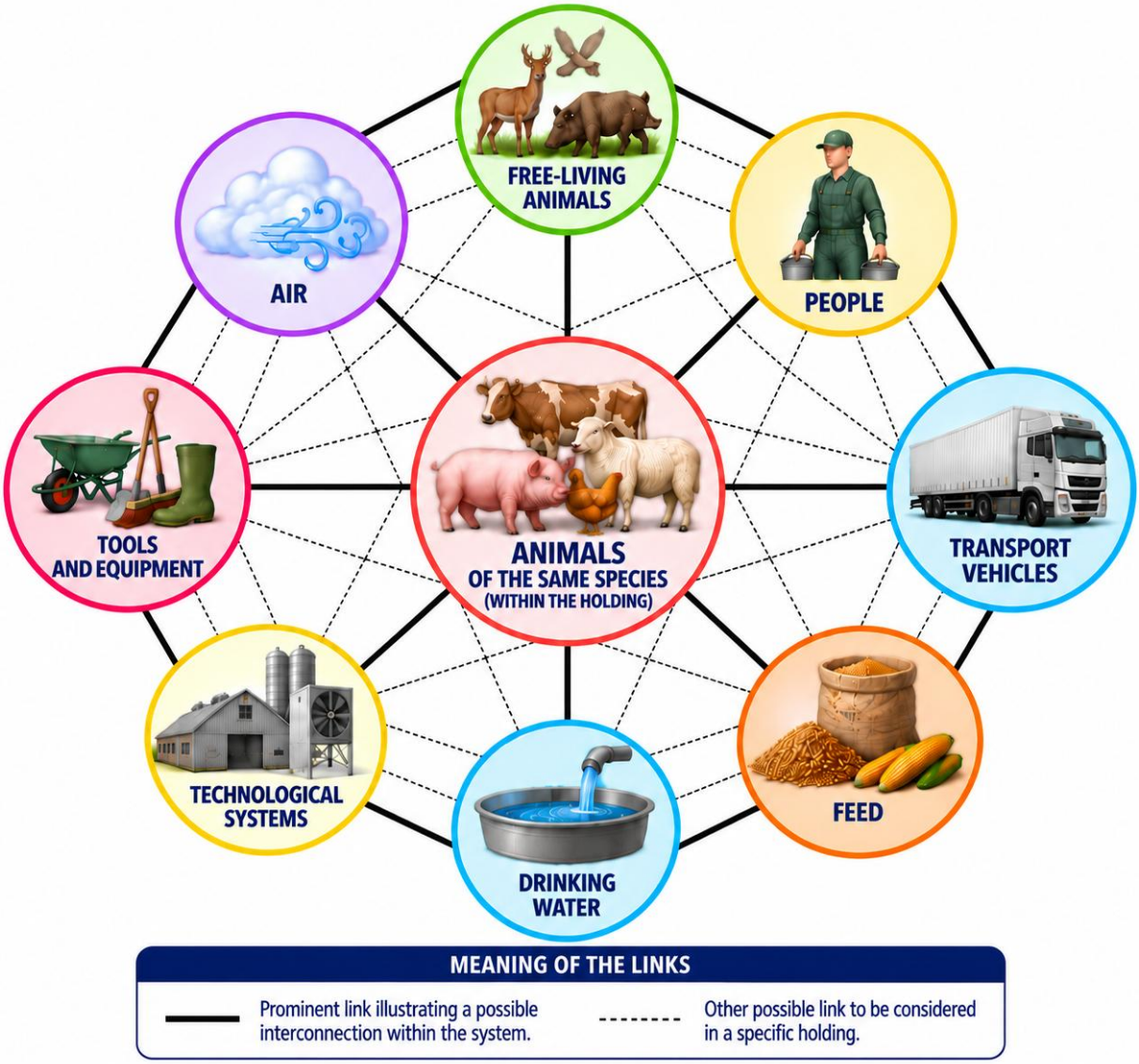
THICK SOLID LINE = an example of a possible link highlighted for illustration. DOTTED LINE = another possible link requiring investigation. NO CONNECTING LINE = the link is not pre-drawn; nevertheless, it may exist on a particular farm.

NO CONNECTING LINE proves the existence of an actual operational link or the transmission of a pathogen. The line type and thickness do not indicate probability, magnitude of risk, direction of transmission or degree of scientific certainty.

What surprised me / what I need to investigate: _____

FINAL SPIDER DIAGRAM OF THE 9 PATHWAYS

Potential interconnections of transmission pathways for hazardous pathogens in livestock holdings



The spider diagram illustrates the potential interconnections among nine transmission pathways for hazardous pathogens within livestock holdings.
It does not represent the magnitude of risk, the probability of transmission, or the direction of transmission.
Furthermore, neither line thickness nor line type indicates the significance or severity of a link.
The absence of a connecting line does not imply that such a link cannot exist within a specific holding.

VII. References

ALARCÓN LV, ALLEPUZ A, MATEU E. Biosecurity in pig farms: a review. Porcine Health Management. 2021;7:5.

APHIS Biosecurity on U.S. Sheep operations. Info Sheet. Veterinary Services. Centres for epidemiology and animal health. USDA, 2003, 4.

AYALA, A.J., M.J. Yabsley, Hernandez, S.M. A review of pathogen transmission at the backyard chicken–wild bird interface. Front. Vet. Sci. 2020; 7: 539925.

BACKHANS, A., SJÖLUND, M., LINDBERG, A., EMANUELSON, U. Biosecurity level and health management practices in 60 Swedish farrow-to-finish herds. Acta Veterinaria Scandinavica. 2015; 57,14.

Bakutis, B., Monstviliene, E., Januskeviciene, G. Analyses of airborne contamination with bacteria, endotoxins and dust in livestock barns and poultry houses. ActaVeterinaria Brno. 2004; 73:283–289.

BALOUN, P. Posílení imunity mláďat. Náš chov. 2005. [online] Available from: naschov.cz/posileni-imunity-mladat/ [cit. 2020 - 04 – 25]

BANHAZI, T.M., CURRIE, E., QUARTARARO, M., AARNINK, A.J.A. Controlling the concentrations of airborne pollutants in broiler buidings. In: Aland, A. and Madec, F. (eds.) Sustainable animal production: The challenges and potential developments for progessional farming. Wageningen Academic Publishers, Wageningen, the Netheralands, 2009a, 347-364.

BANHAZI, T.M., RUTLEY, D.L., PITCHFORD, W.S. Identification of risk factors for sub-optimal housing conditions in Australian piggeries – Part IV: Emission factors and study recommendations. Journal of Agricultural Safety and Health. 2008; 14:53-69.

BARDOŇ,J. Vybrané bakteriální zoonózy. Multimediální prezentace. Lékařská fakulta Univerzita Palackého v Olomouci. 2011, 81 s.

BATAILLE, A., KWIATEK, O., BELFKHI, S., MOUNIER, L., PARIDA, S., MAHAPATRA, M., CARON, A., CHUBWA, C.C., KEYYU, J., KOCK, R. et al. Optimization and evaluation of a non-invasive tool for peste des petits ruminants surveillance and control. Sci. Rep. 2019; 9:4742.

BelVet-SAC (Belgian Veterinary Surveillance of Antibacterial Consumption). National Consumption Report 2015. 2016. Available from: https://www.fagg-afmps.be/ sites/default/files/belvetsac rapport 2015_final.pdf.

BOKLUND, A. Exotic Disease in Swine: Evaluation of Biosecurity and Control of Strategies for Classical Swine Fever. PhD Thesis. Denmark, 2008.

BOONE, R., BURNSILVER, S., THORNTON, P., WORDEN, J., GALVIN, K., Are, A. Quantifying declines in livestock due to land subdivision. Rangeland Ecol. Manag. 2005; 58 (5):523–532.

