Surveillance and control programmes for terrestrial and aquatic animals in Norway
Norwegian Veterinary Institute

*Annual Report · 2012*

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ISSN 1890-9973

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**Date:** 2013-04-03

**Front page photo:** Hanne Mari Jordsmyr



**Example of citation:**
Sviland S, Benestad SL, Bornø, G, Høgåsen HR, Hopp P. The surveillance and control programme for bovine spongiform encephalopathy (BSE) in Norway 2012. *Surveillance and control programmes for terrestrial and aquatic animals in Norway. Annual repo*rt 2012. Oslo: Norwegian Veterinary Institute 2013.

# The surveillance and control programme for bovine spongiform encephalopathy (BSE) in Norway 2012

*Ståle Sviland, Sylvie Lafond Benestad, Olav Eikenæs, Helga Rachel Høgåsen, Petter Hopp*

**All 18,343 samples, originating from 8,466 herds, were tested negative for BSE in 2012.**

## Introduction

The BSE surveillance programme was initially based on passive surveillance (1998-2000), with active surveillance introduced in May 2000. In the period 1998-2000 the samples were investigated by histopathological examination. From 2001 onwards the samples were examined by an Enzyme-Linked ImmunoSorbent Assay (ELISA) method for detection of resistant prion protein ($PrP^{Sc}$). In addition, clinically suspected animals were also investigated by Western blot investigation for the detection of $Pr^{Sc}$ and/or histopathological examination according to the protocol of the Office International des Epizooties (OIE) (1). The number of samples examined in each category in the period 1998-2012 is presented in Table 1. BSE has never been detected in any of the examined animals.

## Aim

The aim of the surveillance programme is to document that the Norwegian cattle population is free from BSE.

## Surveillance programme

### Programme outline

For 2012 the surveillance programme included examination of the following categories:

- clinically suspected cattle irrespective of age
- all cattle older than 24 months of age, which have died or been culled, but not slaughtered for human consumption (fallen stock)
- all emergency slaughtered cattle older than 24 months
- all cattle older than 24 months, with abnormal findings at ante-mortem examination, rejected for human consumption, or which died at the abattoir or during transport (referred to as ante-mortem animals)
- all slaughtered cattle with unknown age or origin irrespective of age
- all slaughtered imported cattle from any country irrespective of age

### Implementation

The farmers were requested to report all cases of clinically suspected cattle irrespective of age, fallen stock older than 24 months and when delivering imported cattle to slaughter to the Norwegian Food Safety Authority. The brain or head from clinically suspected cattle or a spoon sample from the medulla oblongata from fallen stock were submitted and analysed at the Norwegian Veterinary Institute, Oslo. Inspectors from the Norwegian Food Safety Authority collected the spoon samples of the medulla oblongata from the other categories at the abattoirs and sent them within 24 hours in a cool insulated container to the Norwegian Veterinary Institute in Oslo or Harstad.

# Laboratory methods

## Clinically suspected animals

The usual protocol followed for the clinically suspected animals is that the whole brain is divided mid-sagittally into equal halves. One half is formalin-fixed and processed according to a standard routine protocol, embedded in paraffin, sectioned at 5 µm and stained with haematoxylin eosin (HE). Immunohistochemical staining for detection of $PrP^{Sc}$ is performed on selected sections using a monoclonal anti-PrP antibody (SAF 84, courtesy of J. Grassi, CEA, France). From the non-fixed half, tissue from the obex area is analysed by ELISA for detection of $PrP^{Sc}$ (TeSeE®, Bio-Rad) and by Western blot (TeSeE® WESTERN BLOT, Bio-Rad) for detection of $PrP^{SC}$ as described by the manufacturer.

**Table 1.** Number of samples from cattle collected for BSE examination by the Norwegian surveillance programme according to categories from 1998-2012

| Reason for submission to the laboratory | 1998-2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Clinically suspected animals | 78 | 14 | 2 | 2 | 3 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 1 |
| Fallen stock | | 1352 | 1482 | 1872 | 2145 | 2318 | 2364 | 2213 | 2391 | 2435 | 2788 | 3078 | 2936 |
| Emergency slaughtered | | 7073 | 7246 | 7322 | 9217 | 8462 | 8177 | 7304 | 8358 | 8320 | 7438 | 7241 | 6841 |
| Ante-mortem animals | | 2612 | 3562 | 4102 | 1355 | 102 | 36 | 48 | 16 | 27 | 11 | 23 | 7 |
| Imported slaughtered animals | 19* | 88 | 39 | 39 | 24 | 10 | 4 | 9 | 5 | 3 | 1 | 1 | 0 |
| Healthy slaughtered animals | | 2400 | 9907 | 10726 | 10443 | 10486 | 10455 | 10000 | 9373 | 9451 | 127'' | 7878 | 8744 |
| **Total** | **97** | **13539** | **22238** | **24063** | **23187** | **21379** | **21036** | **19574** | **20143** | **20237** | **10365** | **18221** | **18529** |

