Summary: TSEs are a family of diseases occurring in humans and animals that are characterised by a degeneration of brain tissue giving a sponge-like appearance. The family includes diseases, such as Creutzfeldt Jakob disease (CJD) in humans, bovine spongiform encephalopathy (BSE) in cattle and scrapie in sheep and goats. The identification in 2000 of BSE in native-born cattle in European countries, previously thought to be free from the disease, led to increased concern about the extent of the BSE epidemic and possible risks for public health. The concern extended beyond Europe, partly as a result of uncertainty about risks that may result from past international trade of cattle and cattle products from BSE-affected countries. The feeding nature, the specific epidemiology and the long incubation period of the disease make it difficult to handle in comparison with other diseases. International trading patterns, which often include the processing and re-exportation of products, can mask the original source and movement of animals and animal products, including meat and bone meal. An Ad hoc Group of experts on BSE (OIE Ad hoc Group for Evaluation of Country Submissions for Recognition as Complying with the Code as Bovine Spongiform Encephalopathy Free) has been set up by the OIE and the Group has developed guidelines to facilitate the submission of data by Member Countries in accordance with the requirements in the current edition of the Code. At the OIE 71st General Session in May 2003, new amendments of the BSE Chapter of the Terrestrial Animal Health Code were adopted.

1. WHAT ARE TSEs?

TSEs are a family of diseases occurring in humans and animals that are characterised by a degeneration of brain tissue giving a sponge-like appearance.

The family includes diseases, such as Creutzfeldt Jakob disease (CJD) in humans, bovine spongiform encephalopathy (BSE) in cattle and scrapie in sheep and goats.

2. WHAT IS BSE?

- A fatal neurological disease of adult cattle.
- First recognised in Great Britain in 1986.
- Pathological changes, epidemiological pattern and transmissibility indicate that BSE is one of the subacute spongiform encephalopathies caused by unconventional transmissible agents or prions.
- The BSE agent is also believed to be the common source of transmissible spongiform encephalopathies (TSEs) in several other species of animals.
3. SIGNS AND SYMPTOMS

The main clinical signs are neurological: apprehension, fear, increased startle, or depression, ataxia of gait, including hypermetria, autonomic dysfunction: reduced rumination, bradycardia and altered heart rhythm. No gross post-mortem changes and a characteristic spongiform encephalopathy is present in most cases.

4. EPIDEMIOLOGY

- The causative agent is an unconventional transmissible agent closely similar to that causing scrapie of sheep and goats. It is hypothetically termed a prion.
- The causative agent is stable over a wide range of pH, survives in tissues post-mortem after a wide range of rendering processes and physical inactivation is porous load autoclaving at 134–138°C for 18 minutes.
- Hosts include bovidae, greater kudu, Arabian horses, eland, bison, felidae and is experimentally transmissible to cattle, pigs, sheep, goats, mice, mink, marmosets and macaque monkeys.
- BSE occurs as a result of dietary exposure to feedstuffs containing infected meat and bone meal (MBM).
- There is some evidence of a maternally associated risk for calves born to affected cows. The biological mechanisms involved are unknown, but this effect is insignificant in the epidemiology.
- There is no evidence of horizontal transmission of BSE between cattle, while some cases of vertical transmission are thought to be possible.
- Occurrence of new variant Creutzfeldt-Jakob disease (CJD) suggests zoonotic potential via oral exposure.
- The incidence during the course of the epidemic in Great Britain has been low within affected herds; the maximum annual incidence was 3%.
- BSE, as it occurs in Great Britain, has a peak incidence in cattle aged between 4 and 5 years.
- Some cases of vertical transmission are thought to be possible.

5. CHRONOLOGY OF THE DISEASE EVENTS

- November 1986: BSE was identified in cattle in Great Britain.
- December 1987: Initial epidemiological studies in cattle were completed. These concluded that ruminant derived MBM was the only viable hypothesis for the cause of BSE.
- June 1988: The use of ruminant derived MBM for feeding to ruminants was banned.
- December 1988: BSE was designated a zoonoses.
- November 1989: Specified bovine offal banned from human food including parts thought to have the highest likelihood of carrying the BSE agent.
- September 1990: A ban was placed on specified bovine offal in all animal feed, including pet food.
- March 1991: The first case of BSE in offspring born after the ruminant feed ban (June 1988) was announced (vertical).
- November 1994: All mammalian protein was banned in ruminant feed.
- December 1995: prohibition of the use of the bovine vertebral column in the manufacture of all mechanically recovered meat. The spinal cord had already been included in the specified offal ban.