BREMBERG, B. Livestock and the Environment: Law and Policy Aspects of Odor. In TIAER, 1994.

BROOM, D. Sentience and animal welfare. U.K., Wallingford, CABI, 2014: 200.

BROOM, D.M., FRASER A.F. Domestic Animal Behaviour and Welfare, 5th edn. U.K., Wallingford, CABI, 2015: 472.

BUCHERER, M., HOLZHAUSEN, J., CONRATHS, F.., PROBST, C. Infrastruktur von Tierhaltungen: Bauliche Schlüsselelemente in Bezug auf Biosicherheit auf der Grundlage von Erfahrungen aus Deutschland. Berliner und Münchener Tierärztliche Wochenschrift. 2021. 134, 1-12 2021.

CLAUSS, M. Emission of bioaerosols from livestock facilities - Methods and results from available bioaerosol investigations in and around agricultural livestock farming. In Thünen Working Paper 138a. Germany, Braunschweig, Thünen Institute of Agricultural Technology, 2020, 119pp.

COETZER, J.A.W., TUSTIN, R.C. Infectious diseases of livestock. Oxford University Press. 2nd Ed. 2004, 1-3.

CURTIS, S.E. Environmental management in Animal Agriculture. The Iowa State University Press. Ames. Iowa, 1988, 409. ISBN 0-8138-0556-2

CUTLER, S.J., FOOKS, A.R., VAN DER POEL, W.H. Public health threat of new, reemerging, and neglected zoonoses in the industrialized world. Emerg Infect Dis.2010; 16 (1):1–7.

DAMIAANS B et al. A risk-based scoring system to quantify biosecurity in cattle production. Preventive Veterinary Medicine. 2020; 179:104992.

DANISH RECOMMENTADTIONS (2001): Housing Design for Cattle - Danish Recommentadtions, Interdisciplinary report, Third edition. Danmark: Spceialtrykkeriet i Viborg, 123 s.

DAVIES, R., WALES, A. Antimicrobial Resistance od Farms: A Review Includig Biosecurity and thePotential Role of Disinfectants in Resistance Selection. Comprehensive Reviews in Food Science and Food Safety. 2019; 18 (3): 753- 774.

DAVIES, R.H., WRAY, C. Persistence of Salmonella enteritidis in poultry units and poultry food. British Poultry Science. 1996; 37 (3): 589-596.

DEWULF, J., VAN IMMERSEEL, F. Biosecurity in animal production and veterinary medicine. 2018. Acco Netherland . 522 p.

DI GIORGIO, C., KREMPFF, A., GUIRAUD, H., BINDER, P., TIRET, C., DUMENIL, G. Atmospheric pollution by airborne microorganisms in the city of Marseilles. Atmospheric Environment. 1996; 30 (1): 155-160.

DONHAM, K.J. Association of environmental air contaminants with disease and productivity in swine. American Journal of Veterinary Research. 1991; 52: 1723-1730.

DONHAM, K.J. Respiratory disease hazards to workers in livestock and poultry confinement structures. Sem. Respir. Med. 1993; 14: 49-59.

DVORAK, G. (2008): Disinfection 101. Iowa State University: Center for Food Security and Publick Health, 22pp.

EFSA (European Food Safety Authority). Analysis of the baseline survey on the prevalence of Campylobacter in broiler batches and of Campylobacter and Salmonella on broiler carcasses in the EU, 2008. Part B Campylobacter. EFSA Journal. 2010; 8(8):1522.

EPRUMA, European Platform for the Responsible Use of Medicines in Animals. 2017. Available from: http://www.epruma.eu/.

Evans, D. Sheep lice – biosecurity can prevent introduction [online]. Goverment of Western Australia, Department of Agriculture and Food, Australie. Available from: http://www.agric.wa.gov.au

EVERS, E.G., PIELAAT, A., SMID, J.H., VAN DUIJKEREN, E., VENNEMANN, F.B.C., WIJNANDS, L.M., CHARDON, J.E. Comparative exposure assessment of ESBL-producing Escherichia coli through meat consumption. PLoS One. 2017; 12 (2): e0173134.

FAO**.** *FAO Biosecurity Toolkit*. Rome: Food and Agriculture Organization of the United Nations, 2007. 128 s. ISBN 978-92-5-105729-2.

FABIÁNOVÁ, K. Zoonózy (nemoci zvířat přenosné na člověka). Státní zdravotní ústav [online]. 2008 [cit. 2015-04- 17]. Available from: http://www.szu.cz/ tema/prevence/antropozoonozy

Fernstrom, A. Goldblatt, M. Aerobiology and its role in the transmission of infectious diseases. J. Pathogens. 2013; 6: 1-13.

FIERRO, M. Physical properties and physiological effects. In. Particulate Matter, 2000, 20pp. Available from: https://airinfonow.org/pdf/Particulate_Matter.pdf

FOTHERINGHAM, V.J.C. Disinfection of livestock production premises. Rev. sci. tech. Off. Int. Epiz. 1995; 14 (1): 191-205.

FRIESE, A., SCHULZ, J., HOEHLE, L., FETSCH A., TENHAGEN, B.A., HARTUNG J., ROESLER, U. Occurrence of MRSA in air and housing environment of swine barns. Vet. Microbiol. 2012; 158:129–135.

GELAUDE, P., SCHLEPERS, M., VERLINDEN, M., LAANEN, M., DEWULF, J. Biocheck.UGent: A quantitative tool to measure biosecurity at broiler farms and the relationship with technical performances and antimicrobial use. Poultry Science. 2014; 93, 1–12.

GLOBIG, A., BAUMER, A., REVILLA-FERNÁNDEZ, S., BEER, M., WODAK, E., FINK, M., GREBER, N., HARDER, T. C., WILKING, H., BRUNHART, I. et al. Ducks as sentinels for avian influenza in wild birds. Emerg. Infect. Dis. 2009; 15:1633–1636.

GLOSTER, J., SELLERS, R.F., DONALDSON, A.I. Long distance transport of Foot and Mouth Disease Virus over the sea. Vet Rec. 1982; 16;110(3):47-52.

GOODWIN, R (1985) Apparent reinfection of enzootic-pneumonia-free pig herds: search for possible causes. Vet Rec. 1985; 116 (26): 690-694.

GÖPFERTOVÁ, D., PADZIORA, P., DÁŇOVÁ, J. Epidemiologie infekčních nemocí. Karolinum: Univerzita Karlova v Praze, 2000, 2, 230 s.

GORDON, I.J. Review: livestock production increasingly influences wildlife across the globe. Animal. 2018; 12(s2): 372–382.

GORTAZAR, C., DIEZ-DELGADO, I., BARASONA, J.A., VICENTE J., DE LA FUENTE J., BOADELLA M. The wild side of disease control at the wildlifelivestock-human interface: a review. Front. Vet. Sci. 2014; 1:27.

GORTAZAR, C., I. Diez-Delgado, J.A. Barasona, J. Vicente, J. De La Fuente, and M. Boadella. 2014. The wild side of disease control at the wildlifelivestock-human interface: a review. Front. Vet. Sci. 1:27.

GREENWOOD, B. The contribution of vaccination to global health: past, present and future. Phil. Trans. R. Soc. B 369: 20130433. Available from: http://dx.doi.org/10.1098/rstb.2013.0433

GUSTAFSSON, G. Investigations of factors Affecting Air Pollutants in Animal Houses. Annals of Agricultural and Environmental Medicine. 1997; 4 (2): 203-215.

HANSBRO, P.M., WARNER, S., TRACEY, J.P., ARZEY, K.E., SELLECK, P., O'RILEY, K., BECKETT, E.L., BUNN, C., KIRKLAND, P.D., VIJAYKRISHNA, D. et al. Surveillance and analysis of avian influenza viruses, Australia. Emerg. Infect. Dis. 2010; 16:1896–1904.