* All the samples were examined in 2000.
** Healthy slaughtered animals were excluded from the surveillance program in 2010

## Risk population and routine slaughtered animals

Non-fixed brain tissue from the obex area was analysed by ELISA for detection of $PrP^{Sc}$ (TeSeE®, Bio-Rad) as described by the manufacturer. In cases with positive or inconclusive test results, the remaining half obex was fixed in 10% neutral buffered formalin, embedded in paraffin, sectioned at 5 µm, and stained with HE. Subsequently, the sections were analysed by immunohistochemical detection of $PrP^{Sc}$ using the same protocol as for specimens from clinical suspects.

Brain samples were evaluated as unsuitable for examination when they were severely autolysed, the dorsal part of the obex area was partially missing, the obex was not present, or the medullar anatomy was not recognisable.

## Results and discussion

The Norwegian Veterinary Institute received samples from 18,529 cattle. Of these, 186 (1.0%) samples were unsuitable for examination (158 from fallen stock, 10 from normal slaughter and 18 from emergency slaughter).

For 151 samples (0.8%) the herd of origin was not reported. However, it is important to note that in case of a positive test result from such a herd, the identity could be traced via the carcass number. The remaining 18,378 samples originated from 6,933 dairy cattle herds and 1,590 beef cattle herds. The mean number of examined animals per herd was 2.1.

### Clinically suspected animals (passive surveillance)

In 2012, one animal was investigated as clinical suspect due to abnormal behaviour and tremor. Improved methods for clinical examination to distinguish between real suspected BSE cases and cases with central nervous disease of other causes has probably resulted in few clinical suspected cases in later years. It is likely that animals with diseases related to the central nervous system have been examined either as fallen stock, emergency slaughtered animals or ante-mortem animals, and thus included in these categories.

### Surveillance of slaughtered animals and fallen stock (active surveillance)

The number of samples from fallen stock older than 24 months has increased with 25 % in the last three years period (2010 to 2012) compared to the previous three years period. This development improves the quality of the programme since fallen stock is an important risk population for the surveillance of BSE.

The geographical distribution of the cattle population and the animals of different categories tested are presented in Table 2. There is a relatively good correlation between the collection of samples for fallen stock and emergency slaughtered animals from different regions and the distribution of the cattle population in the regions, but the proportion of sampled animal in the age groups from 30 to 83 months of age is much larger than the corresponding proportion in the population which is requested in this programme (Table 3).

**Table 2.** Regional distribution of Norwegian cattle and the cattle tested for $PrP^{Sc}$ in 2012. There were 151 samples (0.8%) from cattle with unknown region. These samples are assumed to be distributed following the regional distribution of the cattle from known region within each target group.

| Region | Total population (%) | Fallen stock (%) | Emergency slaughter (%) | Ante mortem animals (%) | Clinically suspected animals (%) | Healthy slaughtered animals (%) | Total (%) |
|---|---|---|---|---|---|---|---|
| **Troms and Finnmark** | 2.7 | 3.4 | 3.3 | 14.3 | 0 | 4.7 | 4.0 |
| **Nordland** | 7.3 | 5.9 | 6.6 | 0 | 0 | 6.5 | 6.4 |
| **Trøndelag, Møre and Romsdal** | 28.5 | 37.7 | 32.0 | 71.4 | 0 | 26.5 | 30.2 |
| **Hordaland, Sogn and Fjordane** | 9.8 | 7.5 | 7.2 | 0 | 100 | 9.3 | 8.3 |
| **Rogaland and Agder** | 21.4 | 23.8 | 22.5 | 14.3 | 0 | 24.0 | 23.4 |
| **Buskerud, Vestfold and Telemark** | 6.9 | 6.9 | 4.2 | 0 | 0 | 11.1 | 8.0 |
| **Oslo, Akershus and Østfold** | 4.8 | 6.2 | 6.4 | 0 | 0 | 5.9 | 6.1 |
| **Hedmark and Oppland** | 18.6 | 8.6 | 17.8 | 0 | 0 | 12.1 | 13.6 |
| **Total number of animals** | **883,536** | **2,778** | **6,823** | **7** | **1** | **8,734** | **18,343** |

