2023

Supplement to the Animal Disease Surveillance Report

Methods and specific information concerning the 2022 surveillance programmes

423/2014/00031 \ COO.2101.102.4.1004505 \ 000.00.61

Contents

1 Introduction

Animal disease surveillance serves to record and document the health status of farm animals in Switzerland. Every year the FSVO and cantonal veterinary services use random sampling under disease-specific surveillance programmes for several animal diseases and zoonoses to document the health status of Swiss farm animals. Official veterinarians take samples from farm animals on behalf of the national veterinary service. Recognised diagnostic laboratories test these samples for pathogens. Depending on the disease and animal species, samples are collected on farms, during milk collection and in slaughterhouses ("RiBeS"). The results of this surveillance are crucial in deciding whether animal products can be exported or whether control measures need to be adopted or adjusted.

This Supplement describes the general methods used in the surveillance programmes and gives information on methodological features specific to each disease.

2 Different objectives: disease-free status, control, early detection

Depending on the objective of the programme, it may be appropriate to use different methods. The surveillance programmes carried out in Switzerland pursue three different objectives, depending on the animal disease.

Demonstrating disease-free status: Animal diseases that have been successfully controlled and eradicated in Switzerland could be reintroduced at any time. Freedom from eradicated diseases has therefore been ensured since 1995 by means of regulations and testing on import. Domestic surveillance is based on two pillars: the investigation of clinically suspected cases and an annual surveillance programme. Freedom from disease is monitored for the following diseases: IBR, EBL, BTV, AD, PRRS, brucellosis in small ruminants (*Brucella melitensis)*, BSE.

Monitoring the success of control: The control of animal diseases is a protracted process. Its success has to be documented regularly in order to determine any necessary adjustments to the control measures. Control is monitored for the animal diseases BVD and Salmonella infection in poultry. The control and surveillance measures are disease-specific and are described in the Sections 2.3.1.und 2.3.3.

Early detection: The task of early detection is to continuously assess the risks posed by serious infectious diseases and to pass on the resulting information to decision-makers in a targeted manner. In the best scenario, the introduction of a disease can be prevented or the risk minimised. But in any case, early detection contributes to risk reduction, including damage limitation. Here too, the methods used are disease-specific and are described in the individual sections.

2.1 General principles for demonstrating freedom from disease

2.1.1 Requirements for freedom from disease

"Demonstration of freedom from disease" relies on random testing, which in turn is based on statistical considerations. If all tests in the random sample are negative, the presence of the disease can be ruled out with a high degree of probability. In demonstrating freedom from disease, this probability is referred to as "confidence" and is expressed as a percentage. The maximum value is 100%. However, it can only be achieved in theory, as this would require all units of the population to be examined with a perfect test. However, 99% confidence can be achieved even with comparatively small sample sizes.

Freedom from disease is generally demonstrated on an annual basis. In order to demonstrate freedom from an animal disease, there must be no prior evidence that the disease is present in the area concerned. Such a condition can only be met if there is an obligation to investigate cases of disease and suspected cases and to report them to the relevant authorities. If there is also a risk of introduction of a disease, this must be communicated and disease awareness increased in order to identify suspected cases: animals showing typical clinical signs of the disease must be examined accordingly.

If there is no evidence that the disease in question is present in Switzerland, the requirements for statistically based demonstration of disease-free status are met by means of random sampling. For some diseases, bilateral treaties with the EU stipulate that disease-free status must be demonstrated in order to export animals and derived products to EU countries which also have disease-free status. Disease-free status also authorises countries to regulate the import of animals and animal products. Demonstrating freedom from disease therefore has economic advantages. Switzerland therefore demonstrates its freedom from disease "voluntarily" in certain cases, i.e. without being required to do so by treaties (one example is PRRS).

An important prerequisite for comparing disease-free status between individual regions and countries is that the quality of surveillance and the results obtained permit statistically sound conclusions and are therefore comparable. The scientific and statistical basis of the Swiss surveillance programme meets this condition.

2.1.2 Random sample testing

Samples are selected based on statistical principles that are scientifically published and thus generally accepted. The principles rely on random selection of the farms to be tested. As a basic principle, it is only possible to draw inferences about the total or target population if the units of a sample are determined at random. The units from which the sample is selected are called the sample population. It is important that inferences can be drawn from the sample population regarding the surveillance objective for the total population. This is also possible under certain conditions if the farms in the sample are selected not randomly but in a targeted manner. For freedom from disease, inferences can be drawn from a targeted risk-based selection if the distribution of risk factors in the population and the sample is known.

Based on these facts, the Federal Food Safety and Veterinary Office (FSVO) has developed and refined additional methods in recent years. The aim is to select samples as efficiently as possible. The two main methods it uses are:

- risk-based random sample calculation: using this method, the annually calculated number of farms in the sample is lower than with the standard method;
- risk-based farm selection: farms which have an increased risk of the disease are specifically selected, tested and evaluated.

Both methods reduce the number of farms tested, reducing the costs of the testing programme. The difference between the two methods is that risk-based sample calculation results in a lower confidence of detecting any cases of disease present, due to the lower annual number of tests. With risk-based farm selection on the other hand, despite the smaller number of annual tests, the confidence remains the same as there is more testing of high-risk farms.

Risk-based random sample calculation: Switzerland's bilateral EU treaties call for the tests necessary to demonstrate disease-free status to be repeated annually. The reason for this is that the tests can only detect a prior outbreak of disease. They therefore provide meaningful results only for the past year. Based on the following consideration, it is possible to reduce the extent of repeat sampling: once freedom from disease has been successfully demonstrated there remains a constant, small possibility of the disease being introduced despite import rules and tests. As a result, the level of confidence decreases over time. This decrease is calculated using a quantitative risk assessment. The annual repeating of the testing programme therefore only needs to compensate for this decrease in confidence. Using

this calculation method developed by the FSVO, we are able to reduce the number of farms tested annually and to do so on a scientifically sound basis.

Risk-based farm selection: Farms that have an increased risk of the disease are described as "sentinel farms". They are specifically included in the sample. Because these farms have a higher risk of the disease, the total number of farms in the sample can be reduced. However, the majority of farms are still selected at random, so the sample can still be regarded as a random selection.

To apply risk-based farm selection, risk factors are identified and quantified. These are used to gauge the probability of a disease occurring on a farm. This gives the relative risk of individual farms. This means that a farm with a high relative risk counts more heavily for surveillance purposes than another farm with a smaller calculated risk. For example, one farm with three times the relative risk can replace three farms with an average relative risk. This allows us to reduce the number of farms for testing.

Confidence of freedom from disease: The testing of samples collected according to statistical principles allows us to draw conclusions about the total population by means of probability calculation (stochastics). Using this method, we calculate how probable the sample result is if the population is composed of a particular species. In the case of demonstrating freedom from disease, we therefore determine how probable it is that the sample is negative if some cases of the disease did occur in the population. This probability is described as the confidence of freedom from disease. The requirement for the surveillance programme is that a certain assumed prevalence at herd level (the "design prevalence") has to be detected with a defined level of confidence. Specifically: at least one contaminated farm – out of several farms assumed to be contaminated – would need to be found in the sample with a given probability. Based on this assumption, we calculate the necessary sample size. For IBR, EBL, brucellosis in small ruminants and Aujeszky's disease, the criteria to be met are set out in the bilateral agreements with the EU. For PRRS (voluntary demonstration of disease-free status), these criteria were defined independently.

