Report on

the Assessment of

the Geographical BSE-Risk

(GBR) of

SINGAPORE

NOTE TO THE READER

Independent experts have produced this report, applying an innovative methodology by a complex process to data that were voluntarily supplied by the responsible country authorities. Both, the methodology and the process are described in detail in the final opinion of the SSC on "the Geographical Risk of Bovine Spongiform Encephalopathy (GBR)", 6 July 2000. This opinion is available at the following Internet address:

<http://europa.eu.int/comm/food/fs/sc/ssc/outcome_en.html>

In order to understand the rationale of the report leading to its conclusions and the terminology used in the report, it is highly advisable to have read the opinion before reading the report. The opinion also provides an overview of the assessments for other countries.

FULL REPORT

1. DATA

- The available information was suitable to finalise the GBR risk assessment.

Sources of data

Country dossier consisting of:

- Completed questionnaire for the assessment of the Geographical BSE-risk of Singapore transmitted by the Agri-Food and Veterinary Authority of Singapore (AVA) on November 6, 2000 and received by the Commission on November 14, 2000 plus attachment.
- Fax received on November 28, 2000 confirming that no rendering industry exists in Singapore.
- Comments by the Agri-Food and Veterinary Authority of Singapore, received by the Commission on February 22, 2001 and March 27, 2001.

Other sources:

- EUROSTAT data on exports of "live bovine animals" and of "flour, meal and pellets of meat or offal, unfit for human consumption; greaves", from EU Member States, covering the period 1988 to 1999.
- NIMEXE 1976-1987 data on exports from EU Member States to Singapore.
- UK-export data on "live bovine animals", 1980-1996, and on "Mammalian Flours, Meals and Pellets", 1980-2000. As it was illegal to export mammalian meat meal, bone meal and MBM from UK since 27/03/1996, exports indicated after that date may have included non-mammalian MBM.

2. EXTERNAL CHALLENGES

2.1 Import of cattle from BSE affected countries

According to the country dossier, Singapore has not imported any live cattle from the UK or any other BSE-affected country. This statement is supported by UK, NIMEXE, and EUROSTAT export data.

2.2 Import of MBM or MBM-containing feedstuffs from BSE affected countries

Combining information from the available sources Singapore has received between 1980 and 1999 in total 5631 tons of MBM[1], exported from the UK (1858t) and other BSE affected countries. However, the information provided in the country dossier (CD) and by the different export statistics (UK, EU) differ (see table 1).

Singapore explains that it is a major transhipment hub for the region and that the authorities do not register products if they do not enter Singapore's territory, but remain in the Free-Trade Zone between transhipment.

[1] MBM covers: Flour, meals and pellets of meal or offal, greaves; unfit for human consumption

Import controls in Singapore require an import permit. Except for one import from the Netherlands such import permits were only issued for petfood in processed form, i.e. only as complete food in extruded form or as canned food. They originate from Germany, The Netherlands, France, Austria and UK.

Import of MBM, MM, BM or greaves (t/year) into SINGAPORE from BSE-affected countries

Period	UK		IRL	DE	FR	NL	IT	Non-UK	
Source:	EU	UK	EU	EU	EU	CD	EU	CD	EU
1980									
1981									
1982									
1983									
1984									
1985						3773			
80-85						**3773**		**3773**	**0**
1986	49	49							
1987							53		53
1988									
1989									02
1990									
86-90	**49**	**49**					**53**		**53**
1991	801	801							
1992									
1993									
91-93	**801**	**801**							**0**
1994			210		1183				1393
1995							820		820
1996	687	687					485		485
1997	321	321	207	26					233
1998									
1999			256						256
94-99:	**1008**	**1008**	**673**	**26**	**1183**		**1305**		**3187**
80-99	**1858**	**1858**	**673**	**26**	**1183**	**3773**	**1305**	**3773**	**3240**

Table 1: MBM-imports. Shading indicates period of different risk that exports carried the agent, 1986-1990 being the period of highest risk for UK imports while 1994-1999 UK-exports are assumed to have been safer than exports from other BSE-affected countries. Sources: CD = Country Dossier, EU = Eurostat, Nimexe, UK = UK-Export statistics.

2.3 Overall assessment of the external challenge

The level of the external challenge that has to be met by the BSE/cattle system is estimated according to the guidance given by the SSC in its final opinion on the GBR of July 2000.

It appears that the challenge resulting from live cattle imports has been negligible throughout the reference period 1980-1999.

The imports of MBM posed a negligible external challenge from 1980 to 1984 but the import of 3775t from the Netherlands in 1985 is regarded as a high external challenge. The imports from UK and IT in 1986/91 and 1987 represented a moderate external challenge and since 1994 sufficient exports of MBM from BSE affected countries to Singapore are registered to assume a high external challenge.