It had proven difficult to remove the spinal cord completely from all carcasses. It was, therefore, decided to avoid the problem of fragments of spinal cord remaining by prohibiting the use of the vertebral column altogether.
March 1996: The first cases of nvCJD were announced.

March 1996: The over thirty months’ rule was designed to prevent BSE infected cattle from entering the food chain (GB).

April 1996: The feeding of mammalian MBM to all farmed livestock was prohibited.

January 1997: Introduction of a selective cull of cattle most at risk of BSE.

December 1997: Legislation requiring deboning of all beef derived from cattle aged over 6 months at slaughter before marketing.

The identification in 2000 of BSE in native-born cattle in European countries, previously thought to be free from the disease.

The concern extended beyond Europe, partly as a result of uncertainty about risks resulting from past international trade of cattle and cattle products from BSE-affected countries.

6. PUBLIC HEALTH IMPORTANCE OF BSE

a) The disease is transmissible to humans; scientific consensus confirms that food is the main avenue of exposure.

b) Bovines, bovine products and by-products potentially carrying the BSE agent have been traded worldwide, giving this risk a global dimension.

c) These exchanges have or can have repercussions on public health, animal health and trade.

• In 2000, BSE in native-born cattle in European countries thought to be free from the disease, led to increased concern about the extent of the BSE epidemic and possible risks for public health.

• Although the BSE agent has not been isolated, substantial experimental evidence has accumulated regarding the distribution of infectivity throughout cattle tissues.

• Recent evidences have shown that the protein, which accumulates in the brains of individuals with the new form of CJD, is similar to the protein found in cattle infected with BSE, rather than that found in classical CJD.

• Researchers concluded that the most likely origin of this new disease was human exposure to the BSE agent.

• Distribution of infectivity varies in cattle tissues.

• The OIE Code established a list of tissues and products that, depending upon the BSE-status of a country, should not be traded internationally.

• The international organisations recommended a regular review of the list of tissues in the light of emerging scientific evidence and of information on the practical aspects of their exclusion.

7. CATTLE INFECTIVITY DOSE (ID) ASSOCIATED WITH EACH TISSUE

Other tissues might be infected (tonsils and the entire intestine from duodenum to rectum) or could be contaminated by Specified Risk Material (SRMs) (during the slaughter process).

• Risk management in sheep: all countries are encouraged to undertake notification and surveillance for TSEs of sheep and goats and to take steps to mitigate the risks identified.

• Other ruminants: Meat and bone meal contaminated with BSE may have been fed to water buffalo, cervids, camelids and other ruminants.

There is no evidence of neurological disease caused by the BSE agent in these animals, but there is limited knowledge on the full range of susceptibility.
In the meantime, water buffalo, cervids, camels and other domestic ruminants should be included in any ruminant feed bans.

The research available to date indicates that experimental oral BSE challenge of pigs and poultry with brain material from cattle with BSE does not result in disease and that there is no evidence for residual infectivity present in tissues; there have been no reports of a naturally occurring TSE in these species either.

8. RESPONSE OF THE INTERNATIONAL ORGANISATIONS

On 26 January 2001, the FAO urged countries around the world, to be concerned about the risk of BSE and its human form (nvCJD) and announced that all countries that have imported cattle or meat and bone meal (MBM) from Western Europe during and since the 1980s can be considered at risk.

Joint WHO/FAO/OIE Technical Consultation on BSE public health, animal health and trade was held at the OIE Headquarters, Paris, 11-14 June 2001 to draw up advice for countries, particularly developing countries, to protect their human population from nvCJD, their livestock from BSE, and their industries from trade restrictions and their repercussions.

9. OIE - BSE AD HOC GROUP

The Group has developed guidelines to facilitate the submission of data by Member Countries in accordance with the requirements in the current edition of the Code Evaluation of a Country Submission as BSE Free.

Member Countries applying for evaluation to be considered provisionally free from BSE should meet part of the costs in accordance with Resolution XVIII adopted during the 70th General Session.

The 71st General Session of the OIE in May 2003 adopted the new amendments of the BSE Chapter of the Terrestrial Animal Health Code.