Two points often cause confusion and must therefore be addressed: first, the aim of the surveillance programme is to demonstrate freedom from a particular animal disease. This means that no cases should be discovered by other means, e.g. by testing suspected cases or investigating abortions. Second, the assumption that some contaminated farms or animals are present is made solely in order to calculate the sample. It is simply a calculation aid. Consequently, this assumption does not allow any contaminated farms or animals to actually be detected outside the sample. Were this to happen, Switzerland would lose its disease-free status for the disease in question.

Evaluation of samples: Since 2012, we have used a special statistical method to evaluate the samples, combining the results of the current sample with sample information from previous years (Bayesian method). To calculate the decrease in confidence for the previous year's sample, we have carried out a quantitative risk assessment over many years. We include the resulting information in the Bayesian method, but without carrying out a risk assessment every time: in evaluating the current sample, we use a fixed value for the annual decrease in confidence for the previous year's sample, provided the number of imported animals is below a specified level.

2.1.3 Farm selection

Because livestock are kept on farms, the objective of a surveillance programme to demonstrate freedom from disease is normally a statement at farm level. If the sampling unit is the farm, we calculate, for each farm tested, how reliably we can rule out infection of the herd or flock. In doing so, we take the total tests of individual animals as a diagnostic test for the farm. Farms can be grouped into different farm categories.

Where requirements exist at animal level, the calculation is carried out – for simplicity – at animal level without considering the farm.

Risk factors and risk groups: In order to integrate farms into the sample on a risk basis in addition to random selection (see risk-based sample calculation and/or sentinel farms), disease-specific risk factors

need to be determined in advance. Farms with the same combination of risk factors have the same relative risk of the disease; they be-long to the same risk group. Farms with a very high risk of the disease (upper risk groups) are selected as sentinel farms. Farms with a lower risk (lower risk groups) are selected at random. The random sample is additionally stratified by canton. This ensures that the distribution of tested farms among the cantons corresponds to the distribution of the number of farms with the species to be tested. This ensures that all cantons are represented equally in the sample.

Cattle: Farms from which milk samples are collected regularly for milk testing by Suisselab AG in Zollikofen are classed as dairy (milk supplying) farms; all other farms are classed as non-dairy.

Sheep and goats: The sheep and goat populations are regarded as a single population for brucellosis in small ruminants. A farm with sheep and goats is counted twice in the population and sample: once as a sheep farm and once as a goat farm.

Pigs: The target population of the surveillance programme comprises all pig farms, irrespective of whether fattening or breeding pigs are sampled. This is due to the special structure of pig farms in production (breeding pyramid). However, depending on whether breeding or fattening pigs are sampled, the population and sample may comprise only fattening, breeding or mixed farms. For example, random sampling is currently carried out only on breeding pigs, i.e. from breeding or mixed holdings, since they have a higher risk of entry of the diseases included in the sample.

2.1.4 Laboratory testing

Sample collection: Blood samples are collected on farms by authorised veterinarians. The samples are sent for testing to several FSVO-approved laboratories, where they are individually diagnosed. The veterinarian must complete a sampling report for each selected farm. If no blood samples could be taken, for example because the farm had stopped keeping the species in question or had no animals at the time of inspection, the reason must be given.

The milk samples tested come from milk inspection at Suisselab AG (Zollikofen). Besides being used for milk quality testing, these samples are also used for the diagnosis of animal diseases.

The collection of blood samples has increasingly been shifted to the slaughterhouses. Traceability of the animals sampled is important in this respect. Most sampling of cattle and pigs is now carried out at the slaughterhouse by the official veterinarians responsible for meat inspection.

In the case of cattle, traceability is ensured via the animal movements database (AMD); in the case of pigs, the official veterinarians responsible for meat inspection record the animals' farm of origin. For cattle samples, official veterinarians are supported by a web service of the animal movements database on cattle sampling at the slaughterhouse ("RiBeS"). This web service shows the veterinarian which animals to sample, in the slaughterhouse's commercial software (ERP) or via an app, and creates the documentation (test request and sample labelling). Shifting the sampling for non-dairy cattle from farm to slaughterhouse has made sample collection easier and less dangerous. However, the design of the surveillance programme has had to be adjusted, as only a few animals per farm can be tested; however, the results depend on how many animals from individual farms are sent for slaughter.

Since it is assumed prior to sample testing that Switzerland is free of the diseases in question, a negative test result is expected. Neither the competent veterinary authorities nor the keepers of the herds tested are sent a laboratory report if the results are negative.

Sensitivity and specificity: Any laboratory diagnostic method can yield false results, albeit very rarely and only under certain conditions. The result can be false-negative or false-positive. In the case of a false-negative result, an infected animal is not recognised as such. False-negative results reduce the sensitivity of a test. The sensitivity indicates the proportion of infected animals correctly detected as positive in the test. In the case of a false-positive result, a healthy animal is wrongly identified as infected. False-positive results reduce the specificity of a test. The specificity indicates the proportion of non-infected animals correctly detected as negative in the test.

To demonstrate freedom from disease, a serological test for specific antibodies is usually carried out. The first step is to carry out a screening test, usually an ELISA that is as sensitive as possible. This ensures that no infected animals are missed. However, it may give a few false-positive results. Samples testing positive in the ELISA are then retested using a specific test to identify the false-positive samples. These confirmation tests on all positive samples are carried out by the national reference laboratory for the disease in question.

Evaluation of laboratory results: Here a distinction needs to be drawn between laboratory tests detecting antibodies and those detecting pathogens. In demonstrating freedom from disease, most samples are tested for the presence of antibodies. If antibodies are found, it means the animal was in contact with the pathogen at some time and its immune system responded by producing antibodies. However, it can also mean that the animal was vaccinated, in which case it cannot infect other animals. Very rarely, animals may react positively to a serological test even though they have never had contact with the pathogen in question. These animals are described as “singleton reactors”. Reasons for this response include non-specific immune reactions or cross-reactions with other pathogens. False-positive PCR results may occur, for example, if there are other closely related pathogens with genetic material very similar to that of the pathogen in question. As a result, different initial situations can lead to the same positive test result. In the event of a positive finding, therefore, the situation needs to be clarified more precisely. Investigations are based on the measures prescribed in the Epizootic Diseases Ordinance (EzDO) in the event of an animal disease. It is only by conducting further tests on the animal and by investigating the affected farm and in-contact farms that we can differentiate singleton reactors from a real disease outbreak, identify the introduction route and tailor measures to the actual risk. In an international context, it is important to demonstrate that these are singleton reactors – as this does not lead to the loss of disease-free status.