However, it is reliable that significant parts of the exports registered by Eurostat were indeed only in transit and should not be taken into account. It remains, however, the import of 3773 tons from NL in 1985 that is indicated only in Singapore's import statistic but not in the Eurostat/NIMEXE export data. This import posed a high external challenge in 1985.

External Challenge experienced by SINGAPORE				
External challenge		***Reason for this external challenge***		
Period	**Level**	**Cattle imports**	**MBM imports**	**Comment**
1980-84	**Negligible**	**Negligible**	**Negligible**	**MBM imports from the UK and other BSE-affected countries**
1985	**High**		**High**	
1986-1993	**Moderate**		**Moderate**	
1994-1999	**High**		**High**	

Table 2: External Challenge resulting from live cattle and/or MBM imports from the UK and other BSE-affected countries. The Challenge level is determined according to the SSC-opinion on the GBR of July 2000.

This assessment is a worst case scenario, based on the assumption that all exports registered by the UK-and EUROSTAT/NIMEXE export statistics did indeed enter Singapore and were not only transhipped in the Free Trade Zone.

3. STABILITY

3.1 Overall appreciation of the ability to avoid recycling of BSE infectivity, should it enter processing

Feeding:

Since 1997 feeding MBM to all farmed animals is prohibited in Singapore. The "Feeding Stuff Act CAP 105" of 1997 allows the control over the composition and use of animal feedingstuff.

There are 7 commercial feed mills licensed by AVA (Veterinary Service of Singapore). Only one of them produces complete feed for poultry and pigs, mainly for export and to supply complete feed to one local quail farm. The MBM used is obtained from non-European countries. The remaining 6 feed mills manufacture premixes for export, according to the country dossier they do not use ingredients of animal origin. There is no local feed mill producing commercial feeds for ruminants.

Feed mills are annually inspected on sanitation management, handling and storage of the products, risk of cross-contamination and re-contamination of products, audit of processing systems and to ensure compliance with the licensing conditions.

The three dairy cattle farms (altogether 700 animals) in Singapore mix their own feed. They do not use animal-derived feed products but only grass, hay, corn straw, molasses, soy bean cake, soy bean pulp, wheat bran, wheat pollard, corn, lentils, bean sprouts, mineral mix (does not contain ingredients of animal origin) and peanut skin. These ingredients are mainly locally sourced and imported directly to the farm.

The feed practice and composition have remained unchanged over the last 15-20 years of their farming. Animal-derived feed products are not used for ruminant feeding on local farms for the following two reasons:

- Cattle farms supply milk on a regular basis to Hindu temples for religious purposes. Therefore the country dossier states that feed used must be vegetable in origin.

- There are no animal-product processing plants in Singapore to obtain MBM. AVA controls the imports of MBM and has prohibited the use of MBM in feeds for ruminants in Singapore.

Rendering:

A rendering industry does not exist in Singapore and did not exist during the reference period (1980-1999). There is also no sub-industrial scale rendering. The small number of animals slaughtered (averaged less than 160 heads of cattle per year over the last 5 years) would not provide sufficient raw material. Slaughter of cattle at the local abattoir has ceased in March 2000. Slaughter offal, including condemned material and animals, is incinerated in an incinerator attached to the only slaughterhouse that exists in Singapore.

SRM and fallen stock

There is no SRM-ban in place in Singapore. SRM from animals fit for human consumption is used for human consumption after passing post mortem inspection.

Fallen stock from local cattle farms are either buried on-farm or disposed through licensed contractors. These are required to dispose these carcasses by incineration at 1 of 3 public incineration plants in Singapore catering to the general disposal of waste materials. All wastes in Singapore (other than construction waste) are required to be disposed only by incineration. Dumping of waste in landfills, other than construction waste, is not allowed. Culled stock and bull calves are currently being exported to Malaysia, no further explanation thereon is provided.

Cross-contamination:

According to the available information the only measure in place to reduce cross-contamination of cattle feed with any mammalian protein is licensing of farms and controls of farms by the Veterinary Authority at least every two weeks.
These checks include visual inspections of feed to ensure the MBM ban is adhered to. This measure can only detect MBM already mixed in if there is at least about 2% present of it included in the mix. It could, however, recognise stocks of it. Since no compound feed for cattle is produced locally, all feeds are mixed on farm and co-species farming does not exist, it can be assumed that it is highly unlikely that cross-contamination takes place.

Conclusion on the ability to avoid recycling

In light of the above-discussed information it has to be assumed that the BSE agent, should it have entered the territory of Singapore would not have been recycled and could not have been amplified.