HARTUNG, J., SCHULZ, J. Risks caused by bio-aerosols in poultry houses. In.: Procc. Poultry in the 21st Century. Institute of Animal Hygiene, Welfare and Behaviour of Farm Animals, University of Veterinary Medicine Hannover, Bünteweg, 2008, 17pp.

HILLIGER, H.G. Emissions of dust and microbes from animal housing. Dtsch Tierarztl Wochenschr. 1991; 98 (7):257-61.

HINTON, M.H. Infections and intoxications associated with animal feed and forage which may present a hazard to human health. Vet J. 2000; 159 (2):124-138.

HUBÁLEK, Z., RUDOLF, I. 2011. Microbial Zoonoses and Sapronoses 1st edition, Netherlands: Springer. 2011. 457 pp. ISBN 978-90-481-9656-2.

HULBERT, L.E., MOISÁ, S.J. Stress, immunity, and the management of calves. J.Dairy Sci. 2016; 99 (4): 3199-3216.

CHLEBICZ, A., ŚLIŻEWSKA, K. Campylobacteriosis, salmonellosis, yersiniosis, and listeriosis as zoonotic foodborne diseases: a review. Int. J. Environ. Res. Public Health. 2018; 15 (5): 863.

ISOMURA, R., MATSUDA, M., SUGIURA, K. An epidemiological analysis of the level of biosecurity and animal welfare on pig farms in Japan and their effect on the use of veterinary antimicrobials. J. Vet. Med. Sci. 2018; 80 (12): 1853–1860.

JOHNSON, R.W. The energy cost of illness on Swine. In. Porknet The Online Resource for the Pork Industry, University of Illinois, IPIC, 1996, 4.

JORI, F., BRAHMBHATT, D., FOSGATE, G.T., THOMPSON, P.N., BUDKE, C., WARD, M.P., FERGUSON, K., GUMMOW, B. A questionnaire-based evaluation of the veterinary cordon fence separating wildlife and livestock along the boundary of the Kruger National Park, South Africa. Prev. Vet. Med. 2011; 100: 210–220.

JORI, F., DE NYS, H., FAYE, B., MOLIA S. Characteristics and perspectives of disease at the wildlife-livestock interface in Africa. In: Vicente, V.K.C.J., Gortázar, C., editors. Diseases at the wildlife—Livestock Interface. Wildlife Research Monographs. Springer; WIREMO, 3, 2021, 181–215.

JORI, F., ETTER, E. Transmission of foot and mouth disease at the wildlife/livestock interface of the Kruger National Park, South Africa: can the risk be mitigated? Prev. Vet. Med. 2016; 126:19–29.

JORI, F., HERNANDEZ-JOVER, M., MAGOURAS, I., DÜRR, S., BROOKES, V.J. Wildlife–livestock interactions in animal production systems: what are the biosecurity and health implications? Animal Frontiers. 2021; 11 (5): 8-19.

LAANEN, M., PERSOONS, D., RIBBENS, S. et al. Relationship between biosecurity and production/ antimicrobial treatment characteristics in pig herdsThe Veterinary Journal. 2013; 198 (2): 508-512.

LAYTON, D.S., CHOUDHARY, A., BEAN, A.G.D. Breaking the chain of zoonoses through biosecurity in livestock. Vaccine. 2017; 35: 5967-5973.

LÉGER, A., DE NARDI, M., SIMONS, R. et al. Assessment of biosecurity and control measures to prevent incursion and to limit spread of emerging transboundary animal diseases in Europe: An expert survey. Vaccine. 2017; 35 (44): 5956-5966.

LEVIS, D.G., BAKER, R.B. Biosecurity of Pigs and Farm Security. University of Nebraska – Lincoln Extentision, EC289, 2011, 32.

LEWERIN, S.S., ÖSTERBERG, J., ALENIUS, S. et al. Risk assessment as a tool for improving external biosecurity at farm level. BMC Veterinary Research. 2015; 11, 171.

LINTON, A.H. Epidemiology of infectious diseases in animals. In: Linton, A.H., Hugo, W.B., Russell, A.D. Disinfection in veterinary and farm animal practice. London; Oxford, Blackwell Scientific Publications, 1987: 1-11.

MATTHIAS-MASER, S., Jaenicke, R. The size distribution of primary biological aerosol particles with radii >02 μm in an urgan/rural influenced region. Atmos Res. 1995; 39(4): 279-286.

MEUNIER, M., GUYARD-NICOD, M., DORY, D., Chemaly M. Control strategies against Campylobacter at the poultry production level: biosecurity measures, feed additives and vaccination. Journal of Applied Microbiology. 2015; 120: 1139-1173.

MIGUEL, E., GROSBOIS, V., CARON, A., POPLE, D., ROCHE, B., DONNELLY, C.A. A systemic approach to assess the potential and risks of wildlife culling for infectious disease control. Commun. Biol. 2020; 3(1): 353.

MÜLLER, W., WIESER, P. Dust and microbial emissions from animal production. In: Strauch D (Hrsg,): Animal production and environmental health. Amsterdam: Elsevier, 1987, 47–89.

MYSTERUD, A., ROLANDSEN, C. M. Fencing for wildlife disease control. J. Appl. Ecol. 2019; 56 (3):519–525.

NIEDERWERDER, M. C., STOIAN, A. M. M., ROWLAND, R. R. R., DRITZ, S. S., PETROVAN, V., CONSTANCE, L. A., GEBHARDT, J. T., OLCHA, M., DEE, S. A., WOODWORTH, J. C., TOKACH, M. D., GOODBAND, R. D., JONES, C. K. Infectious Dose of African Swine Fever Virus When Consumed Naturally in Liquid or Feed. Emerging Infectious Disease. 2019; 25(5), 891–897.

NÖREMARK, M., STERNBERG-LEWERIN, S. On-farm biosecurity as perceived by professionals visiting Swedish farms. Acta Veterinaria Scandinavica, 2014, 56: 28.

PANTALEON, L. One health and biosecurity: a safeguard against diseases. Dairy Knowledge Center LLC. 2019. 6 pp.

PEDERSEN L et al. Semi-Quantitative Biosecurity Assessment Framework Targeting Prevention of the Introduction and Establishment of Salmonella Dublin in Dairy Cattle Herds. Animals. 2023; 13:2649.

PENDELL, D.L., MARSH, T.L., COBLE, K.H., LUSK, J.L., SZMANIA, S.C. Economic Assessment of FMDv Releases from the National Bio and Agro Defense Facility. PLoS ONE. 2015; 10(6): e0129134.

POSPÍŠILOVÁ, M. Systém zajištění bezpečnosti (zdravotní nezávadnosti) potravin v ČR. Informační centrum bezpečnosti potravin ČR. 2009. Available from: http://www.bezpecnostpotravin.cz.

POSTMA, M., BACKHANS, A. COLLINEAU, L. LOESKEN, S. et al. Evaluation of the relationship between the biosecurity status, production parameters, herd characteristics and antimicrobial usage in farrow-to-finish pig production in four EU countries. Porcine Health Management. 2016; 2:9.

POSTMA, M., VANDERHAEGHEN, W., SARRAZIN, S., MAES, D., DEWULF, J. Reducing Antimicrobial Usage in Pig Production without Jeopardizing Production Parameters. Zoonoses and Public Health, 2017, 64, 63–74.

Purdue University Health Management Tips for Disease Prevention. The concept of SEW and the rules to make it work. Purdue Agriculture Extension Service, 2007. www.ag.puedue.edu.

RÖDL, P. et al.: Standardní metodika ochranné deratizace. Státní zdravotní ústav. 2002, 24 s.