2.2 Demonstrating freedom from disease: disease-specific information

2.2.1 Infectious bovine rhinotracheitis (IBR) and enzootic bovine leukosis (EBL)

Requirements: In parallel with clinical surveillance, testing for infectious bovine rhinotracheitis (IBR/IPV) is carried out on abortions, artificial insemination bulls and animals participating in shows or admitted to animal hospitals. For enzootic bovine leukosis (EBL), no further surveillance testing is conducted outside the sample. Lymph node changes detected during meat inspection are investigated. All of these tests must be negative in order to demonstrate freedom from disease for both of these diseases.

Based on the bilateral agreements with the EU, the sensible approach is to carry out a surveillance programme by random sampling in order to demonstrate freedom from IBR and EBL and be able to export bovine animals and derived products to other IBR- or EBL-free countries. In addition, imports of bovine animals and semen are regulated. In the case of IBR, imported animals must meet additional guarantees and are tested on import from non-IBR-free countries. Genetic products are also subject to special import conditions.

Sample calculation: The sampling procedure is identical for IBR and EBL, and largely the same farms and animals are tested. This keeps sampling and logistical costs low. Because testing using bulk-tank milk samples is much cheaper for a farm than testing using individual animal blood samples (although this is necessary for non-dairy farms), it seems attractive to focus on testing dairy farms. However, such an approach would violate the basic principle of random sample selection. Dairy and non-dairy farms are therefore regarded as separate sub-populations and freedom from disease is demonstrated separately for each. Looking at the overall bovine population, these objectives go well beyond the EU requirements. There is therefore a greater probability of detecting any outbreaks of IBR or EBL. When this sampling procedure was introduced in 2022, care was taken to ensure that the costs remain unchanged.

The 2022 surveillance programme was designed in such a way that there is a 99% confidence of detecting the 0.2% design prevalence (corresponding to around 80 infected farms) in both sub-populations (dairy and non-dairy farms). Both requirements stem from the bilateral agreements with the EU and apply to the entire bovine population. Extrapolating from sub-populations to total population yields either a very high confidence at a 0.2% design prevalence or approximately halves the design prevalence at an existing confidence level of 99%.

Besides dividing farms into dairy and non-dairy, it is also necessary for risk-based farm selection to distinguish between sentinel farms and randomly selected farms in both sub-populations. Half of the necessary confidence comes from the testing of randomly selected farms. The other half comes from the testing of sentinel farms. Owing to the stochastic correlation, a confidence level of 90% corresponds to half of a 99% confidence level. At least 90% confidence must therefore come from each of the four types of farm (Table 2.2.1-1). The EBL random sample requires more sentinel farms than the IBR random sample. The reason for this is the smaller number of risk factors in the case of EBL. Because EBL sentinel farms are integrated into the IBR random sample, slightly fewer randomly selected farms were tested for IBR than for EBL. However, since the number of farms involved is comparatively small and the organisational effort would be comparatively high, this discrepancy is not compensated for. All farms and animals are simply tested for both diseases. A reserve is added to the calculated number of samples, since it may not be possible to sample individual selected farms. In the case of non-dairy farms, we do not use an additional reserve because evidence of freedom from disease must ultimately be provided for the total population and over-testing would cause comparatively high costs. In return, the slightly higher risk of not quite reaching the target of 99 % confidence is accepted.

The risk-based sample calculation to reduce the number of farms to be tested is abandoned in favour of higher surveillance quality. This is justified because there is a real risk of introduction of both animal diseases.

Selection and testing of farms: For random sampling to test for IBR and EBL, some of the cattle selected for BVD are sampled. All cattle sampled are screened for both diseases. For the random sample, holdings are therefore not selected in advance; rather, 9,000 animals are sampled as they arrive at the slaughterhouse. No random selection of the cattle and holdings to be sampled is possible in advance, as it is not known which cattle are to be slaughtered. However, the draw corresponds to a random selection, since there is no known distortion due to this procedure. Sentinel farms, on the other hand, are identified *a priori*. Sampling at the slaughterhouse is carried out with the aid of the “RiBeS” system, which triggers a signal at the slaughterhouse when a sample needs to be taken from a slaughtered bovine animal. The animal must meet certain selection criteria in the AMD (see “Animal selection” below) and tests also need to be conducted for BVD on the farm of origin.

Table 2.2.1-1: Selection of farms and sample collection period.

Animal disease	**IBR and EBL**			
Farm type	**Non-dairy farms** (blood samples)		**Dairy farms** (bulk-tank milk samples)	
Data basis	AMD as at 11.11 in the previous year		Milk testing as at 11.11 in the previous year	
Selection method	Random selection	Sentinel farms	Random selection	Sentinel farms
Random selection	Yes	No	Yes	No
Stratification	Yes	No	Yes	No
Sampling period	1 January to March /until safety achieved		2 samples per farm, in January and April	

The bulk-tank milk sample is a pooled sample from all lactating cows on a farm. When testing bulk-tank milk samples, we need to bear in mind that only some of the cows on a farm are in lactation at any one time. We therefore test two samples with a three-month interval to cover all cows on a farm, or calculate the herd sensitivity for a sampling, reducing the test sensitivity by a factor corresponding to the proportion of non-lactating cows.

For IBR and EBL, in addition to random selection, we apply risk-based selection of sentinel farms.

IBR sentinel farms have one or more of the following characteristics identified in a survey of experts as IBR risk factors:

- Summer pasturing
- Farms with above-average animal movement (animal movements in the AMD)
- Farms that have imported cattle
- Farms close to the border (within 5 km of the border and cross-border roads)
- Farms in areas with a high farm density (farms/km^2)

These five risk factors give 32 possible combinations or risk groups. Sentinel farms are selected from the upper risk groups.

In a separate survey of experts, three EBL risk factors were identified for the selection of sentinel farms:

- Summer pasturing
- Farms with above-average animal movement (AMD)
- Farms that have imported cattle

These three risk factors give eight possible combinations or risk groups. Farms with the highest relative risk are used as sentinel farms. Farms with a lower risk are not all required; sentinel farms from this group are therefore selected at random. The rest of the procedure is the same as for IBR. The risk factors used in 2021 were determined in 2017 using data from 2016. The risk factors need to be regularly redefined.

Animal selection: On non-dairy farms, blood samples are collected from bovine animals between six months and five years old and tested for IBR and EBL antibodies. When sampling at the slaughterhouse using RiBeS, the number of animals per farm depends on the size of the group of animals to be tested for BVD. In most cases, the number of animals is five or fewer; the mean in 2022 was 23.7.

During on-farm sampling, if fewer than seven animals are older than 24 months, a total of seven blood samples are collected, including some from younger animals.

However, in the case of dairy farms, it is not known which cows supplied the milk contained in the bulk-tank milk sample. But by testing two samples with a three-month interval, there is a high likelihood that all lactating cows on the farm will be covered. Young stock and male animals are not covered by the testing of bulk-tank milk.

In the case of dairy farms, two samples with a three-month interval enable us to achieve an over 99% probability of detecting any bovine animals infected with IBR or EBL. With only one sample, however, the herd sensitivity would be only 78.8%.

