Norwegian Veterinary Institute

Report 25 – 2026

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REPORT 25/2026

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Suggested citation

Meling, Siv, Ånestad, Lise M, Ytrehus, Bjørnar, Tessema, Girum T, Kolbjørnsen, Øyvor, Austbø, Lars, Tarpai, Attila. The surveillance programme for bovine tuberculosis in Norway 2025. Surveillance programme report. Veterinærinstituttet 2026. © Norwegian Veterinary Institute, copy permitted with citation

Quality controlled by

Merete Hofshagen, Surveillance Programme Coordinator, Norwegian Veterinary Institute

Commissioned by

Norwegian Food Safety Authority

Published

2026 on www.vetinst.no
ISSN 1890-3290 (electronic edition)

Colophon

Cover photo: Colourbox
www.vetinst.no

Content

Summary

In 2025, no infection with *Mycobacterium tuberculosis* complex was detected in cattle, camelids or cervids. Results from passive surveillance, risk-based active surveillance in cattle, and the investigation of one suspected case in cattle, were consistent with the continued absence of bovine tuberculosis in Norway

Introduction

Bovine tuberculosis (bTB) is a chronic infectious disease caused primarily by *Mycobacterium bovis* and is recognised as a zoonosis of public health significance. In bovids and many other species, the infection is characterised by the formation of nodular granulomas (tubercles), predominantly in the lungs and associated lymph nodes, however, lesions may also be observed in other organs. The disease typically follows a subclinical course, and when clinical signs occur, they are generally non-specific and may include deterioration of general condition, progressive weight loss, coughing, and enlarged lymph nodes. Cattle are considered the principal reservoir of *M. bovis*, although the pathogen has a broad host range, affecting numerous domestic and wild mammalian species. In certain epidemiological settings, wildlife populations function as maintenance hosts and may contribute to the persistence and transmission of infection to livestock (1, 2).

In Norway, tuberculosis caused by three members of the *Mycobacterium tuberculosis* complex (MTBC) (*Mycobacterium bovis, M. caprae*, and *M. tuberculosis),* is classified as a List 2 disease in accordance with national legislation. Within the European Union, bovine tuberculosis is categorised as category B in bovine animals (including cattle, buffalo, and bison), category D in other artiodactyl species, and category E in other susceptible mammals. Classification with category B entails the implementation of compulsory eradication measures across all Member States. Furthermore, bovine tuberculosis is also listed by the World Organisation for Animal Health (WOAH).

Norway has been considered free from bovine tuberculosis since 1963, with exception of two isolated herd-level outbreaks recorded in Sogn og Fjordane County in 1983 and 1986 (3). In addition, *Mycobacterium africanum* was isolated during an outbreak involving cattle and pigs in 1985. More recently, *Mycobacterium bovis* was detected by PCR in a llama in 2016. The animal exhibited gross liver lesions consistent with tuberculosis; however, histopathological findings were inconclusive, and bacteriological culture was negative. Both incidences where thoroughly investigated, but no source of infection could be identified. Since 1994, Norway has been official recognised as free from bovine tuberculosis by the EFTA (European Free Trade Association) Surveillance Authority (ESA), in accordance with ESA Decision 032/21/COL.

In 2022, bovine tuberculosis caused by *M. bovis* was confirmed in a single cattle herd in Rogaland County, representing the first confirmed detection of bovine tuberculosis in Norway since 1986. The outbreak was identified through routine post-mortem inspection at a slaughterhouse, where lesions suggestive of tuberculosis were detected in one animal. Relevant tissue samples were submitted to the Norwegian Veterinary Institute (NVI), which confirmed the diagnosis by laboratory analyses.

Following laboratory confirmation, the Norwegian Food Safety Authority (NFSA) initiated outbreak investigations and epidemiological tracing to prevent further spread, eradicate the infection, and identify the most probable source of introduction. Subsequent immunological testing identified additional positive animals within the index herd, as well as in two epidemiologically linked contact herds, with detections occurring during the period 2022 - 2023.

Notwithstanding this incident, Norway’s officially recognised free status for bovine tuberculosis at national level was maintained. The affected establishments subsequently regained official disease-free status following documented compliance with the requirements set out in Regulation (EU)2020/689.

Since 2000, a national surveillance programme for bovine tuberculosis has been in implemented in Norway. The programme includes examination of organ and tissue samples from cattle, llamas, alpacas, as well as from both farmed and wild red deer.