RÖDL, P., STEJSKAL, V., AULICKÝ, R. Certifikovaná metodika pro minimalizaci zdravotních rizik, působených především městskými holuby a ostatními létajícími obratlovci. Metodika pro pracovníky v DDD. Státní zdravotní ústav, příspěvková organizace, Výzkumný ústav rostlinné výroby, v.v.i., 2011. 69 s.

SARRAZIN, S., CAY, A. B., LAUREYNS, J., DEWULF, J. A survey on biosecurity and management practices in selected Belgian cattle farms. Preventive Veterinary Medicine. 2014, 117 (1): 129-139.

SCOTT, A.B., TORIBIO, J.A., SINGH, M., GROVES, P., BARNES, B., GLASS, K., MOLONEY, B., BLACK, A., HERNANDEZ- JOVER, M. Low pathogenic avian influenza exposure risk assessment in australian commercial chicken farms. Front. Vet. Sci. 2018; 5: 68.

SEAMAN, J.S., FANGMAN, T.J. Biosecurity of Swine Today´s operation. MU extension. Unversity of Missouri. 1995, G 2340.

SEDLÁČEK, D., KOUBOVÁ, A. Klinicky významné zoonózy. In.: Sborník abstraktů. Pediatrie pro praxi. Kongres pediatrů a dětských sester. XXXI. dny praktické a nemocniční pediatrie. Suppl.A, 2013. s.A10-A11.

SEDLÁK, K., TOMŠÍČKOVÁ, M. Nebezpečné infekce zvířat a člověka. Sciencia, 2006;167 s.

SEEDORF J. Emissions of airborne dust and micro-organisms. Landtechnik. 2000; 55 (2): 182-183.

SEEDORF, J. Emissions and dispersion of livestock-related biological aerosols – an overview. University of Applied Sciences Osnabrück, Unit for Animal Hygiene and Food Safety, Oldenburger Landstraße, 24, D-49090 Osnabrück, Germany; 2007, 14 pp.

SEVI, A., MASSA, S., ANNICCHIARICO, G., DELL'AQUILA, S., MUSCIO, A. Effect of stocking density on ewes milk yield and incidence of subclinical mastitis. J. Dairy Res. 1999; 66:489-499.

SCHIMMER, B., TERSCHEGGET, R., WEGDAM, M. et al. The use of a geographic information system to identify a dairy goat farm as the most likely source of an urban Q-fever outbreak. BMC Infectious Diseases, 2010,10: 69-78.

SCHROEDER, J.W. Biosecurity Important for Dairy Herds. News for North Dakotans. Agriculture Communication. North Dacota State University. 1998, 17, 2.

SMÍŠKOVÁ, D. Zoonózy – nejčastější klinické projevy a diferenciální diagnostika. In.: Medicína pro praxi [online]. 2010;7 (10): 384-386

SMULSKI, S., TURLEWICZ-PODBIELSKA, H., WYLANDOWSKA, A., WŁODAREK, J. Non-antibiotic possibilities in prevention and treatment of calf diarrhoea. Journal of Veterinary Research, 2020, 64 (1): 119-126.

STÄRK, K. Brief overview of strategies to reduce antimicrobial usage in pig production. Eip-Agri. Agriculture and inovation. 2013. 11 pp.

STEINFELD, H., GERBER, P., WASSENAAR, T., CASTEL, V., ROSALES, M., DE HAAN, C. Livestock's long shadow: Environmental issues and options. Rome, Food and agriculture organization of the United nations, 2006; Available from: https://www.globalmethane.org/expo-docs/china07/postexpo/ag_gerber.pdf.

STOKSTAD, M., KLEM, T.B., MYRMEL, M., OMA, V.S., TOFTAKER, I., ØSTERÅS, O., NØDTVEDT, A. Using Biosecurity Measures to Combat Respiratory Disease in Cattle: The Norwegian Control Program for Bovine Respiratory Syncytial Virus and Bovine Coronavirus. Front. Vet. Sci. 2020; 7:167.

SUTMOLLER P., BARTELING S. S., OLASCOAGA R. C., SUMPTION K. J. Control and eradication of foot-and-mouth disease. Virus Res. 2003; 91 (1): 101–144.

ŠATRÁN, P., DUBEN, J. Nákazy zvířat přenosné na člověka a bezpečnost potravin. Ústav zemědělských a potravinářských informací, Praha., 2006, 30 s.

TAKAI, H., PEDERSEN, S. et al. Concentrations and emissions of airborne dust in livestock buildings in Northern Europe. J. Agric. Eng. Res. 1998; 70(1):59-77.

TEAGASC. (Agriculture and Food Development Authority). Protect Your Farm Against Antimicrobial Resistance – 15 Ways to Improve your Biosecurity. Department of Agriculture and the Marine – Guidance on Agri-food and AMR. 2018, 3 pp.

Thomson, J. U. Implementing biosecurity in beef and dairy herds. In Proceedings of the Annual Conference of the American Bovine Practitioners, 1997, 8-14.

TIELEN, M.J. Pathogen supply modified by environment and stage of production. Tijdschr. Diergeneeskd. 1987; 112 (17): 10005-11.

TREML, F. HEJLÍČEK, K. Epizootologie pro veterinární hygieniky II. Bakteriální a protozoální choroby. Vysoká škola veterinární v Brně. 1991, 164 s.

TREML, F., LÁNY, P., POSPÍŠIL, Z., ZENDULKOVÁ, D. Infekční choroby zvířat I. Veterinární a farmaceutická univerzita Brno, 2014, 64 s.

TREML, F., LÁNY, P., POSPÍŠIL, Z., ZENDULKOVÁ, D. Infekční choroby zvířat II. Veterinární a farmaceutická univerzita Brno, 2014, 64 s.

TREML, F., LÁNY, P., POSPÍŠIL, Z., ZENDULKOVÁ, D. Obecná epizootologie. Brno: Veterinární a farmaceutická univerzita Brno, 2014, 64s.

TREVEJO, R.T., BARR, M.C., ROBINSON, R.A. Important emerging bacterial zoonotic infections af ecting the immunocompromised. Vet Res. 2005; 36 (3): 493–506.

TRINH, P., ZANEVELD, J.R., SAFRANEK, S., RABINOWITZ, P.M. One Health Relationships Between Human, Animal, and Environmental Microbiomes: A Mini-Review. Front. Public Health 2018: 6.

TUBBS, R.C., FLOSS, J.L. Herd Management for Disease Prevention. Agricultural publication G 2507. 1993,4.

Van ROOYEN, J. A. Biosecurity for small ruminant flocks. Grootfontein Agricultural Development Institute. 2011; 11 (1): 1–16.

VERHAEGHE, J. Effective cleaning and disinfection on the dairy farm. International Dairy Topics. 2011; 10: 11-13.

WATHES, C.M. (1994): Air and surface hygiene. In: Wathes,C.M., Charles,D.R. (eds.) Livestock housing CAB International, Wallingsford, UK, 1994, 123-148.

WHITE, L.A., TORREMORELL, M., CRAFT, M.E. Influenza A virus in swine breeding herds: Combination of vaccination and biosecurity practices can reduce likelihood of endemic piglet reservoir. Preventive Veterinary Medicine. 2017; 138: 55-69.

WHO (World Health Organization) Critically important antimicrobials for human medicine: 6th Revision 2018. Available from: https://www.who.int/publications/i/item/9789241515528 WHO (World Health Organization). Antimicrobial resistence: global report on surveillance. Geneva. Switzerland, WHO Press, 2014: 232. Available from: https://apps.who.int/iris/handle/10665/112642

WHO (World Health Organization). The WHO Golden Rules for Safe Food Preparation, WHO Surveillance Newsletter, 1989, 22, 5 pp.