Laboratory testing: In the case of bulk-tank milk samples, diagnosis is based on the remaining sample material after official milk testing has been carried out by Suisselab AG. All samples in the IBR selection are also tested for EBL. All laboratory methods are used to detect antibodies to BHV-1 or EBL.

If the results are positive, the samples are subjected to confirmation tests according to Table 2.2.1-2 and 2.2.1-3. Because the bulk-tank milk tests are both highly sensitive and specific, the same ELISA test is repeated if the result is positive. If the second test is also positive, all bovine animals on the farm that are at least 24 months old are tested by means of blood samples. If the second test is negative, the sample is tested a third time and this result is used.

Table 2.2.1-2: Methods used to test for IBR, including sensitivity and specificity, and the IBR reference laboratory.

Animal disease	**IBR**	
Type of sample	Blood samples	Bulk-tank milk samples
Screening method	ELISA test	ELISA test
Sensitivity and specificity for individual animal / farm	99.3% and 98.3% / depending on farm size and number of samples	Two samples almost 100%; with one sample, herd sensitivity 78.8%

	tested; sensitivity for randomly selected farms Ø 30%; sentinel farms Ø 68%; specificity 100%	
Confirmation testing method for positive samples	Serum neutralisation test	Blood samples on farm; all bovine animals > 24 months
Sensitivity and specificity	Very good, 98.3–100% respectively	99% and 100%
Reference laboratory	Institute of Virology of the Vetsuisse Faculty of the University of Zurich	

Table 2.2.1-3: Methods used to test for EBL, including sensitivity and specificity, and the EBL reference laboratory.

Animal disease	**EBL**	
Type of sample	Blood samples	Bulk-tank milk samples
Screening method	ELISA test	ELISA test
Sensitivity and specificity	Almost 100% and 99.8% respectively	Two samples almost 100%; with one sample, herd sensitivity 78.8%
Confirmation testing method for positive samples	ELISA-Ab GP-51	Blood samples on farm are tested using ELISA-Ab GP-51
Sensitivity and specificity for individual animal / farm	Almost 100% / sensitivity for randomly selected farms Ø 30%; sentinel farms Ø 68%; specificity 99.5%	–
Reference laboratory	Institute of Virology and Immunology (IVI) of the Vetsuisse Faculty at the University of Bern	

Case definition: The Epizootic Diseases Ordinance stipulates that in the case of IBR and EBL each antibody-positive bovine animal confirmed by the reference laboratory constitutes a case of disease and that measures must be taken on the farm concerned.

The additional investigations required in the event of disease make it possible to differentiate between a singleton reactor and an actual disease outbreak. If the findings are confined to a serologically positive result for an individual animal and no virus is found, the case is classed as a singleton reactor.

2.2.2 Aujeszky's disease

Requirements: Random sampling for Aujeszky's disease has been in place since 2001. Because Switzerland's neighbouring countries are also free of Aujeszky's disease and no live breeding pigs are imported, there is only a low risk of introduction. However, in previous years antibody-positive animals have been found in Switzerland during testing of wild boar. Based on the bilateral agreements with the EU, the sensible approach for Aujeszky's disease is to carry out a surveillance programme by means of random sampling. The programme is necessary in order to export live pigs and derived products to countries which also have disease-free status. This also allows us to regulate imports of live pigs and porcine semen.

Samples from the Aujeszky's disease surveillance programme are also tested for Porcine reproductive and respiratory syndrome (PRRS). Synergies between the two programmes are exploited to the full, leading to low sampling and logistical costs.

Sample calculation: For Aujeszky's disease, we apply risk-based sample calculation. The reason is that the risk of introducing Aujeszky's disease is very low and there have been no further outbreaks in Switzerland since the introduction of random testing. The lower surveillance quality of random sampling associated with this procedure is not a concern for this disease and we are able to exploit the economic advantages. For Aujeszky's disease, according to the bilateral agreements, we need to be able to demonstrate in a random sample with 99% confidence that herd prevalence is below 0.2%. The testing programme from 2022 is only aimed at breeding farms, as these have a higher risk of entry in relation to the diseases in question (in particular PRRS), and an entry into the Swiss pig population can therefore be detected earlier than by testing the fattening farms downstream in the production chain. For organisational reasons, samples for Aujeszky's disease and PRRS are processed together. As the outbreaks

in recent years show, there is a real risk of introduction in the case of PRRS. However, there are no internationally valid additional guarantees that would require a surveillance programme for PRRS. The efficient combination with Aujeszky's disease is therefore considered more important here than improving early detection by a larger sample without risk-based sample calculation. Efforts to improve early detection are focused on abortion investigations and exclusion testing.

The Bayesian method is used to **evaluate the samples**. Because Switzerland stopped imported breeding pigs several years ago, it is not possible to carry out a quantitative import risk assessment for Aujeszky's disease. The method therefore uses the simplified procedure, in which an annual 10% decrease in confidence is integrated into the calculation. This 10% figure is based on a management decision and is intended to encompass all conceivable import risks. The 10% decrease corresponds to a halving of the confidence level, i.e. the sample is around half as large as it is without this calculation method. The confidence level from the current sample must be 90% to compensate for the previous year's decrease and achieve an overall confidence level of 99 %.

Selection of farms and animals: Sampling for Aujeszky's disease is carried out together with that for PRRS. The sample is identical. Details concerning the selection of farms and animals are therefore described in the section on PRRS.

Table 2.2.2-1: Total number of pig farms in Switzerland and the calculated sample size at sample level.

Animal disease	**Aujeszky's disease and PRRS**
Animal category	Breeding pigs
Total samples	7,500 blood samples from individual animals (breeding animals)
Total number of pig farms	Some 5800, including 1800 breeding farms
Samples per farm	Not specified, expected to average six samples per farm
Sampling period	1 January to 31 July each year

Laboratory tests: The blood samples taken by meat control personnel are sent to the designated diagnostics laboratories, where they are tested for antibodies against Aujeszky's disease and PRRS. Any laboratory diagnostic method can yield false-negative or false-positive results, albeit very rarely and only under certain conditions. The screening and confirmation testing methods for Aujeszky's disease, the respective sensitivities and specificities, and the reference laboratory for Aujeszky's disease are indicated below (Table 2.2.2-2).

Table 2.2.2-2: Methods used to test for Aujeszky's disease, including sensitivity and specificity, and the reference laboratory for Aujeszky's disease.

Animal disease	**Aujeszky's disease**
Type of sample	Blood samples
Screening method **Sensitivity and specificity**	ELISA test 99.5% and 99.9% respectively
Confirmation testing method for positive samples **Sensitivity and specificity**	Serum neutralisation test (SNT) Gold standard, over 99.5%
Reference laboratory	Institute of Virology of the VETSUISSE Faculty of the University of Zurich

Case definition: The Epizootic Diseases Ordinance stipulates that in the case of Aujeszky's disease each antibody-positive pig confirmed by the reference laboratory constitutes a case of disease and that measures must be taken on the farm concerned. However, because different initial situations can lead to a positive test result, it is important to investigate the situation more closely and to differentiate between singleton reactors and a real disease outbreak.

