Assessment of the Risks to Norway in Association with Increased International Trade in Animals and Animal Products: Hazard Identification

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1. Introduction

Norway enjoys a very favorable animal health status mainly due to the relative physical isolation of the country and partially due to the conservative import policy and the vigorous eradication efforts when a disease exotic to Norway is discovered. The expected increase in international trade as a result of the Agreement on Agriculture, a part of the General Agreement on Tariffs and Trade (GATT) has caused concern regarding increased risk associated with the increased trade. An accepted international principle is that all nations have the right to adopt measures which are necessary to protect human, animal and plant health. In addition, non-trade concerns including food security, environmental protection and rural viability need to be addressed when determining whether import restrictions or protective tariffs are to be changed. In the past, many of the disease control measures were adopted not to protect the health of animals, plants or humans but to protect the industries of the importing country from competition and as such were non-tariff barriers to trade. A further principle is that these measures should only be as stringent (in regard to the extent that they interfere with trade) as is necessary to achieve disease control objectives. This means that total bans on imports cannot be justified if scientifically based control measures could reasonably be expected to prevent entry of disease (Wilson and Banks, 1993). In the event of a decision to refuse the importation of a commodity or to impose significant constraints on the importation, the importing country should, if requested, be prepared to justify its decision by providing details of the procedures and results of the import risk analysis exercise to the exporting country (OIE, 1993).

In the past, international trade was often based on the concept of “zero” risk to the importing country which meant that if the disease in question was present in the exporting country the import was banned. The General Agreement on Tariffs and Trade (GATT) Code and the Sanitary and Phytosanitary Agreement (SPS) define principles for applying quarantine measures and handling disputes. These principles include:

1. harmonization - regulations must be based on international standards.
2. equivalence - allowing different but equivalent measures to achieve international standards.
3. national treatment- imports are treated no more stringently than domestic produce.
4. transparency - open policy for rule formulation and dispute settlement.
5. disease free zones - accepting animals and products from disease free areas of otherwise affected countries or areas.

Article 5 of the SPS agreement requires members to base their animal, plant and health requirements related trade on an objective assessment of risk. The SPS agreement defines risk assessment as “ the evaluation of the likelihood of entry, establishment or spread of a pest or disease within the territory of an importing Member according to the sanitary or phytosanitary measures which might be applied, and of the associated potential biological and economic consequences; or the evaluation of the potential for adverse effects on human or animal health arising from the presence of additives, contaminants, toxins, or disease causing organisms in food, feedstuffs and beverages (SPS Annex A).

The GATT and SPS agreement established the World Trade Organization (WTO) as the dispute settlement organization. The Office International Des Epizooties(OIE) publishes the International Animal Health Code which contains guidelines for import risk analysis for animals and animal products. In addition the OIE has devoted several issues of Revue Scientifique et Technique to Risk Analysis (OIE, 1993; OIE, 1995, OIE, 1997).

There are no standardized techniques for import risk analysis and further no standard definition for “acceptable” risk. ***However, it is generally accepted that a risk analysis should consider the probability of entry of an agent, the probability of exposure and establishment in the importing country, the management options that exist to reduce or eliminate the risk as well as the consequences should introduction occur.*** The most important risk factor is the prevalence of the disease (hazard) in the exporting country. Other important factors are the disease control and reporting systems, the surveillance and monitoring system, the risk reducing methods available, the likelihood of exposure to and establishment of the disease in the importing country. Although a major consideration when assessing the risks associated with increased international trade the consequences of the occurrences the hazards will not be stressed. However, the classification of the various diseases by the OIE is based in part on the consequences of introduction of the diseases with List A being the most severe. It will be assumed that imports from any country in the world might be possible. It is also assumed that imports might eventually amount to 30% of the yearly consumption.

The approach used in this analysis will be qualitative. The qualitative approach was chosen because of the lack of specific data on the quantitative risk elements as well as the large number of species, diseases, and potential exporting countries, each of which would have a different quantitative risk element. ***It is the intention of this project to identify potential hazards, some of the risk mitigation measures that exist for those hazards and possibly identify specific imports from specific countries for which a quantitative risk analysis would be meaningful. An attempt to broadly categorize the diseases into high, moderate and low impacts, should they be introduced and high, moderate and low risks based on the probability that they could be introduced.***

It must be emphasized that this document is not a risk analysis. It is a hazard analysis which is only the first step in the process of what later may become a risk analysis.

This report used many information sources. *The importation into New Zealand of meat and meat products: A review of the risk to animal health*. New Zealand Ministry of Agriculture and Fisheries provided starting points that were in some cases expanded and in others condensed. Skjerve et al.(1996) in an analysis done in Norway identified many hazards (risks) to animal and human health associated with increased international trade. MacDiarmid (1991) is a qualitative analysis of the risk to animal health in New Zealand associated with increased trade in meat and meat products. Neither report attempts to quantify all of the risks identified. However, MacDiarmid, 1991 does address many available risk reducing measures which for the most part were overlooked by Skjerve et. al. Recently, the New Zealand Ministry of Agriculture and Fisheries released a semi-quantitative analysis of the risks associated with the importation of chicken meat in general and turkey meat for a specific packing plant in the UK (MAF, 1999). General disease information was obtained from Veterinary Medicine, 7th edition by Blood and Radostits, 1989 ; Diseases of Poultry,9th edition, B.W.Calnek. ed. ; Hagstad, H.V. and Hubbert,W.T. 1986. Food Quality Control: Foods of Animal Origin. Information on zoonoses and foodborne diseases was largely obtained in Veterinary Medicine and Human Health, Schwabe, 1984. Other references such as the Revue Scientifique et Technique, the Animal Health Yearbook , International Animal Health Code, HandiSTATUS, ADNS MSIS rapport and others were utilized to the fullest extent possible. (See Appendix 1- References and other information sources)

Definition of Risk

Recently, the definition of risk has been restated in a generalized form by Kaplan (1997). It defines risk as an information triplet which, for a particular case or component **i**, consists of, a) *a complete sequence of events*, called a scenario **Si** , which ranges from the initiating event to the causation of the adverse consequence; b) *the definition of the adverse consequence* **Ci** , and c) *the likelihood* **Li** that ***both*** the scenario **Si** and consequence **Ci** occur.

Classification of Risks

Risks also be regarded as *quantifiable* if a plausible scenario can be described, the adverse consequence can be identified and the likelihood of occurrence of both the scenario and the adverse outcome can be assigned. The risk of introduction of a specific disease by the importation of a specific number of animals from a specific source is a quantifiable risk. *Qualifiable risks* (or hypothetical risks) are those risks for which a scenario and outcome can be described but empirical evidence is lacking and thus no likelihood of either the scenario nor the outcome can be assigned. The risk of introduction of a specific disease by the importation of animals from an unspecified source qualifiable risk. *Speculative risks* are those in which the scenario cannot be fully described nor can the likelihood of occurrence of the scenario but severe consequences are deemed likely if not inevitable. An example of a *speculative risk* is the assumption that there may be hidden differences between transgenic and non-transgenic plants which cannot, as yet, be described but could lead to severe harm.

Because the list of quantifiable, qualifiable and speculative risks to Norway associated with increased trade in animals and animal products is potentially limitless this report will focus only on risks to animal and human health. Major emphasis will put on the transmissible and zoonotic diseases of food producing animals and poultry. Diseases of fish and other aquatic species will not be addressed.

Disease classification

The OIE classifies diseases as List A, List B and other significant diseases. List A diseases are defined as *transmissible diseases which have the potential for very serious and rapid spread, irrespective of national borders, which are of serious socio-economic or public health consequence and which are of major importance in the international trade of animals and animal products.* List B diseases are defined as *transmissible diseases which are considered to be of serious socio-economic and/or public health importance and which are significant in the international trade of animals and animal products.* The occurrence of a List A disease must be reported to the OIE as soon as possible. List B diseases are also reportable but these reports are at intervals. The Food and Agriculture Organization (FAO) also maintains a List C and other significant diseases but these do not require reports to the OIE and have little impact on international trade. Norway has its own list of diseases that is similar but not identical to the OIE and FAO lists.

Risk mitigation or risk management

Some risk assessments report only the unrestricted risk estimates (URE) (Morley, 1993) or do not consider the risk management or mitigation options available and often already in place that will greatly reduce or eliminate the risks (Skjerve, et.al.,1996). A general list of risk management options can be found in the International Animal Health Code, chapter 1.4.2. (1998). These include;

Choice of the origin of the commodity
Restricting the destination
Pre- and post-shipment quarantine, with or without sentinel animals
Diagnostic testing with tests of estimated validity parameters
Vaccination
Processing, maturation and storage for a specified time and temperature
Treatments, e.g. heat treatment for a specified time and temperature, use of veterinary drugs, washing of embryos, fumigation of eggs, etc.

Requirements for an outbreak.

In order for the importation of an animal import unit (AIU), be it an animal or unit of product, to result in a disease outbreak the following series of events must occur (Morley,1996). This could be considered the scenario (Si) in the definition of Kaplan, 1997.

- The animal/product must be infected with the agent
- The agent survives commodity handling, treatment, in-transit time, (or evades diagnosis, LGP)

- The commodity is exposed to susceptible animals or man
- The agent is exposed to a portal of entry and is transmissible via a mode of transmission
- The agent induces infection
- The agent induces disease
- The disease spreads
- The disease is detected.

The above events and their probabilities provide the basis for a risk assessment model.

Norwegian animal population and production data

Norway covers an area of 323.895 square km and has a population of 4.4 million people of which about 0.8 million live in and around the capital Oslo. The livestock population and the number of animals slaughtered in 1998 are presented in Table 1. The domestic production and import of feed materials and compound feed stuff in 1998 are presented in Table 2. Figures 1-6 are maps of Norway showing the number of herds and mean animal density per square kilometer for the major domestic species.

Table 1.Livestock population in Norway as of July 31, 1998 (June 1, 1998 as regards sheep) and the number of animals slaughtered during 1998. The animal numbers are rounded to the nearest hundred.

Animal category	No. Animals[1)]	No. Herds[1)]	No. Slaughtered animals[3)]
Cattle	1 035 000	30 877[2)]	355 700
Dairy cows (incl. in above total)	313 800	23 770	
Goats	81 400	1 504[2)]	25 200
Dairy goats (incl. in above total)	55 100	864	
Sheep	2 391 600	-	1 165 600
Breeding sheep >1 year (incl. in above total)	962 700	24 054	
Swine	-	6 275	1 345 600
Breeding animals > 6 months	90 200	3 880	
Fattening pigs for slaughter until July 31st	748 500	5 695	
Egg laying hens (>20 weeks of age)	3 127 200	3 845	2 265 537
Broilers for slaughter until July 31st	12 975 900	434	26 347 182
Turkeys for slaughter until July 31st	386 500[2)]	140[2)]	579 614
Ducks and geese for slaughter until July 31st	37 400[2)]	approx. 200[2)]	56 146

[1)] Statistics Norway, preliminary figures [2)] Register of Production Subsidies [3)] Register of Slaughtered Animals

Table 2. The domestic production and import of feed materials and compound feed stuff in 1998. Combined totals in tons, figures are rounded to nearest thousand. NA = data not available.

Category	Domestic production[1)]	Import[1)]
Straight feed and raw materials		
Straight feed of vegetable origin		490 000
Soy meal	80 000	
Fish meal	300 000	99 000[2)]
Destruction fat	23 000	0
Meat-bone meal	42 000	0
Fish silage	45 000	0
Feed stuff		
Compound feed for ruminants and pigs	1 446 000	0
Compound feed for poultry incl. Ostriches	242 000	1 000[2)]
Compound feed for fish		27 000[2)]
Moist feed for fur animals	77 000	0
Others (compounds for pet animals and horses)	13 000	39 000

[1)] The Norwegian Agricultural Inspection Service. [2)] Statistics Norway, Division for external trade, energy and industrial production statistics.

Imports of living animals

Relative to many countries, there have been very few imports of live animals to Norway. During the period 1991-1998 there were approximately 1300 primarily beef cattle imported. However, 1998 there were only 13 cattle imported. In the same period, approximately 190 swine, 3 sheep and 49 goats were imported. Nearly 30,000 reinsdyr and 680,000 høns (chickens) were imported. The reinsdyr (reindeer) were primarily imported for slaughter while the chickens were intended for breeding purposes. In addition, about 8000 fur bearing animals were imported. There appears to be increasing interest in the importation of exotic species such as ostriches, emus and llamas as well as bovine semen and embryos (Grøndalen, 1999).

2. Risks associated with the importation of cattle and cattle products.

2.1 Cattle.
The term cattle shall include buffalo, bison and exotic bovidae.

2.1.1 *Live cattle or cattle products.*

At present cattle imported into Norway are used primarily for breeding purposes. However, at some time in the future when tariffs have decreased importation of cattle for slaughter might become economically feasible. There are some imports of meat, meat products, semen and embryos. The risk associated with importation increases proportionally to the number of animal import units (AIU) (MacDiarmid, 1993). Whenever imports are allowed there are risks associated although the likelihood of occurrence and consequences vary greatly.

2.1.2 *List A Diseases*

The OIE List A diseases are considered the most significant in terms of socio-economic and public health effects and also are of major importance to trade in animals and animal products. It is not uncommon and acceptable for countries to forbid imports of susceptible species or unprocessed products from countries affected with List A diseases.

The OIE List A diseases that affect cattle

Foot and Mouth Disease
Vesicular Stomatitis
Contagious Bovine Pleuropneumonia
Lumpy Skin Disease

Rift Valley Fever

In addition, Norway has up-graded some OIE List B diseases to the A list that it maintains for its internal use. The additional List A diseases affecting cattle are

Anthrax
Rabies
Brucellosis

Norway is currently free of List A diseases from both lists. However, Foot and Mouth Disease and Contagious Bovine Pleuropneumonia, once present, were last reported in 1952 and 1860, respectively.

2.1.3 List B diseases

The List B diseases are those with significant socio-economic and public health effects and also are significant, but not major importance, to trade in animals and animal products. The list B diseases are more problematic than the List A diseases in terms of number and agreement between trading partners as to their importance. Many of the List B diseases are endemic in many parts of the world. Like the List A diseases, Norway has up-graded some OIE List C and other diseases to B status.

The OIE List B diseases that affect cattle. Some of the diseases affect multiple species. The Norwegian Classification is shown in ().

Anthrax (A)
Bovine tuberculosis
Leptospirosis
Q fever
Rabies (A)
Paratuberculosis
Heartwater
Screwworm *(Cochliomyia hominovorax)*
Anaplasmosis
Babesiosis
Brucellosis (A)
Bovine genital campylobacteriosis
Cysticercosis (*C. bovis*)
Dermatophilosis
Enzootic bovine leukosis
Haemorrhagic septicemia
Theileriasis
Trichomoniasis
Surra (*Trypanosoma evansii)*
Malignant catarrhal fever
Bovine spongiform encephalopathy
Infectious bovine rhinotracheitis (B)

In addition to the OIE list, Norway includes the following on its B list. Intestinal salmonella infections and Bovine virus diarrhea/Mucosal disease are List C diseases in the OIE classification. Ringworm is not listed by the OIE or FAO.

Ringworm of cattle
Bovine Salmonellosis
Bovine virus diarrhea/Mucosal disease

2.1.4 List C diseases.

The Food and Agriculture organization of the United Nations (FAO)The list C diseases have, in general, little impact on international trade in live animals at present but may have a larger impact in the future because of their public health significance especially as food borne pathogens. Examples of diseases of multiple species and cattle in this category include; Listeriosis, toxoplasmosis, botulism, intestinal Salmonellosis, Yersiniosis and campylobacteriosis. The FAO List C diseases that affect cattle include:

Listeriosis
Toxoplasmosis
Meliodosis
Blackleg (*Clostridium perfringens*)
Botulism (*Clostridium botulinum*)
Other Clostridial diseases
Other pasteurelloses
Actinomycosis
Enteric salmonella infections
Coccidiosis
Distomatosis (liver fluke)
Filariasis
Mucosal disease/ bovine virus diarrhea
Vibrionic dysentery
Warble infestation

*2.1.5 Significant diseases of cattle present in Norway (*Skjerve, et.al.,1996)

The following is a list of cattle diseases known to be present in Norway. Note that are no OIE List A diseases. Intestinal Salmonellosis is a FAO List C disease. Ringworm and mastitis are not listed by the OIE or FAO.

Anthrax
Bovine virus diarrhea
Bovine respiratory syncytial virus
Cysticercosis
Paratuberculosis
Malignant catarrhal fever
Ringworm
Mastitis
Salmonella?

The absence of most other diseases is based on lack of reported outbreaks and diagnoses not systematic surveys. However, there are ongoing surveillance programs for Salmonella spp., enzootic leukosis, IBR and Brucellosis that confirm the absence or very low prevalence (Salmonella) of these diseases at present.

2.2 Diseases that may be introduced through the importation of live cattle or cattle products

Theoretically, there are risks of introduction of any of the diseases listed in the previous sections and these risks will increase with increased imports (MacDiarmid, 1993). However, not all diseases listed need be considered in a risk assessment. Diseases that are already established or endemic in the importing country cannot be used for grounds for prohibiting imports for another country. Other diseases occur only limited geographic areas, have little animal or public health significance, be excluded because of proximity to a more serious disease or pose no risk because of the absence of vectors or means of transmission once introduced. Other very serious diseases, especially List A diseases, in reality pose less risk of introduction because of the vigorous disease control measures international prohibition of exports from affected countries. Therefore, it is more likely that a disease that were introduced by importation of live cattle would be one with mild clinical signs, have a long incubation period, be characterized by asymtomatic carriers or be one in which diagnostic techniques are not adequate. Obviously, some exceptions to these generalities exist.

2.2.1. Skjerve, et.al., 1996 discussed 11 diseases of cattle that they thought posed a significant risk of introduction through imports from the EU countries although they did not elaborate on how introduction might occur. The list included diseases that could be introduced by live cattle, semen, embryos and other species. It included:

Bovine spongiform encephalopathy (BSE)
Brucellosis
Campylobacteriosis
Enzootic bovine leukosis (EBL, BLV)
Infectious bovine rhinotracheitis (IBR/IPV)
Leptospirosis
Parafilariasis
Foot and mouth disease
Paratuberculosis
Trichomoniasis
Tuberculosis

2.2.2 Diseases specifically listed on the Norwegian Health certificate.
Apparently the Norwegian animal health officials have special concern regarding the following diseases because they are specifically mentioned on the import health certificate for cattle.

Rabies
IBR
Tuberculosis
Brucellosis
FMD
Anthrax
Rinderpest
CBPP
EBL
BSE

2.2.3 Meat and meat products

MacDiarmid, 1996 conducted an assessment of the risk associated with the importation of meats and meat products to New Zealand. Some of the diseases have public health as well as animal health implications. The following cattle diseases which could be introduced through the carriage of pathogens in meat were considered. Not all were found to pose significant risks.

Foot and Mouth disease
Rinderpest
Anthrax
Leptospirosis
Q fever
Rabies
Paratuberculosis
Brucellosis
Tuberculosis
Cysticercosis
Bovine spongiform encephalopathy
Listeriosis
Toxoplasmosis
Botulism
Clostridial infections
Salmonella infections
BVD/MD
Yersiniosis
Campylobacteriosis
Sarcocystis sp.

2.2.4 Bovine semen

Eaglesome and Garcia (1997) assessed the risk to animals health from artificial insemination (AI) with bovine semen. They classified the diseases as those with moderate to high risk of transmission though AI (category 1) , those with evidence of low risk of transmission (category 2) and those with little or no information regarding the risk of transmission (category 3). This group was sub-divided into those where transmission would be likely (category 3a) and those where transmission would be unlikely (category 3b) .

The **category 1 (High risk)** diseases included:

Foot and Mouth disease
Vesicular stomatitis
Rinderpest
IBR
BVD/MD
Bovine tuberculosis
Bovine brucellosis
Bovine genital campylobacteriosis
Trichomonas
Mycoplasmosis
Haemophilus somnus
Ubiquitous bacteria (eg. *E.coli, Pseudomonas* spp)

The **category 2** (Low risk) diseases included:

Blue tongue
Enzootic bovine leukosis (EBL)
Bovine ephemeral fever
Akabane virus
Leptospirosis

The **category 3a** (**No information but likely)**) diseases included:

Epizootic hemorrhagic disease
Bovine immunodeficiency virus
Bovine paratuberculosis
Contagious bovine pleuropneumonia

Category 3b diseases will not be considered because the probability of transmission by AI is considered unlikely (Eaglesome and Garcia, 1997).

2.2.5 Bovine embryos

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Sutmoller and Wrathal, 1997 reviewed the risk of disease transmission by embryo transfer in cattle and Wrathal, 1997 reviewed the risk of transmitting scrapie and bovine spongiform encephalopathy by semen and embyros. The general conclusions were that if the procedures for collection, processing and storage of embryos and donor management outlined in the International Animal Health Code (IAHC) and the Manual of the International Embryo Transfer Society (IETS) the risks of disease transmission by embryo transfer are negligible. However, more research is indicated.

3.Specific List A diseases

Diseases of cattle that appear on any of the previous lists will be considered beginning with the most serious OIE and Norwegian List A diseases and then those of lesser importance (OIE List B, FAO List C and others). The order in which the diseases are discussed does not reflect the probability of introduction through increased trade.

3.1 Foot and mouth disease (FMD; Mund og klausjuke) OIE code A010.

3.1.1 The disease

Foot and mouth disease is one of the most contagious diseases of domestic animals. It is discussed under the heading of cattle disease for convenience only because it affects multiple cloven footed species including cattle, buffaloes, sheep, goats, llamas, camels, swine and deer. It is an acute viral disease characterized by vesicles and erosions on the mouth, nose, feet and teats and is caused by a picorna virus. Subclinical infections occur in sheep and goats. Horses are not susceptible (Blood and Radostits, 1989).

3.1.2 Distribution

FMD occurs endemically in large parts of South America, Africa and Asia. It has been eradicated from North America, British Isles, Australia, Japan and New Zealand and Europe. The last FMD recorded in Norway was in 1952 (Sandvik and Næss, 1994). A list of FMD free countries and FMD free zones can be found on the Internet at http//www.oie.int/Status/A_fa.htm. There are 51 FMD free countries, 4 free zones where vaccination is not practiced and 3 free zones where vaccination is practiced.

3.1.3 Impact of introduction

An outbreak of FMD or any List A disease always has severe consequences. Losses occur due to:

- Morbidity and associated production losses.
- Mortality losses.
- Loss of export earnings.
- Costs associated with quarantine, slaughter, and disposal.
- Cost of compensation for livestock slaughtered.
- Cost of storing animal products such as meat and dairy products during the period of trade restrictions.
- Cost of ongoing control/eradication should the disease become established.

Loss of export income from livestock would not comprise a large loss in Norway but the other costs could still be devastating. However, the diagnosis FMD of would cause export restrictions to be placed on potential Norwegian exports of animals or products of any susceptible species by most countries for 6-12 months after the last diagnosis.

3.1.4 Routes of introduction and transmission

Pigs are the animals most often infected by new introductions of FMD to a free area. Pigs are often exposed and infected by eating meat scraps which are infected. Spread from the pigs is by via movement of people, abattoir waste, or animals. Air borne spread is also important.

Foot and mouth disease is spread by both inhalation and ingestion. In cattle, spread is primarily by inhalation while in pigs both ingestion and inhalation are important. Uncooked and unprocessed meats are common sources of infection. Other possible vehicles include carrier animals, flash pasteurized milk, milk powder, butter, butter oil, casein and casein products, semen and zona pelucuda free embryos, and birds (Blood and Radostits, 1989)

3.1.5 Preventing entry of FMD

Complete embargo on animals and animal products from animals capable of capable of being infected with FMD from countries or zones where FMD is endemic.

Preventing the entry of uncooked meats from ships, airplanes and other means of transport and in parcels originated in FMD infected areas.

Disinfection of clothing and personal effects of people arriving from infected areas.

Embargo on the importation of semen and zona-pellucida free embryos (hatched blastocysts and older) from countries/zones where FMD is endemic.

For specific recommendations regarding importing meat and meat products from countries which have not been free of FMD for at least the preceding 12 months see MacDiarmid, 1991.

Some general recommendations are;

All meat and meat products must originate from animals that have passed veterinary ante- and postmortem inspection.
Only beef can be imported as chilled, frozen, dried or cured and not requiring refrigeration.
Cattle must have been vaccinated for FMD.
The meat must be de-boned.
The meat must have reached pH 6.0 before freezing, drying or during lactic acid curing.
Ham and bacon and de-boned wild game must be officially certified “Prosciutto di Parma” or have been heated to 80-100°C or greater for 2-3 minutes or 70° or greater for 25 minutes.

3.1.6 Conclusions and comments.

Although FMD is one of the most feared diseases because of it’s effects on international trade I believe that it might be one of the least likely to be introduced via official trade. Importation of meat and offal from countries where FMD exists is the most likely source of infection.

3.2 Rinderpest

3.2.1 The disease

Rinderpest is an acute, high contagious paramyxovirus disease of cattle, sheep, goats and all cloven hoofed animals. The virus is related to distemper and measles viruses and is closely related the viruses of *peste des petits ruminants* and *kata* a disease of Nigerian dwarf goats. It is characterized by high fever, necrotic stomatitis and gastroenteritis, severe diarrhea and dysentery. Mortality rates in epizootics may reach 90-100% in naive populations and 30-50% where the disease is endemic.

3.2.2 Distribution

Rinderpest is present in much of Africa, the Middle East, and Asia. It does not occur in Europe, North or New Zealand. South America and Australia each had a single outbreak that was quickly stamped out.

3.2.3 Impact of introduction.

In addition to the high morbidity and mortality associated with outbreaks, the costs associated with control/eradication would be enormous. All trade in live ruminants would cease as well as trade in meat and meat products for at least 12 months after the disease has been eradicated. Rinderpest, of all animal diseases, has the greatest influence on the world food supply.

3.2.4 Routes of entry and transmission.

Transmission is primarily by close contact between infected and non-infected animals and by the nasopharygeal route. However, pigs can be infected by the oral route through eating meat from infected animals and later transmit the disease to other animals and species. Introduction to a previously free country is most often by the importation of infected animals, especially to zoos, meat from infected animals can also infect pigs.

3.2.5 Preventing entry

Importation of live ruminants and pigs should only be permitted from countries/zones free of rinderpest and peste de petits ruminants. A country can be considered free if rinderpest has not occurred for a period of 3 years or 6 months if a stamping out policy was carried out. Meat and meat products should be only from animals that passed ante- and post-mortem inspection
and have been cooked or processed such that the virus is inactivated. Semen and embryos should originate from unaffected donors and be collected, processed and stored in accordance with recommendations of the IAHC and the IETS.

3.2.6 Conclusions and comments.

Although the consequences of introducing rinderpest would be severe the probability of entry through official trade seems remote provided the recommendations in the IAHC are followed. The need for bio-security at swine facilities to prevent exposure to infected materials cannot be over-emphasized.

3.3 Contagious Bovine Pleuropneumonia (CBPP)

3.3.1 The disease.

Contagious bovine pleuropneumonia is a highly infectious septicemia characterized by localization in the lungs and pleura. It is one of the major plagues in cattle causing heavy losses in many parts of the world (Blood and Radostits, 1989). It is caused by *Mycoplasma mycoides* var. *Mycoides.* In susceptible cattle morbidity approaches 90% and case fatality rate maybe as high as 50%. Recovered carriers are common.

3.3.2 Distribution

CBPP is endemic in many large areas of eastern Europe, Asia, Africa and Iberian Peninsula. CBPP has never been recorded in Norway.

3.3.3 Impact of introduction or an outbreak.

In addition to the high morbidity and mortality associated with outbreaks, the costs associated with control/eradication would be enormous. All trade in live ruminants would cease as well as trade in meat and meat products for at least 6 months after the disease has been eradicated. Control and eradication are possible with vaccination and test and slaughter. CBPP was the first disease successfully eradicated from the United States in 1892:

3.3.4 Routes of introduction and transmission.

The principle method of transmission is by inhalation of infected droplets but oral transmission by infected feed has been accomplished experimentally. Introduction would certainly most likely by importation of an infected or carrier animal.

3.3.5 Preventing introduction.

Importation of cattle should only be permitted from countries/zones free of CBPP. Countries can be classified as provisionally free of CBPP, free of clinical CBPP and free of CBPP. Details regarding the requirements for meeting any of these classifications and surveillance for CBPP can be found in the **IAHC**, *Recommended Standards for Epidemiological Surveillance for CBPP.*

Meat and meat products should be only from animals that passed ante- and post-mortem inspection. These are the most efficient means of detecting the infection however the complement fixation test is also used.

Semen and embryos are unlikely routes or vehicles of infection.

3.4 Vesicular Stomatitis

3.4.1 The disease

Vesicular stomatitis (VS) is an acute vesicular disease primarily of Equidae, Bovidae and Suidae but it can also affect white-tailed deer, rodents and humans. VS is a minor zoonosis. It is caused by *Vesiculovirus* of the family Rhabdoviridae. It has two strains, New Jersey and Indiana. Morbidity may reach 90% in herds. However, mortality rates tend to be low. It greatest importance is it's close clinical resemblance to FMD, Swine vesicular disease and Vesicular exanthema of swine. Lesions consist or vesicles and erosion of the nose and mouth areas, teats in cattle and the feet, especially in swine. In the US any vesicular disease is treated as FMD until FMD can be ruled out. Diagnosis can be by virus isolation (required for confirmation in the US), serum neutralization or ELISA tests. Horses are refractory to FMD. The incubation period is 21 days (IAHC, 1998, Blood and Radostits, 1989)

3.4.2 Distribution.

VS is, at present, only seen in the Americas but outbreaks in France and South Africa have been reported.

3.4.3 Impact of introduction.

The greatest impact of VS is its effect on trade. The diagnosis of any vesicular disease is usually followed by immediate quarantine, restriction of animal of movements and complete shut-down of exports of affected species and products until the etiology has been established and often for many months after the out break is over. Direct losses associated with the disease are usually not great. However, mastitis in dairy cattle associated with VS can be quite costly.

3.3.4 Routes of introduction and transmission.

Transmission is by contamination via the transmucosal or transcutaneous route. Transmission by arthropod vectors is important and transmission via soil and plants is suspected. There is some seasonal variation in occurrence, being more common during the rainy season in the tropics. In the temperate zone transmission usually ceases after the first killing frost. The virus is found in saliva, vesicular fluid and epithelium around the lesions.

Introduction would most likely be via importation of an infected animal. However, entrance of infected arthropod vectors and contaminated materials should be considered, The virus can survive long periods at low temperatures.

VS is a disease with a moderate to high risk of transmission by artificial insemination (AI) with infected semen. The risk of transmission via properly collected and processed embryos is low.

3.4.5 Preventing introduction.

When importing animals from free countries the IAHC recommends a health certificate attesting that the animals showed no clinical signs of VS on the day of shipment and came from a VS free country. If the free country borders an infected country a 30 day quarantine and a negative serological test 21 days after the beginning of the quarantine as well as protection from arthropod vectors. When importing animals from infected countries the IAHC recommends a health certificate attesting that the animals showed no clinical signs of VS on the day of shipment and came from an establishment where VS had not occurred for at least 21 days, a 30 day quarantine and a negative serological test 21 days after the beginning of the quarantine as well as protection from arthropod vectors.

3.4.6 Conclusions and comments.

Although the consequences of introducing VS would be severe due to the need to quickly differentiate the disease from FMD the probability of entry through official trade seems remote provided the recommendations in the IAHC are followed. The need for bio-security at export facilities to prevent exposure to infected materials and arthropods cannot be over-emphasized.