From 2022, selected abattoirs were instructed to submit a defined number of organ or tissue samples, specifically from lungs and associated lymph nodes exhibiting pathological changes where tuberculosis could not be excluded. Such lesions may include, for example, parasitic nodules or enlarged lymph nodes. This expansion of sampling criteria was introduced to increase the overall sample volume and thereby improve the sensitivity of the surveillance programme.

Follow the outbreak detected in 2022, the surveillance programme was further expanded in 2023 to include targeted monitoring of wild red deer in municipalities surrounding the affected dairy herd in which *M. bovis* was initially identified. Surveillance activities in red deer comprised both an awareness-raising information campaign directed at hunters, encouraging the reporting of suspicious lesions to local authorities, and laboratory testing (PCR) of lymph node samples collected from apparently healthy felled animals (4).

A risk-based active surveillance programme for bovine tuberculosis (bTB) in cattle was established in 2025 in accordance with Regulation (EU)2020/689. The programme was designed to fulfil the requirements for demonstrating and maintaining freedom from infection with *M. bovis* in the national cattle population, while strengthening confidence in the documented absence of disease. In addition to meeting the minimum regulatory requirements, the programme has been further expanded to increase the sensitivity of detection and to provide a higher level of assurance of freedom from bTB.

The NFSA is responsible for implementation of the bovine tuberculosis surveillance programme, including intradermal tuberculin skin testing of cattle in the at-risk population. The NVI is responsible for planning the programme, coordinating the collection of samples from wild red deer, conducting laboratory investigations of organ or tissue samples, and reporting the results. Organ or tissue samples from cattle slaughtered at abattoirs, as well as from fallen stock in the field (camelids and farmed red deer), are collected by NFSA inspectors.

Aim

The aim of the surveillance programme for bovine tuberculosis in Norway is designed to demonstrate and maintain freedom from infection with *Mycobacterium bovis* in accordance with the requirements laid down in Regulation (EU) 2020/689. In addition to meeting the minimum requirements, the surveillance system is designed to provide a higher level of confidence in the demonstrated absence of bovine tuberculosis in the Norwegian cattle population.

Materials and methods

The surveillance system comprises three complementary components:

i. Passive surveillance,
ii. Active risk-based surveillance
iii. Investigation of suspected cases

Passive surveillance is based on routine ante-mortem and post-mortem inspection, as well as the examination of fallen stock and animals with non-specific pathological findings. Active surveillance consists of targeted testing of defined at-risk cattle populations identified through epidemiological investigations. The investigation of suspected cases constitutes a separate component, ensuring that all clinically or pathologically relevant findings are subject to immediate notification, appropriate follow-up, and confirmatory laboratory testing.

These components are integrated to ensure a high level of surveillance sensitivity, enabling early detection of infection in the event of introduction, while providing robust and consistent evidence supporting the conclusion of absence of bovine tuberculosis in the national cattle population.

Passive surveillance

Routine meat inspection (cattle)

The NFSA submits representative specimens collected during the mandatory veterinary meat inspection of bovine carcasses at slaughter. These specimens include lung tissue, lymph nodes, and other organs exhibiting pathological lesions where tuberculosis cannot be excluded, such as nodular formations or enlarged lymph nodes. Lesions considered compatible with bovine tuberculosis are immediately reported to competent authority as suspect cases in accordance with national procedures.

All samples are submitted to NVI for laboratory examination.

Fallen stock and non-bovine species

Farmed red deer, llamas, and alpacas are included in the surveillance programme following notifications to the NFSA of animals that have died or euthanised due to illness. Most post-mortem examinations of the farmed deer, llamas, and alpacas are conducted by the NVI, although some necropsies are performed in the field.

Samples from wild red deer are submitted to NVI for laboratory examination either by the NFSA following observation of lesions where bTB cannot be excluded during game meat inspection, or when NFSA inspect carcasses of hunted deer after being called for by hunters who observe lesions that raise suspicion of tuberculosis. In some cases, hunters, rangers, or wildlife managers submit samples directly to the NVI.

Targeted sampling at selected abattoirs

The NVI designates selected abattoirs from which the NFSA is requested to submit lung and lymph node samples from a defined minimum number of cattle presenting lesions where bTB cannot be excluded. All samples are submitted to NVI for further examinations.

In 2025, this targeted sampling included abattoirs processing cattle originating from herds epidemiologically linked to the herd in which bovine tuberculosis caused by *M. bovis* was confirmed in 2022. These abattoirs, located in Rogaland and Vestland counties and were requested to submit samples from a total of 40 cattle.