2.2.3 Porcine reproductive and respiratory syndrome (PRRS)

Requirements: In the case of PRRS, there is a high risk of introduction. The disease has spread rapidly in Europe since the mid-1990s and occurs in most European countries. It is therefore important to have a sound basis for the annual testing programmes. The basis for Switzerland's PRRS-free status was laid in 2001 when, following a minor outbreak, a mass screening programme was conducted in which over 40,000 pigs were serologically tested for PRRS. The results confirmed that Switzerland was once again PRRS-free after successfully controlling the outbreak. Since then, random testing has been sufficient to demonstrate freedom from the disease. However, a risk of introduction remains, as outbreaks in 2012 and 2014 show. And in recent years antibody-positive animals have been found in Switzerland during testing of wild boar. Strong disease awareness and effective early detection are therefore extremely important. Animals showing typical clinical signs must be investigated. For example, breeding sows in a herd with a noticeably high rate of abortions must be tested for PRRS.

Unlike in the case of internationally regulated animal diseases, Switzerland cannot adopt import regulations for PRRS. Import organisations adhere voluntarily to their own stringent rules. All pigs tested for swine fever due to a suspicion or for exclusion purposes will continue to be tested for PRRS as well, as

the clinical symptoms are the same.

The PRRS testing programme is identical to the Aujeszky's disease surveillance programme; the samples collected are tested for both diseases. This makes the best possible use of synergies. This also ensures that the PRRS surveillance programme is underpinned by scientific and statistical data.

Sample calculation: The PRRS surveillance programme is based on that for Aujeszky's disease. Risk-based sample calculation is therefore applied. A herd prevalence below 0.2% must be detected in a sample with 99% confidence. All other aspects of sample calculation are as described for Aujeszky's disease.

An obvious disadvantage of the smaller sample obtained by risk-based sample calculation is that the likelihood of finding contaminated farms – if any exist – is also reduced. Although this disadvantage can be tolerated for Aujeszky's disease due to the favourable international disease situation, it is not acceptable for PRRS, where there is a risk of introduction. In recent years, several cases of introduced PRRS and related outbreaks have been detected in Switzerland, sometimes as a result of the surveillance programme. To increase the likelihood of finding contaminated farms by using a surveillance programme, the latter's effectiveness was increased by testing breeding farms as from 2018. Breeding farms are important for the spread of the virus and have a higher risk of virus introduction than fattening farms. Consequently, the testing of breeding pigs may also reveal the presence of the disease earlier than the testing of fattening pigs.

Selection of farms and animals: In order to carry out screenings for Aujeszky's disease and PRRS, farms are selected by means of convenience sampling by the meat control personnel at 11 slaughterhouses. The meat inspectors decide independently from which animals and thus from which farms they will take samples. The FSVO specifies only the period and the total number of samples to be taken by the slaughterhouse, not the number of animals to be sampled per holding of origin. For logistical reasons, such a requirement is not possible for the sampling of breeding pigs. In addition, many breeding farms supply animals to different slaughterhouses, which means that animals from the same farm may be sampled at different slaughterhouses. Therefore, the number of animals actually submitted for testing may vary per holding of origin. The sample size is determined on the basis of the average number of samples per holding of origin. Based on the average of six animals per farm over recent years, an intra-herd sensitivity of 87% is achieved, assuming a prevalence of 30% on an infected farm. In order to achieve an overall sensitivity, i.e. 90% confidence level for the current sample, it was necessary to test 1,203 farms, i.e. 7,218 samples, for a total population of 6,000 holdings (rounded up) and a design prevalence of 0.2%. However, for logistical reasons it is not possible for slaughterhouses to sample precisely six breeding sows per holding of origin and the number of animals actually sampled per holding varies. This has effects on the overall sensitivity. To be on the safe side, the sample size was therefore set slightly higher – at 7,650 samples. The conclusion for each holding of origin is recorded in the meat inspection documentation.

Laboratory tests: All blood samples from the Aujeszky's disease surveillance programme are also tested for antibodies to PRRS. The procedure is as described for Aujeszky's disease. The screening and confirmation testing methods for PRRS, the respective sensitivities and specificities, and the reference laboratory for PRRS are indicated below (Table 2.2.3-1).

Table 2.2.3-1: Methods used to test for PRRS, including sensitivity and specificity, and the PRRS reference laboratory.

Animal disease	**PRRS**
Type of sample	Blood samples
Screening method **Sensitivity and specificity**	ELISA test 94% and 99.1% respectively
Confirmation testing method for positive samples **Sensitivity and specificity**	Indirect fluorescence antibody (IFA) test 96% and 98.7% respectively
Reference laboratory	Institute of Virology and Immunology (IVI), Mittelhäusern

Case definition: The Epizootic Diseases Ordinance stipulates that in the case of PRRS two antibody-positive pigs on a farm confirmed by the reference laboratory constitute a case of disease. This special definition is necessary due to the comparatively low specificity of PRRS diagnostics. If the virus is detected, on the other hand, even a single pig constitutes a case of disease. If only one pig is confirmed as seropositive out of the six pigs sampled per farm, further samples must be taken on the farm of origin and submitted for testing. These results will determine whether or not a case of disease is recorded.

However, different initial situations can lead to a positive test result. It is therefore important to investigate the situation more closely and to differentiate between singleton reactors and a real disease outbreak. Because antibodies to PRRS virus remain detectable for only a few months, prompt investigations are crucial in order to identify the actual cause of a positive serological PRRS finding.

2.2.4 *Brucella melitensis*

Requirements: In addition to clinical brucellosis surveillance, we also investigate elevated rates of abortion on a sheep or goat farm. This is despite the fact that a different cause is generally assumed, as brucellosis in small ruminants is not endemic in Switzerland. Based on the bilateral agreements with the EU, the sensible approach for brucellosis is to carry out a surveillance programme by means of random samples. The programme is necessary in order to export live small live ruminants and derived products to countries which also have disease-free status. This also allows us to regulate imports of small ruminants and their semen.

Sample calculation: For brucellosis, we apply risk-based sample calculations. The reason is that the risk of introducing brucellosis into Switzerland is very low and there have been no outbreaks since the start of sampling. The lower surveillance quality of random sampling associated with this procedure is therefore not a concern and we are able to exploit the economic advantages.

For brucellosis, according to the bilateral agreements, we need to be able to demonstrate in a random sample with 95% confidence that herd prevalence is below 0.2%. Under EU Directive 91/68/EEC, sheep and goats can be combined in a single population for this purpose.