3.5 Lumpy skin disease (LSD) OIE code A070

3.5.1 The disease

Lumpy skin disease is highly infectious and caused by a *Capripoxvirus,* of the virus family Poxviridae. It affects *Bos taurus* and *Bos indicus* and domestic buffaloes naturally and Oryx, camels impalas,sheep and goats experimentally. It is characterized by fever, anorexia and widespread lumpy lesions in many locations. The nodular lesions affect the skin, subcutaneous tissues, muscles and lymphatic system. Superficial lymph nodes may enlarge 4-10 times. The lesions often drain or become necrotic with hard scabs. Emaciation, lameness, agalactia and infertility are common. The severity of the disease ranges from inapparent to severe. The virus came be isolated from a wide variety of tissues and fluids including saliva, milk and semen. Treatment is not effective.

3.5.2 Distribution.

The disease is found primarily in sub-Saharian Africa, but has spread to Egypt and one outbreak in Israel has been reported.

3.5.3 Impact of introduction.

Although the mortality rate of LSD is low economic losses can be high due to loss of milk production, damage to hides and loss of body condition during the course of the disease. Not to mention the impact on trade as with any List A disease.

3.5.4 Methods of introduction and transmission.

The fact that the disease, for the most part, is confined to sub-Saharan Africa and the rapidity at which it spreads suggests an arthropod vector (not yet identified) may play a primary role. Presence of this vector might be necessary to establish the disease. Otherwise, the natural method of transmission is unknown. The virus is widespread in tissues and excretions. Introduction would most likely be via importation of an infected but not yet clinically affected animal. The incubation period is about 2-4 weeks. (B+R).

3.5.5 Preventing entry.

Prohibition of imports of cattle, and cattle products including semen is the most effective means of preventing introduction. Being a List A disease, the international restrictions on trade and movement of animals with the endemic and nearby areas may have prevented its spread to other areas. When importing products of animal origin (from bovines) destined for industrial use from countries considered infected with LSD, Veterinary Administrations should require the presentation of an *international sanitary certificate* attesting that these products have been processed to ensure the destruction of LSD virus; or for raw hides of bovines the presentation of an international sanitary certificate attesting that these products were stored for at least 40 days before shipment. Semen should only be imported on the presentation of an *international animal health certificate* attesting that the donor animals showed no clinical sign of LSD on the day of collection and for the following 28 days and were kept in the *exporting country*, for the 28 days prior to collection, in an *establishment* or *AI centre* where no *case* of LSD was officially reported during that period, and that the establishment or AI centre is not situated in a LSD infected zone.

3.5.6 Conclusions and comments.

With the present accepted international requirements the risk of introduction of LSD is low.

3.6 Rift Valley Fever (RVF)

3.6.1 The disease.

Rift Valley Fever is an acute , febrile disease of cattle, sheep and man. In lambs and calves RVF is characterized by hepatitis and high mortality. In cattle and ewes abortions occur and in humans RVF is influenza like. RVF is caused by a phlebovirus of the family *Bunyaviridae.* There appear to be 3 strains of the virus (B+R).

3.6.2 Distribution.

Rift Valley Fever is confined to the African continent at present it has great potential for spread to other countries. Outbreaks are occurring in South Africa, Mauritania and other areas at this time.

3.6.3 Impact of introduction.

Rift Valley Fever can be a very devastating disease. During an outbreak in Egypt in 1977, huge losses of cattle, sheep, camels and dogs occurred. In addition, 200,000 human cases occurred with 598 deaths reported (HandiSTATUS, 1997). A with any List A disease the impact on trade is significant.

3.6.4 Routes of introduction and transmission.

The virus is transmitted by various mosquito sp., Culicoides , Simulium and other biting insects. Mosquitoes are both biological vectors in which the virus multiplies and reservoir hosts. Humans are infected by exposure to aerosols from blood, aborted fetal fluids, tissues and insect vectors. Workers in abattoirs have high exposures during outbreaks. The primary means of spread is via insect vectors and aerosols.

3.6.5. Preventing entry

A country is considered free of RVF if no outbreaks have occurred in at least 3 years and has not imported susceptible animals from a RVF infected country in the past 3 years. When importing from countries considered infected with RVF, *Veterinary Administrations* should require the presentation of an international animal health certificate attesting that: vaccinated animals showed no clinical sign of RVF on the day of shipment; were vaccinated using a vaccine complying with the OIE standards not less than 21 days and not more than 90 days prior to shipment; were kept in a quarantine station in the country of origin under official veterinary supervision for the 30 days prior to shipment and showed no clinical sign of RVF during that period; and for vaccinated animals: showed no clinical sign of RVF on the day of shipment; were subjected to the diagnostic tests for RVF with negative results within 30 days before entry into quarantine; were kept in a quarantine station in the country of origin under official veterinary supervision for the 30 days prior to shipment and showed no clinical sign of RVF during that period; were kept in a quarantine station in the country of origin under official veterinary supervision for the 30 days prior to shipment and showed no clinical sign of RVF during that period; were subjected to the diagnostic tests for RVF with negative results not less than 14 days after entry into quarantine; were protected from insect vectors during quarantine and transportation to the place of shipment (IAHC, 1998). Insect control and education of travelers to and from RVF infected areas is important. Meat and meat products should not be imported from RVF infected countries. The is no information available regarding the risk through AI but properly processed embryos are probably low risk.

3.6.6 Conclusion and comments.

It seems odd that the distribution of endemic RVF has remained confined to Africa given the variety of susceptible species, vectors and means of transmission. I appears to this author that the risk of the spread of this disease is high regardless of any increase in trade.

3.7 Anthrax - OIE Code B051

Anthrax is an OIE List B disease but is a List A disease in Norway.

3.7.1 The disease.

Anthrax is an acute to peracute, infectious, non-contagious bacterial disease caused by *Bacillus anthracis.* It affects most mammals, including humans. However, susceptibility varies with sheep being the most susceptible followed by cattle, goats, deer, buffaloes, horses, pigs, dogs and cats. The course is rapid in herbivores but may be as long as 14 days in pigs. Birds are most resistant but ducks, geese, ostriches and carrion eating birds are occasionally affected. Anthrax is a zoonotic disease.

3.7.2 Distribution.

Anthrax occurs worldwide. Sporadic outbreaks occur in Norway. The last recorded in 1993? (Royal Ministry of Agriculture, 1995). Spores are very resistant and survive years in the environment.

3.7.3 Impact of introduction.

Other than the immediate losses associated with the infection and control, especially preventing human exposures, introduction to Norway would have little impact on the livestock industry or trade. Previous outbreaks have not resulted in widespread distribution or occurrence of anthrax in Norway. The importance of anthrax is largely due to it's being a zoonosis and the perceived risk of it's use in biological weapons.

3.7.4 Routes of introduction and transmission.

Most cases of anthrax in herbivores are the result of ingestion of spores on feedstuff. However, carnivores and birds may be infected by eating meat of animals that died from anthrax. Anthrax in humans is usually a result of eating insufficiently cooked meat from animals dying of anthrax. However, inhalation of spores (Woolsorter's disease) and infection through the skin (Malignant pustule) also occur. Introduction into a new area is usually through contaminated animal products such as bone meal, fertilizers, hides, hair, wool or contaminated concentrates or other feed.

3.7.5 Preventing entry.

There is no evidence that anthrax is transmitted by animals before the onset of clinical and pathological signs. Early detection of outbreaks, quarantine of affected premises, destruction of diseased animals and fomites, and appropriate sanitary procedures at abattoirs and dairy factories will ensure the safety of *products of animal origin destined for human consumption*. *Meat*, milk and other products of animal origin destined for human consumption that are certified by a *Veterinary Administration* as fit for human consumption do not constitute a risk for transmission of anthrax and therefore do not require further certification.

Meat, blood or bone meal intended for use as fertilizer should be subjected to heat treatment of 150°C for at least 3 hours.

3.7.6 Conclusions and comments.

Anthrax poses a significant public health problem when an outbreak occurs. However, since outbreaks have occurred in Norway in the past future outbreaks probably will be handled efficiently.

3.8 Rabies - OIE List B058

Rabies is a OIE List B disease but a List A disease in Norway. Rabies has never been reported on the mainland and Norway is currently free of rabies. The disease has been diagnosed in the Svalbard archipelago in fox, reindeer and seals. The last case was in 1992.

3.8.1 The disease.

Rabies is an almost invariably fatal viral disease of all warm blooded animals but infection in birds is uncommon. It is an encephalitic disease and is characterized by unique transmission and a variable incubation period. Affected animals can transmit the disease up to 15 days before the onset of clinical signs until death. Rabies is a very important zoonosis.

3.8.2 Distribution.

Rabies occurs worldwide with the exception of Australia, New Zealand, the Pacific islands, Great Britain, Japan and most of Scandinavia. Norway is free of rabies.

3.8.3 Impact of introduction.

It is difficult to predict what impact the introduction of rabies would have. The disease is a major public health concern. It can be quite effectively controlled in domestic animals by vaccination. Control is very difficult in feral populations although immunization by oral vaccination with baits has shown promise in Europe and the US. The effect on trade would be non-significant.

3.8.4 Routes of introduction and transmission.

Rabies is almost always introduced by infected animals and the primary means of introduction is by the bites of the infected animals. However, transmission via aerosols, especially bat rabies, is suspected and orally as evidenced by the effectiveness of oral vaccination with baits. Information regarding the presence of or survival of the rabies in meat or other animal products was not found. Migration of infected bats from endemic areas in Europe is thought to account for the sporadic appearance of rabid bats in Great Britain.

3.8.5 Preventing introduction.

The requirement of a 4 to 6 month quarantine for animals imported from countries not free of rabies is a common means of preventing the introduction of rabies. However, recent evidence suggests that the importation, without quarantine, of properly vaccinated animals posed no greater risk than animals released after a 6 month quarantine (NZ risk analysis). Since 1994, dogs and cats from countries within the European Economic Association (EEA) have been permitted entry to Norway if vaccinated and have a sufficiently high antibody titer. It is unlikely that increased trade will have any impact on the risk of introduction of rabies to Norway. In the case of importation of frozen semen it should be accompanied by certification that the donor showed no sign of rabies on the day of collection and 15 days thereafter. Quarantine for 6-12 months in the exporting country is often required for animals where a vaccine is not available of possible.

3.8.6 Conclusions and comments.

It is hard to conceive how increased trade would have significant impact on the risk of introducing rabies to Norway.

3.9 Bovine Brucellosis - OIE Code B103

Brucellosis is another disease that is a List A disease in Norway but List B according to OIE classification.

3.9.1 The disease.

Brucellosis is a chronic bacterial disease caused by bacteria of the genus *Brucella.* In cattle the primary species is Br. *abortus* by infections with *Br. mellitensis* and *Br. suis* occur. Brucellosis in animals is characterized by reproductive problems including abortions and infertility. In humans brucellosis is a chronic, recurring illness called undulant fever.

3.9.2 Distribution

Brucellosis has been found throughout the world but has been successfully eradicated from a number of countries and areas within countries such as Australia, Scandinavia, Great Britain and much of the United States. Brucellosis was eradicated from Norway in 1953. There is ongoing surveillance to confirm the absence of the disease and to detect it should it be re-introduced.

3.9.3 Impact of introduction.

The greatest impact of re-introduction of Brucellosis would be in the costs associated with eradicating it again. If the disease became well established the costs could be staggering. It is a major cause of abortion in heifers and results in considerable depression in milk production. Brucellosis is a zoonotic disease so some human cases would likely result, primarily in livestock handlers, veterinarians, and abattoir workers. Consumers of unpasteurized dairy products and uncooked meats would also be at risk. If Norway were involved in the export market the presence of Brucellosis would adversely affect access to markets for dairy products, livestock and possibly meat. Commercially raised deer, elk (Wapiti) and bison can also be infected and threaten control programs in cattle and also the wild populations.

3.9.4 Routes of introduction and transmission.

Introduction of brucellosis into a new area is almost always by movement of an infected animal into a susceptible herd. Although it can be transmitted through ingestion of unpasteurized milk or uncooked meat from infected cattle. Once infected an animal becomes a permanent carrier. Artificial insemination with semen from infected bulls is an efficient mechanism of transmission. Birds, dogs, cats, ticks, and other vehicles are theoretical transmitters but not considered of great importance. The are not reports of transmission via embryo transfer.

3.9.5 Preventing entry.

Importation of animals only from Brucellosis free herds should be recommended. Importation of cattle only from countries with a Brucellosis control/eradication program should be required.
If imports come from countries not free of brucellosis the cattle should undergo pre-export isolation and serological testing. Semen samples from bulls in non-free countries should be tested with the seminal plasma agglutination test (IAHC). Properly collected and processed zona-intact embryos pose no risk (IETS, 1992). Importation of unpasteurized milk and dairy products and uncooked meats from areas not free of Brucellosis should be prohibited.

3.9.6 Conclusions and comments.

The requirement for an ongoing Brucellosis control and surveillance program for Brucellosis in cattle should be a minimum requirement for eligibility for exporting cattle and cattle products.

3.10 Tuberculosis - OIE Code B105

Tuberculosis is a OIE List B and a Norwegian List B disease.

3.10.1 The disease
Tuberculosis is a chronic, infectious disease caused by bacteria of the genus *Mycobacterium*. Cattle are the primary hosts for *M.bovis* but occasionally can be infected by *M.avium* and *M.tuberculosis*. *M. bovis* also infects goats, swine, deer, dogs, cats, horses, possums and humans. It is a major zoonosis.

3.10.2 Distribution
Tuberculosis is distributed worldwide but has been eradicated in much of western Europe, Canada and is close to eradication in Australia and the USA. It is either present in most African countries or there is no data available. Tuberculosis in cattle was last reported in 1986 in one herd in Norway.

3.10.3 Impact of introduction
In addition to the losses associated with the disease in cattle there is a risk for transmission to humans and wild animals such as deer, elg and badgers. If tuberculosis becomes established in a wild population eradication is virtually impossible. The has happened in New Zealand

(deer and possums), Ireland (badgers) and the USA (white-tailed deer in Michigan). Tuberculosis is a very difficult disease to eradicate under the best of conditions because of the lack of sensitive and specific diagnostic tools.

3.10.4 Routes of introduction.
The most probable route of introduction would be the importation of an infected animal from a country or area not free of TB that was not detected by pre-export testing. Uncooked meat, unpasteurized milk and milk products, and semen are also potential sources. Humans infected with *M.bovis* or *M. tuberculosis* have transmitted the disease to cattle. Infection can be transmitted orally, by aerosols and by penetration through the skin.

3.10.5 Preventing entry.
The best way to prevent entry is to prohibit entry of animals and animal products from areas where TB has not been eradicated. This will not completely eliminate the risk because TB can often re-emerge in so-called TB free areas and go undetected for some time. The risk of introduction by travelers and immigrants should not be over-looked. The IHAC lists recommendations for the requirements for export/import that should be adhered to.

3.10.6 Conclusions and comments
Tuberculosis has been eradicated from much of Europe. However, Blood and Radostits, 1989 state that " Complete eradication has not really been achieved in any country. In many a state of virtual eradication has been in existence for years but minor recrudescences occur". The fact that it affects multiple species, both domestic and wild, as well as humans makes it a serious threat if introduced and became established. Fortunately, pasteurization has greatly reduced the risk to humans in most areas.

3.11 Heartwater (Blood and Radostits,1989) OIE Code - B
Heartwater is a tick-borne disease of wild and domestic cattle, sheep and goats caused by *Cowdria ruminatum.* It is an OIE and Norwegian List B disease.

3.11.1 The disease
Heartwater is characterized by fever, nervous signs, edema of the body cavities and diarrhea. Wild game sometimes become symptom-less carriers. Young animals are innately resistant to infection. Imported cattle, sheep and goats are more susceptible than native species.

3.11.2 Distribution
Heartwater is limited in occurrence to Africa, Madagascar, and some of the West Indies. It is considered the most important tick-borne disease in the region. Because it is transmitted by many ticks og the genus *Amblyoma* is feared that it may spread to other areas where the ticks exist.

3.11.3 Impact of introduction
High losses in susceptible populations make the disease very costly. Eradication of the *Amblyoma spp.* tick is usually not feasible and on-going tick control may become necessary.

3.11.4 Routes of introduction
Introduction of Heartwater can be through an affected or carrier animal or an infected *Amblyoma spp.* tick.

3.11.5 Preventing entry.
The OIE-IAHC recommends when importing animals from countries affected with Heartwater that the animals be accompanied by a health certificate sating that the were no signs of Heartwater on the day of exportation, the animals were tested for Heartwater within 15 days of export with negative results and treated with acaracides before export and totally free of ticks.

3.11.6 Conclusions and comments.
It would appear from the limited distribution of the disease that export/import controls and/or the range of the vector has been effective in preventing the spread of the disease.

3.12 Leptospirosis

Leptospirosis (Lepto) occurs in all farm animal species and is an important zoonosis. All leptospires are classified into one species, *Leptospira interrogans* but there are more than 100 different serovars (Blood and Radostits,1989)*. L pomona , L.hardjo, L icterhemorrhagiae and L.gryppotyphosa* are some of the more commonly encountered serovars. The most important carrier hosts for most serovars are rodents.

3.12.1 The disease

Acute, subacute and chronic forms of the disease occur. The acute form is characterized by septicemia, high fever, petechiation, acute hemolytic anemia, hemoglobinuria, jaundice and pallor. Abortions are common during the acute stages and agalactia often follows. The signs are similar in the subacute form but all signs may not be present in the same animal. Abortions often occur 3-4 weeks later. Blood stained or yellow colored milk is common. The chronic form is often restricted to abortions which may occur in storms when many animals are affected.

3.12.2 Distribution

Lepto occurs to a varying degree world wide. It was last reported in Norway in 1992. There is serological evidence that it exists in Finland (PANIS, 1998)

3.12.3 Impact of introduction.

The impact of the introduction of one or more serovars of lepto is difficult to assess. Morbidity in herds often reach 100% however mortality rates vary widely but usually do not exceed 5% in cattle. Losses due to abortions (up to 30%), agalactia and abnormal milk may be greater than death losses. In countries where lepto is endemic the human health considerations are likely more important than the disease in animals. Because the most important carrier hosts for most serovars are rodents eradication would not seem feasible.

3.12.4 Routes of introduction

Leptospirosis can be transmitted by infected animals, semen and improperly processed embryos. Recovered animals often become carriers and shed the organisms in the urine.

3.12.5 Preventing entry

When importing animals from areas where lepto exists, the IAHC recommends that the animal be free of clinical sign, has been in an establishment 90 days where no evidence of lepto has occurred, been treated with dihydrostreptomycin on two occasions (under review) and when required by the importing country, tested for lepto with negative results. Semen and embryos should be collected, processed and stored according to OIE and IETS standards. Antibiotic treatment of semen will reduce but not eliminate the transmission through AI (Ødegaard et.al. 1996).

3.12.6 Conclusions and comments.

3.13 Paratuberculosis (PTB, Johne's disease)

PTB is a specific, infectious enteritis of cattle, sheep and goats but many different wildlife and exotic species including, water buffalo, deer, bighorn sheep, reindeer, antelopes, llamas, alpacas and pigs. It is caused by *Mycobacterium paratuberculosis.* There is some evidence that there might be association between Crohn's disease in humans and *M. paratuberculosis* infections (Chiodini, 199?).

3.13.1 The disease

PTB is a chronic enteric disease characterized by a long incubation period with clinical signs rarely appearing before 2 years of age. Diarrhea, emaciation and submandibular edema are the most obvious signs. Drop in milk production often occurs before development of diarrhea. Cases occur sporadically because of the slow spread of the disease.

3.13.2 Distribution

PTB is distributed throughout the world and the prevalence seems to be increasing in some countries. It occurs in Norway at what is thought to be a low prevalence although no systematic survey has been undertaken. Because, of the because of the low sensitivity and specificity of the available diagnostic tests a national survey to determine the prevalence of

PTB in Norway does not seem feasible (Jordan, 1996, Paisley, et. al, in preparation). PTB is endemic in goats in some areas in Norway.

3.13.3 Impact of introduction.
Introduction of more PTB to Norway would probably have little impact other than the minor losses in production in infected herds and the severe restrictions placed on farms with diagnosed PTB. There is an official eradication program for those herds where PTB exists or were in contact with PTB infected herds. However, because of the low sensitivity and specificity of the available diagnostic tests eradication of PTB even on a herd basis is a process that may take many years to accomplish (Collins, 1993)

3.13.4 Routes of introduction.
Introduction of PTB into areas where it does not exist is usually by the movement of an infected animal, However, transmission by AI is thought to be possible and intrauterine infections occur. There is a lack of information regarding transmission via ET.

3.13.5 Preventing entry
"*Veterinary Administrations* of *importing countries* should require:
<u>for domestic ruminants for breeding or rearing</u>
the presentation of an *international animal health certificate* attesting that the animals: showed no clinical sign of paratuberculosis on the day of shipment; were kept in a herd in which no clinical sign of paratuberculosis was officially reported during the five years prior to shipment; showed negative results to diagnostic tests for paratuberculosis during the 30 days prior to shipment".(IAHC, 1998)

3.13.6 Conclusions and comments.
Importation of live cattle or other susceptible species, semen and embryos from areas where PTB occurs will be accompanied by risk. This is primarily due to the lack of sensitivity of the diagnostic test. Importation from certified PTB free herds, which take 5 or more years of testing to establish are an option.

3.14 Echinococcocis/Hyaditosis
Echinococcosis is a parasitic infestation involving dogs and some wild canids as primary hosts of the tapeworms *Ehinococcus granulosus* or *E. multilocularis.* Secondary hosts of the larval stages are sheep, goats and many other herbivores. Echinococcosis is a serious zoonosis with humans being infected by ingesting eggs passed in canid feces. Humans are not infested by ingesting cysts in infected herbivores.

3.14.1 The disease
Tapeworm eggs are produced by mature adults in the primary host's intestine and passed in the feces. Herbivores (and humans) are infected by ingesting the eggs that develop into cysts in the tissues of the secondary host. The cysts are variable sized space occupying lesions which may reach a very large size in humans. The carnivores are infected by ingesting the cysts in the tissues of infected herbivores.

3.14.2 Distribution
E. granulosum occurs all over the world with the Mediterranean region, the Mid-east, Indian sub-continent, Australia and parts of South America considered as endemic areas. *E. multilocularis* occurs in North America and northern Asia. E. granulosum was last reported in Norway in 1987. It is a notifiable disease in Norway.

3.14.3 Impact of introduction
Echinococcosis was a serious problem in reindeer in Norway until the 1950's, but failed to become established in other parts of Norway. It seems logical therefore that the impact of introduction of an infected animal or animal product would only result in establishment if the animal or product was eaten by a dog or wild canid. Cooking or freezing meats will destroy the cysts as will smoking, and curing. Cysts are rarely found in tissues other than offal.

3.14.4 Routes of introduction
Introduction would be by entry of an infected animal or unprocessed meat.

3.14.5 Preventing entry

The only recommendation in the IAHC regarding Echinococcosis is the requirement for effective anthelmintic treatment of all carnivores prior to importation. New Zealand requires that all meat and meat product originate from animals which have passed anti- and post mortem inspections and offals must be frozen to -18°C for at least 48 hours. Semen and embryos should provide no risk.

3.14.6 Conclusions and comments.
Control and eradication of the disease has been accomplished in some areas primarily through laws governing the feeding of dogs. Post mortem inspection of carcasses probably had minimal effect.

3.15 Cysticercosis - OIE List B106 (bovine) and B252 (swine)
Cysticercosis is the infestation with the larval forms of *Cysticerca bovis* or *C. cellulosae,* the tapeworms *Taenia saginata* and *T.solium.*

3.15.1 The disease
Humans are the obligatory hosts of both tape worms. The larval stages of the disease occur in the muscles of cattle, buffalo and reindeer (*T. saginata*) and pigs (*T. solium*). Humans get the infestation by ingesting the cysts. The adult tapeworms develop in the intestine and pass gravid tapeworm segments in the feces. Cattle and other species become infected by ingesting the gravid segments from the human feces. Humans can also become infested by ingesting the tapeworm segments under poor sanitary conditions. Human infestation with *C. cellulosae* is a very serious disease because of cyst formation in the brain (MacDiarmid, 1991).

3.15.2 Distribution
T. saginata is distributed worldwide but prevalences vary. Prevalence >10% occur in Africa, 5-10% in Europe, Indian subcontinent, southern Asia, Japan, the Phillipines and much of South America. Australia, Canada and the USA have low prevalences. *T.solium* is much more limited in distribution and found mainly in countries of low socio-economic development. It is rare in Europe and in Muslim countries (MacDiarmid,1991). *T. saginata* occurs at a low sporadic incidence in Norway (Royal Ministry of Agriculture, 1995). *T.solium* (*C. cellulosae*)has not been reported in Norway (PANIS, 1999).

3.15.3 Impact of introduction.
Since cysticercosis already occurs sporadically in Norway introduction is not a relevant concern. However, increased prevalence from any source would result in more human cases, higher meat inspection costs and costs associated with processing meat from infested animals.

3.15.4 Routes of introduction
The most probable route in which *T. saginata* or *T. solium* would enter Norway as a result of increased trade would be in the intestines oh humans. Given the prevalence of *T. saginata and M. bovis* in other parts of the world it is likely that it has been introduced many times by travelers and immigrants. Although the risk from human introduction far outweighs the risk of importation of infected meat that possibility exists.

3.15.5 Preventing entry
Nothing can feasibly be down to reduce the risk of introduction by humans except to maintain bio-security at livestock raising enterprises. All meat should pass veterinary inspection but it should be kept in mind that the sensitivity of meat inspection procedures in detecting cysticercosis is only about 15% (0-74%)(MacDiarmid, 1991) If importing meat where the prevalence exceeds 5% chilled meat should be prohibited and unprocessed meat should be frozen to -18°C. Heat treatment at 60°C (140°F) is recommended for processed meats.(FAO/WHO - Codex Alimentarius Commission CAC/RCP 34-1985). Smoking and curing are not reliable methods to kill cysticerci.

3.15.6 Conclusions and comments.
Cysticercosis is primarily of public health importance. Meat inspection procedures will decrease but not eliminate the risk of cysticercosis.

3.16 Q fever - OIE list B057

Q fever is a rickettsial disease, caused by *Coxiella burnettii* that infects a wide variety of insects, animals, birds and humans. The agent is maintained in wildlife including rodents and birds and is transmitted mainly by ticks. Q-fever can cause severe disease in man.

3.16.1 The disease
Cattle, sheep and goats are the domestics animals most likely to show signs of Q-fever. Abortion and placentitis in sheep and goats are common signs of infection. Clinical disease in other species includes fever, conjunctivitis, arthritis, mastitis, abortion and other reproductive problems. The disease in humans is characterized by pneumonic signs and occasionally endocarditis.

3.16.2 Distribution.
Although reported occurrences of Q-fever are sparse(PANIS, HandiSTATUS) Q-fever probably occurs worldwide(MacDiarmid, 1992). It is most well known in the Mediterranean region but has been reported in Sweden (Wadeland et. al. 1996). It has never been reported in Norway.

3.16.3 Impact of introduction
The greatest impact of introduction of Q-fever would be in the sheep and goat population where abortions may occur. There is concern the *C. burnetti* is excreted in the milk of infected animals which makes the disease of public health concern. It would appear from the dearth of reports regarding Q-fever in the literature that it is not a disease worthy of major concern.

3.16.4 Routes of introduction
Transmission in livestock is mainly by ticks and possibly lice. Therefore introduction would likely be via an infected animal or tick. Unpasteurized milk and milk-products would also be sources for human infections. It is unlikely that Q-fever would be transmitted by semen or embryos. Meat is not regarded as a vehicle for transmission.

3.16.5 Preventing entry
The IAHC lists no precautions regarding Q-fever. Other than pasteurization of milk and milk products no specific safeguards are warranted.

3.16.6 Conclusions and comments.
Although Q-fever can cause serious losses in sheep and goats it is probably most important as a human pathogen. Clinical disease in humans, which can be serious, is rare. Human exposure is primarily through aerosols abattoir workers, and livestock handlers.

3.17 New world screw worm - OIE List B060
The New World Screwworm, *Cochlymia hominivorax* and the Old World screwworm, *Chrysomya bezziana* are the last of the multiple species List B diseases to be considered. Both are infestations of wounds by the respective larval forms of these blowflies.

3.17.1 The disease.
The flies are obligatory parasites of all domestic and wild, warm blooded animals and birds laying their eggs only in fresh wounds. Humans are occasionally infested. The larva differ from other blowflies in that they burrow deeply into normal tissues not just the superficial necrotic layers. Affected animals may virtually be eaten alive. (Blood and Radostits, 1989).

3.17.2 Distribution
Cochlymia hominivorax occurs in the Americas but has been eradicated form the USA and much of Mexico and Central America. *Chrysomya bezziana* occurs in Africa and Asia.

3.17.3 Impact of introduction
Screwworm infestations can cause heavy losses to all classes of livestock. Eradication of the flies is possible but re-introduction is a constant risk.

3.17.4 Routes of introduction.
Introduction would be by the entry of an infested animal or the flies themselves.

3.17.5 Preventing entry
The IAHC recommends multiple inspections, wound treatment and insecticide treatments of all animals originating from areas where the flies exist.

3.17.6 Conclusions and comments
Although the screwworms are a serious animal health problem the risk to Norway is probably negligible because of the climate and ease in diagnosing the infested animals.

3.18 Bovine Genital Campylobacteriosis (BGC) - OIE List B104
Bovine genital Campylobacteriosis is a venereally transmitted disease of cattle caused by *Campylobacter fetus* subspecies *venerealis*.

3.18.1 The disease
Bovine genital campylobacteriosis is characterized by repeat breeding, delayed returns to estrus, fetal resorptions, and abortions. The disease is transmitted by coitus or via infected semen. The disease in females is self-limiting in that immunity develops after a few estrus cycles. However, immune carriers occur. Bulls tend to be permanently infected but show no clinical signs..

3.18.2 Distribution.
BGC probably occurs world wide. However, it has been eradicated in many countries and has been largely controlled in dairy cattle through the use of AI with antibiotic treated semen. It is more common where natural breeding is the norm. It was last reported in Norway in 1966.

3.18.3 Impact of introduction
Considerable infertility and pregnancy wastage would occur if BGC were re-introduced to Norway in the beginning. However, since infected females become immune losses would soon become confined to virgin heifers and naive herds. Some countries prohibit imports of cattle from counties where BGC exists.

3.18.4 Routes of introduction.
Live infected animals and infected semen are the primary means of introduction.

3.18.5 Preventing entry
Certification that cattle intended for breeding purposes or as donors for semen or embryos have not been used for natural service or in the case of bull only served virgin heifers is recommended. In addition negative cultures of vaginal mucous, semen and preputial swabs or scrapings might be required. Certification that semen is properly collected, processed and stored from BCG free bulls should be required.

3.18.6 Conclusions and comments.
Although considerable reproductive losses would be expected if BGC were re-introduced to Norway the fact the some imports of breeding cattle and semen have been occurring since the early 1990's with no introductions suggests that while a risk exists it is not large.

3.19 Trichomoniasis - OIE List B112
Trichomoniasis is a venereally transmitted parasitic disease of cattle caused by *Tritrichomonas fetus*

3.19.1 The disease
Trichomoniasis infections result in repeat breeding, delayed returns to estrus, fetal resorptions, abortions and occasionally pyometra. The disease is transmitted by coitus or via infected semen. The disease in females is self-limiting in that immunity develops after a few estrus cycles. However, immune carriers occur. Bulls tend to be permanently infected but show no clinical signs. The disease is difficult to diagnose and requires direct microscopic examination of uterine or vaginal fluids or preputial scrapings before or after culture.

3.19.2 Distribution.
Trichomoniasis is probably distributed worldwide. However, actual reports of the occurrence (as is the case with many List B diseases) are sketchy. It is not a reportable disease in many countries. It is said to be present in Germany, Belgium, France and Hungary (PANIS, 1999). Officially, trichomoniasis has never been reported in Norway but Skjerve et.al. 1996 stated that it was a problem in the past.

3.19.3 Impact of introduction
Considerable infertility and pregnancy wastage would occur if trichomoniasis were re-introduced to Norway in the beginning. However, since infected females become immune losses would soon become confined to virgin heifers and naive herds. Being venereally transmitted and self limiting in females it can be eliminated from herds by AI with semen from non-infected bulls.