WOAH. Terrestrial Animal Health Code. 2021, 19/07/2021. Aavailable from: https://www.woah.org/fileadmin/Home/eng/Health_standards/tahc/current/en/chapitre_listed_emerging_diseases.pdf.

WORLD ORGANISATION FOR ANIMAL HEALTH (WOAH). Criteria for the inclusion of diseases, infections and infestations in the WOAH list. In: *Terrestrial Animal Health Code* [online]. Paris: WOAH, 2024, (Chapter 1.2)

WILSON, A.L., COURTENAY, O., KELLY-HOPE, L.A., SCOTT, T.W., TAKKEN, W., TORR, S.J., LINDSAY, S.W. The importance of vector control for the control and elimination of vector-borne diseases. Plos Negl. Trop. Dis. 2020; 14: e0007831.

Laws and Regulations

ČSN 73 4501 (734501) Farm Animal Facilities – Basic Requirements. Prague: Czech Standards Institute, June 2004, 29.

2013/652/EU. Commission Implementing Decision of 12 November 2013 on the monitoring and reporting of antimicrobial resistance in zoonotic and commensal bacteria. European Commission, 2013:14.

Regulation (EU) 2019/6 of the European Parliament and of the Council of 11 December 2018 on veterinary medicinal products and repealing Directive 2001/82/EC. Official Journal of the European Union. 2019: 125.

Council Regulation (EC) No 1/2005 on the protection of animals during transport and related operations and amending Directives 64/432/EEC and 93/119/EC and Regulation (EC) No 1255/97.

Regulation (EC) No 1831/2003 of the European Parliament and of the Council of 22 September 2003 on additives for use in animal nutrition, which prohibits the use of antibiotics as growth promoters. OJ. L 268, 18.10.2003, p. 29.

Regulation (EU) 2016/429 of the European Parliament and of the Council of 9 March 2016 on transmissible animal diseases and amending and repealing certain acts in the area of animal health ('Animal Health Law'), Official Journal of the European Union, L 84/1, 208 pp.

Commission Implementing Decision (EU) 2018/945 of 22 June 2018 on the communicable diseases and related special health issues to be covered by epidemiological surveillance as well as relevant case definitions. In force from 26 July 2018. OJ L 170, 6.7.2018, pp. 1–74.

Decree No. 208/2004 Coll. on minimum standards for the protection of farm animals, as amended. Ministry of Agriculture of the Czech Republic, Issue 69/2004. Effective from 26 April 2004.

Act of the Czech National Council No. 246/1992 Coll. on the Protection of Animals against Cruelty, of 15 April 1992, as amended. Issue 50/1992, pp. 1284–1289.

VIII. Publications Preceding the Methodology

NOVÁK, P., MALÁ, G., PRÁŠEK, J., SMOLA, J. Hodnocení vlivu managementu chovu na spotřebu antimikrobních látek v chovech hospodářských zvířat. Certifikovaná metodika. Praha: Výzkumný ústav živočišné výroby, v.v.i. a Veterinární univerzita Brno, 2022, 38 s. ISBN 978-80-7403-279-0.

NOVÁK, P., MALÁ, G., PRÁŠEK, J., SMOLA, J. Hodnocení vlivu biosekurity na spotřebu antimikrobních látek v chovech hospodářských zvířat. Certifikovaná metodika. Praha: Výzkumný ústav živočišné výroby, v.v.i. a Veterinární univerzita Brno, 2023. ISBN 978-80-7403-296-7; ISBN 978-80-7305-939-2.

NOVÁK, P., MALÁ, G., PRÁŠEK, J. The importance of prevention, prophylaxis and biosecurity on antimicrobials consumption and the spread of antimicrobial resistance. In: Abstract Book ISAH 2022. Berlin: Freie Universität Berlin, 2022, s. 114–115.

NOVÁK, P., MALÁ, G. The impact of management, prophylaxis and biosecurity level in cattle farms on antimicrobial consumption. In: Proceedings of the XXXI International Congress of the Hungarian Association for Buiatrics. Keszthely, Hungary, 11.–14. 10. 2023, s. 50–61.

NOVÁK, P., MALÁ, G. Evaluation of the impact of biosecurity on antimicrobial resistance in pig farms. In: Conference Proceedings, The 21st International Society for Animal Hygiene Conference. Chiang Mai: Faculty of Veterinary Medicine, Chiang Mai University, 2024, s. 142.

NOVÁK, P., MALÁ, G. Has climate change impacts on cow health and production or does cattle influence climate change? In: XXXII International Scientific Congress of the Hungarian Association for Buiatrics. 2024, s. 33–42. ISBN 978-615-81413-4-5.

MALÁ, G., NOVÁK, P., JIROUTOVÁ, P., KNÍŽEK, J., NEJEDLÁ, E., KOČÍ, M., PROCHÁZKA, D. Effects of different housing systems on the occurrence of dairy calf diseases. In: XXXII International Scientific Congress of the Hungarian Association for Buiatrics. 2024, s. 58–65.

HAVRDOVÁ, N., PECOVÁ, L., KUČERA, J., POBORSKÁ, A., ZÁBRANSKÝ, L., ŠOCH, M., NOVÁK, P., MALÁ, G. Zoohygiena a vliv prostředí na rezistenci parazitů v chovech malých přežvýkavců. In Aktuální otázky bioklimatologie zvířat 2021. Praha Uhříněves: Výzkumný ústav živočišné výroby, v. v. i., 2021, 23-25. ISSN 978-80-7403-263-9

MALÁ, G., NOVÁK, P. Faktory ovlivňující účinnost dezinfekce v chovech zvířat. In Aktuální otázky bioklimatologie zvířat 2021. Praha Uhříněves: Výzkumný ústav živočišné výroby, v. v. i., 2021, 61-63. ISSN 978-80-7403-263-9

MALÁ, G., NOVÁK, P. Kritická místa ovlivňující účinnost sanitace v chovu prasat. Náš chov, 2022, roč. 82(4), 56-57.

MALÁ, G., NOVÁK, P. Obecné zásady dezinfekce v chovech hospodářských zvířat. Certifikovaná metodika. Praha Uhříněves: Výzkumný ústav živočišné výroby, v. v. i., 2014, 51s. ISBN 978-80-7403-117-5. 2014-09-02.

MALÁ, G., NOVÁK, P. Vliv welfare na zdraví telat. Veterinářství, 2018, roč. 68(11), s. 797-803.

MALÁ, G., NOVÁK, P., JAROLÍMKOVÁ, A., FLAK, V. Kde hledat rezervy v odchovu telat v průběhu období mléčné výživy? In Aktuální otázky bioklimatologie zvířat 2018. Praha Uhříněves: Výzkumný ústav živočišné výroby v.v.i., 2018, 32-36. ISSN 978-80-7403-205-9

MALÁ, G., NOVÁK, P., JIROUTOVÁ, P., KNÍŽEK, J., NEJEDLÁ, E., PROCHÁZKA, D., KOČÍ, M. Vliv sanitace chovného prostředí na zdraví telat. Náš chov, 2022, roč. 82(6), s. 46-48.

MALÁ, G., NOVÁK, P., JIROUTOVÁ, P., KNÍŽEK, J., NEJEDLÁ, E., PROCHÁZKA, D., KOČÍ, M. Vliv dezinfekce stájového prostředí na zdraví telat. In Sborník XIV. konference DDD 2022 - Přívorovy dny. Praha: Sdružení pracovníků dezinfekce, dezinsekce, deratizace ČR, z.s., 2022, 20.

MALÁ, G., NOVÁK, P., JIROUTOVÁ, P., KNÍŽEK, J., PROCHÁZKA, D. Hygiena chovného prostředí -základ prevence průjmů telat. Náš chov, 2015, roč. 75(11), s. 56-58.