To constitute the sample for brucellosis testing, blood samples are taken from sheep and goats. We use the Bayesian method to evaluate the sample. In evaluating the current random sample, we assume a decline in confidence for previous samples based on import numbers and the origin of these imports. provided that no more than 800 small ruminants were imported during the previous year we calculate with a probability (PImp-) of 96.5% that no brucellosis has been introduced. This PImp- of 96.5% was calculated in a risk assessment model of the VPHI (2010, scenario B). This conservative scenario assumes that 50% of the imports originate from countries that are not free of brucellosis and has the aim

of not overestimating the resulting confidence level of the current samples. A total of 396 small ruminants were imported in 2019. All originated from brucellosis-free countries or regions (Implementing Regulation (EU) 2021/620 of the Commission dated 15 April 2021: Annex I, Part I, Chapter 2Member States or zones thereof with disease-free status from infection with Brucella abortus, B. melitensis and B. suis in ovine and caprine animal populations).

Farm selection: To constitute the sample for brucellosis testing, farms are randomly selected from the agricultural policy information system (AGIS). Goat farms must have registered at least three goats in AGIS and be recorded as a sheep or goat farm in the Animal Movements Database (AMD). In addition, they must not have been tested for brucellosis as part of a sample in the last three years.

Animal selection: Sheep and goats over 12 months old are tested. In larger herds, a random sample of animals is used. The selection of animals in a sample is random and stratified according to epidemiological units on the farm. The number of samples taken on sheep and goat farms (Table 2.2.4-1) guarantees an appropriate herd sensitivity of 99%. The herd sensitivity is the probability of detecting an existing infection in a herd by means of random sampling. It depends on the sensitivity of the individual animal diagnostics used (assumed as 99%), the proportion of infected animals in the herd (intra-herd prevalence) and the number of animals tested. The larger the sample, the greater the probability of detecting an infected farm. As of 2022 the schema for sampling in sheep and goat farms was matched and an intra-herd prevalence of 15% was assumed (as is assumed in the VPHI model for infection-free countries). This new schema enables us to reduce the number of samples in small and medium size farms (the majority of Swiss farms) in comparison to earlier and simultaneously respect the safety standards.

Table 2.2.4-1: Number of sheep and goats to be sampled for brucellosis testing

Herd size (number of animals over 12 months old)	< 19	20-29	30-55	≥ 56
Number of blood samples	all	19	23	29

Previous Schema (before 2022)

Herd size (number of animals over 12 months old)	< 40	40-99	≥ 100
Number of blood samples	all	40	50

Laboratory tests: The laboratory tests the samples for Brucella antibodies. Any laboratory diagnostic method can produce false-negative or false-positive results, albeit very rarely and only under certain conditions. The screening and confirmation testing methods for brucellosis, the respective sensitivities and specificities, and the reference laboratory for brucellosis are indicated below (Table 2.2.4-2).

Table 2.2.4-2: Methods used to test for brucellosis, including the reference laboratory for brucellosis.

Animal disease	**Brucellosis**
Type of sample	Blood samples
Screening method	ELISA test
Sensitivity and specificity	No information
Confirmation testing method for positive samples	Complement fixation reaction and agglutination test
Sensitivity and specificity	No information
Reference laboratory	ZOBA, Institute of Veterinary Bacteriology of the Vetsuisse Faculty of the University of Bern

The sensitivity and specificity of the laboratory test have not been scientifically published. Nevertheless, investigations by the reference laboratory and all experience to date show that the tests are very good and suitable for use in demonstrating freedom from disease.

Case definition: The Epizootic Diseases Ordinance stipulates that in the case of brucellosis each small ruminant confirmed by the reference laboratory as antibody-positive constitutes a case of disease and that measures must be taken on the farm concerned.

However, different initial situations can lead to a positive test result. It is therefore important to investigate such situations more closely in order to differentiate between singleton reactors and a real disease outbreak. Singleton reactors are rare in the case of brucellosis.

2.2.5 Bluetongue disease

Requirements: Serotype BTV-8 was first detected in Switzerland in autumn 2017. The national surveillance programme identifies the areas affected by BTV-8 and allows an estimate of regional prevalence. For all other BTV serotypes, the national surveillance programme provides evidence of BT-free status according to Swiss self-declaration at national and regional level.

The sampling has to be divided into “BT areas”, defined as areas of 2,000 square kilometres. However, this definition can be waived in favour of existing administrative boundaries. We used geostatistical methods to structure these BT surveillance areas in such a way that they correspond to the cantons as far as possible. This created a total of 16 BT areas for Switzerland, as several small cantons were combined into a single BT area. We also made sure that not only the land area but also the populations of susceptible species are approximately the same in each BT area. This enables us to test the same number of animals in each BT area. The Principality of Liechtenstein is listed as a separate BT area. However, its land area and animal population are much smaller than those of the other BT areas and in epidemiological terms it should be considered together with the adjacent BT area “AI AR SG”.

Because the required prevalence at animal level is very high and already corresponds to an advanced epidemic, we decided that the Swiss surveillance programme should meet higher requirements. This allows us to detect an outbreak as early as possible and to take measures promptly. These requirements are in line with the observed prevalence in BT areas during the 2007/08 outbreak. Switzerland has therefore set the following new requirements for the surveillance programme: at national level, the finding of a 0.2% prevalence at animal level with 99% confidence; in each of the 16 BT areas, the finding of a 2% prevalence at animal level with 95% confidence.

Sample calculation: As a first step, the sample size per BT area was calculated based on the average population size of a BT area. This number of samples per BT area was multiplied by 16 to obtain the required number of samples at national level. The predictive value of this required number of samples at national level was then calculated. If it is not sufficient for the required 99% confidence level, the required number of samples at national level is calculated directly as a second step and this number is then divided between the 16 BT areas. The sample size per BT area is 150 bovine animals. For the whole of Switzerland, therefore, 2,400 bovine animals had to be tested in order to meet the condition. Based on experience with previous surveillance programmes, the necessary reserve was estimated at up to 490 animals. In the case of BT, the reserve ensures that the testing targets are achieved in all BT areas.

Animal selection: Only bovine animals are tested in the surveillance programme. The blood samples are collected at six large slaughterhouses with the aid of “RiBeS”. Both the sampling and the selection of animals are carried out by the on-site meat inspectors. Animals must meet the following conditions:

- They must not be vaccinated. This means that only animals born after May 2010 are sampled.
- Animals must be at least eight months old. This allows the influence of maternal antibodies to be ruled out and ensures that the animals have been exposed to potential transmission for as long as possible. Serological testing of older animals and of bulk-tank milk samples has shown that animals vaccinated against BT are still serologically positive 4–5 years after vaccination and can therefore pass on antibodies to their calves. These animals would thus be protected against BTV-8 infection and would be negative in a PCR test.

If possible, only single animals should be sampled from each farm. This limits the number of samples per farm in RiBeS. Samples for the 2022 programme were taken in November, corresponding to the end of the season with high midge activity. The PCR test is positive for up to 160 days in infected animals.

Laboratory tests: In random BT testing, blood samples from individual animals are tested (Table 2.2.5-1). The samples are sent to several FSVO-approved laboratories, where they are individually examined. Traceability back to the farm of origin is ensured by meat inspection information and animal histories in the animal movements database.

Diagnosis focuses on detection of the BTV genome. Additionally in the case of BT, specific PCRs are used to determine the serotype.