3.19.4 Routes of introduction.
Introduction would be via entry of an infected animal or use of contaminated semen.

3.19.5 Preventing entry.
Proving that an animal is not infected can be difficult and requires multiple attempts at culturing and identifying the organism. For this reason only virgin animals or animals that have not been used in natural service should qualify for imports. Semen should only be imported if it has been collected from bulls that have not been used for natural service and had had at least 3 negative preputial cultures. Embryos should not present a risk.

3.19.6 Conclusions and comments.
If trichomoniasis were introduced to Norway it would likely not become widespread before being detected. Control and eradication can be achieved by AI with semen from non-infected bulls.

3.20 Enzootic bovine leukosis (EBL) (Bovine viral leukosis, Bovine lymphosarcoma) OIE List B108
EBL is an infectious fatal lymphoproliferative disease of cattle caused by a retrovirus of the genus Oncoviridae called bovine viral leukosis virus (BVL). It is characterized by the development of aggregations of malignant lymphocytes in almost any organ.

3.20.1 The disease.
The disease has several forms including enzootic bovine leukosis of adults, sporadic in animals under 3 years of age in which the shin, thymus or lymph nodes are affected and proliferate lymphocytosis, a benign form.

3.20.2 Distribution.
BVLV is distributed world wide but the prevalence varies greatly in different regions. Reactor animals are rare in Australia, New Zealand and the UK while it is present in most EU countries. It has not been reported in Norway and an active surveillance program has been ongoing since 1996?

3.20.3 Impact of introduction.
Yearly death losses in BLV infected herds vary from 2-5% depending on the herd prevalence. Losses due to poor production may be more significant. Losses associated with restrictions on trade within the EU and EEA as well as the EU wide control program could be large. Even though the disease has not been demonstrated in Norway, costs associated with the national control program and surveillance are considerable. Public health concerns regarding the transmission of the virus to humans have not been confirmed.

3.20.4 Routes of introduction.
Infection is primarily transmitted by transfer of infected lymphocytes. Therefore, introduction could be through living cattle or mechanically via bats, insects, contaminated instruments, needles, materials containing blood products (vaccines) and can also be transmitted via milk. *In utero* transmission also occurs. Risk from AI or ET seems to be low although not 0 (Eaglesome and Garcia, 1996).

3.20.5 Preventing entry.
The primary means of preventing entry would be to restrict imports of cattle to those areas or herds considered free of EBL and to require negative test results before entry to Norway or the herd. Only EBL free donors should be allowed for AI or ET donors. Special care regarding blood products should be taken. Processed meats and pasteurized milk should be regarded as low risk.

3.20.6 Conclusions and comments.

Although EBL is widely distributed thus far it has not been conclusively identified in Norway. This may be due to the fact that relatively few cattle have been imported and those that were imported were from areas with low EBL prevalence. It appears that eradication of EBL from herds and countries is possible via test and culling programs although this may prove to be costly.

3.21 Infectious Bovine Rhinotracheitis (IBR)/ Infectious Pustular Vulvovaginitis (IPV); Bovine Herpes Virus 1 (BHV-1) . OIE List B110. Norway List A.

3.21.1 The disease

IBR/IPV is a highly infectious disease caused by a virus, bovine herpes virus 1. The most common signs are rhinotracheitis, conjunctivitis, fever, a short course and high recovery rate. Encephalitis in calves, abortions and infectious pustular vulvovaginitis occur also. The different clinical signs are believed to be due to minor strain differences in tissue affinity. At least five major biotypes of bovine herpes virus have been identified. Once infected an animal remains infected for life (Blood and Radostits, 1989).

3.21.2 Distribution.

BHV-1 is distributed worldwide but in some areas the prevalence is very low or the disease has been eradicated. Denmark, Switzerland and Finland are considered free, Sweden has a very low prevalence. Norway is considered free of IBR, the last diagnosis being in 1993. It is a List A and notifiable disease in Norway. Deer, goats, swine, buffaloes and other game animals are also susceptible to the virus and can be potential sources of infection.

3.21.3 Impact of introduction.

The disease can cause serious economic losses to the cattle industries. In, addition losses due to restrictions on trade within the EU and within Norway would have a major impact. Re-introduction of the disease would mean a loss of all of the efforts and resources expended thus far to prevent entry and to establish freedom from the disease.

3.21.4 Routes of introduction.

The primary route of introduction would be by an animals originating in a IBR endemic area. However, semen from an infected bull is a very real risk. The main sources of transmission are nasal exudates, coughed up droplets, genital secretions, semen, fetal fluids and tissues. Once infected an animal remains a carrier for life and can shed the virus continually or sporadically (Blood and Radostits, 1989). Airborne transmission via prevailing winds is considered possible (V. Bitsch, personal communication).

3.21.5 Preventing entry.

Restricting imports to countries and or herds certified IBR free is the obvious solution. If that is not possible quarantine, and serological testing of animals prior to importation will greatly reduce but not eliminate the risk of introduction. Semen should only be imported from IBR free AI stations from IBR free donors. The IAHC has very specific recommendations regarding preventing the introduction of IBR to free areas and free herds. Highly sensitive and specific diagnostic tests for individual animals are available. Importation of vaccinated animals should be prohibited.

3.21.6 Conclusions and comments.

Given the highly effective diagnostic tools available to detect IBR infected animals if properly conducted prior to importation the introduction of IBR through importation of cattle, semen or embryos seems remote. However, less obvious sources of introduction including goats, swine and wildlife may be of importance.

3.22 Bovine Viral Diarrhea (BVD)/Mucosal Disease (MD) OIE List C652. Norway List B.

BVD/MD is caused by a pestivirus within the family *Togaviridae.* It is closely related to the virus that causes border disease of sheep and classical swine fever (hog cholera) in swine (Blood and Radostits, 1989).

3.22.1 The disease

Infections with the BVD virus lead to a wide variety of manifestations including sub-clinical infections, acute mucosal disease, chronic mucosal disease, unthrifty persistently viremic calves, congenital defects and abortions.

3.22.2 Distribution.
BVD virus is probably present wherever cattle exist. In endemic areas 60-80% of cattle over 1 year of age may be sero-positive (Blood and Radostits, 1989). Paisley, et al., 1996 reported that 90% of 256 US beef cattle operations had seropositive animals. Efforts to control or eradicate the disease are underway in several European countries including Norway. It is considered endemic but at a low or sporadic prevalence in Norway.

3.22.3 Impact of introduction.
Introduction of BVD infected animals to Norway would have little national impact but could cause severe losses in individual naive herds. After the disease becomes endemic major economic losses are difficult to demonstrate.

3.22.4 Routes of introduction.
The primary means of introduction and transmission of the BVD virus is a persistently infected animal but semen is also a major potential source. Probably the most dangerous animal to import would be a sero-positive pregnant female with an unknown time of exposure because of the possibility that it carries a persistently infected fetus. However the virus can be found in nasal discharge, saliva, semen, feces, urine, tears and milk each of which might be capable of wide dissemination. Products the utilize fetal calf serum, for example vaccines and diagnostic reagents, have been responsible for wide dissemination of the virus.

3.22.5 Preventing entry.
Preventing entry of the BVD virus would be extremely difficult if the importation of cattle is allowed. Sero-positive animals have a lifelong immunity to the strain they were infected with but possibly not to other strains. Persistently infected animals usually are sero-negative and require demonstration of the virus through viral isolation or ELISA testing to detect. Both methods lack 100% sensitivity. Semen should be only from bulls who have undergone a series of tests to demonstrate freedom from infection.

3.22.6 Conclusions and comments.
While efforts to prevent further introduction and spread of BVD in Norway are laudable given the prevalence of the disease in the rest of the world, the difficulties in identifying potential sources for the virus and the ease in which it can be transmitted, achieving and maintaining freedom from this disease seem remote.

3.23 Bovine Malignant Catarrh (BMC); Malignant Catarrhal fever (MCF) OIE List B 114.
Bovine Malignant Catarrh (BMC) is an acute, highly fatal, infectious, disease of cattle and deer caused by a herpes-like virus. In Africa the virus is derived from the wildebeeste. Elsewhere it is usually harbored by sheep and possibly goats. They are not affected by the infection.

3.23.1 The disease.
The disease is characterized by erosive stomatitis, gastroenteritis, upper respiratory tract erosions, keratoconjunctivitis, cutaneous exanthema, encephalitis, and lymph node enlargement. Death is the usual outcome.

3.23.2 Distribution.
The disease occurs sporadically in most countries but is most important in Africa. It occurs sporadically in Norway.

3.23.3 Impact of introduction.
Although high morbidity has been reported in some outbreaks the usual situation outside of Africa is for only one or a few individuals to be affected. The disease generally spreads slowly, if at all. The disease in farmed deer seems to be more severe than in cattle. Because of the sporadic occurrence of the disease and slow spread it would cause little disruption of trade and generally cause few losses.

3.23.4 Routes of introduction.
The incubation period is quite prolonged and the disease is characterized by a long period of viremia in some recovered cattle. The fact that direct transmission between cattle does not occur (frequently?) suggests a vector is involved with transmission. Most infections in cattle are associated with close contact with sheep.

3.23.5 Preventing entry.
Restricting imports of sheep from areas where MCF exist would seem to be an obvious method to prevent further introduction but probably would have little impact because the disease is already present in Norway. The virus is very fragile and easily destroyed. The IAHC does not list any requirements regarding MCF.

3.23.6 Conclusions and comments.
MCF incidence is unlikely to be greatly affected by increased trade.

3.24 Haemorrhagic septicemia (HS) - OIE List B109
For the purposes of this report, haemorrhagic septicemia (HS) is defined as a highly fatal disease in cattle and buffaloes caused by specific serotypes of *Pasteurella multocida* designated as 6:B and 6:E. The incubation period for the disease shall be 90 days (active and latent carriers occur).

3.24.1 The disease
Systemic pasteurellosis affects cattle, bison, yaks, camels, water buffalo, pigs and horses. It is characterized by sudden onset of fever, salivation, submucosal petecchiation, depression and death usually within 24 hours.

3.24.2 Distribution.
Haemorrhagic septicaemia is primarily found in south east Asia but has been recorded in the US. HS occurs primarily in areas where little veterinary assistance is available. Pasteurellosis from other sero-types can be found worldwide and are important factors in the bovine respiratory disease complex (BRD). It was reported in Germany in 1986 and Finland in 1993. It has not been reported in Norway.

3.24.3 Impact of introduction.
Introduction of and establishment HC could have serious consequences because of the high mortalities associated with the disease, the repercussions for international trade and the costs of control and eradication.

3.24.4 Routes of introduction
Introduction could occur by the entry of carrier animals, contaminated feedstuffs and possibly insects. Infection is primarily by ingestion. The organism cannot survive for extended periods outside a host.

3.24.5 Preventing entry.
When importing from countries considered infected with HS, to minimize the risk of introducing the disease, Veterinary Administrations should require: for cattle and buffaloes the presentation of an international animal health certificate attesting that the animals: showed no clinical sign of HS on the day of shipment; and were kept in a quarantine station for three months prior to shipment; and were examined for the presence of the causative organism in the naso-pharynx according to the procedures in the Manual on four occasions at weekly intervals during the last month in quarantine with negative results; and were vaccinated not less than 30 days prior to shipment (under study); or showed a positive reaction to the passive mouse protection test (under study) conducted during pre-shipment quarantine (IAHC,1998)

3.24.6 Conclusions and comments.
HS is a serious disease that can cause severe losses. Importation of animals or feedstuffs from countries where the disease exists would not seem prudent. The safeguards recommended by the IAHC will only minimize not eliminate the risk.

3.25 Theileriasis - OIE List B111
The principle disease caused by *Theileria* is East Coast Fever which is caused by *Theileria parva a* protozoan parasite. However, there are at least 7 other strains of Theileria that cause disease in sheep and goats or are benign parasites in some instances. All species are transmitted by ticks of the genera *Rhipicephalus, Hæmaphysalis , Hyalomma or Amblyoma.*

3.25.1 The disease (East Coast Fever)
The disease of cattle is characterized by fever, lymph node enlargement, weakness, emaciation and high death rate.

3.25.2 Distribution.
Theileriosis is distributed primarily in eastern and southern Africa but also occurs in the Middle East. Distribution seems to be limited by the habitat of the ticks that transmit the disease. Wildlife reservoirs occur. Reported in Greece and Portugal.

3.25.3 Impact of introduction.
Because of the severe clinical signs and high death rate it is unlikely that introduction would go undetected for long. Control of the disease is primarily by vector control, but affected animals respond to treatment with parasiticide drugs and vaccination appears effective.

3.25.4 Routes of introduction
Introduction could be via infected animals or ticks. Recovered animals can be carriers.

3.25.5 Preventing entry.
When importing from countries considered infected with theileriosis, *Veterinary Administrations* of infected countries should require: for cattle the presentation of an *international animal health certificate* attesting that the animals: for cattle showed no clinical sign of theileriosis on the day of shipment; and were, since birth, kept in a *part of the territory of a country* known to be free of theileriosis for the previous two years; OR were subjected to a diagnostic test with negative results during the 30 days prior to shipment (under study); and showed negative results from microscopic examination of blood smears; AND were treated with acaricides (under study) prior to shipment and were totally free of ticks. (IAHC, 1996).

3.25.6 Conclusions and comments.
No special requirements above those of the OIE are warranted.

3.26 Babesiosis - OIE List B102
Babesiosis includes those diseases caused by the protozoan parasite Babesia spp. in cattle, sheep pigs and horses. The diseases are transmitted by ticks which are necessary for the life cycle of the parasite..

3.26.1 The disease
Babesiosis is characterized by fever, intravascular hemolysis, anemia, hemoglobinemia, hemoglobinuria.

3.26.2 Distribution.
In general, babesiosis occurs worldwide but the distribution of specific types is limited by the distribution of the tick vectors. It has been reported in Norway, Sweden in some areas at a low sporadic occurrence but is endemic in Finland.

3.26.3 Impact of introduction.
There would be no special significance to the further introduction of the disease other than the losses to individual affected animals. Eradication can be accomplished by eradication of the vector tick as has been done in the USA.

3.26.4 Routes of introduction.
Introduction could be via ticks or infected animals. Carrier animals occur.

3.26.5 Preventing entry.
When importing from countries considered infected with babesioses, Veterinary Administrations of infected countries should require: for cattle the presentation of an international animal health certificate attesting that the animals: for cattle showed no clinical sign of babesiosis on the day of shipment; and were, since birth, kept in a part of the territory of a country known to be free of babesiosis for the previous two years; or were subjected to a diagnostic test with negative results during the 30 days prior to shipment (under study); and were treated with acaricides (under study) prior to shipment and were totally free of ticks. (IAHC, 1996).

3.26.6 Conclusions and comments.

Although babesiosis is a very significant disease in cattle there appears to be more concern about the disease in horses. The parasite is effectively controlled in cattle by vaccination and can be removed from the animal by systemic acaricides. However, treatment of *B. caballi* and *B.equis* does not appear effective and as a result there are very restrictive national and international regulations for movement of horses from affected areas. Control of the vectors is the only really effective means of controlling the disease.

3.27 Anaplasmosis - OIE List B101

Anaplasmosis is a disease of cattle, sheep, and goats caused by the rickettsia *Anaplasma spp. A. marginale* affects cattle, wild ruminants, sheep and goats but cattle are the main hosts. *A. ovis* affects sheep and goats. The disease is transmitted by ticks.

3.27.1 The disease

The disease is characterized by debility, emaciation, anemia and jaundice. It is transmitted by the blood from infected animals and can easily be transmitted by contaminated instruments, needles, obstetrical gloves etc. Young animals are usually immune to the disease although they become permanently infected. Only adults develop clinical signs of the often fatal disease.

3.27.2 Distribution.

Anaplasmosis of cattle is common in the USA, Australia, South Africa and the former USSR. Distribution is somewhat limited by the range of the vectors which include a wide variety of ticks and biting insects. Anaplasmosis of sheep and goats occurs in Africa, Mediterranean countries, the former USSR and the USA. In general it occurs in the same areas as Babesiosis but may extend further.(Blood and Radostits, 1989) It has never been reported in Norway.

3.27.3 Impact of introduction.

Introduction of Anaplasmosis to Norway would have serious consequences. Eradication is not practical because of the wide variety of vectors of the disease. In terms of losses the disease is considered the second most important in the USA. In addition to the serious losses due to deaths, decreased production and abortions limitations on trade can be severe.

3.27.4 Routes of introduction

Introduction could be via infected carrier animals or the numerous vectors. The infection is transferred by the blood of infected animals.

3.27.5 Preventing entry.

When importing from countries considered infected with anaplasmosis, Veterinary Administrations of free countries should require: for cattle the presentation of an international animal health certificate attesting that the animals: showed no clinical sign of anaplasmosis on the day of shipment; and were, since birth, kept in a part of the territory of a country known to be free of anaplasmosis for the previous two years; were subjected to a diagnostic test for anaplasmosis with negative results during 30 days prior to shipment; were treated with an effective drug such as oxytetracycline for five consecutive days at a dose of 22 mg/kg (under study).(IAHC, 1996).

3.27.6 Conclusions and comments.

Introduction and establishment of Anaplasmosis in Norway would have serious consequences. However, the diagnostic test seems quite effective and the carrier state can be eliminated by treatment with oxytetracycline. Therefore, introduction of the disease through normal trade channels seems remote.

3.28 Dermatophilosis - OIE List B107

Dermatophilosis is a dermatitis that occurs in all species and is caused by organisms of the genus *Dermatophilus.* There is some controversy about the nomenclature but *Dermatophilus congolensis* is the most important species. It is the greatest problem when associated with tick infestation.

3.28.1 The disease

Dermatophilosis thick, horny, cream to brown colored crusts . The lesions may discharge pus. Initially the lesions usually are confined to the lower extremities but may progress to cover virtually the entire body (Paisley, unpublished observations). In calves the lesions consist only of scaling and hair loss. In sheep and goats the lesions usually begin around the mouth and muzzle. In most areas the lives of affected animals are not endangered but in the Caribbean losses to cattle, sheep and goats can be devastating. Approximately 90% of the cattle, sheep and goat populations of St.Kitts and Nevis were lost in association with infections with *D. congolensis* (Paisley, unpublished).

3.28.2 Distribution.
Dermatophilosis occurs sporadically in many areas of the world including Norway but is a great problem only in hot, damp areas of the world.

3.28.3 Impact of introduction.
There would be little adverse trade impact if the disease were re-introduced. Severe losses due to damaged and discolored wool can occur in sheep.

3.28.4 Routes of introduction.
Most transmission occurs from contact with infected animals although mechanical vector transmission are also important.

3.28.5 Preventing entry.
Prevention of entry consists of preventing entry of infected or tick infested animals.

3.28.6 Conclusions and comments.
No special recommendations or comments.

3.29 Bovine spongiform encephalopathy (BSE) - OIE List B115
Bovine spongiform encephalopathy (BSE) is an infectious disease of cattle caused by an unconventional agent, a prion. It is very similar to scrapie in sheep. It is characterized by a long incubation period, spongiform lesions in the brain and 100% mortality in affected animals. BSE was first recognized in the UK in 1986 and over the next 4 years became epidemic in the UK (Kimberlin, 1993). Note because of the vast amount of attention BSE has already received this will be superficial coverage.

3.29.1 The disease.
Cattle or infected by consumption of feed that contains the infectious prion material. The incubation period is thought to be 2-8 years. Clinical signs include, temperament changes, incoordination, blindness, hyperesthesia and other signs indicative of a CNS disease. The signs are progressive and culminate in death. Treatment is not successful.

3.29.2 Distribution.
The vast majority of cases have occurred in the UK but some have occurred in France, Portugal ,Switzerland, the Netherlands and Belgium (List not complete?). Denmark and Germany have had cases in cattle imported from the UK. BSE has not been reported in Norway. It widely thought that the occurrence of BSE is under-reported especially in countries that imported and fed large amounts of meat and bone meal (MBM) form the UK. Because of the low prevalence, difficulty in diagnosis and the grave political and economic consequences associated with the diagnosis of BSE the true prevalence of BSE is largely unknown.

3.29.3 Impact of introduction.
In general, the diagnosis of BSE in a previously free country, results in a ban on imports of cattle, meat and some other products of bovine origin from that country on an international basis. Removal of the stigma of having the disease may be impossible or at least not economically feasible. There is much world-wide concern (if not hysteria) over the putative relationship between BSE and a new variant Creutzfeld-Jakobs disease (nv-CJD) in humans.

3.29.4 Routes of introduction.
Entry of BSE into previously free areas has been associated with the importation of cattle or meat and bone meal (MBM) from the UK. There is a potential for transmission by other materials of bovine origin that could somehow enter the feed destined for cattle. Bovine semen and embryos are not considered to be a great risk. However, the precautions

associated with the selection of donors, collection etc. are extensive. It unclear if maternal transmission occurs.

3.29.5 Preventing entry.
If the importation of cattle, specified products and MBM from countries where BSE is known to exist is prohibited, as is the usual case, the risk of introduction can be greatly reduced.

3.29.6 Conclusions and comments.
It seems that the BSE epidemic in the UK is nearing the end. The ban on feeding MBM to ruminants probably had the greatest effect of containing the epidemic. However, as long as there are still cattle in the pre-clinical stages due to illegal feeding of MBM or other causes the will always be a risk of introduction. The fact that normal rendering and other practices that inactivate most infectious agents are not effective against the BSE agent makes it very difficult to guard against exposure.

3.30 Ringworm of cattle- Not Listed by the OIE or FAO- Norway List B
Dermatophytosis or ringworm of the skin is caused by invasion of the keratinized epithelial cells and hair fibers by dermatophytes. Dermatophytosis in cattle is caused by *Trychophyton spp. Microsporum* spp. and Epidermophyton spp. The most common infection in cattle is *T. verrucosum* (Gudding and Lund, 1995)..

3.30.1 The disease.
Although it is superficial skin infection ringworm can have a significant effect on management and economics in affected herds. It spreads very easily in herds and can also affect humans.

3.30.2 Distribution.
Dermatophytosis occur in all countries but are more common where cattle are housed together in close proximity for long periods. Several European countries, including Norway, have control programs in which vaccination is used.

3.30.3 Impact of introduction
Injury to infected animals is of a minor nature and little economic loss occurs. The major impact of further introduction would be the setback in the efforts to control the condition in Norway.

3.30.4 Routes of introduction
The primary means of transmission is by direct contact: However indirect contact with inanimate objects such as bedding, and equipment is also important. Either of these routes could result in introduction.

3.30.5 Preventing entry.
Preventing entry of infected animals or equipment used in connection with infected animals should be effective.

3.30.6 Conclusions and comments.
Because of the vaccination/control program in Norway the incidence of newly infected herds has decreased dramatically. Close inspection of animals before entry should detect those with infections. These animals can be individually treated, vaccinated. Herd control by vaccination is quite effective.

3.31 Intestinal salmonellosis (bovine) - FAO List C619
Salmonellosis is a disease of all animals caused by a number of different species of salmonellae and manifested by one of 3 major syndromes: peracute septicemia, acute enteritis or chronic enteritis. Salmonellosis is a major cause of food-borne illness in humans. The main species associated with cattle are *S. typhimurium, S. dublin* and *S. newport* but there are many other “exotic” or unusual species of importance. Cross species infections are common.

3.31.1 The disease.

Salmonellosis is cattle is usually only seen sporadically in animals that have been stressed. Explosive outbreaks in calves are not uncommon. The endemic presence of a few sporadic cases on infected farms is common. The usual forms of the disease are acute or chronic enteritis but the septicemic form also occurs in calves. Abortions sometimes occur with S, dublin outbreaks. Asymptomatic carriers are common. Shedding of the organism can be induced by stress.

3.31.2 Distribution.
The distribution of Salmonellae is worldwide but certain areas, including Norway, have a very low prevalence. It is a reportable disease in Norway and a nationwide control program is in operation.

3.31.3 Impact of introduction.
Norway is one of the few areas of the world where introduction of Salmonella is even an issue. This is because of the extremely low incidence of diagnoses made in native animals animal products and feeds. Of special interest is the multiple antibiotic resistant form of *S. typhimurium* DT104 that seriously affects both animals and man. The impact of infection on an individual farm could be very severe in terms of morbidity and mortality as well as those associated with restrictions applied as a result of diagnosis.

3.31.4 Routes of introduction.
There are many routes by which Salmonellae could be introduced to Norway including infected animals, contaminated meats and animal products, animal feeds, rodents, birds, reptiles, travelers, inanimate objects.

3.31.5 Preventing entry.
Little specifically can be done to prevent entry of Salmonellae because of the vast number of ways they can be transmitted and transferred. On an individual case basis, importing from areas that have low prevalence, have surveillance and monitoring reporting systems, from certified Salmonella free establishments etc. will help to reduce the risk. Testing of imported unprocessed foods, goods and animals may also reduce the risk but certainly not eliminate it. Little can be done about human carriers, smuggled goods, rodents, migratory animals and birds .

3.31.6 Conclusions and comments.
With increased trade in animals and animal products as well as increased travel and immigration it seems inevitable that one or more species of Salmonella will be introduced and become established in Norway. The impact will depend on the species of Salmonella, the infected animal(s) and to a great extent the threat to human health.

4. Risks associated with the importation of swine and swine products.

As was the case with cattle, the risks associated with the increased import of swine and swine products will be discussed in terms of diseases of swine, multlple species diseases where swine are the primary host and zoonotic diseases. The discussion will begin with the OIE List A diseases followed by Norwegian List A diseases, the OIE and Norwegian List B diseases, the FAO List C diseases and miscellaneous diseases.

The OIE List A diseases include:
- Foot and mouth disease
- Swine vesicular disease
- African swine fever
- Classical swine fever (Hog cholera)

The OIE List B diseases include:
- Atrophic rhinitis
- Cysticercosis
- Aujeszky’s disease
- Teschen disease

Norway List A (additional)
- Transmissible gastroenteritis

Brucellosis

Norway List B (additional)

Swine influenza

Necrotic enteritis (Cl.perfringens C) Brucellosis

Trichinellosis

Porcine respiratory and reproductive syndrome

The Norwegian health certificate for the importation of swine lists the following diseases that would appear to be of the most concern regarding introduction by living animals.

Foot and Mouth Disease
Swine Vesicular Disease
Teschen Disease
Brucellosis
African Swine Fever
Classical Swine Fever
Rabies
Anthrax
Pseudorabies
Transmissible Gastroenteritis

4.1 Foot and mouth disease (See section 3.1)

4.2 Swine vesicular disease - OIE List A030

4.2.1 The disease

Swine vesicular disease (SV) is a contagious viral disease of swine that is clinically indistinguishable form foot and mouth disease, vesicular stomatitis and vesicular exanthema. Swine and humans are the only species that have natural infections. Sheep can be infected experimentally but show no signs of the disease (MacDiarmid, 1993).

4.2.2 Distribution.

The disease was first recognized in Italy in 1996 and was quickly eradicated by slaughter. Until now SV, has been confined to mid and southern Europe, the UK, Japan, Hong Kong and probably China. Thus far, Scandinavia, the Americas, Africa, Australia and New Zealand have remained free.

4.2.3 Impact of introduction

If SV were introduced to Norway very high incidences would be expected because of its very contagious nature and a totally susceptible population. Economic effects of the primary disease are minor. However, the costs of eradication by slaughter can be very high. In addition, after an outbreak has been stamped out the requirement for a national serologic survey to document freedom from the disease can be expensive. Once established the disease is extremely costly to eradicate. In countries where export of swine and/or sheep is important these markets would be lost for at least 6 months after the disease was eradicated and freedom was documented.

4.2.4 Routes of introduction

The most important means of spread (or introduction) are feeding garbage to pigs that contains meat from infected pigs, movement of infected pigs from infected to non-infected premises and movement of pigs in contaminated vehicles.

4.2.5 Preventing entry.

Import of live swine form areas where SV exists should be prohibited. Importation of uncooked pig meat products from these areas should also be prohibited. If meat products are heated to at least 70°C they should present no risk as would certified “Prosciutto di Parma” hams. The virus can survive indefinitely in salted intestinal casings so should be treated in 0.5% citric acid which inactivates the virus in 24 hours (MacDiarmid, 1993).

4.2.6 Conclusions and comments.

The disease is often mild and can go undetected for sometime in some herds. This along with the fact that farmers may be reluctant to report an outbreak (because of the stamping out policy) combine to make it likely that infected hogs will get into the food chain in countries where it exists. In countries where the feeding of garbage, especially uncooked garbage, is not allowed this would not pose an appreciable risk. The entry of infected pork products to Norway with travelers from infected areas is likely. However, an outbreak resulting from this practice seems very unlikely.

4.3 African swine fever - OIE List A120

4.3.1 The disease

African swine fever (ASF) is an acute, severe, highly contagious disease of swine that closely resembles Classical swine fever but is caused by a distinctly different viral agent. It is characterized by high mortalities and the development of prolonged viremia in recovered animals (MacDiarmid, 1993).

4.3.2 Distribution.

For the most part ASF is confined to Africa and the Mediterranean region. However there have been out breaks in Portugal, France and Italy as well as Brazil and the island of Hispaniola. It's natural range in generally where warthogs and the *Ornithodorus moubata* tick occurs.

4.3.3 Impact of introduction

The disease causes extensive losses and once established in an area it is extremely difficult to eradicate mainly because of the prolonged viremic survivors. Prohibition of export of pigs and pig products from affected countries is the rule.

4.3.4 Routes of introduction.

Introduction is usually by movement of a viremic shedding animal. However, the virus occurs in high titers in meat, blood and feces and presumably would occur in semen. The virus is maintained and transmitted by the *Ornithodorus moubata* tick but indirect transmission from contaminated pens and building is reported. The OIE states the following; "Veterinary Administrations of countries should consider whether there is a risk regarding ASF in accepting importation or transit through their territory, directly or indirectly from other countries, of the following commodities:

1) domestic and wild pigs, particularly of the Sus, Potamochoerus, Phacochoerus and Hylochoerus genera;
2) semen of domestic and wild pigs;
3)embryos/ova of domestic and wild pigs;
4) fresh meat of domestic and wild pigs;
5) meat products of domestic and wild pigs which have not been processed to ensure the destruction of the ASF virus;
6) products of animal origin (from pigs) destined for use in animal feeding or for industrial use which have not been processed to ensure the destruction of the ASF virus;
7) products of animal origin (from pigs) destined for pharmaceutical use which have not been processed to ensure the destruction of the ASF virus;
8) pathological material and biological products (from pigs) which have not been processed to ensure the destruction of the ASF virus".(Anon, 1998).

4.3.5 Preventing entry.

The OIE recommendations for reducing the risk of introduction of ASF are very inclusive and need not be repeated here. In general there should be complete prohibition of importation of pigs or pig products from areas where ASF exists.

4.3.6 Conclusions and comments.

The consequences of an introduction of ASF are grim. However, the guidelines for prevention of the spread of ASF for the most part have been successful.

4.4 Classical swine fever (Hog cholera) OIE List A130

4.4.1 The disease

Hog cholera or Classical swine fever (CSF) is a high infectious disease of pigs characterized by rapid spread, septicemia hemorrhage and high mortality. In susceptible populations morbidity and mortality may approach 100%. CSF is probably the most important disease is swine on a worldwide basis (MacDiarmid,1993)

4.4.2 Distribution.

CSF is generally distributed worldwide but has been successfully eradicated from a number of areas. It is enzootic in most areas of Latin America, Asia and Africa. Recent outbreaks in Germany and The Netherlands pose a constant threat to the Norwegian pig population. It was last reported in Norway in 1963 (Bjorn Lium, pers com. 1999)

4.4.3 Impact of introduction

Because the entire population is susceptible an outbreak of CSF in Norway would be devastating in terms of losses due to the disease itself and the cost of stamping out. Losses in the Netherlands in the outbreak in 1997-98 totaled more than 11 million pigs lost or destroyed at a total cost of 4.7 billion NLG (Dijkhuizen, 1999). Export markets lost during an outbreak are often difficult to re-establish.