Animal originating from herds with epidemiological links to the outbreak were subject to enhanced ante mortem and post mortem inspections at slaughter, to increase the likelihood of detecting lesions consistent with bovine tuberculosis.

Active risk-based surveillance

Active surveillance in cattle

The programme targets a defined at-risk population comprising herds epidemiologically linked to the outbreak. These epidemiological links were identified through contact tracing chains, including three steps upstream (sources of origin), one step downstream (recipient herds), and one lateral step (herds linked through a shared upstream contact).

Herds are categorized into different risk levels according to their epidemiological proximity to the outbreak. These risk categories determine the testing frequencies, whereby herds classified as high risk are subject to annual testing, while herds in lower risk categories are tested every second or third year.

The active surveillance programme is carried out using the single comparative intradermal tuberculin (SCIT) test applied to all animals six weeks of age or older in the herd.

Animals reacting to the SCIT test are not considered confirmed cases but are classified as reactors (suspect cases) and are subject to compulsory slaughter and samples shall be submitted to NVI. Submitted specimens primarily consist of selected lymph nodes. In cases where lesions suggestive of bovine tuberculosis are identified, additional samples from affected organs or tissues are also collected and submitted for examination. Samples are subject to gross and histopathological examinations and further laboratory investigation using real-time PCR and/or bacterial culture.

Herds in which all animals are sent directly to slaughter (specialised cattle fattening units), and which are therefore considered to have limited potential for onward transmission, are excluded from the active surveillance programme. These herds are monitored through routine post mortem inspection at slaughter.

Active surveillance in wildlife (red deer)

Targeted surveillance of wild red deer was implemented as part of the overall risk-based surveillance system following the detection of bovine tuberculosis in cattle in 2022. The objective of this component is to assess the potential involvement of wildlife as a reservoir and to support the demonstration of absence of infection.

The surveillance is focused on defined geographical areas surrounding the affected cattle herd; Suldal, Vindafjord and Tysvær municipalities. Lymph node sampling, primarily retropharyngeal lymph nodes, are collected from hunted animals older than 1.5 years. Sampling is done in collaboration with hunters and is voluntary. In Suldal it is coordinated with the existing Chronic Wasting Disease surveillance programme.

In addition, awareness campaigns encourage the reporting and submission of animals with lesions suggestive of tuberculosis, ensuring that both active and passive elements are integrated within the wildlife surveillance component.

All samples are submitted for laboratory examination, including molecular detection of MTBC by real-time PCR.

Laboratory examinations and diagnostic methods

All samples collected through passive surveillance, active surveillance and investigation of suspected cases are subjected to standardized laboratory examination at NVI.

Investigation of passive surveillance cases

Samples are subjected to macroscopic and histopathological examinations. If no pathological lesions are compatible with bovine tuberculosis, no further tuberculosis-specific diagnostic investigations are carried out.

Investigation of suspected cases

A suspicion of bovine tuberculosis is raised (following EU regulations 2020/689) in the presence of clinical or pathological findings consistent with infection, and/or results for laboratory analysis or diagnostic testing (SCITT) indicating probability of infection.

All suspicions are immediately notified to the NFSA and handled in accordance with established contingency procedures.

Samples from suspected cases are subjected to comprehensive diagnostic approach comprising histopathological examination, molecular detection, and, if necessary, bacteriological culture.

Intradermal skin testing

The Single Comparative Intradermal Tuberculin (SCIT) test is performed in accordance with the European Reference Laboratory (EURL) for Bovine Tuberculosis Standard Operating Procedure for bovine animals (SOP/001/EURL) (8). Briefly, avian and bovine purified protein derivatives (PPDs) were injected intradermally at separate sites in the mid-cervical region. Prior to injection, skin thickness at both sites was measured using calibrated callipers. The injection sites were re-examined 72 (±4) hours later, and skin thickness was measured again. Test results were interpreted by comparing the increase in skin thickness at the bovine and avian injection sites in accordance with the criteria established in the EURL protocol and applicable European legislation.

Gross examination

At the NVI, all macroscopic examinations of organ or tissue samples are conducted by trained veterinary pathologists. Lesions are systematically described with respect to size, shape, colour, consistency, number, etc.

Histopathological examination

Tissues are fixed in 10% neutral phosphate-buffered formalin for a minimum of 24 hours, processed according to standard routine protocol, embedded in paraffin, sectioned at 3 µm, and stained with haematoxylin and eosin (HE). Ziehl-Neelsen (ZN) staining is applied in suspected cases of mycobacterial infection to demonstrate the presence of acid-fast bacteria, particularly in granulomatous lesions.