3.2 Overall appreciation of the ability to identify BSE-cases and to eliminate animals at risk of being infected before they are processed

Cattle population structure

Singapore has a very small cattle population of 700 heads of which 99 % are dairy cattle. There are only 6-8 breeding bulls in the herd, bull calves are exported to Malaysia. The average age of population is over five years and the age of slaughter is between 6 and 7 years.

Cattle dairy farms were closed between 1985-1989 due to relocation to an "Agrotechnology Park". All three cattle farms were set up at their present location after 1990.

In Singapore it is illegal (under the Cattle Act) to keep ruminants such as cattle and goats in places other than approved areas. In view of this, the only farms in Singapore keeping ruminants are located within the designated Agrotechnology Park. Hence it can be excluded that there are small-scale farms in Singapore where ruminants are kept with other species of farm animals. There are no pig farms, 3 dairy cattle farms, one dairy goat farm, 8 layer hen farms, 2 quail farms and 90 fish farms.

Detailed information is provided on the husbandry practices for farmed species other than cattle:

- There is no broiler chicken or meat duck farming in Singapore, but there are 8 layer hen farms. With the exception of 2 layer farms which import complete feed from a feedmill in Malaysia, the remaining 6 farms mix feed for their own use and this contains fishmeal as animal protein source.
- In the two quail farms in Singapore, one mixes its own feed using fishmeal and soybean meal as protein source, the other obtains complete feed from one local licensed feed mill.
- There is no commercial feed mill manufacturing fish feed. Most fish farms use trash fish as their only feed source and about 10% may also use imported formulated feeds, which are either marine protein or plant-protein based.
- The only dairy goat farm in Singapore uses imported commercial pelleted feed which does not contain any ingredients of animal origin.

Surveillance and culling

Notification of BSE is compulsory since 1994.

A description is given of the criteria for a BSE-suspect: cattle display neurological signs, nervousness/apprehension, lack of co-ordination, behavioural changes, neuro-motor dysfunction and loss in production. Diagnosis will further be made based on histopathological examination of the brain and detection of BSE-specific

prion proteins using test kits. The use of the PRIONICS-test kit is under evaluation.

Awareness/training measures are in place. Field officers in AVA under the supervision of veterinary surgeons were, according to the country dossier, "taught to diagnose BSE suspects based on clinical signs", but it is not clear since when this training started, most likely not before 1994. All veterinary officers in the AVA are graduates of British Commonwealth universities with degrees recognised by RCVS, UK or of American veterinary degrees which are recognised by AVMA, USA. Continuous training for officers in AVA is provided through scientific journals, periodicals and educational videos. An US-trained veterinary anatomic pathologist, who completed a three-year residency at Cornell University with experience in the histopathological diagnosis of BSE, is deployed at the Central Veterinary Laboratory of AVA. This laboratory undertakes post mortem and laboratory examinations of animal specimens for the detection of animal diseases in Singapore. On the basis of the available information, the efficiency of the training/awareness-building measures related to BSE cannot be fully judged but appears to be rather good.

No compensation is foreseen to cover the market value of confirmed BSE-cases or for culled suspects.

The current surveillance is based on detection of clinically affected animals through detection of neurological signs but during the last 10 years no CNS-suspects were analysed for BSE.

An active BSE surveillance has been implemented on 1 February 2001. It includes: clinical observation of animals whereby suspected cases will be euthanased for further investigation, collection of CNS tissue from every fallen stock and from every killed cattle of 30 months of age or older.

3.3 Overall assessment of the stability

For the overall assessment of the stability the impact of the three main stability factors (i.e. feeding, rendering and SRM removal) and of the additional stability factors, mainly cross-contamination and surveillance plus culling, has to be estimated. Again the guidance provided by the SSC in its opinion on the GBR of July 2000 is applied.

Feeding: Feeding MBM to cattle was legally possible until 1997 but the information provided indicates that it was uncommon practice for dairy cattle to be fed with MBM.

The available information on the control of the 1997 feed-ban does not allow to judge the efficiency of the feed-ban. However, because cattle feed is mixed on-farm, all three farms being regularly controlled, and because no co-farming exists, no domestic MBM production takes place, and no animal protein is said to be contained in cattle feed rations, it is assumed that feeding was "not OK" before but “reasonably OK” after the ban.

Rendering: There is no rendering industry or sub-industrial rendering in Singapore. Therefore, rendering is assessed as being "OK".

SRM-removal: There is no SRM ban but all SRM of animals fit for human consumption is destined for human consumption. If condemned, it would be incinerated. Therefore SRM-removal is assessed as being "OK".