4.4.4 Routes of introduction

Outbreaks of CSF are often traced to feeding pigs with garbage containing infected pig meat. Movement of infected animals is also common and spread within an outbreak is often due to movement of people, feeds, vehicles etc. between infected and non-infected premises. Airborne transmission over short distances has been proposed. Contact with infected wild pigs, which appear to be the reservoir for the disease is important in many areas of Europe. The animals and products listed as being potential risk factors for ASF are the same for CSF.

4.4.5 Preventing entry.

The OIE recommendations for prevention of entry by importing swine or swine products are well detailed. In general, they recommend that pigs and pig products be imported only from countries free of CSF for at least 2 years, 1 year if stamping out and vaccination are done or 6 months if only stamping out is practiced.

4.4.6 Conclusions and comments.

Because of the ease of transmission by live pigs and a variety of products as well as mechanical and human vehicles the entry of CSF to Norway at some point seems likely. If the disease is not quickly diagnosed and stamped out the consequences would be grave. The near proximity of the disease in Europe makes it a greater threat than some other diseases.

4.5 Aujeszky's disease

Aujeszky's disease (AD), or pseudorabies may affect all domestic species and many species of birds. It is caused by porcine herpes virus 1.

4.5.1 The disease

It is a rapidly progressing fatal disease in all species except swine. In piglets, it causes nervous disease, pneumonia, poor growth rate in fatteners and abortion and infertility in adults. AD may cause morbidity and mortality of near 100% in suckling pigs but in mature swine the disease may produce no clinical manifestations and the pigs usually recover (Blood and Radostits, 1989).

4.5.2 Distribution.

AD occurs or has occurred in almost all swine raising countries. Australia and Canada are free and it has been eradicated in Great Britain and Denmark. It has never been reported in Norway.

4.5.3 Impact of introduction

Serious economic losses could be expected if AD became established in Norway. If introduced eradication, with its associated costs would be attempted.

4.5.4 *Routes of introduction*
Pig and possibly rodents are the primary hosts for the virus. It virus is present in the nasal secretions from the first day after infection and up to 17 days later. Recovered pigs can be latent carriers as can vaccinated pigs. Transmission is primarily by direct contact but can be transmitted via drinking water, feed and venereally, although the virus has not been found in semen. Air.borne transmission seems likely. Infected meat would have to be fed to swine to cause an out break. Other species except rodents are dead-end hosts.

4.5.5 *Preventing entry.*
Importation of pigs only from countries, regions or herds that are free of AD is recommended. Testing and isolation of all imported pigs should always be done. Meat should not be a significant risk factor nor should semen or properly processed embryos.

4.5.6 Conclusions and comments.
Nothing to add.

4.6 Transmissible gastroenteritis - OIE List B254 - Norway List A disease
Transmissible gastroenteritis is a highly contagious disease of swine caused by a corona virus.

4.6.1 The disease
Transmissible gastroenteritis is characterized by vomiting and profuse diarrhea. Young piglets are the most seriously affected and mortality may reach 100% in newly infected herds. Mortality in pigs older than 5 weeks is rare. The virus is shed in the feces.

4.6.2 Distribution.
TGE is widespread in much of Europe, the Americas, and the far East. It has not been reported in Norway. A surveillance program for TGE has been in effect since 1994 (Bakken, 1995).

4.5.3 *Impact of introduction*
Economic losses due to TGE can be substantial being greatest when the disease is first introduced to a herd but mortalities in weaner pigs may occur in endemically infected herds. If a stamping out program were undertaken in the case of an outbreak increased cost would be incurred initially but the overall cost of the disease would be less in the long run. There would be no significant impact on trade and it does not constitute a public health risk. TGE is not amenable to eradication once it is established. If introduced to Norway eradication would be attempted.

4.6.4 Routes of introduction
Transmission is primarily by the fecal oral route but pigs have been infected experimentally by feeding them large quantities of meat from viremic animals. It has been introduced to herds via feeding uncooked blood and meat scraps. Other routes include transiently infected dogs, cats, birds and flies. The virus can probably be transmitted via semen if it were collected during a viremic period.

4.6.5 Preventing entry.
Importation from countries free of TGE should be recommended. Otherwise the pigs should have been in isolation for at least 40 days with no signs of the disease and or be tested for TGE prior to export. The same precautions for semen donors should be observed. Both New Zealand and Australia concluded that the risk of introduction of TGE by meat or meat products was extremely low.

4.6.6 Conclusions and comments.
Nothing to add.

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4.7 Porcine epidemic diarrhea

Porcine epidemic diarrhea (PED) is not listed by the OIE. PED is a disease similar to transmissible gastroenteritis and is also caused by a corona virus. The two viruses are serologically unrelated.

4.7.1 The disease

PED is characterized profuse diarrhea and weight loss. All age groups are affected and mortality may reach 50% in young piglets in newly infected herds. Mortality in pigs older than 5 weeks is rare . The virus is shed in the feces.

4.7.2 Distribution.

PED is not as widespread as TGE but it is present in several European countries including Belgium, England, Germany, France, the Netherlands as well as China and Taiwan.

4.7.3 Impact of introduction

Same as TGE

4.7.4 Routes of introduction

Same as TGE

4.7.5 Preventing entry.

Same as TGE

4.7.6 Conclusions and comments

Same as TGE.

4.8 Viral encephalomyelitis of pigs; Teschen/Talfan disease; poliomyelitis suum - OIE List B256 - Norway List A disease

Viral encephalomyelitis of pigs (VEP) is caused by several related but antigenically different enteroviruses. There appear to be at least 8 subgroups with variable virulence.

4.8.1 The disease

This encephalomyelitis occurs only in pigs and is characterized by hyperesthesia, tremors, paresis and convulsions. Losses are due to deaths and paralysis. Subclinical infections are common.

4.8.2 Distribution.

The most severe form of the disease (Teschen) occurs only in Europe and Madagascar while Talfan a milder form occurs in Europe, Scandinavia, and North America. In Denmark the diseases is known as poliomyelitis suum.

4.8.3 Impact of introduction.

By the time clinical disease is discovered and the disease diagnosed it is usually widespread. In most cases the disease is sporadic and doesn't warrant a control program. Teschen disease can be controlled by vaccination and has been successfully eradicated in Austria.

4.8.4 Routes of introduction

The virus is transmitted mainly by the oral route but can be transmitted by nasal instillation. The virus is shed in the feces. The OIE International Health code states that there could be a risk of introduction of VEP by the importation of live wild and domestic swine, swine semen, meat, meat products not treated to inactivate the virus, other products of porcine origin for use in animal feeds, industry or pharmaceuticals.

4.8.5 Preventing entry.

The OIE recommendations, in general, are for isolation for 40 days before export, serologic testing and or vaccination more than 30 days and less than 1 year before export.

4.8.6 Conclusions and comments.

No comments.

4.9 Porcine Brucellosis - OIE List B253 - Norway List A

4.9.1 The disease
Brucellosis is a chronic bacterial disease caused by bacteria of the genus *Brucella.* In cattle the primary species is Br. *abortus* by infections with *Br. mellitensis* and *Br. suis* occur. Brucellosis in animals is characterized by reproductive problems including abortions and infertility. In humans brucellosis is a chronic, recurring illness called undulant fever. Br. suis affects pigs but also cattle, horses and humans. It is found in wild hares in Europe and can infect rodents.

4.9.2 Distribution.
Br. suis is endemic in North, Central and South America, in Southeast Asia and in some western European countries. It does not occur in Norway. All boars selected for breeding in AI stations are tested and all have tested negative, thus far.

4.9.3 Impact of introduction.
Br. suis is more difficult to control than Br. abortus. Introduction in to Norwegian swine would cause problems for individual farmers but would have little impact on trade. Br. suis is a significant human health risk as it can be transmitted by ingestion of raw or undercooked infected pork.

4.9.4 Routes of introduction.
Introduction is almost always by movement of an infected animal into a non infected herd. However, pigs can be infected by eating infected hares or rodents. Humans can be infected by eating undercooked infected meat.

4.9.5 Preventing entry.
Importation of animals only from Brucellosis free herds should be recommended. Importation of swine only from countries with a Brucellosis control/eradication program should be required. If imports come from countries not free of brucellosis the pigs should undergo pre-export isolation and serological testing. Semen samples from swine in non-free countries should be tested with the seminal plasma agglutination test (IAHC). Properly collected and processed zona-intact embryos pose no risk (IETS, 1992). Importation of uncooked meats from areas not free of Br. suis should be prohibited.

4.9.6 Conclusions and comments.
The requirement for an ongoing Brucellosis control and surveillance program for Brucellosis in swine should be a minimum requirement for eligibility for exporting pigs and pig products.

4.10 Atrophic rhinitis - OIE List B251.
Atrophic rhinitis (AR) occurs in a number of herds in Norway. Economic losses have been reduced by a voluntary vaccination program. Affected herds are normally not subject to restrictions. Increased trade would be unlikely to greatly affect the AR situation.

4.11 Cysticercosis (*C. cellulosae*)- OIE List 252
Discussed in section 3.1.5

4.12 Trichinellosis - OIE List B 255
Trichinellosis is an infestation with the nematode parasite *Trichinella spiralis*. It infects all species of carnivores and omnivores but is especially important in swine, rats cats and humans.

4.12.1 The disease.
Trichinellosis is a serious zoonosis. Although infections in humans are often sub-clinical sign may be severe and mortality in outbreaks may reach 40%. Signs include fever, myalgia, facial edema, exanthema and functional disorders of the circulatory, respiratory and muscular systems.

4.12.2 Distribution.
Trichinellosis occurs worldwide but the prevalence varies widely by location. The disease was last reported in a pig at slaughter in Norway in 1994. The last previous report was in 1981. It is relatively common in Eastern Europe. It is often associated with low hygienic standards and

poor management practices such as feeding uncooked garbage to swine. It is relatively rare where swine are fed grain ration. Horse meat, bear meat and marine mammals heat occasionally have caused outbreaks.

4.12.3 Impact of introduction.
Further introduction would have little impact on agriculture in Norway. The importance of the disease is solely in it's effect on humans.

4.12.4 Routes of introduction
Meat is the usual vehicle for introduction and transmission although it could be introduced by importation of any infected animal provided it was eventually eaten by a carnivore or omnivore. Infection is by ingestion of infested meat.

4.12.5 Preventing entry.
Meat from countries known to be infested should only come from herds certified as free of trichinellosis for at least 3 years or be subjected to a trichinoscopic examination or be frozen by a regimen recognized by the OIE as being effective in destroying all trichinella cysts or have been cooked to a temperature of at least 60°C. Arctic strains of the parasite may be resistant to normal freezing techniques.

4.12.6 Conclusions and comments
It would seem prudent to recommend thorough cooking, to at least 60°C, of all meat products not matter the source because microscopic testing for trichinellosis has a very low sensitivity and the fact that many other food-borne pathogens will be inactivated by this temperature.

4.13 Swine vesicular exanthema - OIE List B

4.13.1 The disease.
Swine vesicular exanthema (SVE) is an acute febrile vesicular disease caused by one or more strains of marine caliciviruses. Its importance is its resemblance to FMD. It can infect pigs, dogs, horses, goats, sheep, whales and marine pinnipeds.

4.13.2 Distribution.
Except for small outbreaks in Hawaii and Iceland the disease has been confined to the USA. It has not been reported since the 1950's. It is possible that the marine caliciviruses are widespread.

4.13.3 Impact of introduction.
As with any vesicular disease an outbreak of SVE would have serious consequences due to its resemblance to FMD.

4.13.4 Routes of introduction
Meat from infected animals. Most outbreaks have due to feeding pigs garbage from ships. Waste from fish processing plant is a potential source, as is whale meat.

4.13.5 Preventing entry.
Since no outbreaks have occurred in 30+ years no special precautions are warranted.

4.13.6 Conclusions and comments: None
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4.14 Swine influenza - Norway List B 150

4.14.1 The disease.
Swine influenza (SI) is a highly contagious disease of pigs caused by an Influenza A virus. It is characterized by fever and respiratory signs. Several different H,N strains have been identified. SI is characterized by explosive outbreaks, high morbidity and low mortality. It is often associated with concurrent *Haemophilus parasuis* and *Actinobacillus pleuropnuemonia* infections. The virus may be transmissible between man and pigs and possibly birds.

4.14.2 Distribution.

SI was first reported in the US in 1918 after the human pandemic. It has been reported in the UK and several European countries but not in Norway.

4.14.3 Impact of introduction.
Swine influenza would not be expected to have a great impact on the swine industry in Norway because it generally is a very mild disease if endemic. When first introduced it may be more severe. Because it is highly contagious and has a somewhat slow onset after exposure it maybe come wide spread before it is finally diagnosed. Since Norway would probably try to eradicate the disease the economic impact could be quite large. The potential that pigs act as a reservoir for influenza in humans should not be overlooked.

4.14.4 Routes of introduction
Importation of an infected animal is most likely. Infected pigs may shed the virus for 2-4 weeks after infection. Transmission by humans and birds is possible but much less likely.

4.14.5 Preventing entry.
Current testing procedures used for importation of swine seem to be effective in delaying the introduction of the disease to Norway. Avoidance of importing pigs from countries where the disease is known to occur would help.

4.14.6 Conclusions and comments.
Because of the ability for influenza virus to antigenically and in virulence make potentially it a very dangerous disease both the swine and to humans and possibly even poultry.

4.15 Necrotic enteritis (*Cl.perfringens C*) - Norway List B154

4.15.1 The disease.
Necrotic enteritis of swine is caused by the bacteria *Clostridium perfringens*, type C. It affects piglets during the first week of life. Rarely weaning pigs are affected. It is also known as pig enterotoxemia. The disease affects new born piglets. They are normal at birth but become dull, depressed ,exhibit diarrhea, dysentery and most die. Whole litters are usually affected. (Blood and Radostits, 1994)

4.15.2 Distribution.
The disease is most often reported in the USA, UK and Denmark. It has been diagnosed in Norway in 1984 and again in 1998 (Lium, pers.com.).It is a notifiable disease in Norway.

4.15.3 Impact of introduction.
The disease can cause large losses in individual farms but would not be expected to spread widely because it is not highly contagious. Once a farm is infected organism can survive for long periods and would be expected to persist indefinitely causing repeated outbreaks.

4.15.4 Routes of introduction
The organisms are found in the feces of infected animals so that introduction would be by fecally contaminated materials or animals.

4.15.5 Preventing entry.
Preventing the entry of fecally contaminated materials or animals..

4.15.6 Conclusions and comments
No comments.

4.16 Porcine respiratory and reproductive syndrome (PRRS) - Norway List B154

4.16.1 The disease
PRRS is an acute, highly contagious disease of swine caused by an Arterivirus. It is characterized by high morbidity and reproductive problems including abortions, stillbirths, mummies and respiratory disease.

4.16.2 Distribution.

It was first reported in the USA in 1987 and shortly after in Europe. Since that time it has become well established in many areas of the world. PRRS has never been found in Norway. A surveillance program for PRRS has been on going since 1995. It is a notifiable disease in Norway.

4.16.3 Impact of introduction.

The disease can cause large losses in individual farms and would be expected to spread widely because it is highly contagious.

4.16.4 Routes of introduction

The disease is characterized by long period of viremia and shedding after recovery from the disease. Seropositive animals can shed the virus. The virus can be shed in semen.

4.16.5 Preventing entry.

Preventing the entry of infected animals and semen should be effective. However, existing testing procedures and test regimens allowed by the EØS appear to be inadequate to guarantee that no infected animal enters Norway (Paisley,1997). The risk of introduction of PRRS will increase in proportion to the number of pigs imported from infected countries.

4.16.6 Conclusions and comments

It seems inevitable that PRRS will eventually be introduced to Norway if importation of swine increases. The impact of introduction depends on how quickly it is recognized and what steps are taken to contain the outbreak. Great Britain and Malta both isolated by water both became infected despite substantial controls on live pig and pigmeat imports. South Korea banned all imports from infected countries but still became infected.

5. Risks associated with the importation of sheep, goats and their products.

As was the case with cattle and swine, the risks associated with the increased import of sheep, goats and products will be discussed in terms of diseases of each, multiple species diseases where sheep or goats are the primary host and zoonotic diseases. The discussion will begin with the OIE List A diseases followed by Norwegian List A diseases, the OIE and Norwegian List B diseases, the FAO List C diseases and miscellaneous diseases.

The OIE List A diseases include:

- Peste des petits ruminants
- Bluetongue
- Sheep and goat pox

The OIE List B diseases include:

- **Ovine epididymitis B151**
- caprine and ovine brucellosis B152
- **Contagious caprine pleuropneumonia**

Norway List A (additional)

- **Sheep mange**

Norway List B (additional)

- **Border disease**
- **Footrot**
- **Enzootic abortion of ewes**
- Ovine pulmonary adenomatosis
- Nairobi sheep disease
- Salmonellosis Sal. abortus ovis
- Scrapie
- Maedi-visna
- Caprine arthritis/encephalitis
- Contagious agalactia

5.1 Peste des petits ruminants (PPR) - OIE List A050
Peste des petits ruminants is a disease similar to rinderpest that is caused by a paramyxovirus closely related but distinct from the virus of rinderpest.

5.1.1 The disease.
PPR is characterized by high fever, necrotic stomatitis and gastroenteritis, severe diarrhea and dysentery in goats. Mortality rates in epizootics may reach 90-100% in naive populations and 30-50% where the disease is endemic. Sheep are easily infected but usually don't develop severe clinical signs (Blood and Radostits, 1989)

5.1.2 Distribution.
Like Rinderpest, PPR is present in much of Africa, the Middle East, and Asia.

5.1.3 Impact of introduction.
In addition to the high morbidity and mortality associated with outbreaks, the costs associated with control/eradication would be enormous. All trade in live ruminants would cease as well as trade in meat and meat products for at least 12 months after the disease has been eradicated.

5.1.4 Routes of introduction
Transmission is primarily by close contact between infected and non-infected animals and by the nasopharygeal route. However, pigs can be infected by the oral route through eating meat from infected animals and later transmit the disease to other animals and species. Introduction to a previously free country is most often by the importation of infected animals, especially to zoos, meat from infected animals can also infect pigs.

5.1.5 Preventing entry.

Importation of live ruminants and pigs should only be permitted from countries/zones free of rinderpest and peste de petits ruminants. A country can be considered free if rinderpest has not occurred for a period of 3 years or 6 months if a stamping out policy was carried out. Meat and meat products should be only from animals that passed ante- and post-mortem inspection
and have been cooked or processed such that the virus is inactivated. Semen and embryos should originate from unaffected donors and be collected, processed and stored in accordance with recommendations of the IAHC and the IETS.

5.1.6 Conclusions and comments
Although the consequences of introducing rinderpest or PPR would be severe the probability of entry through official trade seems remote provided the recommendations in the IAHC are followed. The need for bio-security at swine facilities to prevent exposure to infected materials cannot be over-emphasized.

5.2 Bluetongue - OIE List A090

5.1.1 The disease.
Bluetongue (BT) is a disease of sheep and occasionally of cattle and other ruminants caused by an orbivirus and transmitted by insects. It is characterized by catarrhal stomatitis, rhinitis and enteritis, lameness and coronitis. There are at least 20 distinct serotypes of the virus. Cattle seem to be the primary reservoir host. In new introductions morbidity may reach 50-75% and mortality from 20-50%. Abortions and congenital malformations occur in both cattle and sheep (Blood and Radostits,1989).

5.1.2 Distribution.
BT is widespread in Africa but has occurred in a variety of locations including India, the West Indies, Brazil, Cyprus, Japan, Israel, the USA, Portugal and Spain. The distribution is somewhat defined by the presence of the primary vectors, *Culicoides spp*. *Aedes lineatopinus* and *Melophagus ovinus* are the other known natural vectors (Blood and Radostits,1989)

5.1.3 Impact of introduction.
Although the losses from the disease are severe in newly affected herds and areas the disease becomes endemic and losses vary with the availability of the vector. The losses associated with trade in ruminants may be greater because many countries have very

restrictive rules regarding the import of ruminants, meats and semen from areas where BT exists.

5.1.4 Routes of introduction
The routes of introduction include infected ruminants and infected insects. Semen form infected bulls can transmit the virus. The virus can exist in the presence of antibodies. Properly collected and processed embryos pose little or no risk.

5.1.5 Preventing entry.
Prevention of entry of the diseases into a country that has natural barriers against uncontrolled livestock entry depends on quarantine measures to prevent introduction of any ruminant form countries where the disease occurs and adequate treatment of aircraft to prevent entry of infected insects. Some procedures exist to minimize the risk of importing semen and embryos.

5.1.6 Conclusions and comments
Once BT becomes endemic in an area vaccination seems to be the only feasible method of control.

5.3 Sheep and goat pox - OIE List A100

5.3.1 The disease.
The diseases are highly infectious and caused by capripoxviruses. The virus of sheep pox affects only sheep. The disease in goats is similar to that in sheep but is caused by an antigenically distinct caprivirus. Sheeppox is the most serious of all pox diseases of animals often causing death in up to 50% of infected animals. Goatpox is even more severe (Blood and Radostits,1989).

5.3.2 Distribution.
Sheeppox is restricted in its distribution to the Middle East, Southeastern Europe, Scandinavia, North Africa, China, India and Russia. It was last reported in Norway in 1882.

5.3.3 Impact of introduction.
The death losses and the impact on trade make these pox diseases serious, indeed. Most countries prohibit the import of animals and animal products from countries affected by either disease. The disease is controlled by a stamping out policy in many countries.

5.3.4 Routes of introduction.
The diseases are highly contagious with direct transmission by contact being most important. Spread by contaminated article and inhalation also occur. The diseases can be spread by stableflies (*Stomoxys calcitrans*).

5.3.5 Preventing entry.
Prohibition of importation from infected areas.

5.3.6 Conclusions and comments

5.4 Ovine epididymitis - OIE List B151

5.4.1 The disease.
The disease is caused by infection with *Brucella ovis.* The primary effect of the infection is epididymitis in rams. It also is associated with abortion in ewes in New Zealand. The disease is transmitted venereally (Blood and Radostits,1989).

5.4.2 Distribution.
The disease has been reported in Australia, New Zealand, The USA, South Africa and Europe. It has not been reported in Norway.

5.4.3 Impact of introduction.

Infertility in infected rams would be the major impact. Abortions do occur but the incidence is not high. Eradication in infected flock can be achieved in 2-3 years by testing and culling infected rams.

5.4.4 Routes of introduction.
Importation of infected rams is the primary route. However, semen from infected rams can transmit the disease to ewes. Young rams are infected by sodomy.

5.4.5 Preventing entry.
Testing of all imported rams by ELISA or CF. Infected rams have poor semen quality thus would not usually be suitable as semen donors. The disease would be easily transmitted to ewes by insemination with infected semen.

5.4.6 Conclusions and comments
Introduction of infected rams would result in a local outbreak of the disease a single flock. If the rams are not routinely evaluated for fertility including palpation of the testes and epididymis the disease may go undetected for an extended period, thus increasing the probability of spread to other flocks.

5.5 Caprine and ovine brucellosis - OIE List B152

5.5.1 The disease.
Brucellosis in goats and sheep is caused by *Brucella mellitensis. Br. mellitensis* infection in humans causes “Malta” or “Mediterranean” fever and is a serious zoonosis. *Br. mellitensis* is capable of infecting most species of domestic animals and seems to be increasing in prevalence in cattle. Late term abortion storms are the most common clinical sign in goats and sheep (Blood and Radostits, 1989).

5.5.2 Distribution.
Originally the disease was observed in southern Europe but has since occurred in Central and North America and Africa. It has not been reported in the UK or Scandinavia.

5.5.3 Impact of introduction.
Br. mellitensis is a major cause of reproductive problems in countries where it occurs. It is also more difficult to control and eradicate than *Br. abortus.* Because of the serious threat to human health the disease usually requires an official nationwide control/eradication program.

5.5.4 Routes of introduction.
Infected animals, semen, and unpasteurized milk and uncooked meat products are all possible means of introduction of the disease.

5.5.5 Preventing entry.
Restricting imports to countries that have official Brucellosis control programs is recommended. No other specific safeguards appear necessary.

5.5.6 Conclusions and comments

5.6 Contagious caprine pleuropneumonia- OIE List 155

5.5.1 The disease.
The disease is one of several in sheep and goats caused by *Mycoplasma spp*. Contagious caprine pleuropneumonia is caused by *M. mycoides* subsp.*capri*. Blood and Radostits, 1994 state that the disease is caused by Mycoplasma strain F38 which is not the same as *M. mycoides* subsp. *capri*. For the purposes of the OIE Code, contagious caprine pleuropneumonia (CCPP) is defined as a disease of goats caused by *Mycoplasma capricolum subsp. capripneumoniae*. The incubation period for the disease shall be 45 days (chronic carriers occur). The FAO defines the disease as being caused by *M. mycoides* subsp.*capri*, *mycoides* or F38 (PANIS, 1999). The disease is severe with a morbidity of near 100% and a case mortality rate of 60-100%. Clinical signs and necropsy lesions a similar to CBPP.

5.6.2 Distribution.
Given the difficulty in defining the disease the distribution is also difficult to determine. However, it appears to occur mainly in Asia, India, southern and eastern Europe and Northern Africa. It has not been reported in Norway but has in Sweden. It was last reported in Sweden in 1883.

5.6.3 Impact of introduction.
The disease is easily transmitted and losses in infected herds are severe. Many countries prohibit importation of goats, meat, semen or embryos from infected countries.

5.6.4 Routes of introduction
The organism does not survive in the environment so introduction is by an infected animal or carrier. Semen and embryos presumably can spread the disease.

5.6.5 Preventing entry.
Prohibition of importation of live domestic or wild goats, semen and embryos from infected countries.

5.6.6 Conclusions and comments
The disease is very serious in terms of direct losses and losses due to control and eradication.

5.7 Caprine arthritis/encephalitis - OIE List 153

5.7.1 The disease.
Caprine arthritis/encephalitis (CAE) is a viral disease of goats characterized by either acute encephalitis, chronic arthritis of the carpal joints, severe enlargement of the udder, indurative mastitis or chronic pneumonia. It is caused by a lentivrus of the family Retroviridae and is similar to the virus of Maedi-Visna. There are two antigenically different strains (Blood and Radostits, 1989).

5.7.2 Distribution.
The disease is recorded in the UK, US, Canada, Australia and much of western and northern Europe including Norway.

5.7.3 Impact of introduction.
The disease is already present in Norway so re-introduction would have little impact.

5.7.4 Routes of introduction
Transmission is primary through colostrum and milk. Some horizontal transmission is possible for example in milking parlors.

5.7.5 Preventing entry.
Testing of goats prior to importation or importation only from free flocks.

5.7.6 Conclusions and comments

5.8 Contagious agalactia - OIE List 154

5.8.1 The disease.
The disease is one of sheep and goats caused by *Mycoplasma agalactiae.* It is characterized by an acute onset of mastitis, opthalmitis and arthritis. Mortality rate is 10-30% and the udder is permanently damaged. Abortions are common and a long period of recovery of 1 to several months occurs (Blood and Radostits, 1989).

5.8.2 Distribution.
The distribution is approximately the same as that for CCPP. The disease has never been reported in Norway.

5.8.3 Impact of introduction.

The entire sheep and goat population is Norway is susceptible so that an outbreak could have serious consequences if the disease spread.

5.8.4 Routes of introduction.
The disease organism probably cannot survive in the environment therefore would have to be introduced by an infected animal.

5.8.5 Preventing entry.
The IAHC rules are very general requiring only a health certificate stating the animal came from a herd free of the disease for 6 months prior, was free signs of the disease at export and had been in isolation for 21 days before export.

5.9 Maedi-visna - OIE List B161

5.9.1 The disease.
The disease is a chronic pneumonia of sheep (Maedi) which is caused by a lentivirus of the family Retroviridae. When the virus invades the brain it causes Visna. It also causes arthritis, indurative mastitis and illthrift (Blood and Radostits, 1989).

5.9.2 Distribution.
MV is probably distributed worldwide except in New Zealand and Australia. It is present in Norway.

5.9.3 Impact of introduction.
Since the disease is present in Norway further introduction would impact only the importer and contacts. A nation-wide control program has been underway since 1975. The program was apparently successful and in 1994 all restrictions were lifted. The disease was diagnosed again in 1995.

5.9.4 Routes of introduction
Infected animals especially rams are associated with the introduction and transmission of the disease. The Texel breed seems to be heavily infected.

5.9.5 Preventing entry.
For sheep and goats for breeding the presentation of an international animal health certificate attesting that: animals over 1 year of age were subjected to a diagnostic test for maedi-visna with negative results during the 30 days prior to shipment; maedi-visna was neither clinically nor serologically diagnosed in the sheep and goats present in the flocks of origin during the past 3 years, and also that no sheep or goat from a flock of inferior health status was introduced into these flocks during that period

5.9.6 Conclusions and comments

5.10 Scrapie

5.10.1 The disease.
The disease is a non febrile, fatal, chronic disease of sheep and goats which is caused by a prion. When the prion invades the brain it causes a spongiform encephalopathy. It causes pruritis, abnormalities of gait and death. The incubation period is several years (Blood and Radostits,1989).

5.10.2 Distribution.
Scrapie is probably distributed worldwide except in New Zealand and Australia. It is enzootic in the UK and much of Europe and it is present in Norway.

5.10.3 Impact of introduction.
There is no evidence that scrapie can be transmitted to humans. However, because of it’s similarity to BSE that can be transmitted to humans there is great concern over it’s presence in any country. Since the disease is present in Norway further introduction would impact only the importer and contacts. A nation-wide control program is underway but lack of a suitable method of diagnosis there seems little hope of achieving success in a reasonable time and at an affordable cost.

5.10.4 Routes of introduction
Infected animals are associated with the introduction and transmission of the disease. There is both vertical and horizontal transmission of the agent. It is believed that oral transmission from contaminated feeds is likely and has been accomplished experimentally

5.10.5 Preventing entry.
Because there is no currently available test with high sensitivity to diagnose scrapie in a living animal there is no realistic way to prevent entry of the disease if sheep are imported from areas/flocks where scrapie exists.

5.10.6 Conclusions and comments
There are some promising ante-mortem tests for scrapie under development that may allow successful diagnosis and eventual eradication of scrapie. Thus far efforts to control/eradicate scrapie on a national basis have proven unsuccessful and very expensive.

5.11 Ovine pulmonary adenomatosis - OIE List B157

5.11.1 The disease.
The disease is a chronic, progressive pneumonia of sheep which is caused by a virus of the family Retroviridae. It affects only sheep but has been experimentally transmitted to baby goats. The disease is 100% fatal. It has a long incubation period, from 5 months to several years (Blood and Radostits,1989)

5.11.2 Distribution.
The disease is recorded in Britain, the US, Canada, Europe, South Africa, Israel, Asia and Iceland. Britain and Scotland appear to be the foci where other outbreaks have arisen (Blood and Radostits,1989). It has never been reported in Norway.

5.11.3 Impact of introduction.
The introduction of the disease to Iceland resulted in an epidemic with high death losses.. Eradication was accomplished by slaughtering all sheep in the affected areas.

5.11.4 Routes of introduction
Infected animals are associated with the introduction and transmission of the disease. Closed housing during the winter facilitates spread. Transmission is by inhalation of droplets.

5.11.5 Preventing entry.
(The IAHC does not list any specific recommendations for OPA but I assume they would be similar to those for Maedi-Visna because of the similar etiology).

For sheep and goats for breeding the presentation of an international animal health certificate attesting that: animals over 1 year of age were subjected to a diagnostic test for maedi-visna with negative results during the 30 days prior to shipment; maedi-visna was neither clinically nor serologically diagnosed in the sheep and goats present in the flocks of origin during the past 3 years, and also that no sheep or goat from a flock of inferior health status was introduced into these flocks during that period.