Table 2.2.5-1: Methods used to test for BTV

Animal disease	**BT**
Type of sample	Blood samples
Screening method	Pan-BTV-PCR on virus genome of all known BTV serotypes tested; pools of 5
Sensitivity and specificity	99.99% and 99.99% respectively
Confirmation testing for positive samples	Serotype-specific PCR
Sensitivity and specificity	No information
Reference laboratory	Institute of Virology and Immunology (IVI), Mittelhäusern

Case definition: The Epizootic Diseases Ordinance stipulates that in the case of BT any virus-positive animal constitutes a case of disease and that measures must be taken on the farm.

Midge surveillance: This is used to define the vector-free period. Animals can be moved more easily during this period because no fresh infections occur. Because sufficient data on midge activity has been collected in Switzerland in recent years, it can be used to define the vector-free period (from 1 December to 31 March).

2.3 Monitoring the success of control: disease-specific information

2.3.1 Bovine viral diarrhoea

Requirements: Freedom from disease is not demonstrated for BVD. As a result, there are no specific requirements for implementation of the surveillance programme. Nor is any random testing based on statistical principles carried out. No international requirements apply.

The 2022 BVD surveillance programme was based on the same concept as the 2021 BVD surveillance. All farms are to be inspected at least once a year. In addition, changes were made to the procedure for affected farms after the end of the farm and livestock quarantine.

Farm selection: All farms with cattle according to the animal movements database (AMD) are part of the active national surveillance programme. Cattle farms in the surveillance programme are divided into dairy and non-dairy farms according to the type of surveillance. Dairy farms are farms from which two bulk-tank milk samples were tested during the surveillance period. Non-dairy farms are tested once by means of blood samples from suitable cattle (cattle group). In most cases, the average of five samples was collected with the RiBeS application in the large slaughterhouses or via the RiBeS app in small slaughterhouses. For farms not suitable for RiBeS, sampling had to be carried out directly on the farms

by means of farm sampling. The cantons can also test “special farms” on an individual schedule (in particular, additional calf sampling by means of ear punching).

Animal selection: Serological testing of a group of bovine animals is subject to the following conditions: testing must cover 10% of the average number of animals kept in the herd, with a minimum of five animals, that are least six months old and no more than five years old, or over five years old with at least one negative serology result in the last five years. Animals have never tested serologically positive for BVD, have been kept exclusively in recognised BVD-free herds and have been in the current herd for a total of at least two months (on-farm samples six months) in the last 12 months. This information is also stored in and can be retrieved from the veterinary service information system (ISVet). These criteria are also used to select animals for sampling at the slaughterhouse. If the minimum number of five animals cannot be achieved, but 10% of the average bovine herd has been tested, the canton may class the farm as successfully monitored.

Laboratory tests: BVD diagnosis uses serological tests for samples of milk, bulk-tank milk and blood. Virological detection is performed by PCR or antigen ELISA. The reference laboratory also uses a range of additional tests, depending on the request.

Case definition: Detection of a persistently infected animal (PI animal) on a farm constitutes a case of disease. If additional PI animals are found on the farm, they are assigned to the previously identified case. If no PI animals are found but all test results indicate that one was present on a farm (it may have already been slaughtered, for example), the farm is classed as suspected of contamination.

2.3.2 Bovine spongiform encephalopathy

Requirements: In the case of bovine spongiform encephalopathy (BSE), no random testing is carried out to demonstrate freedom from disease. There are therefore no specific requirements for implementation of the surveillance programme. Nor is any random sampling based on statistical principles carried out. Based on international (EU) obligations and in order to maintain the OIE (World Organisation for Animal Health) status of “negligible BSE risk”, Switzerland is required to carry out an annual surveillance programme. The OIE transfers the BSE test results to a points system. In order to maintain the status of “negligible BSE risk”, Switzerland has to gain sufficient points through surveillance every year.

Animal selection: In addition to suspected clinical cases, all fallen or culled bovine animals over 48 months old are tested for BSE. The investigation of suspected clinical cases is not part of the surveillance programme.

Laboratory tests: Except for suspected cases, brain stem samples are investigated using a rapid test. In suspected cases, immunohistological procedures are used as well.

Case definition: A case is recorded if altered prion protein was detected and the result was confirmed by the reference laboratory. The detection of classical and atypical BSE constitutes a case. Only classical BSE cases would lead to the loss of OIE status.

2.3.3 Salmonella infection in poultry

Requirements: Salmonella infection in poultry is an animal disease to be controlled (EzDO Art. 255 et seq.). The aim of control is to prevent eggs or poultry meat from infected flocks from entering the human food chain. Control targets of <= 1% prevalence in breeders and broilers and <= 2% prevalence in layers have been set for this purpose. These targets relate to the serovars which most commonly pose a threat to human health. These are *S.* Enteritidis*, S.* Typhimurium and the monophasic *S.* Typhimurium 1,4,[5],12:i:- and additionally *S.* Virchow*, S.* Hadar and *S.* Infantis in breeding flocks. If these serovars are detected in surveillance samples taken from the birds themselves, control measures are initiated.

Farm selection: Poultry farms with more than 250 breeders or 1,000 layers or broiler chickens (if the floor area of the poultry house is more than 333 m^2) or broiler turkeys (if the floor area of the poultry

house is more than 200 m^2) must be tested for Salmonella in accordance with the Technical directive on the collection and testing of samples for Salmonella infection in domestic poultry. Samples are usually taken by the poultry farmers themselves.

Owners of poultry farms who test their poultry for Salmonella must register the stocking of each flock in the AMD. The test request form generated in the AMD must be used when testing these flocks. This form automatically incorporates important flock information such as the AMD number, flock ID, flock size and use (broiler, layer, etc.).

Data from this surveillance programme are evaluated via the aRes laboratory database. Tested flocks can be included in the evaluation only if the AMD request form containing all relevant flock information is sent to the laboratory with the sample material.

Animal selection: As a general rule, all flocks on the farms described above must be sampled regularly in accordance with the Technical directive on the collection and testing of samples for Salmonella infection in domestic poultry. Surveillance is generally carried out by testing boot covers or dust samples or by serology in eggs or blood. If Salmonella or Salmonella antibodies are detected in environmental samples or during serological testing, or if illness occurs in the human population due to consumption of poultry meat or eggs, a suspected case is recorded. In a suspected case, the official veterinarian takes samples from 20 birds.

Laboratory tests: Environmental samples are tested bacteriologically for Salmonella. Eggs and blood samples are tested serologically for Salmonella antibodies. Muscle, liver and spleen from the 20 animals sampled in the suspected case are tested bacteriologically for Salmonella.

Case definition: A case of disease is recorded if *S.* Enteritidis or *S.* Typhimurium (including monophasic strain 1,4,[5],12:i:-) are detected in the muscle, liver or spleen of poultry (additionally *S.* Virchow, *S.* Hadar or *S.* Infantis in breeding birds).