Molecular examination

Detection of mycobacterial DNA in tissue samples is performed by real-time PCR on extracted nucleic acids. Initial screening for the MTBC is carried out using a PCR assay targeting the insertion sequence IS*6110*, which is present in members of the MTBC (5). Final confirmation is achieved by additional detection of IS*1081* (MTBC-specific) and the deleted region of difference 4 (RD4), which is characteristic of *M. bovis* (6).

Bacteriological examination

Bacteriological investigations are performed in accordance with the procedures described in the WOAH manual (1). Tissue samples are homogenised, decontaminated using 5% oxalic acid, and centrifuged. The resulting sediment is used for both microscopic examinations following Ziehl-Neelsen staining and culture. Sediment is inoculated onto slopes of Löwenstein Jensen medium, Stonebrink's medium, Middelbrook 7H10 medium with and without antibiotic supplementation, and Dubos medium. The slopes are incubated under aerobic conditions at 37°C for two months and checked every week for growth of acid-fast bacilli, determined by the Ziehl-Neelsen method. If colonies of acid-fast bacilli are detected, molecular methods are used for species identification.

Case definition and interpretation of laboratory results

Laboratory findings are interpreted in accordance with established case definition. Final case classification is based on the outcome of laboratory investigations.

Detection of lesions consistent with tuberculosis or identification of acid-fast bacilli may support the classification of a case as suspected. Final confirmation of infection with *Mycobacterium bovis* is based om positive results obtained by real-time PCR and/or bacteriological culture.

Suspect cases are ruled out when findings are not consistent with bovine tuberculosis and laboratory results are negative.

Results and discussion

Passive surveillance

Cattle – routine meat inspection

Organ samples from seven cattle identified through routine slaughterhouse inspection were submitted. Gross and histopathological examinations (including Ziehl-Neelsen (ZN) staining) were performed on tissues from all submitted cases. None of the samples exhibited findings indicative of infection with *Mycobacterium* spp. The most frequently observed pathological changes were various forms of bronchopneumonia, and reactive lymphadenopathy was frequently observed in the regional lymph nodes. However, the lesions were not considered typical for tuberculosis and none of the seven cattle were classified as suspect cases. Therefore, the samples were not followed up by PCR or bacteriological culture.

Camelids (alpaca, llama)

Carcasses of three alpacas were submitted. Gross and histopathological examinations (including Ziehl-Neelsen (ZN) staining) were performed on tissues from all submitted cases. None of the samples exhibited findings indicative of infection with *Mycobacterium* spp. As no pathological lesions consistent with tuberculosis were detected, neither PCR nor bacteriological culture was performed.

Cervids (farmed and wild deer)

Lymph node samples from one farmed deer were submitted and examined by real-time PCR. *Mycobacterium tuberculosis* complex was not detected in any of the samples.

Active targeted surveillance in wild red deer

Lymph node samples from 47 wild deer shot during the ordinary hunting season were examined by real-time PCR. Among these, 43 originated from Suldal and four from Vindafjord, while no samples were retrieved from Tysvær.

Mycobacterium tuberculosis complex was not detected in any of the samples. However, one sample tested positive in a PCR targeting *Mycobacterium* spp. (ITSmyc) and showed a weak positive signal in a PCR targeting *Mycobacterium tuberculosis* complex (IS6110). This sample was negative in additional PCR assays targeting IS1081, RD4 and IS1311, as well as negative by bacterial culture.

Based on the combined results, the finding was not indicative of infection with MTBC, and the sample was therefore classified as negative.

The number of submitted samples from wild red deer was relatively low compared to the total harvest of 1,285 deer across the three municipalities that year, including 403 deer older than 1.5 years (numbers from Hjorteviltregisteret.no, last time visited 12th of June 2026). Therefore, the limited number of samples reduces the ability to draw conclusions regarding the presence of infection in the wildlife population.

NVI did not receive any reports about suspicious lesions in hunted deer in the three municipalities.

Active risk-based surveillance in cattle

Herd-level testing

In 2025, a total of 28 herds were included in the risk-based active surveillance programme and subjected to whole-herd testing using the SCIT test. Herds were categorised according to their epidemiological risk based on their proximity to the outbreak detected in 2022

SCIT reactor and follow-up

In 2025, two adult cows from one herd reacted positively to the SCIT test. In accordance with established procedures, all reactor animals were culled and subjected to further diagnostic investigation. In addition, one calf from the same herd, which exhibited signs of poor condition, was also culled and included in the follow-up investigation.