5.11.6 Conclusions and comments

5.12 Nairobi sheep disease - OIE List B158

5.12.1 The disease.
Nairobi sheep disease (NSD) of East African goats and sheep is caused by a bunyavirus . It is transmitted transtadially and transovarially by the tick *Rhipicehalus appendiculatis.* It is

characterized by fever, anorexia, nasal discharge, dyspnea, diarrhea and abortion in pregnant ewes (Blood and Radostits, 1989).

5.12.2 Distribution.
NSD occurs only in East Africa

5.12.3 Impact of introduction.
The disease can result in mortality rates of 70%.

5.12.4 Routes of introduction
Infected animals are associated with the introduction and transmission of the disease. Transmission would depend on the presence of the tick vector.

5.12.5 Preventing entry.
Prevention of entry of tick infested sheep and goats. Acaracide treatments.

5.12.6 Conclusions and comments
Blood and Radostits, 1989 devote 13 lines to NSD so its importance cannot be great.

5.13 Salmonellosis (Sal. abortus ovis) - OIE List B159

5.12.1 The disease.
Salmonella abortusovis is a relatively uncommon cause of abortions in ewes. Spread is by carrier animals. The reservoir is infected animals that don't abort. Venereal spread has been postulated. The infection can be present in semen. Other *Salmonella spp*. including *S. dublin* and *S. typhimurium* are probably more important (Blood and Radostits, 1989).

5.13.2 Distribution.
Very scant information on distribution is available. It has been reported in many African, Middle East and European countries. It is not present in Norway (HandiSTATUS, 1998).

5.13.3 Impact of introduction.
Since the disease is not present in Norway introduction would seriously impact the ongoing efforts to maintain a very low prevalence of *Sal. spp* in Norway .

5.13.4 Routes of introduction
Infected carrier animals, rams and semen are associated with the introduction and transmission of the disease.

5.13.5 Preventing entry.
The IAHC contains no information regarding import/export recommendations.

5.13.6 Conclusions and comments

5.14 Sheep mange - OIE List C706 - LIST A IN NORWAY

5.14.1 The disease.
Psoroptic mange is of most importance in sheep where it causes sheep scab or sheep mange but it can also affect cattle, horses, goats and rabbits *Psoroptes ovis* affects sheep. Several other *Psoroptes spp*. affect other animals (Blood and Radostits, 1989).

5.14.2 Distribution.
Sheep mange was once widely distributed but has been eradicated from most progressive countries where wool production is important. It is a reportable disease in most countries and most cases are subject to movement restriction, mandatory treatment etc. It is not present in Norway???

5.14.3 Impact of introduction.
Psoroptic mange is a major cause of losses to the sheep industry because of loss of wool quality as well as illthrift due to the irritation. It also causes losses in cattle especially in feedlot or other close confinement.

5.14.4 Routes of introduction
Infested animals and inanimate objects such as wool, sheers, clippers, combs, blankets are capable of transmission of the mite.

5.14.5 Preventing entry.
Mandatory treatment with an approved acaracide of all animals from infected areas. Restrictions on the movement of animals from infested premises aids in the prevention of spread of this disease.

5.14.6 Conclusions and comments

5.15 Border disease - Norway List B - Not Listed by OIE or FAO

5.15.1 The disease.
Border disease is a congenital disease of lambs caused by a pestivirus of the family Togaviridae. The virus is closely related to the viruses of BVD and Classical Swine Fever. Affected lambs are characterized by long hairy coats, tremors, CNS demyelination, inferior growth, skeletal deformities and are often persistently infected with the virus. Goats are occasionally infected with the virus. The affected lambs are infected in-utero (Blood and Radostits, 1989).

5.15.2 Distribution.
The disease has a somewhat spotty reported distribution worldwide where sheep are grown. It has been reported in Norway.

5.15.3 Impact of introduction.
Since the disease is present in Norway introduction would impact the ongoing efforts to maintain a very low prevalence the disease in Norway.

5.15.4 Routes of introduction
The primary source of infection, introduction and transmission of the virus are persistently infected animals.

5.15.5 Preventing entry
Preventing further entry of the BD virus would be extremely difficult if the importation of sheep or goats is allowed. Sero-positive animals have a lifelong immunity to the strain they were infected with but possibly not to other strains. Persistently infected animals usually are sero-negative and require demonstration of the virus through viral isolation or ELISA testing to detect. Both methods lack 100% sensitivity. Semen should be only from rams who have undergone a series of tests to demonstrate freedom from infection.

5.15.6 Conclusions and comments

6. Risks associated with the importation of poultry and their products.

As was the case with cattle, swine, sheep and goats the risks associated with the increased import of poultry and poultry products will be discussed in terms of diseases where poultry are the primary host and zoonotic diseases. The risks associated with importation of poultry and poultry products are quite different when one considers whether hatching eggs, day old chicks or older birds are imported. Regarding poultry products the type or processing is of utmost importance. The discussion will begin with the OIE List A diseases followed by Norwegian List A diseases, the OIE and Norwegian List B diseases, the FAO List C diseases and miscellaneous diseases. Unless specifically cited differently disease information was taken from Diseases of Poultry, 10th Edition, B.W.Calnek (ed.), Iowa State University Press, Ames. 1997.

The OIE List A diseases include:

- Fowl Plague A150
- Newcastle Disease A160

The OIE List B diseases include:

- Avian infectious bronchitis-B301
- Avian infectious laryngotracheitis 302 Norway A
- Avian tuberculosis B303
- Duck hepatitis B304
- Duck enteritis virus B305
- Fowl cholera B306
- Fowl pox B307
- Fowl typhoid *S. gallinarum B308*
- Infectious bursal disease B309
- Marek's disease B310
- Mycoplasmosis B311
- Avian chlamydiosis B312
- Pullorum *S. pullorum B313*

6.1 Fowl plague - Highly pathogenic avian influenza (HPAI) OIE List A150

6.1.1 The disease.
The disease caused by influenza A viruses in chickens and turkeys historically has been called "fowl plague". It describes an infection with a virulent strain with clinical signs including lacrimation, respiratory distress, sinusitis, edema of the head, cyanosis and diarrhea. Sudden death may be the only sign. Clinical signs vary greatly depending on the host, age, presence of other infections and environmental conditions. Morbidity and mortality make reach 100%. Highly pathogenic strains are defined by the OIE as being able to produce death in at least 6 of 8 susceptible -8 week old chickens within 10 days of intravenous inoculation. (MAF, 1999). All reported HPAI outbreaks have been due to H5 or H7 subtypes. AI viruses may be zoonotic.

6.1.2 Distribution.
Avian influenza viruses in the natural hosts, waterfowl, have a worldwide distribution. During 1997, there were HPAI outbreaks in Hong Kong and Australia (MAF, 1999). HPAI has never been reported in Norway

6.1.3 Impact of introduction.
Losses to the poultry industry could be huge if HPAI were introduced to Norway. Chickens, turkeys or duck could be affected. Individual producers would have losses and the cost of control would be large. Infection of the wild bird population could establish a reservoir that would threaten domestic poultry production. There is no evidence that AI becomes endemic in poultry.

6.1.4 Routes of introduction
Introduction by migratory waterfowl is the most common route. Transmission appears to be by respiratory aerosols, directly or by contaminated water or food. The fecal oral route is the most important route. Transmission is not possible by feeding the muscle of viremic birds.

6.1.5 Preventing entry.
Since most outbreaks are associated with migratory waterfowl little can be done to prevent the most common cause of outbreaks. Although the likelihood of introduction by chicken meat was considered remote, New Zealand established recommendations for risk management. The OIE, IAHC list a number of specific recommendations for the importation of poultry, wild birds, eggs, poultry meat, poultry products, and semen that are pertinent to both HPAI and Newcastle disease. They will not be listed here.

6.1.6 Conclusions and comments
It does not seem likely that increased trade would have a significant impact on the risk of introduction of HPAI.

6.2 Newcastle disease - OIE List A160

6.2.1 The disease.
Newcastle disease (ND) is caused by a member of the genus Rubulavirus in the family Paramyxoviridae. There are 9 avian paramyxoviruses in this genus. ND is caused by avian

paramyxovirus type 1 (PMV-1). All birds are susceptible to ND viruses but pathogenicity varies. The spectrum of virulence is from inapparent infection to 100% mortality. There are 5 different pathotypes based on the clinical signs induced in chickens. The velogenic viruses have the greatest virulence. Humans are susceptible to ND. However, clinical signs are usually confined to conjunctivitis with no systemic manifestations (MAF, 1999).

6.2.2 Distribution.
Widespread vaccination has somewhat limited the geographical distribution of ND but most poultry raising countries have had outbreaks in recent years. Epidemics are common in Africa, Asia, Central and South America. Australia has an ongoing outbreak at this writing (ProMed-AHEAD Digest,1999). An outbreak of ND occurred in 1 flock in Norway in 1997. Extensive surveillance of nearby flocks demonstrated that this outbreak did not spread. Serological evidence of ND has been found since that time but clinical outbreaks have not occurred.

6.2.3 Impact of introduction.
ND is a List A disease and by definition has a severe impact in the poultry industry, national interests and international trade.

6.2.4 Routes of introduction
Many means of ND introduction and spread have been reported including: Movement of live wild/pet/exotic/ game birds, movement of commercial poultry, movement of animals people and equipment, movement of poultry products, airborne spread, insects, contaminated feed and litter, contaminated water and vaccines. Vaccinated birds can also transmit the virus if they are sub-clinically infected. ND virus is primarily spread by inhalation or ingestion. Meat can contain sufficient virus to transmit the virus if it is ingested by susceptible birds. Backyard flocks an wild birds would most likely be infected by this route but could spread the virus to other birds and eventually commercial flocks.

6.2.5 Preventing entry.
Because of the difference in definition of what constitutes ND formulation of a list of precise recommendations is difficult. The EU has a more stringent definition than the OIE. The OIE IAHC lists specific recommendations for the importation of poultry that will not be duplicated here. Suffice to say that live birds, poultry meat, other poultry products and semen should only be imported from countries or zones free of the disease for a specified period of time. New Zealand has published a quantitative risk analysis for the introduction of avian paramyxoviruses in chicken or turkey meat. The main hazard identified was infection of backyard flock through eating scraps of imported chicken meat. The recommendations were to import fresh meat only if the entire consignment is not vaccinated for PMV-1 or come from an country or zone free of infection with PMV-1 with an intracerebral pathogenicity index (ICPI) greater than 0.0. Cooked meat products (If properly heated) pose no risk (MAF, 1999).

6.2.6 Conclusions and comments.

6.3 Avian infectious bronchitis - OIE List B301

6.3.1 The disease.
Avian infectious bronchitis (IB) is caused by a coronavirus. It is an acute contagious disease of chickens characterized by respiratory signs. IB may cause high morbidity and mortality in young chicks but may be inapparent in older birds or involve respiratory, renal or reproductive signs and decreased egg production. IB causes poor weight gain and feed efficiency and is associated with mixed infections such as air sacculitis (MAF, 1999).

6.3.2 Distribution.
IB viruses are distributed worldwide but virulence and tissue tropism varies. It is found in most European countries and vaccination is practiced. There is serological evidence that it is present in Norway (PANIS, 1999).

6.3.3 Impact of introduction.
IB can cause considerable losses to the poultry industry through mortality, reduced growth rate, nephritis, reproductive problems, reduced egg quality and quantity and condemnation of broilers.

6.3.4 Routes of introduction
The disease can be spread by respiratory, fecal-oral and mechanically. Importation off infected live birds of meat from infected birds would be likely routes of introduction. The virus can be present on eggs and presumably in semen. Vaccinated birds may carry the virus.

6.3.5 Preventing entry.
The OIE recommends only that live birds come from a IB free flock, not show clinical signs if not vaccinated or be vaccinated with a approved vaccine. Hatching eggs should only come from free flocks. Chicken meat with the organs (lung, liver etc.) removed should present minimal risk. The virus survives well in frozen tissues.

6.3.6 Conclusions and comments
IB is so wide spread that introduction through increased imports of live chickens seems likely. Vaccination would have to be done to avoid high economic losses if the more virulent strain became established.

6.4 Avian infectious laryngotracheitis - OIE List B302; Norway List A

6.4.1 The disease.
Laryngotracheitis (LT) is a viral disease of chickens characterized respiratory depression, gasping, expectoration of bloody mucous and high mortality. Mild enzootic forms of the disease are becoming increasingly more frequent (Galnick (ed), 1997).

6.4.2 Distribution.
LT has been recognized in most countries and vaccination is widespread. It was last reported in Norway in 1999 in a hobby flock. It often persists in backyard and fancier flocks.

6.4.3 Impact of introduction.
LT outbreaks can result in high mortality in susceptible flocks. In most areas of intensive poultry production vaccination results in effective control. It is likely that the disease would be under the Norwegian stamping out policy if an outbreak occurred so that the impact would depend on how quickly the disease was recognized and stamped out. LT is relatively easy to contain and to wipe out.

6.4.4 Routes of introduction
The most likely means of introduction would be the entry of infected birds. Both recovered birds and vaccinated birds can carry the virus for long periods. The virus is thought to persist in back yard and fancier flocks. Mechanical transmission by contaminated articles could also occur.

6.4.5 Preventing entry.
Allowing entry of live birds that originate from LT free flocks only. Hatching eggs should also be only from free flocks. Shipping containers should be new and unused.

6.4.6 Conclusions and comments
If LT were introduced the short term consequences may be quite severe. However, the disease can be effectively controlled through vaccination or eradicated effectively.

6.5 Avian tuberculosis - OIE List B303;

6.5.1 The disease.
Tuberculosis of poultry (ATB) is a chronic, infectious disease caused by *Mycobacterium avium*. It will persist in a flock once established and tends to produce unthriftiness, decreased egg production and finally death (Galnick (ed), 1997)..

6.5.2 Distribution.
ATB in chickens occurs worldwide but most frequently in the North Temperate zone. It is widespread in Europe but has not been recently diagnosed in Norway. It is not a significant problem in commercial flocks. Because of the difficulty in testing all birds the prevalence is

usually unknown. Most diagnoses are made at post mortem. All birds appear to be susceptible to ATB. The disease is also common in zoos.

6.5.3 Impact of introduction.
Introduction and establishment of avian TB would be an undesirable event but would not have an enormous impact on the poultry industry. However, swine are very susceptible and should the infection become established in the swine the impact could be large. Immuno-compromised humans such as AIDS patients are increasingly becoming infected with avian TB. The organisms can persist in the environment for long periods so that if a premises becomes contaminated it will remain so indefinitely.

6.5.4 Routes of introduction.
The disease lesions are primarily in the intestinal tract and large number of organisms are shed in the feces. Thus fecally contaminated items, living or inanimate may transmit the disease. Post-mortem inspection at slaughter will not identify all infected carcasses so chicken meat could be a source. Eggs have been shown to contain the organism but transmission via eggs is considered unlikely.

6.5.5 Preventing entry.
Importing live birds, meat or eggs from certified free flocks should not constitute a risk. Traffic by people and products possible contaminated by bird feces should be minimized.

6.5.6 Conclusions and comments
A large number of domestic mammals are also susceptible to ATB and may maintain the infection. These infections and possibly just exposure to ATB are thought to contribute to the low specificity of the tuberculin test in the species.

6.6 Duck hepatitis - OIE List B304

6.6.1 The disease.
Duck hepatitis (DH) is a rapidly spreading, highly fatal disease of young ducklings characterized by hepatitis. Lesions are an enlarged liver mottled by hemorrhages. It can be caused by any of three different viruses designated as Duck hepatitis virus-1 (DHV-1), DHV type 2 (DH2) and DHV type 3 (DHV3). DHV 1 is an RNA type virus and is classified as a picornavirus (Galnick (ed), 1997)..

6.6.2 Distribution.
DHV1 has a worldwide distribution. However, the disease has not been reported in many countries. This may be due to the structure and importance of the duck industry. The disease has not been reported in Norway, Sweden or Finland but has been present in Denmark, the UK and parts of the EU.

6.6.3 Impact of introduction.
The impact of introduction is difficult to assess. There is no duck industry in Norway. Losses in individual flocks that raise duckling could be very high. The infection has been known to disappear from areas.

6.6.4 Routes of introduction
The virus spreads rapidly in infected broods. The exact means of transmission is unknown. The virus is excreted in feces for up to 8 weeks after recovery. Wild bird and rats are suspected of being reservoir hosts. Eggs do not seem to be involved in transmission. Vectors are not involved.

6.6.5 Preventing entry.
The IAHC, 1999 only lists recommendations of a general nature similar to all the other viral diseases of poultry. These include:
<u>for ducks,</u>
the presentation of an *international animal health certificate* attesting that the birds: showed no clinical sign of DVH on the day of shipment; come from *establishments* which are recognized as being free from DVH; have not been vaccinated against DVH; or have been vaccinated against DVH (the nature of the vaccine used and the date of vaccination shall also be stated in the certificate)..

for day-old ducks
the presentation of an *international animal health certificate* attesting that the day-old birds: come from *establishments* and/or hatcheries which are regularly inspected by the *Veterinary Authority* and from hatcheries which comply with the standards referred to in Appendix 4.2.4.1.; come from *establishments* and/or hatcheries which are regularly inspected by the *Veterinary Authority* and from hatcheries which comply with the standards referred to in Appendix 4.2.4.1.; have not been vaccinated against DVH; or have been vaccinated against DVH (the nature of the vaccine used and the date of vaccination shall also be stated in the certificate); are the progeny of parent flocks which: a) come from establishments and/or hatcheries which are recognized as being free from DVH; b) come from establishments and/or hatcheries in which vaccination against DVH is not practiced on the parent stock; or c) come from establishments and/or hatcheries in which vaccination against DVH is practiced on the parent stock; were shipped in clean and unused packages.

for *hatching eggs* of ducks
the presentation of an *international animal health certificate* attesting that the hatching eggs: have been disinfected in conformity with the standards referred to in Appendix 4.2.4.1.; come from *establishments* and/or hatcheries which are recognized as being free from DVH and from hatcheries which comply with the standards referred to in Appendix 4.2.4.1.; were shipped in clean and unused packages (IAHC, 1999).

6.6.6 Conclusions and comments
None.

6.7 Duck virus enteritis (Duck Plague)- OIE List B305

6.7.1 The disease.
Duck virus enteritis (DVE) is an acute, contagious herpesvirus infection of ducks, geese and swans characterized by vascular damage, tissue hemorrhages, digestive mucosal eruptions, lymphatic lesions and degeneration of parenchymatous organs. Outbreaks have occurred in commercial duck operations, free flying ansiformes , zoos and farm flocks (Galnick (ed), 1997).

6.7.2 Distribution.
DVE was first reported in the Netherlands in 1923 and since has been reported in the USA, China, France, Belgium, India, Thailand, England, Canada, Hungary, Denmark, Austria and Vietnam. It has never been recorded in Norway. DVE was once considered exotic to the USA but after several outbreaks in free-flying ducks and geese it is now considered endemic (MAF,1999).

6.7.3 Impact of introduction.
In duck producing areas the disease has caused significant economic losses in market ducklings and layers due to mortality, condemnations and decreased egg production. In addition, large losses in migratory waterfowl have occurred.

6.7.4 Routes of introduction
Most outbreaks have been associated with contact between domestic and wild ansiformes. Once introduced the virus can spread by direct and indirect contact especially through contact with contaminated premises and water. Egg transmission has not been document but is thought to occur.

6.7.5 Preventing entry.
Biosecurity at duck farms and following the IAHC recommendations for viral diseases of poultry are the only things that can be done to prevent entry.

6.7.6 Conclusions and comments
Due to the presence of the virus in wild populations of ducks, geese and swans any contact between these and domestic waterfowl should be minimized.

6.8 Fowl cholera - OIE List B306

6.8.1 The disease.
Fowl cholera is an infection of domestic and wild birds with *Pasteurella multocida.* It is a septicemic disease associated with high mortality but chronic and benign infections also occur. Of domestic species turkeys are most susceptible. Older birds are more susceptible than young birds. Chronic carriers are very common (Galnick (ed), 1997; MAF, 1999)..

6.8.2 Distribution.
Fowl cholera occurs sporadically or enzootically in most countries. Pasteurellosis occurs sporadically in Norway but it is not considered fowl cholera because of the mild signs.

6.8.3 Impact of introduction.
Further introductions to Norway would have minimal impact except in the affected farm.

6.8.4 Routes of introduction
Most routes of introduction to flocks are not identified but the carrier birds are suspect. Eggs do not appear to be important in transmission. Other animals such as pigs may be the source as may contaminated crates, feed bags, or equipment. Wild birds and rodents may also harbor the organism. Fecal oral transmission is not important (Galnick (ed), 1997; MAF, 1999)..

6.8.5 Preventing entry.
With the ubiquitous nature of the organism and the multiple sources there are few if any specific steps that can be taken to prevent further introductions. Sanitation, biosecurity and importation from *P. multocida* free flocks is recommended.

6.8.6 Conclusions and comments
None specific.

6.9 Fowl pox - OIE List B307

6.9.1 The disease.
Fowl pox is a common viral infection of domestic and wild birds with *Avipoxvirus* of the family *Poxviridae.* It is a slow spreading disease characterized by discrete nodular skin proliferations or fibrino-necrotic and proliferative lesions of the mucous membranes of the upper respiratory tract. The skin form usually has a low mortality but the respiratory form may caused large losses. Avian pox has no public health significance (Galnick (ed), 1997; MAF, 1999)..

6.9.2 Distribution.
Fowl pox occurs sporadically or enzootically in most countries. It has never been reported in Norway.

6.9.3 Impact of introduction.
Introductions to Norway would have minimal impact except in the affected farm. Control of the disease is by vaccination.

6.9.4 Routes of introduction
Transmission is primarily through direct contact but insects are important as mechanical vectors. Over 60 species of birds can be infected with the virus. Dried pox lesions and scabs contain large amounts of the virus so that contaminated feed and equipment may be important. The virus can also be easily transmitted by humans such as bird handlers.

6.9.5 Preventing entry.
With the ubiquitous nature of the organism and the multiple sources there are few if any specific steps that can be taken to prevent further introductions. Sanitation, biosecurity and importation from *pox* free flocks is recommended.

6.9.6 Conclusions and comments.
The numerous sources of pox virus make it very likely that it will eventually arrive in Norway.

6.10 Avian Salmonellosis

Fowl typhoid; *S. gallinarum* - OIE List B308
Pullorum *S. pullorum B313*

6.10.1 The diseases.

NOTE: For the sake of brevity the older nomenclature to identify the various different Salmonella will be used. The majority of this information was taken from Import risk analysis: chicken meat and chicken meat products; Bernard Matthews Food Ltd turkey meat preparations from the United Kingdom, Ministry of Agriculture Regulatory Authority, Wellingyon NZ, 1999.

Fowl typhoid and Pullorum disease are caused by the non-motile, host specific serotypes *S.gallinarum* and *S. pullorum*, respectively. Fowl typhoid is an acute or chronic septicemic disease of growing and mature chickens and turkeys. Pullorum disease is an acute systemic disease of chicks and poults. Other birds such as quail, pheasants, ducks, peafowl and guinea fowl are also susceptible. Mortality and morbidity rates vary widely but can reach 100% in some outbreaks. Neither organism is an important public health problem although humans infections can occur (Galnick (ed), 1997; MAF, 1999).

6.10.2 Distribution.
Although both diseases had nearly worldwide distributions in the past both have been eradicated for commercial flocks in most of the world. They are still problems in Central and South America, Africa and the Middle East. Recently outbreaks have been reported in Germany and Denmark. Fowl typhoid has never been reported in Norway and Pullorum was last reported in 1960. Norway has a national surveillance program for Salmonella spp. in cattle, swine and poultry. The number of isolates on a yearly basis is extremely low (MAF, 1999)..

6.10.3 Impact of introduction.
Both infections are highly adapted to chickens and turkeys so infections in other species are seldom a problem. Both diseases would cause a short economic losses until they were eradicated. Eradication costs would likely exceed those of the disease.

6.10.4 Routes of introduction
Live birds or hatching eggs both can introduce the disease to previously free flocks and countries. Chicken carcasses and uncooked meat could conceivably infect backyard flocks if they were fed these products. Once a flock is infected the infection will persist indefinitely thus being a constant threat to commercial poultry.

6.10.5 Preventing entry.
Live birds and hatching eggs should only be from flocks certified as free of both diseases. Chicken meat must be imported only from free countries or free zones or free flocks and the meat must be heated to a minimal internal temperature on 79°C. Microwave cooking is not permitted. Slaughter establishments should have a functioning HACCP plan to minimize the risk of contamination of the meat (MAF, 1999)..

6.10.6 Conclusions and comments
Avian Salmonella are among the few diseases that uncooked chicken or turkey meat was thought to be a significant threat to New Zealand. Norway's status of being virtually Salmonella free is similar to that of New Zealand in regard to these two diseases.

6.11 Paratyphoid Salmonellosis

6.11.1 The disease.
The paratyphoid Salmonella are a diverse group of serotypes that are mainly of concern because of their role in foodborne infections in humans. They are not host-specific and are found ubiquitously in domestic and wild animals and humans. They rarely cause disease in birds but are of some importance in mainly young animals where they cause gastrointestinal disease. They are often associated with neonatal diarrheas that may cause high mortalities. They are relatively resistant to various environmental factors thus can survive and cause re-infections. The two most important serotypes are *Salmonella typhimurium* (ST) and *S. enteritidis (SE).* Shedding of the organism for long periods after recovery and persistent infections are common (Galnick (ed), 1997; MAF, 1999)..

6.11.2 Distribution.
Both serotypes are widely distributed and can be found in commonly in foods of animal origin as well as rodents, pets. Eggs and egg products are the most common source for SE but ST can be found in a multitude of products from cattle, swine and poultry. Human carriers are also common. Norway is virtually free of both organisms in its animal and poultry herds and flocks yet salmonellosis in humans is a common diagnosis. It is suggested that the majority of human cases in Norway originate elsewhere (MSIS, 1998).

6.11.3 Impact of introduction.
The major impact of introduction of Sal. spp. to Norway would be a potential increase in the number of foodborne infections due to Salmonella in humans. In addition, efforts to re-eradicate the organisms would be costly and possibly unsuccessful if they become established in rodents, wild animals etc. and the environment becomes contaminated. *Sal. typhimurium* type DT104 is of special significance because of its severity and the fact that it is multi-antibiotic resistant.

6.11.4 Routes of introduction
Most routes of introduction to flocks are not identified but the carrier birds, rodents, contaminated feed and water, humans and eggs among many other things are suspect. Eggs appear to be important in transmission of SE to humans. Other animals such as pigs may be the source as may contaminated crates, feed bags, or equipment. Wild birds and rodents may also harbor the organism. Paratyphoid salmonella can be introduced to poultry flocks from many different sources and the wide host range produces many reservoirs. Contaminated feeds, and various animal and insect vectors are very important. Fecal contamination and

cross contamination of foods is the primary source for STM infections while uncooked eggs and egg products are the primary source for SE (Galnick (ed), 1997; MAF, 1999)..

6.11.5 Preventing entry.
With the ubiquitous nature of the organism and the multiple sources there are few if any specific steps that can be taken to prevent further introductions other than a complete ban on imports. Sanitation, bio-security, rodent control and importation from Salmonella free flocks are recommended but very few Salmonella free sources exist. Import testing of imported animals and products will likely have little significant impact if the volume of food imports increases. Cross contamination is a very serious problem.

The New Zealand recommendations for management of the risks associated with chicken meat include importing only from “free” countries or “free zones” or allowing importation if the country has a HACCP program approved by the government of New Zealand that ensures that the breeding flock, hatchery and rearing farms of poultry destined for export to New Zealand are free of S. typhimurium DT104 and *S. enteritidis* PT4 (MAF, 1999). These two serotypes have not been found in New Zealand. Other serotypes are commonly isolated in New Zealand.

6.11.6 Conclusions and comments
It seems to this author that increased trade will bring about an increase in Salmonella exposure to both the human and animal populations. Increased travel will likely also have an effect if, in fact, most infections are acquired out of country. At this time, safe food handling and preparation seem to be the consumer’s only real protection. However, control of the infection at the farm level holds promise. Irradiation of foods will effectively eliminate the organisms but cannot prevent cross-contamination from other sources.

6.12 Infectious bursal disease - OIE List B309

6.12.1 The disease.
Infectious bursal disease (IBD) is an acute, highly contagious disease if young chickens caused by the IBD virus, a member of the genus *Arbirnavirus* in the family *Birnaviridae*. The clinical signs are complicated by immunosuppression, a result of damage to the Bursa of Fabricus. Mortality is often low but may reach 100% with some of the newer strains. In many outbreaks the only signs are impaired weight gains. IBD serotype 1 (IBD1) viruses infect fowl and antibodies are widespread. There are many strains of IBD1. IBD2 viruses are widely distributed in turkeys but are not known to cause disease in any avian species (Galnick (ed), 1997; MAF, 1999).

6.12.2 Distribution.
IBD virus is distributed worldwide. It was first identified in Norway in 1977 and sero-reactions are seen but not commonly. Clinical disease is rare.

6.12.3 Impact of introduction.
Some strains of the virus are much more virulent than that which is now present in Norway so economic losses might be expected with further introductions. IBD1 causes disease only in chickens. IBD2 which is widespread in turkeys apparently does not cause disease so would pose no risk.

6.12.4 Routes of introduction
Large amounts of virus are shed in the feces of infected birds. Infection is by the oral route so that fecal contamination of feed, water, and the environment are important to the spread of the disease. New Zealand workers concluded that chicken meat posed a serious risk for the introduction of serotypes of the IBD1 virus more virulent than those already present in NZ (MAF, 1999).The virus could survive in the meat of an infected chicken up to 6 days after slaughter. The virus can be found in the meat up to 4 weeks after infection. In addition, the virus is extremely resistant to inactivation by heat or freezing.

6.12.5 Preventing entry.

Importation of chicken meat only from sources shown to be free of IBD and not vaccinated against the disease. Obviously the importation of live birds only from free sources should be allowed.

6.12.6 Conclusions and comments.
Introduction of the more severe strains of the IBD virus via the importation of chickens or chicken meat poses a significant risk to Norway.

6.13 Marek's disease - OIE List B310

6.13.1 The disease.
Marek's disease is the major disease problem in Norway. It is controlled by vaccination. Further introduction would have little impact.

6.14 Mycoplasmosis - OIE List B311

6.14.1 The disease.
Infection of chickens with *Mycoplasma gallisepticum* (MG) is called Chronic Respiratory Disease (CRD) and in turkeys it is called Infectious Sinusitis. It is characterized by respiratory rales, coughing, nasal discharge and in turkeys, sinusitis. Air sacculitis often results if there is a concurrent infection with a virus or bacteria. The disease is associated with significant condemnations at slaughter, reduced feed efficiency and egg production. Control costs such as antibiotics and vaccination can also be significant (Galnick (ed), 1997; MAF, 1999).

6.14.2 Distribution.
Mycoplasmosis is or was present in much of the world including Europe and Norway. Due to control efforts the disease has a low sporadic occurrence in most European countries nowadays (PANIS, 1999). Testing of commercial flock is Norway in 1995 revealed no reactors but positive non-commercial flocks were found (Royal Ministry of Agriculture, 1995)

6.14.3 Impact of introduction.
Further introductions to Norway would have significant economic impact in the affected farm. I would not expect the disease to become widely dispersed unless it were affecting a flock that produces replacements.

6.14.4 Routes of introduction
Transmission is by direct contact in adult birds. Transmission by contaminated objects is suspected but not documented. Eggs and semen are important in transmission.

6.14.5 Preventing entry.
This can only be accomplished by obtaining replacements and eggs form sources known to be free of MG. Serologic testing appears to be effective in establishing flock freedom from MG.

6.14.6 Conclusions and comments
There appear to be ways to effectively prevent the dissemination of MG. The threat of introduction from native infected flocks appears to be as great as those associated with increased trade.