MALÁ, G., NOVÁK, P., JIROUTOVÁ, P., KNÍŽEK, J., PROCHÁZKA, D. Má hygiena chovného prostředí vliv na výskyt průjmových onemocnění telat? In Mezinárodní fyziologická konference. České Budějovice: Jihočeská univerzita, 2015, 14-18. ISSN 978-80-7394-535-0

MALÁ, G., NOVÁK, P., JIROUTOVÁ, P., KNÍŽEK, J., PROCHÁZKA, D., KOČÍ, M. Hygiena chovného prostředí je základem odchovu zdravých telat. Náš chov, 2020, roč. 80(6), s. 55-56.

MALÁ, G., NOVÁK, P., KNÍŽEK, J., PROCHÁZKA, D. Analýza vybraných ukazatelů chovného prostředí v objektech pro ustájení koz. In Aktuální otázky bioklimatologie zvířat 2017. Praha Uhříněves: Výzkumný ústav živočišné výroby, v.v.i., 2017, 37-41. ISSN 978-80-7403-170-0

MALÁ, Gabriela, NOVÁK, Pavel, JIROUTOVÁ, Pavlína, KNÍŽEK, Josef a PROCHÁZKA, David. Vliv toalety vemene na kvalitu mléka. Náš chov, 2016, roč. 76(2), s. 82-84.

NOVÁK P., MALÁ, G. Dezinfekce – základ prevence antimikrobiální rezistence. Selská revue, 2022, roč. 2022(3), s. 98-102.

NOVÁK, P, MALÁ, G., PRÁŠEK, J. Kritická místa v chovech dojeného skotu ve vztahu k antimikrobiální rezistenci. Náš chov, 2022, roč. 82(9), s. 60-62.

NOVÁK, P, MALÁ, G., PRÁŠEK, J. Má management chovu vliv na zdraví a spotřebu antimikrobiálních látek. Náš chov, 2022, roč. 82(12), s. 60-62.

NOVÁK, P. a MALÁ, G. Hodnocení chovného prostředí v objektech pro ustájení hospodářských zvířat. Certifikovaná metodika. Praha Uhříněves: Výzkumný ústav živočišné výroby v.v.i., 2018, 26s. ISBN 978-80-7403-213-4. 2018-12-21.

NOVÁK, P., MALÁ, G. Analysis of welfare, health and biosecurity in calves farms. In Animal Physiology, Nutrition and Welfare. České Budějovice: Faculty of Agriculture, University of South Bohemia in České Budějovice, 2019, 195-201. ISSN 978-80-7394-771-2

NOVÁK, P., MALÁ, G. Analýza správné chovatelské praxe a preventivních opatření v období odchovu telat po narození. Veterinářství, 2018, roč. 68(11), s. 788-796.

NOVÁK, P., MALÁ, G. Dairy cows housing environment – an integral part of the herd health, welfare and biosecurity. In Bienestar animal en la practica, en producciones lecheras, desde la perspectiva europea. the Netherlands: F.J.C.M. van Eerdenburg, 2018, 22-25.

NOVÁK, P., MALÁ, G. Dairy cows housing environment - an intergral part of the herd health, welfare and biosecurity. In 10o SEMINARIO INTERNACIONAL EN REPRODUCCIÓN ANIMAL Y PRODUCCIÓN DE LECHE Y CARNE. Universidad Autónoma Metropolitana - Unidad Xochimilco, Mexico: Casa abierta al tiempo Universidad Autónoma Metropolitana - Unidad Xochimilco, 2018, 153-157.

NOVÁK, P., MALÁ, G. Komfortní chovné prostředí - základ welfare, zdraví a biosecurity v chovech dojnic. In Aktuální otázky bioklimatologie zvířat 2016. Praha Uhříněves: Výzkumný ústav živočišné výroby, v.v.i.,2016, 33-36. ISSN 978-80-7403-155-7

NOVÁK, P., MALÁ, G. Podestýlka - významný faktor zdraví a pohody kuřat chovaných na maso. Náš chov, 2019, roč. 79(10), s. 58-62.

NOVÁK, P., MALÁ, G. Prevence respiračních onemocnění prasat. Náš chov, 2017, roč. 77(4), s. 61-63.

NOVÁK, P., JIROUTOVÁ, P., KNÍŽEK, J., PROCHÁZKA, D. Vliv hygieny chovného prostředí na výskyt průjmových onemocnění telat. Veterinářství, 2017, roč. 67(12), s. 952-955.

NOVÁK, P., MALÁ, G. Testování účinnosti dezinfekčních prostředků v provozních podmínkách chovů prasat. Náš chov, 2021, roč. 81(5), s. 56-58.

NOVÁK, P., MALÁ, G. Welfare, zdraví a biosekurita -základ produkce v chovech. Náš chov, 2015, roč. 75(10), 59-63.

NOVÁK, P., MALÁ, G. Zásady sanitace v chovech dojeného skotu. Náš chov, 2017, roč. 77(5), s. 69-73.

NOVÁK, P., MALÁ, G. Zdraví zvířat – základ produkce kvalitních surovin a potravin živočišného původu. Selská revue, 2021, roč. 2021(7), s. 128-131.

NOVÁK, P., MALÁ, G. Zvíře, stáj a výživa předpoklad zdraví, reprodukce a produkce v chovech skotu. In Animal Physiology, Nutrition and Welfare 2018. České Budějovice: University of South Bohemia, 2018, 95-110. ISSN 978-80-7394-715-6

NOVÁK, P., MALÁ, G., JAROLÍMKOVÁ, A. Animal, housing and nutrition as prerequisite for health, reproduction and production in dairy cattle. In Proceedings of the XIXth International Congress of the International Society for Animal Hygiene. Wroclaw, Polsko: Wroclaw University of Environmental and Life Sciences, 2019, 49-51.

NOVÁK, P., MALÁ, G., JAROLÍMKOVÁ, A. Jednoduché screeningové hodnocení farem pro chov dojeného skotu. In Aktuální otázky bioklimatologie zvířat 2018. Praha Uhříněves: Výzkumný ústav živočišné výroby, v.v.i., 2018, 59-65. ISSN 978-80-7403-205-9

NOVÁK, P., MALÁ, G., JAROLÍMKOVÁ, A. Kde jsou kritická místa v chovu mastného skotu? Náš chov, 2019, roč. 79(3), s. 79-80.

NOVÁK, P., MALÁ, G., JAROLÍMKOVÁ, A. Screeningová analýza výkalů - významný zdroj informací. Náš chov, 2018, roč. 78(9), s. 85-88.

NOVÁK, P., MALÁ, G., JAROLÍMKOVÁ, A. Screeningové hodnocení – předpoklad zdraví, produkce a ekonomické rentability chovu dojného skotu. Náš chov, 2018, roč. 78(10), s. 47-51.

NOVÁK, P., MALÁ, G., JAROLÍMKOVÁ, A. Vhodné řešení boxového lože pro dojnice -základ zdraví a produkce mléka. Náš chov, 2019, roč. 79(1), s. 52-55.

NOVÁK, P., MALÁ, G., JAROLÍMKOVÁ, A., VOKŘÁLOVÁ, J., 2019 Kritická období odchovu telat. In Aktuální otázky bioklimatologie zvířat 2019. Praha Uhříněves: Výzkumný ústav živočišné výroby v.v.i., 2019, 57-60. ISSN 978-80-7403-226-4

NOVÁK, P., MALÁ, G., POLCR, S. Má tepelná izolace stájí vliv na tepelnou pohodu skotu? Veterinářství, 2016, roč. 66(11), s. 827-831. ISSN 0506-8231.