2.4 Early detection of animal diseases: disease-specific information

2.4.1 Low pathogenic avian influenza (LPAI) and Newcastle disease (ND) in commercial poultry

Requirements: Blood samples from Swiss commercial poultry have been tested for antibodies against avian influenza viruses (AIV) H5/H7 and Newcastle Disease (ND) from 2006 to 2021. The surveillance in this period has been limited to free-range laying hens and broiler turkeys. Broiler chickens were not sampled because there is only a low probability of AIV infection due to their short lifespan. Ducks and geese are often kept outdoors and are therefore more likely to come into contact with AIV. However, the risk of spreading low pathogenic avian influenza (LPAI) is regarded as low because these largely small flocks kept by hobbyists or pure-breed enthusiasts (<50 ducks/geese) rarely have close contact with commercial poultry farms. In addition, sampling these duck/goose flocks entails a great deal of effort.

The previous monitoring was extended as of 2022 to include a risk-based component, such that the disease-freedom for ND can now also be detected with a certain confidence.

The degree of sampling consequently includes the following two components as of 2022:

a) random sampling at the slaughterhouse: The sampling size per year numbers at least 60 to max. 80 flocks of free-range laying hens and ca. 27 flocks of broiler turkeys from farmed broiler turkeys which slaughtered their flocks at Frifag. A maximum of one flock per farm should be examined per year. Ten blood samples are taken from each flock.

b) risk-based selection of sentinel farms: At least 40 and max. 50 sentinel farms, selected according to specific risk factors, should be examined per year. From these sentinel farms, blood samples must be sampled from 25 animals per year.

Sample calculation: From 2006 to 2021 the number of flocks to be tested was set in such a way that at least one LPAIV-infected farm is found at a farm prevalence of at least 5% and a test sensitivity of 95%. For Switzerland, with over 250 laying hen farms, this meant a randomly and representatively drawn sample of 60 farms. In the case of broiler turkeys, all farms are sampled every year.

The number of birds to be tested per flock was set in such a way that at least one LPAIV-seropositive bird is detected at a prevalence of ≥ 30% LPAIV-seropositive birds with a test sensitivity of 95%. Therefore at least ten birds per flock were sampled. Samples from the LPAI testing programme were also tested in the laboratory for Newcastle Disease (ND) antibodies. The samples were not taken for the purpose of demonstrating freedom from disease and were not suitable for that purpose.

What is new since 2022, the number of flocks to be examined is defined such that at least one ND-infected farm is found for a farm prevalence of at least 1%, an animal prevalence of at least 10% is found within a positive farm and with a test sensitivity of 95%.

Farm selection:

a) random sampling at the slaughterhouse:

Free-range laying hen farms are selected by the FSVO on the basis of regularly updated slaughter lists from Gallo Circle, part of the Gallo Suisse egg producers' association. Flocks slaughtered in close succession are prioritised in order to minimise the effort entailed in sending samples from the German slaughterhouse. Due to the restriction (i.e. that only free-range laying flocks sent for slaughter are sampled), the selection of flocks is relatively limited and the farms tested each year are fairly similar.

b) risk-based selection of sentinel farms:

The sentinel farms are determined exclusively based on the following risk-factors by means of the Scenario-Tree model according to Martin et al. (2007) (those highlighted in bold type have a greater influence in the model):

- **Keeping** (BTS / outdoors / Bio):

  Outdoors and Bio have a higher risk than BTS
- **Ducks, quails and/or geese on the farm** (yes, no):

  The presence of such species is a higher risk
- **Distance to still water** (<1km, >1 km):

  Distance below 1 km is a higher risk
- Poultry density (number of other farms with >50 animals within 1km: 0, 1-2, >2):

  The more farms located within one kilometre, the higher the risk
- Number of poultry species on the farm (1, 2-3, >3):

  Farms with more poultry species have a higher risk
- Presence of poultry farms with ducks, quails and/or geese within 1 km (yes, no):

  The presence of such farms within 1km means a higher risk
- Usage (fattening /laying / breeding):

  Due to age, laying/breeding animals have a higher risk than fattening animals

Laboratory tests: Blood samples from Swiss poultry for avian influenza viruses (AIV) H5/H7 and antibodies against Newcastle Disease (ND) are examined. Laboratory tests are carried out in the departments for veterinary bacteriology and poultry and rabbit diseases (NRGK). The diagnostic procedures comply with the requirements of the World Organisation for Animal Health (WOAH). All blood samples are tested using commercial, ELISA tests (competitive AI / blocking ND). Positive and inconclusive samples are tested using a haemagglutination inhibition test (HIT) to detect specific antibodies against the AIV subtypes H5/H7 or against avian orthoavulavirus 1 (AOAV-1).

Case definition: In infected flocks, we would expect to find antibodies in several birds. Flocks with only one bird showing an inconclusive test result are classed as negative and are not monitored further. Only if multiple birds in a flock give positive or inconclusive results is a farm classed as antibody-positive. Subsequent flocks or, in the case of farms with multiple age groups, the flocks remaining on the farm are tested serologically and virologically and epidemiological investigations are carried out.

2.4.2 Highly pathogenic avian influenza (HPAI) in wild birds

Requirements: Highly pathogenic avian influenza (HPAI, also known as bird flu) usually leads to significant clinical abnormalities and, depending on the virus subtype, wild bird species and weather conditions, may be fatal. HPAI viruses circulating in the wild bird population pose a risk of transmission to commercial poultry. To detect such circulation as early as possible, we test dead or diseased wild birds.

Animal selection: The public is asked to maintain increased vigilance. Findings of dead wild birds should be reported to the gamekeeper or police. Reported carcasses are collected and disposed of safely. Sampling should be carried out in the following cases:

A ***wild bird finding to be clarified*** is recorded if a swan, two or more waterfowl or birds of prey, or five or more other wild birds, are found diseased or dead at a single location within 24 hours, and there is no sufficiently substantiated connection to another cause of disease or death. Tests must always be requested using the NRGK's "Application for the testing of wild birds for classical avian influenza". It is especially important to give coordinates, the bird species and the number of dead birds found, as this provides an overall picture of the numbers of wild bird deaths.

Laboratory tests: The combined choanal and cloacal swabs are tested for influenza A viruses at NTGK using RT-qPCR.

Case definition: Detection of highly pathogenic influenza viruses is classed as a case of disease.

General information on animal disease surveillance

The principles of animal health surveillance are described online (in German) at: https://www.blv.admin.ch/blv/de/home/tiere/tiergesundheit/ueberwachung.html

The case numbers cited in this report are based on the FSVO's information system for disease reports (InfoSM). These can be found at: https://infosm.blv.admin.ch

An annual compilation of cases per disease, per month and per canton is published in the rubric Animal disease statistic on page https://www.blv.admin.ch/blv/de/home/tiere/publikationen/statistiken-berichte-tiere.html.

This report and those from previous years can be found in the rubric animal health report at: https://www.blv.admin.ch/blv/en/home/tiere/publikationen/statistiken-berichte-tiere.html

The monthly FSVO Radar Bulletins on the international animal disease situation can be found (in German) at:

https://www.blv.admin.ch/blv/de/home/tiere/tiergesundheit/frueherkennung/radar.html.

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