6.15 Avian chlamydiosis - OIE List B312

6.15.1 The disease.
Avian chlamydiosis is caused by the bacterium *Chlamydia psittaci.* There are several different serovars of the agent. Several names for the disease have been coined depending on what species is infected. For example the disease in parrots and other psittacines is called psittacosis and in non-psittacines it is called ornithosis. They are considered to be the same disease nowadays. Humans are susceptible and the disease has of high public health significance. High and low virulence strains occur. The disease in birds is systemic and usually not fatal but mortality may reach 30%. Clinical signs include lethargy, hyperthermia,

abnormal excretions, nasal and ocular discharges, and reduced egg production. However, chickens are not very susceptible. Older birds may be asymptomatic but will shed the agent a long period of time. There was a pandemic involving 12 countries in 1929-30 and many human cases occurred (Galnick (ed), 1997; MAF, 1999).

6.15.2 Distribution.
Chlamydiosis is in most of the world including Europe and Norway. The most important reservoir is wild birds. The disease has a low sporadic occurrence in most European countries nowadays (PANIS, 1999). Most human infections are associated with caged birds.

6.15.3 Impact of introduction.
Further introductions to Norway would have significant economic impact except in the affected farm. I would not expect the disease to become widely dispersed unless it were affecting a flock that produces replacements.

6.15.4 Routes of introduction
Transmission is by direct contact in adult birds. Secretions and excretions contain large number of the agent. Contact with wild birds may be important in free ranging flocks. Transmission by contaminated objects and humans is suspected but not documented. Eggs and semen might be involved in transmission.

6.15.5 Preventing entry.
This can only be accomplished by obtaining birds from sources free of the disease. Many countries and the US prohibit movement of birds from infected flocks. Serologic testing should be required. Chicken and turkey meat were not considered to present significant risks to New Zealand poultry or humans (MAF, 1999).

6.15.6 Conclusions and comments
Because of its human health significance avian chlamydiosis is a relatively high profile disease but its significance in poultry is not great relative to some other List B diseases. In the USA, 70% of human infections are associated with caged birds.

7. Diseases of horses and other Equidae.

It is unknown if trade in horses and other equidae will increase as trade in other animals and animals products is expected too but the possibility is considered. Since these animals are not major food producing animals their impact on potential foodborne diseases will be minimal but not zero. As such, any risk associated with increased trade would primarily impact the equine industry with little impact on other livestock or human health. There are a few notable exceptions.

As was the case with cattle, swine, sheep and goats and poultry, the risks associated with the increased import horses and equine products will be discussed in terms of diseases where equidae are the primary host and zoonotic diseases. The discussion will begin with the OIE List A diseases followed by Norwegian List A diseases, the OIE and Norwegian List B diseases, the FAO List C diseases and miscellaneous diseases.

The OIE List A diseases include:

Vesicular Stomatitis	- A020, A021, A022, A023
African Horse Sickness	- A120

The OIE List B diseases include:

Contagious equine metritis	- B201
Dourine	- B202
Epizootic lymphangitis	- B203
Equine encephalomyelitis	- B204
Equine infectious anemia	- B205
Equine influenza (Type A)	- B206
Equine piroplasmosis (Babesiosis)	- B207
Equine viral rhinopneumonitis	- B208
Glanders	- B209
Horse pox	- B210

Equine viral arteritis	- B211
Japanese encephalitis	- B212
Horse mange	- B213
Salmonellosis	
(S. abortivoequi)	- B214
Surra	- B215
Venezuelan equine encephalomyelitis	- B216

7.1 Vesicular Stomatitis - A020, A021, A022 and A023

7.1.1 The disease

Vesicular stomatitis (VS) is an acute vesicular disease primarily of Equidae, Bovidae and Suidae but it can also affect white-tailed deer, rodents and humans. VS is a minor zoonosis. It is caused by *Vesiculovirus* of the family Rhabdoviridae. It has two strains, New Jersey and Indiana. Morbidity may reach 90% in herds. However, mortality rates tend to be low. It greatest importance is it's close clinical resemblance to FMD, Swine vesicular disease and Vesicular exanthema of swine. Lesions consist or vesicles and erosion of the nose and mouth areas, teats in cattle and the feet, especially in swine. In the US any vesicular disease is treated as FMD until FMD can be ruled out. Diagnosis can be by virus isolation (required for confirmation in the US), serum neutralization or ELISA tests. Horses are refractory to FMD. The incubation period is 21 days (IAHC, 1998, Blood and Radostits, 1989)

7.1.2 Distribution.

VS is, at present, only seen in the Americas but outbreaks in France and South Africa have been reported.

7.1.3 Impact of introduction.

The greatest impact of VS is its effect on trade. The diagnosis of any vesicular disease is usually followed by immediate quarantine, restriction of animal of movements and complete shut-down of exports of affected species and products until the etiology has been established and often for many months after the out break is over. Direct losses associated with the disease are usually not great. However, mastitis in dairy cattle associated with VS can be quite costly.

7.1.4 Routes of introduction and transmission.

Transmission is by contamination via the transmucosal or transcutaneous route. Transmission by arthropod vectors is important and transmission via soil and plants is suspected. There is some seasonal variation in occurrence, being more common during the rainy season in the tropics. In the temperate zone transmission usually ceases after the first killing frost. The virus is found in saliva, vesicular fluid and epithelium around the lesions.

Introduction would most likely be via importation of an infected animal. However, entrance of infected arthropod vectors and contaminated materials should be considered, The virus can survive long periods at low temperatures.

VS is a disease with a moderate to high risk of transmission by artificial insemination (AI) with infected semen. The risk of transmission via properly collected and processed embryos is low.

7.1.5 Preventing introduction.

When importing animals from free countries the IAHC recommends a health certificate attesting that the animals showed no clinical signs of VS on the day of shipment and came from a VS free country. If the free country borders an infected country a 30 day quarantine and a negative serological test 21 days after the beginning of the quarantine as well as protection from arthropod vectors. When importing animals from infected countries the IAHC recommends a health certificate attesting that the animals showed no clinical signs of VS on the day of shipment and came from an establishment where VS had not occurred for at least 21 days, a 30 day quarantine and a negative serological test 21 days after the beginning of the quarantine as well as protection from arthropod vectors.

7.1.6 Conclusions and comments.

Although the consequences of introducing VS would be severe due to the need to quickly differentiate the disease from FMD the probability of entry through official trade seems remote provided the recommendations in the IAHC are followed. The need for bio-security at export facilities to prevent exposure to infected materials and arthropods cannot be over-emphasized.

7.2 African Horse Sickness - A120

Extracted from Blood and Radostits, 1984).

7.2.1 The disease.

African horse sickness is a highly fatal, infectious disease of equidae caused by a number of strains of orbiviruses (family *Retroviridae*). It is spread by insect vectors. Acute, subacute and mild forms of the disease occur.

7.2.2 Distribution.

African horse sickness (AHS) is endemic in Africa south of the Sahara and has spread as far as the Middle East, eastern Mediterranean, Cyprus and Spain. The disease has great potential for spread and establishment in other countries and areas because of the ease in which the Culicoides vector can be transported by aircraft and winds.

7.2.3 Impact of introduction.

Mortality rates in horses can reach 90% but is somewhat lower in other equidae. Strict international controls of movements and imports of horses from areas where AHS exists make the disease very burdensome. Once established in an area AHS is nearly impossible to eradicate thus control costs can be heavy.

7.2.4 Routes of introduction

Introduction of AHS can occur with the entry of an infected animal or an infected insect vector. The spread of AHS to new areas is most often attributed to transport of the vector by aircraft or strong winds.

7.2.5 Preventing entry.

Preventing the entry of AHS by infected equidae can be accomplished by restricting the importation of equines from areas where the disease exists, vaccinating and quarantining prior to embarkation, quarantine in insect proof facilities on arrival and vaccinating all horses within a 16 kilometer area of the point of entry. The period of quarantine at the point of entry should be 30 days.

7.2.6 Conclusions and comments

The introduction of AHS to Norway is more likely to occur by transport of the infected vector than by importation of an infected animal or animal product.

7.3 Contagious equine metritis - B201

7.3.1 The disease.

Contagious equine metritis (CEM) is a sexually and congenitally transmitted disease of horses first identified in the UK in 1978. The causative agent is *Taylorella equigenitalis* a non-motile coccoid rod in the family *Pasteurellaciae.* The disease is characterized by an acute, gray mucoid vaginal discharge appearing 7-10 days after breeding. Mares often conceive and deliver foals that are infected in-utero or at birth. Stallions contract and spread the disease by natural service or by artificial insemination (Blood and Radostits, 1989).

7.3.2 Distribution.

Despite rigid controls on the movement of infected mares, stallions and semen CEM has been reported in many Western European countries, the US and Canada. CEM is present in Norway.

7.3.3 Impact of introduction.
Since CEM is already present in Norway further introduction would have little impact on a national level but the individual horse owner may have considerable disruption of normal equine activity.

7.3.4 Routes of introduction.
The disease would be introduced by an infected animal or semen. Virginal animals are not safe because of the in-utero or natal infections that occur.

7.3.5 Preventing entry.
Despite rigid testing protocols developed in the USA and elsewhere the disease has been re-introduced several times after it was first detected and eradicated form the USA.. Repeated, multiple site swabbing and cultures as well as mandatory antibiotic treatment of stallions is required to reduce the risk of introduction. Mares can be tested with a CF test, a latex agglutination test and polymerase chain reaction (PCR) test.

7.3.6 Conclusions and comments
Unless new technology is developed to detect infected animals CEM will continue to be a problem for the industry.

7.4 Dourine - B202

7.4.1 The disease.
Dourine is a contagious trypanosomiasis (*Trypanosoma equiperdum*)of horses transmitted by coitus and characterized by inflammation of the genitalia, cutaneous lesions and paralysis. Mortality may be 50-75% of cases
(Blood and Radostits, 1989).

7.4.2 Distribution.
Dourine is enzootic in Africa, Asia, South America, Southeastern Europe and a small area in the USA.
It has not been reported in Norway.

7.4.3 Impact of introduction.
Because of the ease in diagnosis of the disease it is very unlikely that it would not be contained and eradicated quickly. It would cause a temporary restriction of movements of horses outside of Norway.

7.4.4 Routes of introduction
The only means of introduction and transmission is by an infected animal. Non-clinical carriers occur.
Semen could potentially be a vehicle but no information was found concerning the possibility.

7.4.5 Preventing entry.
Prevention of importation of horses from enzootic areas would be prudent. A efficient complement fixation test is available to detect infected animals that can be successfully treated with anti-trypanosomal drugs.

7.5 Surra - B215

7.5.1 The disease.
Surra is a disease of horses and camels caused by *Trypanosoma evansoni*. It is transmitted by biting flies. Many feral animals can be infected and act as reservoirs (Blood and Radostits, 1989).

7.5.2 Distribution.

Surra has a wide distribution in North Africa, the Middle East, Asia, Central and South America. It has never been reported in Norway. The range is limited principally by the range of *Glossina* (tse-tse fly).

7.5.3 Impact of introduction.
Introduction would have little impact because the vector is not present.

7.5.4 Routes of introduction
Introduction would be by infected animals and vectors.

7.5.5 Preventing entry.
Same as dourine.

7.6 Epizootic lymphangitis - B203

7.6.1 The disease.
Epizootic lymphangitis is a chronic, contagious disease of horses characterized by suppurative lymphangitis, lymphadenitis and skin ulcers or pneumonia. It is caused by a fungus, *Histoplasma farciminosum* (Blood and Radostits, 1989).

7.6.2 Distribution.
Epizootic lymphangitis has a distribution in Africa, the Mediterranean, and Asia. It has never been reported in Norway.

7.6.3 Impact of introduction.
The impact of introduction would be moderate because the disease is chronic and capable of being spread by infected animals and contaminated materials.

7.6.4 Routes of introduction
Introduction would be by infected animals and contaminated materials including equipment, utensils, tack and bedding.

7.6.5 Preventing entry.
Strict hygienic precautions must be observed when importing materials that have been in contact with horses from infected areas. Infected animals have distinctive lesions so would not likely be imported.

7.6.6 Conclusions and comments
None

7.7 Equine encephalomyelitis (Eastern and Western)- B204
(Venezuelan) - B216

7.7.1 The disease.
Eastern, western and Venezuelan equine encephalomyelitis (EE or EEE, WEE, VEE) are be caused by alphaviruses (family *Togaviridae*). They are characterized by deranged consciousness, motor irritation and paralysis. The disease is spread by insect bite chiefly mosquitoes, but also ticks, blood sucking bugs, mites and lice. Wild birds are the main reservoir(Blood and Radostits, 1989).

7.7.2 Distribution.
EE are confined to the Americas.

7.7.3 Impact of introduction.
The diseases are serious in horses but also infect man and are of major public health concern. Once established eradication is impossible and control must be by vaccinations and vector control.

7.7.4 Routes of introduction
Introduction would be by infected vectors, wild birds or infected horses.

7.7.5 Preventing entry.
Veterinary Administrations of *importing countries* should require:
<u>for equines</u>
the presentation of an *international animal health certificate* attesting that the animals:
1) showed no clinical sign of equine encephalomyelitis on the day of shipment and during the 3 months prior to shipment;
2) were kept for the 3 months prior to shipment in an *establishment* where no *case* of equine encephalomyelitis was officially reported during that period; or
3) were kept in a *quarantine station* for the 21 days prior to shipment and were protected from insect vectors during quarantine and transportation to the *place of shipment*; or
4) were vaccinated not less than 15 days and not more than 1 year prior to shipment.(IAHC, 1998).

7.7.6 Conclusions and comments
Because of the seriousness of the disease in horse and man extreme caution should be taken to avoid introduction of any of these diseases.

7.8 Equine infectious anemia - B205

7.8.1 The disease.
Equine infectious anemia (EIA) is a contagious caused by a lentivirus (family *Retroviridae*) and characterized by a long relapsing illness after an initial acute attack. Clinical signs are due to an immunologically mediated acute anemia. Once infected an animal remains so for life. The disease is transmitted mechanically by biting insects or other means where transfer of infected blood is possible (Blood and Radostits, 1989).

7.8.2 Distribution.
EIA a distribution worldwide but in general the prevalence is quite low. It was last reported in Norway in 1975.

7.8.3 Impact of introduction.
Re-introduction and spread of the disease could have a large impact on the horse industry because the almost universal control method is testing and slaughter of reactors to the agar gel immunodiffusion (Coggins) test.

7.8.4 Routes of introduction
Introduction would be by infected horse and vectors.

7.8.5 Preventing entry.
Quarantine and testing with the Coggins test are currently routinely practiced. One drawback is the latent period of up to 45 days after infection before EIA can be detected.

7.9 Equine influenza - Type A - B206

Equine influenza is present in Norway and further introduction would have little impact.

7.10 Equine piroplasmosis (Babesiosis) - B207

7.10.1 The disease.
Equine babesiosis is caused by *Babesia equi* or *B. caballi*. It is characterized by fever and intravascular hemolysis causing anemia, hemoglobinuria, and hemoglobinemia. The organisms are transmitted to horse chiefly by ticks of the genera *Rhipcephalus, Hyaloma* and *Dermacentor*. The ticks are biological vectors. Mechanical transmission with needles and other instruments is possible (Blood and Radostits, 1989).

7.10.2 Distribution.
Equine babesiosis only occurs in the Americas and Asia but there is great international concern that the disease may be introduced elsewhere by the international movement of horses for racing and other competitions. It has not been reported in Norway.

7.10.3 Impact of introduction.
Introduction could major impact because the vector is likely present. Bovine babesiosis has been reported in Norway.
7.10.4 Routes of introduction
Introduction would be by infected animals and vectors.

7.10.5 Preventing entry.
Veterinary Administrations of *importing countries* should require: the presentation of an *international animal health certificate* attesting that the animals:
1) showed no clinical sign of equine piroplasmosis on the day of shipment;
2) were subjected to diagnostic tests for equine piroplasmosis (*Babesia equi* and *B. caballi*) with negative results during the 30 days prior to shipment;
3) were treated against ticks within the 7 days prior to shipment. (The importing country may decide to import only during seasons when ticks are not active on its territory.) (IAHC, 1998).

7.10.6 Conclusions and comments.
Real or perceived fears of the introduction of equine piroplasmosis to areas where it does not exist cause some countries to be extremely restrictive in their import and quarantine procedures for this disease. This is due in part to the unknown relationship between a positive complement fixation test result and infectivity to other horses (Blood and Radostits, 1989).

7.11 Equine viral rhinopneumonitis - B208

Equine rhinopneumonitis and equine herpesvirus abortions are diagnosed each year in Norway, Re-introduction would have no significant impact.

7.12 Glanders (Snive) - B209

7.12.1 The disease.
Glanders is a contagious disease of solipeds characterized by nodules or ulcers in the respiratory tract or skin. It is caused by *Actinobacillus mallei*. Man is susceptible and infections are usually fatal. Most infected animals die of pneumonia and surviving animals become chronic carriers (Blood and Radostits, 1989).

7.12.2 Distribution.
Glanders has a distribution in North Africa, the Middle East, Asia, and Eastern Europe. It has been virtually eradicated from North America. It was last reported in Norway in 1889 (PANIS, 1999).

7.12.3 Impact of introduction.
Introduction would have a major impact on the horse industry because of the need to detect and destroy all infected animals and the quarantine and dis-infection of all premises.

7.12.4 Routes of introduction
Introduction would be by infected animals and contaminated equipment. Infection is by ingestion of contaminated materials.

7.12.5 Preventing entry.
When lesions occur they are easily mistaken for other diseases for example epizootic lymphangitis. The pneumonic signs can also be mistaken for other respiratory conditions. When importing equines from countries considered infected with glanders, Veterinary Administrations should require the presentation of an international animal health certificate attesting that the animals: 1) showed no clinical sign of glanders on the day of shipment; 2) were kept for the 6 months prior to shipment in an establishment where no case of glanders was officially reported during that period; 3) were subjected to the mallein test and the complement fixation test for glanders with negative results during the 15 days prior to shipment (IAHC, 1998).

7.12.6 Conclusions and comments
The fact that glanders is usually a fatal human disease makes it of significant public health risk. The risk, however, is to a very limited population that would come in contact with infected equines or contaminated materials.

7.13 Horse pox- B210

7.13.1 The disease.
Horse pox is a benign disease characterized by the formation of typical pox lesions on the limbs, lips or buccal mucosa. Recovery is uneventful and solid immunity develops (Blood and Radostits, 1989).

7.13.2 Distribution.
Horsepox only occurs in Europe and it is rare. It has never been reported in Norway.

7.13.3 Impact of introduction.
Introduction would have little impact because the benign nature of the disease. It might temporarily be confused with vesicular stomatitis or other vesicular disease.

7.13.4 Routes of introduction
Introduction would be by infected animals or contaminated materials.

7.13.5 Preventing entry.
Veterinary Administrations of *importing countries* should require, for equines , the presentation of an *international animal health certificate* attesting that the animals: showed no clinical sign of horse pox on the day of shipment; were kept for the 3 months prior to shipment in an *establishment* where no *case* of horse pox was officially reported during that period (IAHC, 1998).

7.14 Equine viral arteritis- B211

7.14.1 The disease.
Equine viral arteritis (EVA) is characterized by an acute upper respiratory infection followed by abortion in mares. Small arteries are primarily affected. It is caused by an arterivirus (family *Togaviridae*). Only one antigenic type of the virus is known. It can often be confused with other respiratory and abortion diseases of mares. The disease can be transmitted in semen and recovered stallions may shed the virus for several years after infection (Blood and Radostits, 1989).

7.14.2 Distribution.
EVA is found most often in the USA but it is present in Europe. Serological reactors are found but clinical disease is not reported in Norway.

7.14.3 Impact of introduction.
Introduction would likely have little impact because the disease is already present. However, precautions regarding importation of semen should be observed.

7.14.4 Routes of introduction
Introduction would be by infected animals and semen. It is assumed that transmission in racing stables occurs by ingestion of contaminated materials. The disease can also be transmitted venereally.

7.14.5 Preventing entry.
Veterinary Administrations of *importing countries* should require: for uncastrated male equines imported on a temporary basis for breeding or on a permanent basis the presentation of an *international animal health certificate* attesting that the animals: 1)showed no clinical sign of EVA on the day of shipment and during the 28 days prior to shipment; 2) were subjected to two diagnostic tests for EVA on blood samples at least 14 days apart with negative results during the 28 days prior to shipment; or 3) were subjected between 6 and 12 months of age to a diagnostic test for EVA on a blood sample with negative results, immediately vaccinated for EVA and regularly revaccinated; or 4) have been subjected to a diagnostic test for EVA with positive results and then:

a) either were subsequently test mated to two mares which were subjected to two diagnostic tests with negative results on blood samples collected at the time of test mating and again 28 days after the mating;

b) or were subjected to a virus isolation test with negative results (under study), carried out on semen collected during the 28 days prior to shipment.

for uncastrated male equines imported on a temporary basis other than for breeding, and for equines other than uncastrated males the presentation of an *international animal health certificate* attesting that the animals:1) or were subjected to a virus isolation test with negative results (under study), carried out on semen collected during the 28 days prior to shipment.2) were subjected during the 28 days prior to shipment to two diagnostic tests on blood samples collected not less than 14 days apart which demonstrated negative results or stable or declining antibody titres;3) were subjected between 6 and 12 months of age to a diagnostic test for EVA on a blood sample with negative results, immediately vaccinated for EVA and regularly revaccinated.

Veterinary Administrations of *importing countries* should require: for fresh or frozen *semen* the presentation of an *international animal health certificate* attesting that the animal donors: the presentation of an *international animal health certificate* attesting that the animals: 1)showed no clinical sign of EVA on the day of shipment and during the 28 days prior to shipment; 2) were subjected to two diagnostic tests for EVA on blood samples at least 14 days apart with negative results during the 28 days prior to shipment; or 3) were subjected between 6 and 12 months of age to a diagnostic test for EVA on a blood sample with negative results, immediately vaccinated for EVA and regularly revaccinated; or 4) have been subjected to a diagnostic test for EVA with positive results and then:

a) either were subsequently test mated to two mares which were subjected to two diagnostic tests with negative results on blood samples collected at the time of test mating and again 28 days after the mating;

b) or were subjected to a virus isolation test with negative results (under study), carried out on semen collected during the 28 days prior to shipment. (IAHC, 1998).

7.14.6 Conclusions and comments
This disease which can effectively be controlled by vaccinations is of importance primarily because of its abortifacient abilities and the potential value of equine foals.

7.15 Japanese encephalitis - B212

7.15.1 The disease.
Japanese encephalitis (JE) is primarily a disease of humans who are the primary source of infection for animals. Mosquitoes are the vector and a human-mosquito-pig cycle maintains the infection throughout the year (Blood and Radostits, 1989).

7.15.2 Distribution.
The disease in horses appears to be confined to Malaysia.

7.15.3 Impact of introduction.
Introduction would likely have little impact because the vector is not probably not present.

7.15.4 Routes of introduction
Introduction would be by infected humans, horses pigs and vectors.

7.15.5 Preventing entry.
Veterinary Administrations of countries free from Japanese encephalitis may prohibit importation or transit through their territory, directly or indirectly from countries considered infected with Japanese encephalitis, of domestic and wild equines.

When importing horses from countries considered infected with Japanese encephalitis, *Veterinary Administrations* should require the presentation of an *international animal health certificate* attesting that the animals: 1) showed no clinical sign of Japanese encephalitis on the day of shipment;2) were kept for the 21 days prior to shipment in an *establishment* where no *case* of Japanese encephalitis was officially reported during that period;3) were kept in a q*uarantine station* for the 21 days prior to shipment, were not in contact with swine and were protected against insect vectors during that period.

7.15.6 Conclusions and comments

A recent outbreak of human disease in Malaysia was originally thought to be JE but the cause now has been identified as a previously unknown virus now called the Nipah virus. Some dual JE and Nipah viral infections have occurred. Many thousand of pigs in Malaysia have been slaughtered in an attempt to halt the outbreak. Horses have not been affected by the Nipah virus thus far.

7.16 Horse mange - B213

7.16.1 The disease.
Horse mange is most commonly caused by a Chorioptic mite, *Chorioptes bovis* which also affects cattle and sheep. In horses the disease causes much annoyance and inefficiency at work because of the pruritis in the lower parts of the legs (Blood and Radostits, 1989).

7.16.2 Distribution.
Chorioptes bovis has a distribution in North America, Australia and New Zealand. It has never been reported in Norway.

7.16.3 Impact of introduction.
Introduction would have little impact because the condition is easily treated. Eradication of the mite from a herds may require multiple treatments.

7.16.4 Routes of introduction
Transmission is by direct contact. Introduction would be by infected animals perhaps grooming equipment.

7.16.5 Preventing entry.
The IAHC, 1998 only recommends certification that the horse was free of the disease on the day of export and was not exposed to an infested animal for 3 months prior. Treatment with acaricidal drugs might be considered if there is doubt about the status.

7.16.6 Conclusions and comments.
Chorioptic mange causes little damage in cattle but affects the scrotum of rams and may cause infertility due to testicular degeneration.

7.17 Salmonellosis(S. abortivoequina) - B214

7.17.1 The disease.
This a specific disease of horses that is characterized by abortion in mares, testicular lesions in stallions and septicemia in newborn foals. Although common in the early 1900’s the disease is rarely reported nowadays (Blood and Radostits, 1989).

7.17.2 Distribution.
Because the disease is rare no information on the distribution was found. It has been eradicated from most developed countries. It has never been reported in Norway.

7.17.3 Impact of introduction.
Introduction would have little impact because the condition is easily quite easily eradicated by hygienic measures and vaccination.

7.17.4 Routes of introduction
Transmission is by ingestion of materials contaminated with uterine discharges from carrier mares and recently aborted mares. Introduction would be by infected animals or contaminated feed. Since the disease affects the testicles of stallions it might be transmitted by coitus or semen but testicular degeneration associated with the infection would probably render the semen quality too low for use in artificial insemination.

7.17.5 Preventing entry.
The OIE IAHC has no listing for this disease.

7.17.6 Conclusions and comments.
Because of the rarity of this disease the risk of introduction and establishment is remote.

8. List A diseases potentially transmitted by international travelers.

The Centers for Epidemiology and Animal Health, USDA:APHIS:VS at fort Collins, Colorado recently completed a qualitative analysis of the potential for international travelers to transmit foreign animal diseases to US livestock or poultry (USDA:APHIS:VS, 1998). They rated the risks of introduction of15 OIE List A diseases as high, moderate, low, negligible or none for biological or mechanical transmission. The factors considered in rating the disease were, ability of the agent to infect humans, the incubation period, mode of infection in humans, possibility of mechanical transmission and survival of the agent in the environment.

Of those diseases that were transmissible to humans and thus could be capable of biological transmission, none were rated in the high or moderate risk categories, avian influenza and Newcastle disease were rated low risk, Rift valley fever, Foot and mouth disease, swine vesicular disease and vesicular stomatitis were rated as negligible risk and all other List A diseases were rated as no risk. In the case of mechanical transmission, Newcastle disease and Swine vesicular disease were rated high risk, Avian influenza, Foot and mouth disease and African swine were rated moderate risk, Rift Valley fever,Classical swine fever, Lumpy skin disease, Peste des petit ruminants, Rinderpest and Sheep and goat pox were rated negligible and the others were rate at no risk.

They concluded that Newcastle disease and Swine vesicular disease were at high risk for mechanical introduction by travelers. Avian influenza, Foot and mouth disease and African swine fever were at moderate risk for introduction by mechanical means and Vesicular stomatitis was at low risk. Avian influenza and Newcastle disease were also at low risk for biological transmission. Mitigating factors brought into account by international travel further reduces the threat of effective human-to-animal transmission of List A diseases. It was emphasized that this rating system only considered the possibility of humans acting as biological or mechanical vectors and not any products or equipment they may be carrying.

9. Zoonoses and foodborne infections associated with increased trade in animals and animal products.

Several of the OIE List A diseases can infect humans. In general, they are not serious conditions with the exception of Rift Valley Fever and the Influenza virus infections that can be contracted from swine or birds. List A diseases that can infect humans include:

- Foot and mouth disease
- Vesicular stomatitis
- Swine vesicular disease
- Rift Valley Fever
- Fowl plague/ Highly pathogenic avian influenza.
- Newcastle disease

The OIE B list of diseases also includes several diseases of public health significance. Diseases that affect multiple species including humans are:

- Anthrax
- Echinococcosis/Hydatidosis
- Leptospirosis
- Q fever
- Rabies

List B diseases that affect cattle and humans are:

- Bovine brucellosis
- Bovine tuberculosis
- Campylobacteriosis
- Cysticercosis
- Bovine spongiform encephalopathy (the human disease is termed nvCJD)

List B diseases that affect sheep or goats and humans are:

- Caprine and ovine brucellosis
- Scrapie ***(Only included because of its similarity to BSE- No evidence of any human risk exists)***

List B diseases that affect swine and humans are:

- Cysticercosis
- Porcine brucellosis
- Trichinellosis

List B diseases that affect poultry and humans are:

- Avian tuberculosis
- Fowl typhoid (*S. gallinarum*)
- Avian chlamydiosis
- Pullorum disease (*S. pullorum*)

The FAO maintains a list of diseases that are significant either because of the effect on animal health and productivity or because they are significant public health problems. These diseases are often most significant as public health problems (HandiSTATUS,1998). The latter diseases include:

- Listeriosis
- Toxoplasmosis Salmonella infections

Additional foodborne infections associated with animal products include:

- Enterohaemorrhagic *E. coli* (EHEC) (e.g., *E. coli* O157)
- Shigellosis (not really a zoonosis, direct or indirect (through various foods) human to human spread)
- Cholera (not really a zoonosis, direct or indirect (through various foods) human to human spread)
- Yersiniosis
- Tuberculosis
- *Vibrio parahaemolyticus* infection (associated with seafood)

Foodborne intoxications and infections that may be associated with animals and animal products (Schwabe, 1984).

- Staphyococcal food poisoning
- Pasteurella multocida
- Streptococcal infections
- Tuberculosis
- Yersiniosis

At present, the incidence of the above mentioned infectious diseases diseases in Norway is relatively low. The National Notification System for Infectious Diseases (Meldingssystem for smittsomme sykdommer, MSIS-rapport) annual report for 1998 lists the following diseases and number of reports:

Brucellosis	0
Campylobacteriosis	1700
Acquired abroad	884, 52%
Acquired in Norway	709, 42%
Unknown?	107, 6%
Colibaccillosis	49 (assume this is not a typical animal product problem)
EHEC	(6 of which 2 were acquired in Norway and 4 abroad)
Listeriosis	9
Anthrax	0
Rabies	0
Salmonella. enteriditis	827, 55%
Salmonella.Typhimurium	203, 14%
Other Salmonella. spp.	464
All salmonella	1494
Acquired abroad	1255, 84%
Acquired in Norway	179, 12%
Unknown origin	60, 4%
Shigellosis	71 (138 abroad, 26 Norway, 7

	unknown)
Trichinellosis	0
Tularemia	11
Yersiniosis	140 (28 abroad , 91 in Norway, 21 unknown)
Vibrio spp.	0

In 1998, Seventy seven percent (77.84%) of the reported human cases of Salmonellosis and, 52.55% of the Campylobacter cases, 85% of the cases of Shigellosis (not a zoonosis problem) were reported as being acquired out of Norway. It is believed that the number of cases and the proportion that are acquired on Norway of these and possibly some other food-borne diseases will increase exponentially with an increase in imports of foods, animals and animal products (Skjerve et al., 1996). Yersiniosis is an exception in that the majority of human cases are acquired in Norway (65% in 1998) (MSIS, 1998).

Skjerve et al., 1996 listed four organisms whose importance as a source of foodborne disease in Norway they believed would increase with an increase in international trade of animal products. These included: Taenia saginata, *Campylobacter* spp., *Salmonella* spp. and EHEC.