10. APPROACHES TO CONTROL: THE EUROPEAN RESPONSE

A ban on the feeding of mammalian meat and bone meal (MBM) to cattle, sheep and goats, as of July 1994.

High processing standards for the treatment of ruminant animal waste since 1 January 1995. These were re-enforced on 1 April 1997, requiring pressure-cooking (133 °C/3 bars/20 minutes) for all mammalian waste used for the production of MBM.

Surveillance measures for the detection, control and eradication of BSE, as of 1 May 1998, involving active monitoring by veterinarians and passive monitoring through tests.

Culling of animals with a high probability of receiving the same potentially infected feed as BSE, as well as animals of the same age from the same herd (cohort animals) and the latest born offspring to female BSE cases, must also be culled. The rules on culling apply as of 1 July 2001.

Removal of SRMs throughout the European Union (EU) from 1 October 2000 from the human and animal food chains. The list of SRMs has been extended to include the entire intestine of bovines and the vertebral column.

The introduction of targeted testing for BSE, with a focus on high-risk animal categories, from 1 January 2001.

A total EU wide suspension on the use of processed animal protein in feeds for any animals farmed for the production of food, since 1 January 2001.

11. EUROPEAN CLASSIFICATION OF COUNTRIES INTO GEOGRAPHIC RISK CATEGORIES

EU Scientific Steering Committee classification of the geographic risk of BSE in July 2000:

- **Category I** (Highly unlikely to present a BSE risk),
- **Category II** (Risk of BSE is unlikely but cannot be excluded),
• **Category III** (Likely to present a BSE risk, even if not confirmed, or presenting a low level of confirmed BSE risk),

• **Category IV** (Confirmed, at a higher level).
12. NON-EUROPEAN UNION APPROACHES

In 1989, when the USA banned the import of live cattle or beef and beef products from the United Kingdom. This was later extended to any country with confirmed cases of BSE.

By 2000, many non-European countries had also banned EU beef, including Australia, New Zealand and South Africa, Middle Eastern countries, etc.

13. TESTING PROGRAMME FOR BSE IN THE EUROPEAN UNION

Testing of animals slaughtered as emergencies or showing signs of any kind of illness at the ante mortem inspection in the slaughterhouse.

From January 2001 to June 2001: all animals over 30 months of age.

As of 1 July 2001: all animals over 24 months of age in some European Union countries.

14. NEW HORIZONS FOR BSE TESTING AND CONTROL

PROTEOME has developed a range of ‘biomarkers’, which, it says, can detect BSE and equivalent diseases in other live animals.

An Australian company has developed a technology to remove the protein causing BSE and other neuro-degenerative diseases from blood samples.

Researchers in Canada are testing a prototype vaccine that could halt the spread of brain-wasting diseases, such as scrapie, BSE and CJD.

15. CONCLUSIONS

The feeding nature, the specific epidemiology and the long incubation period of the disease makes it difficult to handle in comparison with other diseases.

The original source and movement of animals and animal products, including MBM, can be masked by international trading patterns, which often include the processing and re-exportation of products.

Countries should not become self-satisfied about their risk from BSE because of the following:

- The extremely low initial incidence within the national animal populations,
- The low within-herd incidence of BSE cases at the farm level,
- The long incubation period,
- The non-specific nature of the early clinical signs of BSE can delay the detection of the first cases of disease and may mask the severity of the problem.

In order to introduce appropriate measures to protect public and animal health, national authorities require information on two aspects:

- The risk of BSE infection in cattle populations,
- The risk of human exposure to the BSE agent.

Although the infectious dose for humans is not known and not every exposure necessarily results in infection, it is nevertheless essential to minimise exposure.

In countries where sheep and goat populations have been potentially exposed to BSE infectivity, measures should be taken to minimise the exposure of humans to infectivity from small ruminants.
The OIE encourages all countries to evaluate their potential exposure through systematic assessment of trade data and possible risk factors.

It is clear that even countries that do not have BSE cases can potentially experience cases of vCJD in their human population.

It must not be automatically assumed that finding a case of vCJD in a country is evidence that BSE is present, even though the likelihood of this must be assessed.

Countries should assess the risk and conduct surveillance on water buffalo, cervids, camelids and other domestic ruminants that may have been exposed to potentially contaminated feed.

The uncertainty of the scientific aspects of the disease indicates that more research work should be done to further explore the nature of BSE and its links to other TSEs.