Other stability factors: Also after the feed ban of 1997 cross-contamination is not controlled by feed sampling but is unlikely (see above). BSE surveillance was insufficient, even if the very small herd size makes the detection of clinical cases highly likely. Since 1/2/2001 active surveillance measures are taken. The "other factors" did not influence stability and improve it since 2001.

<table>
<tr><th colspan="6">Stability of the BSE/cattle system in SINGAPORE over time</th></tr>
<tr><th colspan="2">Stability</th><th colspan="4">Reasons</th></tr>
<tr><th>Period</th><th>Level</th><th>Feeding</th><th>Rendering</th><th>SRM</th><th>Other*</th></tr>
<tr><td>1980-1996</td><td>Stable</td><td>Not OK</td><td rowspan="3">OK</td><td rowspan="3">OK</td><td rowspan="2"></td></tr>
<tr><td>1997-2000</td><td rowspan="2">Very stable</td><td rowspan="2">Reasonably OK</td></tr>
<tr><td>At current</td><td></td></tr>
</table>

Table 3: Stability resulting from the interaction of the three main stability factors and the other stability factors. The Stability level is determined according to the SSC-opinion on the GBR of July 2000.

On the basis of the available information it has to be concluded that the country's BSE/cattle system was stable until 1997 and very stable since then. This indicates that incoming BSE infectivity would never have been recycled and always have been eliminated from the system.

4. CONCLUSION ON THE RESULTING RISKS

4.1 Interaction of stability and challenges

The conclusion on the stability of the Singapore BSE/cattle system over time and on the external challenges the system had to cope with are summarised in the table below. From the interaction of the two parameters "stability" and "external challenge" a conclusion is drawn on the level of "internal challenge" that emerged and that had to be met by the system, in addition to external challenges that occurred.

The BSE/cattle system of Singapore was exposed to a negligible external challenge from 1980 to 1984. Due to increasing imports of MBM from BSE affected countries, it was thereafter exposed to a moderate or high external challenge, if these imports were indeed imported to Singapore and not, as claimed, only trans-shipped via the free-trade port of Singapore. No external challenge resulted from cattle imports.

The registered external challenges could theoretically have led to an internal challenge in the 80's, particularly if some of the 1985 MBM-imports from the Netherlands that are indicated in the country dossier were contaminated and reached domestic cattle. Given the information on the husbandry system this is

possible but not likely. However, if such an internal challenge would have developed, it would have met the stable system and infectivity would not have been recycled. Over time it was eliminated from the system when the infected cattle, should those have existed, died. As the average age of the population is high (5 years) and the normal age at slaughter is 6-7 years, a detection of clinical cases seems likely, particularly after 1994. If the exports of MBM to Singapore that are only registered in Eurostat but not by the Country's import statistic did reach Singapore, a further exposure of domestic cattle to the BSE agent could not be fully excluded. However, this is regarded to be unlikely, especially since the 1997 feed-ban.

INTERACTION OF STABILITY AND EXTERNAL CHALLENGE IN SINGAPORE			
Stability		**External Challenge**	**Internal challenge**
Period	**Level**	**Level**	
1980 – 1984	**Stable**	**Negligible**	**Not present**
1985		**High**	**Not fully excluded, decreasing**
1986-1993		**Moderate**	
1994 – 1996		**High**	
1997- at current	**Very stable**		**Highly unlikely**

Table 4: Internal challenge resulting from the interaction of the external challenge and stability. The internal challenge level is determined according to guidance given in the SSC-opinion on the GBR of July 2000.

4.2 Risk that BSE infectivity entered processing

The BSE-agent could have been imported since 1985 via MBM-imports from the NL and other BSE-affected countries. Possibly infected cattle could therefore have reached processing (slaughter) in the early 90s.

4.3 Risk that BSE infectivity was recycled and propagated

Because of the absence of a rendering industry the BSE agent could not have been recycled and propagated.

5. CONCLUSION ON THE GEOGRAPHICAL BSE-RISK

5.1 The current GBR as function of the past stability and challenge

- The current geographical BSE-risk (GBR) level is I, i.e. it is *highly unlikely* that domestic cattle are (clinically or pre-clinically) infected with the BSE-agent**.**

5.2 The expected development of the GBR as a function of the past and present stability and challenge

- Because of the import controls in combination with the feeding practices, the non-existence of rendering and the improved surveillance the probability of cattle to be infected with the BSE-agent will remain very low.

5.3 Recommendations for influencing the future GBR

- Effectively controlling the feed ban by checking cattle feed prepared on the farms for the presence of MBM will further improve the stability of the system.
- The foreseen improved surveillance could allow recognising even single BSE cases, should they appear. Systematic testing of all animals born before 1997 would also provide further evidence of the absence of BSE from the cattle herd in Singapore.