**Table 3.** Age distribution of Norwegian cattle and the cattle tested for $PrP^{Sc}$ in 2012. There were 573 samples (5.1%) from cattle with unknown age. The age of these cattle are assumed to be distributed like the age distribution of the cattle with known age within each target group.

| Age groups (months) | Total population (%) | Fallen stock (%) | Emergency slaughter (%) | Ante mortem animals (%) | Clinically suspected animals (%) | Healthy slaughtered animals (%) | Total tested (%) |
|---|---|---|---|---|---|---|---|
| **< 24** | 58.2 | 0.9 | 1.7 | 0 | 0 | 1.1 | 1.3 |
| **24-29** | 7.5 | 12.3 | 14.5 | 14.3 | 0 | 7.3 | 10.7 |
| **30-35** | 5.9 | 8.9 | 8.7 | 0 | 0 | 10.5 | 9.6 |
| **36-47** | 10.0 | 20.1 | 18.0 | 14.3 | 0 | 24.0 | 21.2 |
| **48-59** | 7.1 | 16.8 | 17.2 | 28.6 | 100 | 21.3 | 19.1 |
| **60-71** | 4.5 | 15.4 | 15.8 | 28.6 | 0 | 14.9 | 15.3 |
| **72-83** | 2.7 | 10.9 | 11.2 | 0 | 0 | 10.1 | 10.6 |
| **84-95** | 1.6 | 6.2 | 6.6 | 0 | 0 | 5.3 | 5.9 |
| **96-107** | 1.0 | 3.2 | 2.9 | 0 | 0 | 2.9 | 2.9 |
| **108-119** | 0.6 | 1.8 | 1.7 | 14.3 | 0 | 1.3 | 1.5 |
| **120-131** | 0.4 | 1.3 | 0.6 | 0 | 0 | 0.6 | 0.7 |
| **132-143** | 0.2 | 0.9 | 0.3 | 0 | 0 | 0.2 | 0.4 |
| **144-155** | 0.1 | 0.4 | 0.2 | 0 | 0 | 0.2 | 0.3 |
| **≥ 156** | 0.2 | 0.8 | 0.5 | 0 | 0 | 0.3 | 0.4 |
| **Total number of animals** | **883,536** | **2,778** | **6,823** | **7** | **1** | **8,734** | **18,343** |

## Conclusion

It is considered probable that the Norwegian cattle population never has been infected with BSE-agent due to few imports to Norway of cattle and products potentially infected with the BSE-agent, limited use of meat and bone meal in concentrates intended for ruminants, and the use of high temperature and pressure in the domestic production of meat and bone meal (2). This is supported by a quantitative risk assessment for BSE in Norway (3) and by the compiled results from the surveillance and control programme for BSE in the years 2001 to 2012 with approximately 232,000 negative samples.

## Acknowledgment

The authors would like to thank all the technical staff from the Norwegian Veterinary Institute in Oslo and Harstad for performing the analyses with excellence.

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The Norwegian Veterinary Institute (NVI) is a nationwide research institute in the fields of animal health, fish health, and food safety. The primary mission of the NVI is to give research-based independent advisory support to ministries and governing authorities. Preparedness, diagnostics, surveillance, reference functions, risk assessments, and advisory and educational functions are the most important areas of operation.

The Norwegian Veterinary Institute has its main laboratory in Oslo, with regional laboratories in Sandnes, Bergen, Trondheim, Harstad og Tromsø, with about 360 employees in total.

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The Norwegian Food Safety Authority (NFSA) is a governmental body whose aim is to ensure through regulations and controls that food and drinking water are as safe and healthy as possible for consumers and to promote plant, fish and animal health and ethical farming of fish and animals. We encourage environmentally friendly production and we also regulate and control cosmetics, veterinary medicines and animal health personnel. The NFSA drafts and provides information on legislation, performs risk-based inspections, monitors food safety, plant, fish and animal health, draws up contingency plans and provides updates on developments in our field of competence.

The NFSA comprises three administrative levels, and has some 1300 employees.

The NFSA advises and reports to the Ministry of Agriculture and Food, the Ministry of Fisheries and Coastal Affaires and the Ministry of Health and Care Services.

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