The zoonotic diseases that will be discussed are those that could reasonably be expected to increase in incidence as a consequence of increased trade. Since it is unlikely that animals or animals products would be imported from an area where an OIE List A disease exists, these diseases will not be considered. In addition, those diseases that require direct contact with an infected animal will not be discussed because transmission to humans would require an outbreak of the disease in Norway. Of the remaining diseases only those in which the primary reservoir is either a live animal or animal product that would likely have increased trade will be discussed. Of the approximately 70 zoonotic diseases listed by Schwabe, 1984 there are about 20 that might be of significance.

9.1 Q fever
Q fever is caused by an infection with *Coxiella burnett*i. It has a world wide distribution and commonly affects wild mammals, ticks, cattle, sheep and goats. It can be transmitted by contact, vehicle and vector. Abattoir workers are at risk of contracting Q-fever via inhalation of aerosols. Unpasteurized milk products would be the most probable source of infection for humans. Animals are not routinely tested for the disease at import.

9.2 Anthrax
Anthrax is a disease caused by the *Bacillus anthracis* bacteria. The disease is widespread throughout the world and has been reported in Norway. Human infections occur primarily through contact with infected animals although transmission by infected meat has occurred. It seems highly unlikely that anthrax would be a serious threat as a result of increased trade because infected animals will become seriously ill.

9.3 Brucellosis
Brucellosis in humans can be caused by *Brucella abortus, B. mellitensis, B.suis and B. canis.* It is a serious disease characterised by recurrent fever, malaise, muscular-skeletal pains and chronic course. The disease affects primarily cattle (*B. abortus*), sheep and goats (B*. mellitensis*) and swine (*B. suis*). *B. canis* affects dogs. The disease can be contracted by contact with infected animals or by vehicle. Unpasteurized milk and products made from unpasteurized milk can be a source of infection. Slaughter house workers are also at high risk of infection. Most countries where Brucellosis occurs have control/eradication programs and animals are routinely tested for the disease prior to importation. A Brucellosis control program should be the minimum requirement for eligibility for export of animals and animal products. Because of the control programs in most countries and the fact that animals are routinely tested for the disease prior to export makes it unlikely that humans in Norway will contract the disease as a result of increased trade.

9.4 Campylobacteriosis
Campylobacteriosis is a very common food-borne zoonotic disease. It usually is caused by *Campylobacter jejuni* and sometimes *C. coli.* In 1998, campylobacteriosis for the first time surpassed salmonella as the most frequently reported common food-borne disease in Norway. The infections in animals are usually in-apparent but may be implicated in cases of

enteritis in cattle, dogs, cats and foals, hepatitis in chickens, abortions in sheep and mink and bovine mastitis (MacDiarmid, 1993). The two bacteria have worldwide distribution and the prevalence in affected chicken flocks and pig herds may approach 100%. However, Norway is, together with Sweden and Finland, in a unique position because salmonella are more or less absent from animal husbandry. This phenomenon is probably a result of climate conditions, the less industrialized animal husbandry as compared to other industrialized countries, and effective control and eradication programs. The infectious dosage for humans is very low for campylobacter, and higher for salmonella (for very susceptible persons the infective dosage is generally low) Contamination rates for campylobacter, especially for chickens after slaughter, is high. However, cattle, sheep and pig meats show high rates of contamination after slaughter but after cooling, storage and aging contamination at the retail outlet is usually low. In contrast, poultry often have a high count at the point of sale. The New Zealand risk assessment for imported meats and meat products concluded that in the case of beef, sheep and pork there was a greater risk from locally produced meats than from imported meats (MacDiarmid, 1993). The disease was not considered in the risk analysis on chicken or turkey meat (MAF, 1999). Approximately 45% of the reported cases of campylobacteriosis in Norway are acquired in Norway. This suggests that the organism is similarly distributed in Norway as elsewhere. If this is true importation of animals and animal products would have little impact on the campylobacteriosis incidence in Norway. In many western countries, including Norway, the incidence of campylobacteriosis has increased significantly during the last few years. However, the contamination rate among Norwegian poultry and poultry meat and the number of cases acquired in Norway are decreasing. This suggest that imported animal products may in the future represent an increased risk for campylobacter contamination relative to Norwegian products.

9.5 Salmonellosis

Salmonellosis is the second most commonly reported food-borne, zoonotic disease in Norway. In many countries it is ranked as number one.. There appears to be a general increase in the incidence worldwide. Many different animals and animal products can be source of the infection in humans and cross contamination of other non-animal food products is common. Salmonellosis is caused by a large number of subtypes that are prevalent in many different host species. *Salmonella typhimurium* and *Salmonella enteriditis* are the subtypes most often associated with human disease, the latter typically associated with egg and egg products. Because the prevalence of *Salmonella* spp. in domestically produced foodstuffs is so low, any imports from a region with a higher prevalence in salmonella in their food chain would result in increased exposure of the population to the pathogens. The actual increase in the number of illnesses in humans and the impact can only be estimated. The extent of the increase will depend on many factors including quantity and type of animals and animal products that will be imported, control programs in the exporting country (certificates etc), the types of Salmonella that are imported, the risk mitigating procedures that are instituted, consumer awareness, and possible new technologies to inactivate the organisms. It should not be forgotten that humans are just as likely to introduce new subtypes of Salmonella to Norway as animals and animal products. It is recommended to perform a separate quantitative assessment of the risk of Salmonella in association with increased trade.

9.6 Tuberculosis

Human tuberculosis can be caused by four different *Mycobacterium* species. *M. tuberculosis* is primarily a human pathogen but it can infect other animals especially cattle. *M. bovis* is primarily a bovine pathogen, but it is a serious public health threat. *M. avium* affects primarily birds, but swine and immuno-compromised individuals are also susceptible. *M. intercellularae* is not as pathogenic, but can infect many species. Tuberculosis can be transmitted by contact and by food vehicles. However the infectious dose via oral inoculation is high making transmission through meats of infected animals a remote possibility. Unpasteurized milk and milk products present the greatest risk to humans for infection by the oral route. However, the importance of this route is very small compared to inhalation. Tuberculosis in cattle is distributed worldwide except in areas where it has been eradicated, for example most of Europe. Avian tuberculosis is also distributed worldwide, but is no longer significant in commercial poultry production. Importation of animals and animal products only from countries or areas with TB control/eradication programs should be required. Since meat is an unlikely vehicle it is unlikely that increased trade in meat and meat products will significantly increase the risk of TB in Norway.

9.7 Cysticercosis

Cysticercosis is the infestation with the larval forms of *Cysticerca bovis* or *C. cellulosae,* the tapeworms *Taenia saginata* and *T.solium.* Humans are the obligatory hosts of both tape worms. The larval stages of the disease occur in the muscles of cattle, buffalo and reindeer (*T. saginata*) and pigs (*T. solium*). Humans get the infestation by ingesting the cysts. The adult tapeworms develop in the intestine and pass gravid tapeworm segments in the feces. Cattle and other species become infected by ingesting the gravid segments from the human feces. Humans can also become infested by ingesting the tapeworm segments under poor sanitary conditions. Human infestation with *C. cellulosae* is a very serious disease because of cyst formation in the brain (MacDiarmid, 1991). The infestation has been reported in Norway, but it is rare. The most probable route in which *T.saginata* or *T. solium* would enter Norway as a result of increased trade would be in the intestines of humans. Given the prevalence of *T. saginata and C.bovis* in other parts of the world it is likely that it has been introduced many times by travelers and immigrants. Although the risk from human introduction far outweighs the risk of importation of infected meat, that possibility exists. Meat inspection procedures will decrease but not eliminate the risk of cysticercosis. In Africa, T. saginata is common among cattle, and import of beef represent from this region represent a risk for spread of this parasite, especially if the meat is used without proper heat treatment (>57 C) (Skjerve et al, 1996)

9.8 Crytosporidiosis

Cryptosporidiosis in humans is rarely reported in Norway (MSIS, 1998). The parasite is relatively important in lambs and calves where it causes neonatal diarrhea. The organism is also common in calves in Norway. Most out breaks in humans area result of contamination of water supplies, but infection might occur as a result of fecal contamination of meat or other foods, e.g. fresh produce. Since the organism is already common in Norway, it is doubtful that increased trade would affect this situation. The most important control measure is proper treatment of drinking water.

9.9 Yersiniosis

Yersiniosis is caused by *Y. enterocolitica*, a bacterium that is associated with pigs and pork products. *Y. enterocolitica* infection is humans results in an acute enteritis, that may result in chronic manifestations including arthritis. The disease occur most frequently in countries with a cold climate. Asymptomatic carriage in swine is common. The route of transmission is fecal-oral often via contaminated food. Yersinia is of special interest because of it's ability to grow in temperatures as low as 4°C, and chilled and vacuum packed pork productsare common sources of human infection (MacDiarmid, 1993). Yersinia is found commonly in Norwegian swine (Skjerve et al., 1996) The majority of human infections in Norway are acquired in Norway (65% in 1998) (MSIS, 1998). Thus increased trade would probably not significantly affect the problem.

Another *Yersinia* species, *Y. pseudotuberculosis*, also can result in disease in humans (pseudotuberculosis). *Y. pseudotuberculosis* infection in humans is characterized by mesenteric lymphadenitis that may be mistaken for appendicitis. The organism can be found among rodents.

9.10 Shigellosis

Shigellosis is the third most common type of food-borne bacterial infection in Norway. It is caused by different serotypes of *Shigella* spp. , a pathogen which is host specific, with humans and other primates as hosts . It is strictly pathogenic, and infections typically result in diarrhea that may be bloody. Complications such as kidney failure occur in some patients. Lethality rates may reach 20% in countries with sub-optimal health care systems. Shigellosis is a human disease. In addition to direct human-to human transmission, indirect transmission through contaminated drinking water and different food products are important in the epidemiology of the disease. Of foods, fresh produce irrigated with contaminated water is probably the most important source of infection. A typical epidemic occurred in Norway and other countries in 1994, when contaminated lettuce from Spain was infected with shigella bacteria. Foods of animal origin are less likely to be a source of infection, but outbreak related to cheese and seafood have been reported... Most Shigella infections in Norway are acquired out of Norway (138 of 171 cases in 1998). One might expect increased exposure if there were an increase in importation of foodstuffs, although foods of animal origin in general do not seem to represent a significant risk.

9.11 Listeriosis

Listeriosis is caused by *Listeria monocytogenes.* In humans, it may cause meningitis, meningoencephalitis, sepsis, or gastroenteritis. In pregnant women it can cause abortion, stillbirth or neonatal disease . Immuno-compromised individuals and pregnant women are at the highest risk. The bacterium occurs ubiquitously, and a wide range of foods may become contaminated. The bacteria do, however, not survive heat treatment. Listeria contamination of foods is becoming more frequently reported (probably because we look harder!)and has resulted in massive recalls of meats and meat products in the USA in the past year (Promed-AHEAD,1998). The incidence in humans, however, is relative low and stable in most countries (2-5 cases per million per year), although outbreaks do occur. Like *Yersinia enterocolitica*, Listeria bacteria are able to grow at refrigeration temperatures, which make chilled vacuum packed ready-to-eat products risk products.. An outbreak in Norway was associated with vacuum packed sandwich meat (Skjerve et al., 1996). An increase in international trade in these chilled and vacuum packed ready-to-eat products with prolonged shelf lives may lead to an increased problem in many countries. Strict hygienic measures and implementation of HACCP-like systems in this kind of industry is necessary to mitigate a potential problem.

9.12 Toxoplasmosis.

Toxoplasmosis is a parasitic disease caused by *Toxoplasma gondii.* Pregnant women and immuno-compromised individuals are at the highest risk. The disease causes influenza like signs in most cases, but infection during pregnancy may result in abortion, teratogenic effects, stillbirth or neonatal disease. The natural host is the cat, but the intermediate stages of the organism occur in various mammals and birds, including swine and in Norway, sheep (Skjerve et al., 1996). Humans become infected through contact with cats, consumption of poorly heat treated pork or lamb meat, and consumption of raw fruits and vegetables. Because the parasite is so common in Norway, it is not likely that increased trade will affect the epidemiology of the disease in Norway significantly.

9.13 Trichinosis

Trichinosis is a parasitic disease caused by *Trichinella spiralis.* Although infections in humans are often sub-clinical sign may be severe and mortality in outbreaks may reach 40%. Signs include fever, myalgia, facial edema, exanthema and functional disorders of the circulatory, respiratory and muscular systems. Infection occurs by ingesting the meat of an infected animal. Trichinellosis occurs worldwide, but the prevalence varies widely by location. The prevalence in Scandinavia is low (MacDiarmid, 1993).The disease was last reported in a pig at slaughter in Norway in 1994. The last previous report was in 1981. Trichinosis is relatively common in Eastern Europe. It is often associated with low hygienic standards and poor management practices such as feeding uncooked garbage to swine. Domestic animals may also become infected via rodents. It is relatively rare where swine are fed grain ration and the hygienic standard is good. Horse meat, bear meat and marine mammals meat occasionally have caused outbreaks. Trichinella may be imported if pork or horse meat is obtained from areas where husbandry is less than ideal, the meat inspection poor, and the meat is consumed without proper heat treatment..

9.14 Enterohaemorrhagic *Escherichia coli* (EHEC)

In most industrialized countries the incidence of infection caused by entero-hemorrhagic *E. coli* (EHEC) has increased during the 1980s and 1990s. EHEC infections are considered an emerging disease. The serotype *E. coli* O157 is the most commonly reported cause of EHEC disease.

The infection typically causes bloody diarrhea, that sometimes develop into hemolytic uremic syndrome (HUS) that might result in kidney failure.. Infections can be fatal in children, old people and immuno-compromised individuals. First identified in the USA in 1982, it has been associated with large outbreaks in the northwest USA, Japan, and the UK. Smaller outbreaks and sporadic cases have been reported worldwide. Very few sporadic cases are reported in Norway (MSIS, 1999). The organism is probably distributed worldwide. The primary host is believed to be ruminants, and the animals do not show any symptoms. The infectious dose for humans is a very few organisms. Surveys in the USA showed that the organism is widely distributed among cattle but the within herd prevalence is usually only about 1%. Surveys from other countries show similar prevalences. In a survey conducted in Norway in 1995, *E.*

coli O157 could be isolated from faecal samples from 0.3% of 2000 cattle. In a survey conducted in Norway in 1998, *E. coli* O157 could be isolated from 0.2% of 2253 cattle carcasses. Thus, there is a reservoir of *E. coli* O157 among Norwegian cattle. The organism is probably distributed worldwide. Intermittent shedding of the organism or transient colonization of the gut of cattle is suspected. Food products associated with EHEC-outbreaks include ground beef, unpasteurized milk, lettuce, sprouts, apple cider, and water. The organism enters the food-chain by fecal contamination at slaughter or milking, or by the use of irrigation water contaminated with the pathogen. Groups in Canada and the USA are conducting risk analyses regarding E..coli O157:H7 the most notorious of the types of EHEC in ground beef. Preliminary studies suggest that decreasing the prevalence of EHEC at the farm level will be the most effective means of protecting humans from the agent. It is possible that increased trade in beef and other foodstuffs will lead to an increased incidence of EHEC infections. Product testing would not be expected to eliminate the risk.

9.16 Antibiotic resistant organisms

Microbial resistance to antibiotics is becoming more prevalent (Eurosurveillance Weekly (http://www.eurosurv.org/). There is much debate regarding the relative importance of antibiotic use in animals vs. humans in the development of antibiotic resistance. However, there is a growing body of evidence that humans can be exposed to the resistant organisms through the food chain. *Salmonella typhimurium* definitive phage type (DT) 104 is the most widely reported food associated resistant organism but vancomycin resistant enterococci (VRE) are also important. The resistant forms of the foodborne pathogens are not considered as separate hazards because the mechanism for introduction would not be different than for non-resistant forms.

10. Categorization of hazards

Each of the hazards identified in the previous sections was placed in one or more categories based on probability of introduction, impact on animal health, human health or trade, mode of transmission, public health significance or probability of introduction with meat or meat products (Appendix 2, Tables 1-13). Finally, Table 14 is a preliminary list of diseases that may increase in association with increased trade.

11. Discussion

The goal of this project was to assess the risks to Norway associated with increased trade in animals and animal products. The driving force behind this effort is an attempt to protect Norwegian agriculture from competition from imported animals and animal products by identifying risks and thus justifying the tariffs and import restrictions currently applied. The assumption was that imported animals and animal products would eventually comprise 30% of Norwegian consumption and that the sources of the animals or products could be anywhere in the world.

At the onset it was recognized that within the designated time frame of approximately 5 months it would be impossible to do a meaningful quantitative assessment. Therefore, an attempt was made to identify important hazards (unwanted events) and to subjectively categorize these hazards as to the likelihood of their occurrence. By doing this a much smaller list of hazards could be identified that eventually may merit a quantitative risk assessment. The hazards identified were those that potentially could have an adverse effect on the health of animals or humans in Norway. The adverse effect on trade of the diseases, which is of primary concern to many countries was considered even though its importance to Norway is small. Norway, in general, does not export a significant amount of animals or animal products other than fish to other countries. In addition, the risk to the economic well-being of animal and animal product producers that were not disease associated were not considered in this assessment nor were any the expected benefits to the producers and consumers that would be associated with increased trade.

It should be emphasized that this document is largely a list of diseases that exist, that could be introduced through imports, and that might, if introduced, cause an outbreak of disease in Norwegian animals or humans. In other words, a list of potential hazards. The list is certainly not all inclusive. The actual likelihood of occurrence of most of these hazards is remote but for a few it seems occurrence almost inevitable, with or without increased trade.

When considering the probability of occurrence one must consider what commodity is likely to be imported and what is the likely use for the commodity. For example, cattle for breeding, cattle for feeding or slaughter, fresh or chilled beef, frozen beef, cooked cured or dried beef bovine semen or embryos all represent potential sources for Foot and Mouth Disease (FMD) introduction but the probabilities of the occurrence of introduction from these commodities is vastly different for each commodity. In addition, the area of origin greatly affects each of the probabilities. Obviously, if FMD does not exist in the country of origin then animals and animal products from that country pose no risk of introducing FMD but may pose a risk for introduction of a variety of other agents. Thus, the risks associated with each species and commodity that may be imported must be assessed on an individual basis starting with the country of origin. In other words, without knowing the source of the commodity, type of commodity, expected use of the commodity, amount of commodity to be imported, as well as all of the processes that make up the continuum between the source and final disposition of the commodity, any judgment regarding the likelihood of disease introduction or other adverse outcome of an importation is purely speculative and may not reflect the true situation.

Some generalizations regarding the probability of introduction of a disease can be made. The diseases more likely to be introduced to Norway have one or more of the following characteristics.

Affect multiple species. Diseases that affect more than one species are provided with multiple pathways for introduction. FMD is an example of such a disease. Wildlife reservoirs often maintain a disease in an area or introduce or disseminate the disease through uncontrollable movements. Classical swine fever in wild boars, wildlife rabies and Newcastle disease are examples.

Several modes of transmission. It is more difficult to prevent introduction of diseases that have multiple modes of transmission than those with only one. FMD is an example of this type of disease. It can be transmitted by the infected animal, fresh and processed meat, semen, improperly processed embryos and vehicles such as people, equipment, contaminated feeds, and probably air.

Asymptomatic cases and carriers. Diseases characterized by asymptomatic cases and carriers are more likely to escape detection than those that cause obvious clinical signs. This is often a problem in vaccinated animals where the vaccination prevents clinical disease but not infection or shedding of the agent. Classical swine fever is a disease that is in this category.

Wide distribution. Diseases that have a wide distribution provide more potential sources for infected animals or products. Disease that are confined to certain regions are much easier to avoid. Diseases that have wide distributions include IBR, BVD, PRRS, and the Salmonellas.

Close proximity. Diseases that are present in nearby areas are more likely to be introduced than those that only occur far away. This is especially true if the disease has multiple modes of transmission including airborne. PRRS that exists in Denmark is an example of this type of disease.

Insensitive diagnostic tests. Diseases that are difficult to diagnose due to long incubation periods, insensitive diagnostic procedures or other reasons are more likely to escape detection and thus be imported. Bovine paratuberculosis, BSE and Scrapie are diseases that fall into this group.

Relatively low impact on trade. This is perhaps the type of disease that would most likely be introduced to Norway. Many diseases when first introduced to a herd or area cause significant losses but when they become endemic have much less negative impact and no longer command a lot of attention. Diseases that are endemic in a country cannot be used as grounds for prohibition of imports. Thus, many ubiquitous diseases that are not present in Norway have no significance regarding trade between other countries. For example, because

PRRS is endemic in Denmark, Denmark cannot require freedom from PRRS as a condition for importation.

Relatively low impact on animal health Also falling into this group are those diseases that are serious human health concerns but cause little or no disease in animals. Some of the more important foodborne infections and intoxications are in this group, for example some types of Salmonellosis and enterohaemorrhagic *E. coli* (EHEC). There are many other diseases that fall in to this category.

There are also some factors that make it more **unlikely** that a disease will be introduced and cause a significant problem.

List A diseases. These diseases are those that have the potential for very serious and rapid spread, irrespective of national borders which are of serious socio-economic or public health consequence and which are of major importance in the international trade of livestock and livestock products. Because these are high profile diseases there is great awareness of them and the chances of them going undetected are not high. Introduction of these diseases usually does not occur through normal trade channels but by natural reservoirs, illegal animal movements, smuggling and other uncontrolled activities. In many cases, the List A diseases are present in areas where the quality or quantity of livestock or product is not suitable for international trade.

Limited range. Many diseases are limited in their distribution by the range of vectors, natural reservoirs or environmental conditions. Diseases like Theileriosis, Nairobi sheep disease are in this category. Imports from areas where these diseases occur can easily be avoided but if introduced probably would not be established because of the absence of vectors.

Diseases with characteristic clinical signs or lesions. Diseases that have obvious clinical signs or lesions are unlikely to be undiagnosed and pass inspections prior to export, thus making it unlikely that they would accidentally be imported.

Diseases for which there are sensitive diagnostic methods. Diseases for which there are sensitive and economical diagnostic tests available are unlikely to escape detection and be accidentally imported. Diseases such as IBR fall into this category.

Diseases with a short incubation period. Diseases with a relatively short incubation period would likely cause an outbreak in at least some individuals before or during preparations for export thus be detected. Foot and Mouth disease is a disease with an incubation period that is usually less than 7 days but may be as long as 21 days in some individuals.

Diseases that have national control programs in the country of origin. Diseases for which there are national control/eradication programs in force are not likely to be exported because of the efforts to detect and control the disease in the exporting country are more intense than in those countries that are thought to be free of the disease or have no control programs. Diseases like Brucellosis and Tuberculosis are examples of diseases that fit into this group.

Diseases spread only by coitus or semen. Diseases that are spread only by coitus or semen are unlikely to be imported if no live breeding animals are imported and only semen from a reputable artificial insemination center where testing for the diseases is routine.

Obviously, each disease, could have nearly any combination of characteristics that make it more or less likely to be introduced. These general principles were applied to subjectively classify the diseases an conditions discussed in this report. The diseases classified several by different criteria including impact on animal health, human health and trade, mode of introduction/transmission and likelihood of introduction are listed in Appendix 2.

A number of steps to reduce the risk of introduction of a disease through increased trade can be taken:

Prohibition or restriction of imports of live animals and animal products.

Historically, this has been the Norwegian policy and it appears to have been quite effective.

Avoid imports from countries where a specific disease is known to exist.
This appears to be the most effective means to reduce the risk of importation of a disease to Norway. Unfortunately, it is certainly not foolproof and really not a feasible solution. In order to require freedom from a disease for eligibility for importation Norway has to be recognized as "free" of the disease or have a national control/eradication program in force. To be recognized as free of a disease, in most cases, requires a systematic, statistically valid survey to be conducted that shows the prevalence of the disease is less than 0.02% of herds. It is obviously not feasible for Norway to conduct such surveys for all of the diseases thought not to occur in Norway and that might present a risk through trade. This is an internationally accepted procedure to prevent the spread of the List A diseases. However, for List B and List C diseases reporting the existence of these diseases is usually less than complete.

Allow imports only from "free zones" or "free herds".
The concept of "regionalization" is now widely accepted whereby certain areas or zones of a country or region that has a List A or B disease present can be declared free of the disease thus allowing movements of animals and products from the free zone. To qualify as a "free zone" strict requirements must be met including a good surveillance program to monitor for presence of the disease. In addition, it is possible in the case of some diseases for herds within infected zones to be certified as free of the disease. Obviously, the importing country must have confidence in the veterinary services of the exporting country for this procedure to work. It should be remembered that countries and producers that have an export market will go to great lengths to preserve that market. The outbreak and dissemination of disease via exported commodities can have a devastating effect on the industry. Examples of this include BSE in the UK and Classical swine fever in the Netherlands.

Restrict the type of commodity imported.
Many diseases that con be transmitted by live animals will not present a risk if animal products only are imported. Processing of the products can further reduce or eliminate the risk. However, for some products normal processing will not eliminate the hazard. The best example is the risk of introduction of exotic strains of IBD virus in chicken meat. The IBD virus is notoriously heat-stable and normal cooking cannot be relied upon to inactivate all of the virus. A risk analysis done in New Zealand concluded that if only 0.1% of the annual consumption of broilers were imported from countries with endemic IBD, without appropriate safeguards, it was virtually certain that infection would be established in backyard flocks (MAF, 1999). These infected backyard flocks would serve as reservoirs for infection of commercial flocks.

Restrict the quantity of commodity imported.
The exposure (risk) of introduction of a disease increases proportionately with the amount of infected commodity imported (MacDiarmid,1991). As imports increase so will the exposure. The risk of introduction of a disease is dependent on the presence and level of the disease in a country (country factor; CF1), presence and level of the disease in a commodity (commodity factor; CF2) and the number of animals or animal product units imported (animal import units; AIU). The probability of introduction (disease entry; PI) can be expressed in the equation $PI=1-(1-CF1*CF2)^{AIU}$. The number of AIUs, therefore, has the most significant effect on the PI because it is an exponential relationship. If there is a 0.1% probability that 1 AIU will introduce a given disease there is a 99.99% probability that it will be introduced if 1000 of the same AIUs are imported.

Require "testing" of imported commodities.
Testing for diseases in animals and animal products prior to importation or release to the consumer will lessen but not decrease the risk. Because not every unit can be tested and because all tests are imperfect some infected animals or products will escape detection and be imported.

General discussion and comments
If one assumed that with increased trade animals and animal products could originate anywhere in the world and would be unrestricted then all of the diseases discussed in this document could be considered as hazards. *However, a hazard with no probability of occurrence does not constitute a risk.* Because trade is not unrestricted and the real number

of sources for imports is limited, so too are the risks associated with increased trade. For example, the List A diseases are very unlikely to be introduced through normal trade because of the severe international restrictions that are put in to force when an outbreak occurs. It is much more likely that these diseases would be introduced through smuggling, movement of wild animals or birds or entry of the agent with international carriers.

It is much more likely that a List B or C disease will be introduced. Although the List B diseases can have a significant impact on trade, the presence of these diseases in an exporting country usually will only become a barrier to trade if the importing country is free of the disease or has a control/eradication program in force. For most countries, the number of diseases in these categories is small. In many countries information regarding List B diseases is insufficient, largely because they are so common that they are not reported. Obviously, no country is likely to export or import animals that are clinically ill. If one considers that fact that exporters want to preserve their markets this greatly reduces the disease risks associated with normal trade channels.

The List C diseases are considered significant but have little adverse effect on trade and as such are not subject to routine reporting and are often quite widespread. Many of the important foodborne agents are List C diseases or diseases that have little impact on animals.

If the goal of increased trade is to increase the quality of animals or animal products in Norway then this will also restrict the potential sources for imports. There would be no incentive to import animals or commodities of lower quality than those that exist already in Norway.

If the goal of increased imports is lower consumer prices then, imports from almost anywhere in the world should be possible. If Norway is willing to import goods of lower (than Norway's) quality this will tend to open the markets worldwide. However, to only import products that meet Norwegian quality standards and at a lower price will tend to reduce the potential sources for imports. "Quality" is used generically and could be flavor, tenderness, sanitary standards at slaughter or processing, country disease status etc. Given the choice, many buyers are willing to purchase "lower" quality goods at a lower price provided the “quality” is not too low and the price is right (for example, kjøttedeig vs. entrecote).

One can purchase food at prices lower than in Norway many places in the world but because of the definition(s) of “quality” used in Norway (especially in regard animal disease status and food borne infectious agents) very few countries, will be qualified as exporters.

If the goal of increased trade is for a larger variety of animals (genes?) or products regardless of quality or price then the potential sources and numbers of imports will tend to be increased.

Because the types of animals, commodities and sources for imports are in fact restricted, so to are the number of real risks associated with increased trade in animals and animal products. The these should be assesses on a case by case basis should the need arise.

Conclusions

- If it is assumed that the "world" is the source for imports, then a great many animal diseases become potential hazards.

- If the potential sources are limited to those countries that realistically would be sources of imports the list of animal disease hazards is greatly reduced.

- If the commodities considered are limited to those that would reasonably be expected to be imported, the list of hazards becomes even shorter.

- If the options available to reduce or eliminate the risks are considered we shorten the hazard list even more.

- If the potential sources, the types of animals or animal products and risk management options available are considered a relatively short list of significant hazards that have a real probability of occurrence remains.

- In general, those hazards that have a high probability of occurrence have a relatively low impact on animal health. They may have a higher impact on human health

- Those hazards that have a highest probability of occurrence have so with or without increased trade.

- Those hazards that are associated with imports and trade are more likely to occur if trade increases. The risks of introduction of a disease increase in direct proportion to the number of diseased animals or amount of contaminated product imported.

- There are no such things as 100% safety nor 0% risk. There are always scenarios, no matter how improbable, where hazards can occur.

- For most animal diseases there are risk management options available that will eliminate or greatly reduce the probability of introduction of the disease to Norway.

- To be of real value, analysis of the risks associated with increased trade in animals and animal products should be **quantitative** and on a country-commodity specific basis.

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Table 1.