NOVÁK, P., MALÁ, G., PRÁŠEK, J. Čistota - půl zdraví, aneb vliv čištění a mytí na šíření antimikrobiální rezistence. Selská revue, 2022, roč. 2022(2), s. 70-73.

NOVÁK, P., MALÁ, G., PRÁŠEK, J. Dodržování zásad správné chovatelské praxe – významná součást omezení spotřeby antimikrobik v chovech. Selská revue, 2021, roč. 2021(3), s. 125-127.

NOVÁK, P., MALÁ, G., PRÁŠEK, J. Hygiena chovu – základ zdraví zvířat. Selská revue, 2022, roč. 2022(1), s. 104-107.

NOVÁK, P., MALÁ, G., PRÁŠEK, J. Kritická místa v chovech drůbeže ve vztahu k antimikrobiální rezistenci. Náš chov, 2022, roč. 82(10), s. 62-64.

NOVÁK, P., MALÁ, G., PRÁŠEK, J. Lze prevencí, profylaxí a biosecuritou omezit vznik rezistence k antimikrobním látkám? Veterinářství, 2021, roč. 71(11), s. 628-634.

NOVÁK, P., MALÁ, G., PRÁŠEK, J. Má dezinfekce vliv na antimikrobiální rezistenci v chovech? Náš chov, 2022, roč. 82(6), s. 66-68.

NOVÁK, P., MALÁ, G., PRÁŠEK, J. Má dodržování zásad správné chovatelské praxe vliv na spotřebu antimikrobik? In Aktuální otázky bioklimatologie zvířat 2022. Praha Uhříněves: Výzkumný ústav živočišné výroby, v. v. i., 2022, 55-57. ISSN 978-80-7403-277-6

NOVÁK, P., MALÁ, G., PRÁŠEK, J. Prevence – profylaxe – biosekurity –rezistence v chovech hospodářských zvířat. In Aktuální otázky bioklimatologie zvířat 2021. Praha Uhříněves: Výzkumný ústav živočišné výroby, v. v. i., 2021, 85-87. ISSN 978-80-7403-263-9

NOVÁK, P., MALÁ, G., PRÁŠEK, J. Vliv úrovně prevence, profylaxe a biosekurity na šíření antimikrobiální rezistence v chovech. In Sborník XIV. konference DDD 2022 - Přívorovy dny. Praha: Sdružení pracovníků dezinfekce, dezinsekce, deratizace ČR, z.s., 2022, 21.

NOVÁK, P., MALÁ, G., PRÁŠEK, J. Význam deratizace v prevenci antimikrobiální rezistence. Selská revue, 2022, roč. 2022(6), s. 94-97.

NOVÁK, P., MALÁ, G., PRÁŠEK, J. Význam dezinsekce v prevenci antimikrobiální rezistence. Selská revue, 2022, roč. 2022(4), s. 94-99.

NOVÁK, P., MALÁ, G., SMUTNÁ, Š. a SMUTNÝ, L. Denní aktivita dojnic - významný indikátor welfare a zdraví. Veterinářství, 2017, roč. 67(12), s. 956-959.

NOVÁK, P., MALÁ, G., SMUTNÁ, Š., SMUTNÝ, L., VOKŘÁLOVÁ, J., ZÁBRANSKÝ, L. Welfare a zdraví z pohledu hodnocení denní aktivity dojnic. In Aktuální otázky bioklimatologie zvířat 2017. Praha Uhříněves: Výzkumný ústav živočišné výroby, v.v.i., 2017, s. 42-45. ISSN 978-80-7403-170-0

NOVÁK, P., MALÁ, G.. Denní časový režim – významný ukazatel welfare v chovech drůbeže. In Aktuální otázky bioklimatologie zvířat 2018. Praha Uhříněves: Výzkumný ústav živočišné výroby v.v.i., 2018, 52-54. ISSN 978-80-7403-205-9

PRÁŠEK, J., NOVÁK, P., MALÁ, G. Infekční průjmy telat jako výzva pro chovatele a veterinární lékaře. In Farmářský den - odchov telat na pranýři. Praha Uhříněves: Výzkumný ústav živočišné výroby, v.v.i. a Česká technologická platforma pro zemědělství, 2021, 20-22.

PRÁŠEK, J., NOVÁK, P., MALÁ, G., SMOLA, J. Management mastitid a možná úskalí robotického dojení. Náš chov, 2020, roč. 80(7), s. 60-61.

PRÁŠEK, J., NOVÁK, P., MALÁ, G., SMOLA, J., ILLEK, J. Zvýšení efektivity léčby mastitid jako klíč ke zdravějšímu stádu. In Aktuální otázky bioklimatologie zvířat 2021. Praha Uhříněves: Výzkumný ústav živočišné výroby, v. v. i., 2021, 98-100. ISSN 978-80-7403-263-9

PRÁŠEK, J., NOVÁK, P., SMOLA, J. Možnosti řízení zdraví mléčné žlázy v prostředí robotického dojení. In Aktuální otázky bioklimatologie zvířat 2019. Praha Uhříněves: Výzkumný ústav živočišné výroby v.v.i., 2019, 72-75. ISSN 978-80-7403-226-4

PRÁŠEK, J., NOVÁK, P., SMOLA, J., ILLEK, J. Možnosti udržení zdraví mléčné žlázy při automatickém dojení. In Aktuální otázky bioklimatologie zvířat 2020. Praha Uhříněves: Výzkumný ústav živočišné výroby, v.v.i., 2020, 82-85. ISSN 978-80-7403-240-0 VOKŘÁLOVÁ, J., NOVÁK, P., MALÁ, G. Otázka respiračních onemocnění prasat ve výkrmu ve vztahu ke klimatickým faktorům ve stáji. In Aktuální otázky bioklimatologie zvířat 2017. Praha Uhříněves: Výzkumný ústav živočišné výroby, v.v.i., 2017, 84-87. ISSN 978-80-7403-170-0

ZÁBRANSKÝ, L., BROŽ, P., ŠOCH, M., MALÁ, G., NOVÁK, P. Management mleziva a péče o telata. Náš chov, 2021, roč. 81(Speciální příloha Jak na správný odchov telat), s. 10-13.

NOVÁK, P., MALÁ, G., PRÁŠEK, J. Může biosekurita omezit výskyt antimikrobiální rezistence v chovech skotu? Náš chov. 2021; 9:40-44.

NOVÁK, P., MALÁ, G., PRÁŠEK, J. Analýza kritických kontrolních bodů biosekurity v chovech drůbeže. Náš chov. 2021; 10: 80-83.

SMOLA J.: Očkování jako strategie pro udržení zdravých stád a tlumení infekčních chorob prasat. Náš chov. 2021; 9: 24-27.

NOVÁK, P., MALÁ, G., PRÁŠEK, J. Má biosekurita vliv na výskyt antimikrobiální rezistence v chovech? Selská revue. 2021; 6: 84-87.

SMOLA, J. Imunita stáda jako nástroj managementu zdraví telat. In Farmářský den - odchov telat na pranýři. Praha Uhříněves: Výzkumný ústav živočišné výroby, v.v.i. a Česká technologická platforma pro zemědělství, 2021, 23-25.

NOVÁK, P., MALÁ, G. Biosecurity – základ ochrany chovů hospodářských zvířat. Praha Uhříněves: Výzkumný ústav živočišné výroby, v.v.i. a Zemědělský svaz ČR - Česká technologická platforma pro zemědělství, 2021, 140 s. ISBN 978-80-7403-264-6

NOVÁK, P., MALÁ, G., PRÁŠEK, J. Individuální plán biosekurity – základ prevence zavlečení ptačí chřipky do chovu. Náš chov. 2022; 3: 27-29.

NOVÁK, P., MALÁ, G., PRÁŠEK, J. Zemědělství 4.0 a živočišná výroba aneb více nemusí vždy znamenat lépe Náš chov. 2022; 7: 65-68.