Relevant lymph nodes were collected and submitted for laboratory examination. All samples were subjected to gross and histopathological examinations and analysed using real-time PCR and bacterial culture.

All laboratory results were negative for mycobacteria. The animals were therefore classified as test reactors and not as confirmed or suspected cases of bovine tuberculosis.

Suspected cases

Suspicions detected at slaughter

In 2025, one case of suspected bovine tuberculosis was identified during routine post mortem inspection at slaughter. The suspicion was based on the presence of pulmonary lesions and enlarged lymph nodes consistent with mycobacterial infection.

Tissue samples from affected organs and associated lymph nodes were collected and submitted for further laboratory investigation. The samples were examined histologically, and Ziehl-Neelsen staining revealed the presence of acid-fast bacilli. Further investigations were performed using real-time PCR targeting members of the MTBC, *Mycobacterium avium*-complex and specific for *M. bovis*. These findings were subsequently followed up by culture for species identification, which confirmed the presence of *Mycobacterium avium* subsp. *avium*.

Infection with MTBC was not confirmed.

Outcome of suspected cases

The suspected case identified in 2025 was resolved based on laboratory findings, where infection with MTBC was not confirmed. The case was found to be infected with *Mycobacterium avium*-complex and was therefore not classified as bovine tuberculosis.

The number of samples submitted and the number of positive samples since the programme started in 2000, are presented in Table 1.

Prior to 2022, relatively few samples were submitted from cases with suspicious lesions, or from lesions where tuberculosis could not be ruled out during post-mortem inspection, suggesting a low prevalence of such findings. Since 2022, after selected abattoirs were asked to submit samples from a minimum number of cattle, submissions increased in 2022 and 2023. From 2024, however, the number of submitted samples declined again, likely due to a limited number of organs with lesions fulfilling the submission criteria.

Table 1. Samples submitted for testing of bovine tuberculosis from 2000 to 2025, and number of positive samples.

Year*	No. of cattle samples	No. of cattle herds	No. of positive cattle samples	No. of camelid samples	No. of camelid herds	No. of positive camelid samples	No. of red deer samples	No. red deer herds/ municipalities	No. of positive red deer samples
2000	0	0	0						
2001	3	3	0						
2002	0	0	0						
2003	1	1	0						
2004	4	4	0						
2005	1	1	0						
2006	3	3	0						
2007	0	0	0						
2008	4	2	0						
2009	1	1	0						
2010	1	1	0						
2011	1	1	0						
2012	0	0	0						
2013	5	4	0						
2014	1	1	0	1	1	0			
2015	2	2	0	15	14	0			
2016	3	3	0	11	10	0			
2017	1	1	0	14	12	0			
2018	1	1	0	9	9	0			
2019	2	2	0	5	5	0			
2020	2	2	0	5	5	0			
2021	5	4	0	2	2	0	1	1	0
2022	70[1]	69	1	6	5	0	1[2]	1[2]	0
2023	67[1]	56	0	4[3]	2	0	48[2,4]	1[2]	0
2024	11[1]	11	0	12	7	0	42[2]	3[2]	0
2025	11[1]	8	0	3	3	0	47[2]	2[2]	0

[1] Includes samples submitted following suspicion of bovine tuberculosis: one sample in 2022, five in 2023, one in 2024 and four in 2025.
[2] Wild animals from one municipality in 2022, one in 2023, three in 2024 and two in 2025.
[3] Includes samples submitted following suspicion of bovine tuberculosis, one sample in 2023.
[4] The samples from wild red deer were not included in the 2023 report, as their analyses were conducted after its publication.

In conclusion, no infection with *Mycobacterium tuberculosis* complex was detected in cattle, camelids or cervids in 2025. The combination of passive surveillance, active risk-based surveillance, and investigation of suspect cases are consistent with the continued absence of bovine tuberculosis in Norway. However, the limited number of samples from wildlife should be taken into account when interpreting the overall findings.

Acknowledgement

The authors would like to thank the technical staff at the Norwegian Veterinary Institute for performing the analyses with excellence. Moreover, the authors would like to thank all personnel from the NFSA for the collection and submission of samples. Finally, the authors thank all other collaborators, particularly hunters in Suldal, Vindafjord, and Tysvær municipalitites, for the collection and submission of samples from wild red deer.

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