ESTIMATED IMPACT AND PROBABILITY OF INTRODUCTION OF DISEASES AFFECTING MULTIPLE SPECIES AND CATTLE

DISEASE	IMPACT	ZOONOSIS	RISK	WHY
Foot and Mouth Disease	High	Yes	Low	International controls
Rinderpest	High		Low	International controls
Contagious Bovine Pleuropneumonia	Mod		Low	International controls
Vesicular Stomatitis	Low-Mod		Low	Distribution; International controls
Lumpy skin disease (LSD	Mod		Low	Distribution; International controls
Rift Valley Fever (RVF)	High	Yes	Low	International controls
Anthrax	Low	Yes	Low	International controls; Present in Norway
Rabies	Mod	Yes	Mod	Multiple sources; Wildlife
Bovine Brucellosis	Low	Yes	Low	International controls
Tuberculosis	Low	Yes	Low	International controls
Heartwater	High		Low/Mod??	International controls; Vector present?
Leptospirosis	Low	Yes	High	Multiple sources, Wide distribution
Paratuberculosis (PTB, Johne's disease)	Low?	???	High	Widely distributed, poor tests
Echinococcosis/Hyaditosis	Mod	Yes	Mod	
Cysticercosis	Low	Yes	High	Human host
Q fever	Low	Yes	High	High prevalence, wide distribution
New world screw worm	High	Yes	Low	International controls; distribution;
Bovine Genital Campylobacteriosis	Low		Mod	Difficult diagnosis; semen spread; few signs
Trichomoniasis	Low		Mod	Difficult diagnosis; semen spread; few signs
Enzootic bovine leukosis (EBL)	Low?		Mod	Wide distribution
Infectious Bovine Rhinotracheitis (BHV-1)	Mod		Mod	Wide distribution ;Very sensitive test
Bovine Viral Diarrhea (BVD	Low		High	Wide distribution; PI animals
Bovine Malignant Catarrh (BMC)	Low		High?	
Haemorrhagic septicemia (HS)	High		Low	Narrow distribution
Theileriasis	High		Low	Narrow distribution; Vector absent?
Babesiosis	Low		Low	Reported in Norway
Anaplasmosis	Mod		High	Same range as Babesia
Dermatophilosis	Low		Low	Present in Norway
Bovine spongiform encephalopathy (BSE)	High	Yes?	High	No diagnostic test available
Ringworm of cattle	Low	Yes	Low	Widely distributed; Not generally of concern
Bovine Salmonellosis	High	Yes	High	Widely distributed; High prevalence

Table 2. **ESTIMATED IMPACT AND PROBABILITY OF INTRODUCTION OF DISEASES AFFECTING SWINE**

DISEASE	IMPACT	ZOONOSIS	RISK	WHY
Swine vesicular disease	High	Yes	Mod	Present in Europe; List A
African swine fever	High		Mod	Present in Europe; List A
Classical swine fever	High		Mod	Present in Europe; List A
Transmissible gastroenteritis	Low		Mod	Present in Europe
Porcine epidemic diarrhea	Low		Mod	Present in Europe
Viral encephalomyelitis of pigs; Teschen/Talfan disease; poliomyelitis suum	Low		High	Sub-clinical infections, Present in Denmark
Porcine Brucellosis	Low	Yes	Low	
Atrophic rhinitis	Low		Low	Present in Norway
Cysticercosis (*C. cellulosae*)	Low	Yes	High	Human pathogen
Trichinellosis	Low	Yes	High	Many hosts, insensitive test
Swine vesicular exanthema	High		Low-Mod	Marine calicivirus
Swine influenza	Low	Yes	High	Wide distribution, high prevalence
Necrotic enteritis (*Cl.perfringens C*)	Low		Low	
Porcine respiratory and reproductive syndrome	High		High	Wide distribution, high prevalence

Table 3. ESTIMATED IMPACT AND PROBABILITY OF INTRODUCTION OF DISEASES AFFECTING SHEEP AND GOATS

DISEASE	IMPACT	ZOONOSIS	RISK	WHY
Peste des petits ruminants (PPR)	High		Low	Distribution; International controls
Bluetongue	High		Mod	Distribution; International controls
Sheep and goat pox	High		Low	Distribution; International controls
Brucella ovis infection	Low		Low	
Brucellosis- Br. melitensis	Mod	Yes	Low	Distribution; International controls
Contagious caprine pleuropneumonia	High		Low	Narrow distribution,
Caprine arthritis/encephalitis	Low		Low	Present in Norway
Contagious agalactia	Mod?		Low	
Maedi-visna	Low		Low	Present in Norway
Scrapie	Low		High	Present in Norway
Ovine pulmonary adenomatosis	High		Low	
Nairobi sheep disease	High		Low	Only found in Africa
Salmonellosis (Sal. abortus ovis)	Low (High)		Mod	
Sheep mange	High		Low	List A in Norway
Border disease	Low		High	Not Listed by OIE or FAO

Table 4 ESTIMATED IMPACT AND PROBABILITY OF INTRODUCTION OF DISEASES AFFECTING HORSES AND OTHER EQUIDAE

DISEASE	IMPACT	ZOONOSIS	RISK	WHY
Vesicular Stomatitis	High	Yes	Low	List A; International controls
African horse sickness	High		Mod	List A; present in Europe, Airborne
Contagious equine metritis	Mod		Mod	Poor test, Wide distribution
Dourine	Mod		Low	Ease of diagnosis
Epizootic lymphangitis	Mod		Low	Ease of diagnosis
Equine encephalomyelitis	High	Yes	Low	Distribution in Americas
Equine infectious anemia	Low		Low	Present in Norway, Coggins test
Equine influenza (Type A)	Low		Low	Present in Norway???
Equine piroplasmosis (Babesiosis)	High		Mod	International awareness, strict regulations
Equine viral rhinopneumonitis	Low		Low	Present in Norway
Glanders	High	Yes	Low	Eradicated in many countries
Horse pox	Low		Low	Obvious lesions
Equine viral arteritis	Low		Low	Present in Norway
Japanese encephalitis	High	Yes	Low	Confined to Malaysia
Horse mange	Low		Low	Well controlled or eradicated
Salmonellosis abortivoequi)	Low		Low	Rare disease
Surra	Low		Low	Distribution; vector absent
Venezuelan equine encephalomyelitis	High	Yes	Low	Distribution in Americas

Table 5. **ESTIMATED IMPACT AND PROBABILITY OF INTRODUCTION OF DISEASES AFFECTING POULTRY**

DISEASE	IMPACT	ZOONOSIS	RISK	WHY
Highly pathogenic avian influenza (HPAI)	High	Yes	High	Mutations, Wild birds; Ease of transmission
Newcastle disease	High	Yes	High	Wild birds; Ease of transmission
Avian infectious bronchitis	Low		High	Wide distribution; Present in Norway
Avian infectious laryngotracheitis	Mod		High	Carriers common, Backyard flocks
Avian tuberculosis	Low	Yes	Mod	
Duck hepatitis	Low		Mod?	Transmission and reservoir unknown
Duck virus enteritis (Duck Plague)	High		High	Wild ansiforme reservoir
Fowl cholera	Mod		High	
Fowl pox	Low		High	Many reservoirs
Avian Salmonellosis	High	Yes?	Low	Eradicated in many countries
Paratyphoid Salmonellosis	High	Yes	High	Many reservoirs
Infectious bursal disease	Low		Low	Widespread in Norway
Marek's disease	Low		Low	Widespread in Norway
Mycoplasmosis	Low		Low	Widespread in Norway
Avian chlamydiosis	Low	Yes	Low	Common in caged birds

Table 6 a. DISEASES CATEGORIZED BY IMPACT ON ANIMALS, HUMANS AND TRADE

DISEASE	ANIMAL IMPACT	HUMAN IMPACT	TRADE IMPACT	INTRODUCTION RISK	WHY
Foot and mouth disease (FMD)	High	Low	High	Low	International controls
Contagious Bovine Pleuropneumonia (CBPP)	High	Low	High	Low	International controls
Rinderpest	High	Low	High	Low	International controls
Vesicular Stomatitis	Low	Low	High	Low	Distribution; International controls
Lumpy skin disease (LSD	High	Low	High	Low	Distribution; International controls
Rift Valley Fever (RVF)	High	High	High	Low	International controls
Heartwater	High	Low	High	Low/Mod??	International controls; Vector?
Rabies	High	Yes	Mod	Mod	Multiple sources; Wildlife
New world screw worm	High	Yes	High	Low	International controls; distribution;
Haemorrhagic septicemia (HS)	High	Low	High	Low	Narrow distribution
Theileriasis	High	Low	Mod	Low	Narrow distribution; Vector absent?
Bovine spongiform encephalopathy (BSE)	High	High	High	?	No diagnostic test available
Bovine Salmonellosis	Mod	High	Low	High	Widely distributed; High prevalence
Swine vesicular disease	High	Low	High	High	Present in Europe
African swine fever	High	Low	High	High	Present in Europe
Classical swine fever	High	Low	High	High	Present in Europe
Swine vesicular exanthema	Low	Low	High	Low-Mod	FMD-like; Marine calicivirus
Porcine respiratory and reproductive syndrome	High	Low	Low	High	Wide distribution, high prevalence
Peste des petits ruminants (PPR)	High	Low	High	Low	Distribution; International controls
Bluetongue	High	Low	Mod	Mod	Distribution; International controls
Sheep and goat pox	High	Low	High	Low	Distribution; International controls
Brucellosis- Br. melitensis	Mod	Mod	Mod	Low	Distribution; International controls
Contagious caprine pleuropneumonia	High	Low	High	Low	Narrow distribution,
Ovine pulmonary adenomatosis	High	Low	High	Low	
Nairobi sheep disease	High	Low	Low	Low	Only found in Africa
Salmonellosis (Sal. abortus ovis)	Low	Low	Low	Mod	
Sheep mange	High	Low	Low	Low	List A in Norway
Highly pathogenic avian influenza (HPAI)	High	Yes	High	High	Wild birds; Ease of transmission
Newcastle disease	High	Yes	High	High	Wild birds; Ease of transmission
Duck virus enteritis (Duck Plague)	High	Low	Low	High	Wild ansiforme reservoir
Avian Salmonellosis	High	Low	Low	Low	Eradicated in many countries
Paratyphoid Salmonellosis	Low	Yes	Low	High	Many reservoirs

Table 6 b.

DISEASE	ANIMAL IMPACT	HUMAN IMPACT	TRADE IMPACT	RISK	WHY
Anthrax	Low	Low	Low	Low	International controls; Present in Norway
Bovine Brucellosis	Mod	High	High	Low	International controls
Tuberculosis	Low	Mod	High	Low	International controls
Leptospirosis	Mod	Mod	Low	High	Multiple sources, Wide distribution
Paratuberculosis (PTB, Johne's disease)	Low?	???	Low	High	Widely distributed, poor tests
Echinococcosis/Hyaditosis	Mod	High	Low	Mod	Reported in Norway
Cysticercosis	Low	Low	Low	High	Human host
Q fever	Low	Low	Low	High	High prevalence, wide distribution
Bovine Genital Campylobacteriosis	Low	Low	Low	Mod	Difficult diagnosis; semen spread; few signs
Trichomoniasis	Low	Low	Low	Mod	Difficult diagnosis; semen spread; few signs
Enzootic bovine leukosis (EBL)	Low?	Low	Mod?	Mod	Wide distribution
Infectious Bovine Rhinotracheitis (BHV-1)	Mod	Low	Low	Mod	Wide distribution ;Very sensitive test
Bovine Viral Diarrhea (BVD	Low	Low	Low	High	Wide distribution; PI animals
Bovine Malignant Catarrh (BMC)	Low	Low	Low	Low	Sporadic in Norway
Babesiosis	Low	Low	Low	Low	Reported in Norway
Anaplasmosis	Mod	Low	Mod	High	Same range as Babesia (in Norway)
Dermatophilosis	Low	Low	Low	Low	Present in Norway
Ringworm of cattle	Low	Low	Mod	Low	Widely distributed; Not generally of concern
Transmissible gastroenteritis	Mod	Low	Mod	Mod	Present in Europe; Norway free
Porcine epidemic diarrhea	Low	Low	Mod	Mod	Present in Europe; Norway free
Viral encephalomyelitis of pigs; Teschen/Talfan disease; poliomyelitis suum	Low	Low	Mod	High	Sub-clinical infections, Present in Denmark
Porcine Brucellosis	Low	Mod	Low	Low	
Atrophic rhinitis	Low	Low	Low	Low	Present in Norway
Cysticercosis (*C. cellulosae*)	Low	Mod	Low	High	Human host
Trichinellosis	Low	Mod	Low	High	Many hosts, insensitive test
Swine influenza	Low	Mod	Low	High	Wide distribution, high prevalence
Necrotic enteritis (*Cl.perfringens C*)	Low	Low	Low	Low	
Brucella ovis infection	Low	Low	Low	Low	
Brucellosis- Br. melitensis	Mod	High	Mod	Low	Distribution; International controls
Caprine arthritis/encephalitis	High	Low	Low	Low	Present in Norway
Contagious agalactia	Mod?	Low	Low	Low	
Maedi-visna	Low	Low	Mod	Low	Present in Norway
Scrapie	Mod	Low	Mod	Low	Present in Norway

Table 6 c.

DISEASE	ANIMAL IMPACT	HUMAN IMPACT	TRADE IMPACT	RISK	WHY
Salmonellosis (Sal. abortus ovis)	Low (High)	Low	Low	Mod	
Border disease	Low	Low	Low	High	Not Listed by OIE or FAO
Avian infectious bronchitis	Low	Low	Low	High	Wide distribution; In Norway
Avian infectious laryngotracheitis	Mod	Low	Low	High	Carriers common, Backyard flocks
Avian tuberculosis	Low	Mod	Low	Low	Common? in Norway
Duck hepatitis	Low	Low	Low	Mod?	Transmission/ reservoir unknown
Fowl cholera	Mod	Low	Low	Low	Transmitted by adult carriers
Fowl pox	Low	Low	Low	High	Many reservoirs
Infectious bursal disease	Low	Low	Low	Low	Widespread in Norway
Marek's disease	Low	Low	Low	Low	Widespread in Norway
Mycoplasmosis	Low	Low	Low	Low	Widespread in Norway
Avian chlamydiosis	Low	High	Low	Low	Most common in caged birds
Vesicular Stomatitis	Mod	Low	High	Low	List A; International controls
African horse sickness	High	Low	High	Mod	List A; present in Europe, Airborne
Contagious equine metritis	Mod	Low	High	Mod	Poor test, Wide distribution
Dourine	Mod	Low	High	Low	Distribution
Epizootic lymphangitis	Mod	Low	Low	Low	Narrow distribution
Equine encephalomyelitis	High	Mod	Low	Low	Distribution in Americas
Equine infectious anemia	High	Low	Mod	Low	Present in Norway, Coggins test
Equine influenza (Type A)	Low	Low	Low	Low	Present in Norway???
Equine piroplasmosis (Babesiosis)	High	Low	High	Mod	Strict International rules
Equine viral rhinopneumonitis	Low	Low	Low	Low	Present in Norway
Glanders	High	High	Mod	Low	Eradicated in many countries
Horse pox	Low	Low	Low	Low	Obvious lesions
Equine viral arteritis	Low	Low	Low	Low	Present in Norway
Japanese encephalitis	High	High	High	Low	Confined to Malaysia
Horse mange	Low	Low	Low	Low	Well controlled or eradicated
Salmonellosis (S.abortivoequi)	Low	Low	Low	Low	Rare disease
Surra	Low	Low	Mod	Low	Distribution; vector absent
Venezuelan equine encephalomyelitis	High	High	High	Low	Distribution in Americas

Table 7a.

DISEASES LISTED BY MODE OF TRANSMISSION / INTRODUCTION

DISEASE	LIVE ANIMAL	MEAT	SEMEN	EMBRYO	VEHICLE	VECTOR
Foot and mouth disease (FMD)	Yes	Yes	Yes	Yes?	Yes	Yes?
Contagious Bovine Pleuropneumonia (CBPP)	Yes	No	No	No	Yes	No
Rinderpest	Yes	Yes	Yes	No?	Yes	Yes?
Lumpy skin disease (LSD	Yes	No	No	No	Yes	
Rift Valley Fever (RVF)	Yes	No	No	No	No	Yes
Heartwater	Yes	No	No	No	No	Yes
Rabies	Yes	Yes?	No	No	Aerosols?	
New world screw worm	Yes	No	No	No	No	Yes
Haemorrhagic septicemia (HS)	Yes	No?	Yes	No	Yes	Yes?
Theileriasis	Yes	No	No	No	No	Yes
Bovine spongiform encephalopathy (BSE)	Yes	Yes	No	No	?	?
Bovine Salmonellosis	Yes	Yes	No?	No	Yes	No?
Swine vesicular disease	Yes	Yes	?	?	Yes	No?
African swine fever	Yes	Yes	?	?	Yes	No?
Classical swine fever	Yes	Yes	?	?	Yes	No?
Swine vesicular exanthema	Yes	Yes	?	?	Yes	No
Porcine respiratory and reproductive syndrome	Yes	No	Yes?	No?	Yes	No?
Peste des petits ruminants (PPR)	Yes	Yes	?	?	Yes	Yes?
Bluetongue	Yes	No	Yes	Yes?	No	Yes
Sheep and goat pox	Yes	Yes?	?	?	Yes	Yes
Brucellosis- Br. melitensis	Yes	Yes	Yes	No	No	No
Contagious caprine pleuropneumonia	Yes	No	Yes	Yes?	No	No
Ovine pulmonary adenomatosis	Yes	No	No?	No?	Yes	No
Nairobi sheep disease	Yes	No	No?	No?	No	Yes
Sheep mange	Yes	No	No	No	Yes	No?
Highly pathogenic avian influenza (HPAI)	Yes	Yes	Yes	No	Yes	No
Newcastle disease	Yes	Yes	Yes	No	Yes	No
Avian Salmonellosis	Yes	Yes	No?	Yes	Yes	No
Paratyphoid Salmonellosis	Yes	Yes	No?	Yes	Yes	No

Table 7b

DISEASES LISTED BY MODE OF TRANSMISSION / INTRODUCTION

*** present in Norway**

DISEASE	LIVE ANIMAL	MEAT	SEMEN	EMBRYO	VEHICLE	VECTOR
*Anthrax	No	Yes	No	No	Yes	No
Bovine Brucellosis	Yes	Yes	Yes	No	No	No
Tuberculosis	Yes	Yes	Yes	?	Yes	?
Leptospirosis	Yes	No	Yes	Yes	Urine, Aerosol	No
*Paratuberculosis (PTB, Johne's disease)	Yes	No?	Yes	?	Milk?	No
*Echinococcosis/Hyaditosis	Yes	Yes	No	No	No	No
Cysticercosis	Yes	Yes	No	No	Meat	No
Q fever	Yes	No	No	No	Milk?	Yes
Bovine Genital Campylobacteriosis	Yes	No	Yes	No	Yes	No
Trichomoniasis	Yes	No	Yes	No	Yes	No
Enzootic bovine leukosis (EBL)	Yes	No	?	?	Yes	Yes
*Infectious Bovine Rhinotracheitis (BHV-1)	Yes	No	No	No	Yes	No
*Bovine Viral Diarrhea (BVD	Yes	No	Yes	No	Yes?	No
*Bovine Malignant Catarrh (BMC)	Yes	No	No	No	No	Yes?
*Babesiosis	Yes	No	No	No	No	Yes
Anaplasmosis	Yes	No	No	No	No	Yes
*Dermatophilosis	Yes	No	No	No	Yes	Yes
*Ringworm of cattle	Yes	No	No	No	Yes	No
Transmissible gastroenteritis	Yes	Yes	Yes	No	Yes	Yes?
Porcine epidemic diarrhea	Yes	Yes	Yes	No	Yes	Yes?
Viral encephalomyelitis of pigs; Teschen/Talfan disease; poliomyelitis suum	Yes	Yes	Yes	No	Yes	No
Porcine Brucellosis	Yes	Yes	Yes	No	Yes	No
*Atrophic rhinitis	Yes	No	No	No	No	No
*Trichinellosis	Yes	Yes	No	No	No	No
Swine influenza	Yes	No	?	?	No	No
Necrotic enteritis (*Cl.perfringens C*)	Yes	No	No	No	Yes	No
Brucella ovis infection	Yes	No	Yes	No	No	No
Brucellosis- Br. melitensis	Yes	No	Yes	No?	No	
*Caprine arthritis/encephalitis	Yes	No	No	No	Milk; Colostrum	No

Table 7c. DISEASES LISTED BY MODE OF TRANSMISSION / INTRODUCTION

* Present in Norway

DISEASE	LIVE ANIMAL	MEAT	SEMEN	EMBRYO	VEHICLE	VECTOR
Contagious agalactia	Yes	No	No	No	No	No
*Maedi-visna	Yes	No	?	?	No	No
*Scrapie	Yes	Yes?	No?	No?	No	
Salmonellosis (Sal. abortus ovis)	Yes	Yes?	Yes	No?	No	No
*Border disease	Yes	No	Yes?	No?	No	No
*Avian infectious bronchitis	Yes	Yes	Yes	Yes (egg)	Yes	No
Avian infectious laryngotracheitis	Yes	No	yes?	Yes (egg)	Yes	No
Avian tuberculosis	Yes	Yes	No?	No?	No	No
Duck hepatitis	Yes	?	?	No	?	No
*Fowl cholera	Yes	No?	No?	No	No?	No
Fowl pox	Yes	No	No	No	yes	Yes
Infectious bursal disease	Yes	Yes	Yes?	No?	Yes	No
*Marek's disease	Yes	No	Yes?	No	No?	No
*Mycoplasmosis	Yes	No	Yes	Yes	No	No
*Avian chlamydiosis	Yes	No	No	No	Yes	No
African horse sickness	Yes	No	Yes?	No	No	Yes
*Contagious equine metritis	Yes	No	Yes	No?	No	No
Dourine	Yes	No	Yes?	No?	No	No
Epizootic lymphangitis	Yes	No	No	No	Yes	No
Equine encephalomyelitis	Yes	No	No?	No?	Yes?	Yes
*Equine infectious anemia	Yes	No	Yes?	No?	No	Yes
*Equine influenza (Type A)	Yes	No	No?	No?	Yes	No
Equine piroplasmosis (Babesiosis)	Yes	No	No?	No?	No	Yes
*Equine viral rhinopneumonitis	Yes	No	Yes	No?	No	No
Glanders	Yes	No	No?	No?	Yes	No
Horse pox	Yes	No	No?	No?	Yes	No?
*Equine viral arteritis	Yes	No	Yes	No?	Yes	No
Japanese encephalitis	Yes	No	No?	No?	No	Yes
Horse mange	Yes	No	No	No	Yes	No
Salmonellosis (S.abortivoequi)	Yes	No	Yes	No?	Yes?	No
Surra	Yes	No	No	No	No	Yes
Venezuelan equine encephalomyelitis	Yes	No	No?	No?	No	Yes

Table 8.

DISEASES CHARACTERIZED BY RELATIVELY HIGH PROBABILITY OF INTRODUCTION AND ESTABLISHMENT

DISEASE		
Salmonellosis	High	Widely distributed; High prevalence
Porcine respiratory and reproductive syndrome	High	Wide distribution, high prevalence
Highly pathogenic avian influenza (HPAI)	High	Wild birds; Ease of transmission
Newcastle disease	High	Wild birds; Ease of transmission
Duck virus enteritis (Duck Plague)	High	Wild ansiforme reservoir
Paratyphoid Salmonellosis	High	Many reservoirs; Wide distribution
Leptospirosis	High	Multiple sources, Wide distribution
Paratuberculosis (PTB, Johne's disease)	High	Widely distributed, poor tests
Cysticercosis (*C. cellulosae*)	High	Human host
Q fever	High	High prevalence, wide distribution
Anaplasmosis	High	Same range as Babesia
Teschen/Talfan disease; poliomyelitis suum	High	Sub-clinical infections; Present in Denmark
Trichinellosis	High	Several hosts, insensitive test
Swine influenza	High	Wide distribution, high prevalence
Border disease	High	Not Listed by OIE or FAO
Avian infectious laryngotracheitis	High	Carriers common, Backyard flocks
Fowl pox	High	Many reservoirs

Table 9.

DISEASES RANKED BY MODERATE PROBABILITY OF INTRODUCTION AND ESTABLISHMENT

DISEASE		
Rabies	Mod	Multiple sources; Wildlife
Swine vesicular disease	Mod	Present in Europe; Highly contagious
African swine fever	Mod	Present in Europe; Highly contagious
Classical swine fever	Mod	Present in Europe; Highly contagious
Echinococcosis/Hyaditosis	Mod	Poor diagnostics;
Bovine Genital Campylobacteriosis	Mod	Difficult diagnosis; semen spread;
Trichomoniasis	Mod	Difficult diagnosis; semen spread;
*Enzootic bovine leukosis (EBL)	Mod	Wide distribution, present in Norway?
Infectious Bovine Rhinotracheitis (BHV-1)	Mod	Wide distribution ;Very sensitive test
Transmissible gastroenteritis	Mod	Present in Europe
Porcine epidemic diarrhea	Mod	Present in Europe
Bluetongue	Mod	Distribution; International controls
Ovine pulmonary adenomatosis	Mod	No practical means of identifying infected animals
Avian tuberculosis	Mod	No practical means of identifying infected birds
Duck hepatitis	Mod?	Transmission and reservoir unknown

Table 10a.

DISEASES RANKED BY LOW PROBABILITY OF INTRODUCTION AND ESTABLISHMENT

DISEASE		
Foot and mouth disease (FMD)	Low	International controls
Rinderpest	Low	International controls
Contagious Bovine Pleuropneumonia (CBPP)	Low	International controls
Vesicular Stomatitis	Low	Distribution; International controls
Swine vesicular exanthema	Low	Marine calicivirus
Lumpy skin disease (LSD	Low	Distribution; International controls
Rift Valley Fever (RVF)	Low	International controls
Anthrax	Low	International controls; Present in Norway
Bovine Brucellosis	Low	International controls
Tuberculosis	Low	International controls
New world screw worm	Low	International controls; distribution;
Haemorrhagic septicemia (HS)	Low	Narrow distribution
Theileriasis	Low	Narrow distribution; Vector absent?
Babesiosis	Low	Reported in Norway
Dermatophilosis	Low	Present in Norway
Ringworm of cattle	Low	Widely distributed; Not generally of concern
Porcine Brucellosis	Low	Distribution; Eradication programs
Necrotic enteritis (*Cl.perfringens C*)	Low	Distribution
Sheep and goat pox	Low	Distribution; International controls
Brucella ovis infection	Low	Ease of diagnosis
Brucellosis- Br. mellitensis	Low	Distribution; International controls
Contagious caprine pleuropneumonia	Low	Narrow distribution,
Caprine arthritis/encephalitis	Low	Present in Norway
Contagious agalactia	Low	Narrow distribution,
Maedi-visna	Low	Present in Norway
Nairobi sheep disease	Low	Only found in Africa
Salmonellosis (Sal. abortus ovis)	Low	Relatively rare cause of abortion in sheep
Avian Salmonellosis	Low	Eradicated in many countries
Infectious bursal disease	Low	Widespread in Norway
Marek's disease	Low	Widespread in Norway
Mycoplasmosis	Low	Widespread in Norway
Avian chlamydiosis	Low	Most common in caged birds
African horse sickness	Low	Distribution; International awareness
Dourine	Low	Distribution; International awareness; Eradicated many places
Epizootic lymphangitis	Low	Obvious lesions
Equine encephalomyelitis	Low	Distribution in Americas; International awareness
*Equine infectious anemia	Low	Present in Norway, Coggins testing
*Equine influenza (Type A)	Low	Present in Norway
Equine piroplasmosis (Babesiosis)	Low	Strict international controls and quarantines.
*Equine viral rhinopneumonitis	Low	International awareness
Glanders	Low	Distribution, Eradicated in many countries
Horse pox	Low	Obvious lesions
*Equine viral arteritis	Low	Present in Norway
Japanese encephalitis	Low	Only in Malaysia
Horse mange	low	Obvious diagnosis, treatment
Salmonellosis (S.abortivoequi)	Low	Very rare disease
Surra	Low	Distribution, severity
Venezuelan equine encephalomyelitis	Low	Distribution in Americas; International awareness

Table 11.

ANIMAL ASSOCIATED DISEASES OF PUBLIC HEALTH SIGNIFICANCE

DISEASE	COMMENTS
Foot and Mouth Disease	Minor human health hazard; Infection by contact with infected animal; Not foodborne
Rift Valley Fever (RVF)	Serious human health risk; Infection by contact with infected animal; Not foodborne
Anthrax	Serious human health risk; Infection by contact with infected animal or animal product; Can be foodborne
Rabies	Serious human health risk; Infection by contact with infected animal.
Bovine Brucellosis	Serious human health risk; Infection by contact with infected animal. Can be foodborne.
Tuberculosis	Serious human health risk; Infection by contact with infected animal. Unlikely to be foodborne.
Leptospirosis	Serious human health risk; Infection by contact with infected animal. Likely to be waterborne.
Paratuberculosis (PTB, Johne's disease)	Unknown human health significance. Crohn's Disease?
Echinococcosis/Hyaditosis	Serious human health risk; Foodborne
Cysticercosis	Human tapeworm; Foodborne.
Q fever	Minor human health problem.
New world screw worm	Rarely infests humans
Bovine spongiform encephalopathy	High profile human disease (nvCJD). Actual risk to human population is probably very low due to controls.
Ringworm of cattle	Minor human health risk.
Bovine and Porcine Salmonellosis	Major human health problem worldwide. Foodborne
Campylobacteriosis	Major human health problem worldwide. Foodborne
Swine vesicular disease	Minor human health hazard; Infection by contact with infected animal; Not foodborne
Porcine Brucellosis	Minor human health hazard; Infection by contact with infected animal; Foodborne?
Trichinellosis	Signifcant human health hazard usually associated with pig meat but also horse and bear meat.
Swine influenza	Potentially a significant human health problem. Probably originated in humans.
Brucellosis- Br. melitensis	Serious human health risk; Infection by contact with infected animal. Can be foodborne.
Avian influenza (HPAI)	Potentially a significant human health problem. Transmission to humans is rare.
Newcastle disease	Minor human health hazard; Infection by contact with infected animal;
Avian tuberculosis	A hazard to immunocompromised individuals.
Avian Salmonellosis	Minor human health risk; Foodborne.
Paratyphoid Salmonellosis	Serious human health risk; Foodborne.
Avian chlamydiosis	Serious human health risk; Not foodborne; Most common in caged birds.
Vibriosis	Vibrio parahemoloyticus infection; Serious human health risk; Foodborne in seafood vehicle.
Listeriosis	Serious human health risk; Foodborne.
Toxoplasmosis	Serious human health risk in pregancy and immunocompromised individuals
Botulism	Serious human health risk; Foodborne
Colibacillosis	Serious human health risk; Foodborne
Shigellosis	Serious human health risk; Foodborne

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Table 12.

DISEASES WITH A SIGNIFICANT RISK OF INTRODUCTION WITH MEAT
(from McDiarmid, 1991; MAF, 1999)

MEAT	FRESH/CHILLED	DRIED/CURED	FROZEN
BEEF	FMD	+/-	
	Rinderpest	+/-	
	Anthrax	+/-	
	Hydatids	-	-
	Leptospirosis	-	
	Cysticercosis	+/-	-
	BSE	+/-	
	VES	+/-	
	Tularemia	+/-	
PORK	FMD	+/-	
	Rinderpest	+/-	
	Swine Vesicular Disease	+/-	
	African Swine Fever	+/-	
	Classical Swine Fever	+/-	
	Anthrax	+/-	
	Hydatids	-	
	Leptospirosis	+/-	
	Cysticercosis	+/-	
	VES	+/-	
	Trichinosis	+	-
	Tularemia	+/-	
SHEEP AND GOAT	FMD	+/-	
	Rinderpest	+/-	
	Anthrax	+/-	
	Hydatids	-	
	Leptospirosis	+/-	
	Scrapie	-	
	VES	+/-	
	Tularemia	+/-	
POULTRY	Newcastle disease	?	
	HPAI	-	
	IBD	+	
FOWL	Anthrax	+/-	
	Newcastle disease	?	
	HPAI	-	
	IBD	+	
HORSE	Anthrax	+/-	
	Hydatids	-	
	Leptospirosis	+/-	
	VES	+/-	
	Tularemia	+/-	
	Trichinosis	+	-

Table 13

DISEASES NOT PRESENT IN NORWAY WITH A SIGNIFICANT RISK OF INTRODUCTION WITH MEAT UNLESS SPECIFIC SAFEGUARDS ARE USED

Foot and Mouth Disease
Swine Vesicular Disease
Rinderpest
African Swine Fever
Classical Swine Fever
Echinococcosis/Hydatids
Leptospirosis
Cysticercosis
Bovine Spongiform Encephalopathy
Vesicular Exanthema of Swine
Trichinosis
Newcastle Disease - virulent forms
Avian Influenza
Infectious Bursal Disease - more virulent forms
Salmonellosis

Table 14.

SOME DISEASES THAT MIGHT BE INCREASED IN ASSOCIATION WITH INCREASED TRADE

DISEASE	COMMENTS
Salmonellosis	Ubiquitous - Sal. spp. are widely distributed. Multiple hosts and sources. Unprocessed foods and humans are likely sources. Almost impossible to find Salmonella free foods.
Porcine respiratory and reproductive syndrome	Wide distribution, high prevalence. Difficult to prove that an animal is not infected. Requires herd testing to detect infected herds.
Leptospirosis	Multiple hosts, Wide distribution
Paratuberculosis (Johne's disease)	Widely distributed, poor tests
Swine influenza	Wide distribution, high prevalence
Trichinellosis	Wide distribution, several hosts, insensitive test
Cysticercosis	Not easily detected at slaughter, Associated with areas with poor human sanitation.