

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

*Ståle Sviland*

*Sylvie Lafond Benestad*

*Olav Eikenæs*

*Helga Rachel Høgåsen*

*Madelaine Norström*



# Surveillance and control programmes for terrestrial and aquatic animals in Norway

Annual report 2011

Project managers at the Norwegian Veterinary Institute:  
Ståle Sviland and Hege Hellberg

**Publisher**  
Norwegian Veterinary Institute  
PO Box 750 Sentrum  
N-0106 Oslo  
Norway

Fax: + 47 23 21 60 01  
Tel: + 47 23 21 60 00  
E-mail: [postmottak@vetinst.no](mailto:postmottak@vetinst.no)  
[www.vetinst.no](http://www.vetinst.no)

ISSN 1890-9973

**Title:**  
The surveillance and control programme for bovine spongiform encephalopathy (BSE) in Norway 2011

**Authors:**  
Sviland Ståle, Benestad Sylvie Lafond, Eikenæs Olav, Høgåsen Helga Rachel, Norström Madelaine

**Date:** 15 May 2012

Front page photo: Hanne Mari Jordsmyr

Any use of the present data should include specific reference to this report.

**Example of citation:**  
Sviland S, Benestad SL, Eikenæs O, Høgåsen HR, Norström M. The surveillance and control programme for bovine spongiform encephalopathy (BSE) in Norway 2011. *Surveillance and control programmes for terrestrial and aquatic animals in Norway. Annual report 2011*. Oslo: Norwegian Veterinary Institute 2012.

# The surveillance and control programme for bovine spongiform encephalopathy (BSE) in Norway 2011

*Sviland Ståle, Benestad Sylvie Lafond, Eikenæs Olav, Høgåsen Helga Rachel, Norström Madelaine*

*All 18, 221 samples, originating from 6,267 herds, were tested negative for BSE in 2011.*

## 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<sup>Sc</sup>). In addition, clinically suspected animals were also investigated by Western blot investigation for the detection of PrP<sup>Sc</sup> 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 1998-2010 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 2011 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<sup>Sc</sup> 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<sup>Sc</sup> (TeSeE®, Bio-Rad) and by Western blot (TeSeE® WESTERN BLOT, Bio-Rad) for detection of PrP<sup>Sc</sup> 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 1998-2011

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

\* 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<sup>Sc</sup> (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<sup>Sc</sup> 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 18,221 cattle. Of these, 198 (1.1%) samples were unsuitable for examination (157 from fallen stock, 16 from normal slaughter and 25 from emergency slaughter).

For 79 samples (0.4%) 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 18,142 samples originated from 6,942 dairy cattle herds and 1,506 beef cattle herds. The mean number of examined animals per herd was 2.1.

### Clinically suspected animals (passive surveillance)

In 2011, 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 10 % from 2010 to 2011.

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 3. 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 2. Age distribution of Norwegian cattle and the cattle tested for PrP<sup>Sc</sup> in 2011. There were 931 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 (%) | Healthy slaughtered animals (%) | Total tested (%) |
|-------------------------|----------------------|------------------|-------------------------|-------------------------|---------------------------------|------------------|
| < 24                    | 55.6                 | 0.8              | 2.0                     | 17.4                    | 1.2                             | 1.5              |
| 24-29                   | 7.7                  | 12.0             | 13.7                    | 0.0                     | 7.0                             | 10.5             |
| 30-35                   | 6.3                  | 9.4              | 8.8                     | 4.3                     | 11.1                            | 9.9              |
| 36-47                   | 10.9                 | 18.2             | 17.3                    | 13.0                    | 23.2                            | 20.0             |
| 48-59                   | 7.4                  | 17.6             | 18.2                    | 8.7                     | 21.3                            | 19.4             |
| 60-71                   | 4.5                  | 17.0             | 16.8                    | 8.7                     | 15.3                            | 16.2             |
| 72-83                   | 2.9                  | 10.6             | 11.1                    | 26.1                    | 9.2                             | 10.2             |
| 84-95                   | 1.8                  | 6.4              | 5.7                     | 13.0                    | 5.9                             | 5.9              |
| 96-107                  | 1.2                  | 3.8              | 3.0                     | 0.0                     | 3.0                             | 3.1              |
| 108-119                 | 0.7                  | 1.8              | 1.5                     | 4.3                     | 1.2                             | 1.4              |
| 120-131                 | 0.4                  | 1.0              | 0.7                     | 4.3                     | 0.6                             | 0.7              |
| 132-143                 | 0.2                  | 0.5              | 0.6                     | 0.0                     | 0.4                             | 0.5              |
| 144-155                 | 0.1                  | 0.4              | 0.3                     | 0.0                     | 0.3                             | 0.3              |
| ≥ 156                   | 0.2                  | 0.5              | 0.4                     | 0.0                     | 0.2                             | 0.3              |
| Total number of animals | 933,697              | 3,078            | 7,241                   | 23                      | 7,878                           | 18,220*          |

\* One import animal not included

Table 3. Regional distribution of Norwegian cattle and the cattle tested for PrP<sup>Sc</sup> in 2011. There were 126 samples (0.7%) from cattle with unknown region, including the one from an imported animal. 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 (%) | Healthy slaughtered animals (%) | Total (%) |
|--------------------------------|----------------------|------------------|-------------------------|-------------------------|---------------------------------|-----------|
| Troms og Finnmark              | 2.7                  | 3.0              | 2.8                     | 0.0                     | 5.1                             | 3.8       |
| Nordland                       | 7.8                  | 5.0              | 6.7                     | 8.7                     | 6.9                             | 6.5       |
| Trøndelag, Møre og Romsdal     | 28.4                 | 35.4             | 32.3                    | 56.5                    | 24.3                            | 29.4      |
| Hordaland og Sogn og Fjordane  | 9.7                  | 6.6              | 6.9                     | 21.7                    | 10.0                            | 8.2       |
| Rogaland og Agder              | 21.7                 | 25.4             | 21.1                    | 8.7                     | 25.8                            | 23.9      |
| Buskerud, Vestfold og Telemark | 6.7                  | 6.7              | 5.7                     | 0.0                     | 11.5                            | 8.4       |
| Oslo, Akershus og Østfold      | 4.9                  | 5.9              | 7.0                     | 0.0                     | 5.1                             | 6.0       |
| Hedmark og Oppland             | 18.1                 | 11.9             | 17.6                    | 4.3                     | 11.3                            | 13.9      |
| Total number of animals        | 933,697              | 3,078            | 7,241                   | 23                      | 7,878                           | 18,220    |

\* one imported animal not included

## 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 2011 with approximately 214,000 negative samples.

## Acknowledgment

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

## References

1. Anonymous. Bovine spongiforme encephalopathy. In: Manual of Diagnostic Tests and Vaccines for Terrestrial Animals. 5th ed. Paris: Office International des Epizooties; 2004. p. 549-69.
2. Mørk T, Bratberg B, Hopp P, Benestad S, Høgåsen H, Bruheim T. The surveillance and control programme for bovine spongiform encephalopathy (BSE) in Norway. In: Fredriksen B, Mørk T (editors). Surveillance and control programmes for terrestrial and aquatic animals in Norway. Annual report 2001. Oslo: National Veterinary Institute; 2002. p. 55-66.
3. Høgåsen HR, de Koeijer AA. Quantitative risk assessment for bovine spongiform encephalopathy in low- or zero-prevalence countries: the example of Norway. Risk Anal. 2007; 27:1105-17