MALÁ, G., NOVÁK, P., PRÁŠEK, J. Analýza kritických kontrolních bodů biosekurity v chovech malých přežvýkavců. Náš chov. 2022; 9: 62-64.

NOVÁK, P., MALÁ, G., PRÁŠEK, J. Význam deanimalizace v prevenci antimikrobiální rezistence. Selská revue. 2022; 7: 62-67.

NOVÁK, P., MALÁ, G., PRÁŠEK, J. Má úroveň welfare zvířat vliv na spotřebu antimikrobik? Náš chov, 2023, roč. 83(1), s. 57-60.

NOVÁK, P., MALÁ, G. PRÁŠEK, J. Vliv managementu odchovu telat na antimikrobiální rezistenci. Náš chov, 2023, roč. 83(2), s. 49-51.

NOVÁK, P., MALÁ, G., PRÁŠEK, J. Precizní zemědělství – zdraví zvířat – antimikrobiální rezistence. Náš chov, 2023, roč. 83(4), s. 50-52.

MALÁ, G., NOVÁK, P., PRÁŠEK, J. Kritické kontrolní body snižující spotřebu antimikrobik v automatických systémech dojení. Náš chov, 2023, roč. 83(5), s. 59-62.

NOVÁK, P., MALÁ, G., PRÁŠEK, J. Přeprava zvířat-hygiena (sanitace)- rezistence. Náš chov, 2023, roč. 83(6), s. 49-51.

MALÁ, G., NOVÁK, P. Jak omezit tepelný stres telat? Náš chov, 2023, roč. 83(6), s. 54-56.

NOVÁK, P., MALÁ, G., PRÁŠEK, J. Stájové prostředí a zdraví. Náš chov, 2023, roč. 83(8), s. 56-58.

NOVÁK, P., MALÁ, G., PRÁŠEK, J. Prevence šíření antimikrobiální rezistence v chovech drůbeže. Náš chov, 2023, roč. 83(10), s. 53-55.

NOVÁK, P., MALÁ, G., PRÁŠEK, J. Jaká opatření mají vliv na spotřebu antimikrobik v chovech?. Náš chov, 2023, roč. 83(12), s. 50-52.

NOVÁK, P., MALÁ, G. Dezodorizace – nedílná součást prevence vzniku antimikrobiální rezistence. Selská revue, 2023, roč. 2023(1), s. 102-106.

NOVÁK, P., MALÁ, G., PRÁŠEK, J. Zvířata – biosekurita - prevence vzniku antimikrobiální rezistence. Selská revue, 2023, roč. 2023(2), s. 142-145.

NOVÁK, P., MALÁ, G., PRÁŠEK, J. Člověk – biosekurita - prevence antimikrobiální rezistence v chovech hospodářských zvířat. Selská revue, 2023, roč. 2023(3), s. 96-99.

NOVÁK, P., MALÁ, G., PRÁŠEK, J. Volně žijící zvířata – biosekurita - prevence antimikrobiální rezistence v chovech hospodářských zvířat. Selská revue, 2023, roč. 2023(4), s. 85-89.

NOVÁK, P., MALÁ, G., PRÁŠEK, J. Přeprava zvířat – biosekurita - prevence antimikrobiální rezistence v chovech hospodářských zvířat. Selská revue, 2023, roč. 2023(5), s. 92-97.

NOVÁK, P., MALÁ, G., PRÁŠEK, J. Krmivo – biosekurita - prevence antimikrobiální rezistence v chovech hospodářských zvířat. Selská revue, 2023, roč. 2023(6), s. 50-53.

NOVÁK, P., MALÁ, G., PRÁŠEK, J. Voda – biosekurita - prevence antimikrobiální rezistence v chovech hospodářských zvířat. Selská revue, 2023, roč. 2023(7), s. 58-61.

NOVÁK, P., MALÁ, G. Hodnocení vlivu managementu chovu se zaměřením na skot ve vztahu ke spotřebě antimikrobik. In Sborník ze semináře - Užívání antimikrobik v chovech skotu v návaznosti na novou legislativu. Brno: Výzkumný ústav veterinárního lékařství, v.v.i., 2023, 3s.

NOVÁK, P., MALÁ, G. Program biosekurity – nedílná součást prevence antimikrobiální rezistence v chovech. In Biosekurita – základ ochrany chovů před zavlečením původců infekčních chorob. Praha Uhříněves: Výzkumný ústav živočišné výroby, v.v.i., 2023, s. 4-6.

MALÁ, G., NOVÁK, P. Význam a zásady biosekurity v průběhu odchovu telat. In Biosekurita – základ ochrany chovů před zavlečením původců infekčních chorob. Praha Uhříněves: Výzkumný ústav živočišné výroby, v.v.i., 2023, s. 7-9.

NOVÁK, P., MALÁ, G., PRÁŠEK, J. 2023 The impact of management, prophylaxis and biosecurity level in cattle farms on antimicrobial consumption. In Magyar Buiatrikus Társaság XXXI. Nemzetközi Tudományos Kongresszusa. Budapest, Hungary: Hungarian Association for Buiatrics, s. 50-61.

MALÁ, G., NOVÁK, P. Zásady biosekurity telat. Náš chov, 2023, 83(12), 52–55.

NOVÁK, P., MALÁ, G. Požadavky na farmy a stáje pro chov drůbeže a prasat z hlediska zajištění biosekurity. Náš chov, 2024, 84(8), 57–59.

NOVÁK, P., MALÁ, G., PRÁŠEK, J. Materiál, zařízení, vybavení, pomůcky, nářadí – biosekurita – prevence antimikrobiální rezistence v chovech hospodářských zvířat. Selská revue, 2024(2), 124–127.

NOVÁK, P., MALÁ, G. Biosekurita – základ prevence zavlečení slintavky a kulhavky do chovů prasat. Náš chov, 2025, 84(5), 59–60.

NOVÁK, P., MALÁ, G. Biosekurita jako součást opatření proti zavlečení slintavky a kulhavky do chovů prasat. Náš chov, 2025, 84(6), 58–61.

NOVÁK, P., MALÁ, G. Preventivní opatření zavlečení slintavky a kulhavky do chovu. In: Aktuální otázky bioklimatologie zvířat 2025. Praha Uhříněves: VÚŽV, 2025, 102–105.

NOVÁK, P., MALÁ, G., PRÁŠEK, J. Vliv biosekurity na kvalitu mléka. Náš chov, 2025, 84(8), 28–30.

NOVÁK, P., MALÁ, G. Velikost chovu prasat a biosekurita. Náš chov, 2026, 85(6), 79–81.

NOVÁK, P., MALÁ, G. Ptačí chřipka – hrozba pro chovy drůbeže. In: Sborník XVI. konference DDD Přívorovy dny. Praha, 2026, 79–82.

NOVÁK, P., MALÁ, G. Kritická místa biosecurity v ohniscích Slintavky a kulhavky. Biosekurita a sanitace základ ochrany chovů před zavlečením původců nebezpečných nákaz. ČTPZ/VÚŽV, Praha Uhříněves, 2026, 4-10.

MALÁ, G., NOVÁK, P. Účinná sanitace jako základ prevence zavlečení nebezpečných nákaz do chovů hospodářských zvířat. Biosekurita a sanitace základ ochrany chovů před zavlečením původců nebezpečných nákaz. ČTPZ/VÚŽV, Praha Uhříněves, 2026, 16-20.

NOVÁK, P., MALÁ, G. Praktické zkušenosti epizootologické surveillance v ohniscích HPAI. Biosekurita a sanitace základ ochrany chovů před zavlečením původců nebezpečných nákaz. ČTPZ/VÚŽV, Praha Uhříněves, 2026, 21-26.

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