



Australian Government
**Department of Agriculture,
Fisheries and Forestry**

Final report: Fresh (chilled or frozen) beef and beef products from Canada

Addendum to the Fresh (chilled or frozen) beef and beef products from Japan, the Netherlands, New Zealand, the United States and Vanuatu – final review

February 2025

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Acknowledgement of Country

We acknowledge the Traditional Custodians of Australia and their continuing connection to land and sea, waters, environment and community. We pay our respects to the Traditional Custodians of the lands we live and work on, their culture, and their Elders past and present.

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Summary

Australia's review of the biosecurity import conditions for the importation of *Fresh (chilled or frozen) beef and beef products from Japan, the Netherlands, New Zealand, the United States and Vanuatu* (the beef review) was published in August 2017 (Department of Agriculture and Water Resources 2017). The beef review considered market access for fresh beef and beef products for human consumption from Japan, the Netherlands, New Zealand, the United States and Vanuatu, referred to as applicant countries.

Since the publication of the beef review, the Canadian government has formally approached the Australian government for market access for fresh beef and beef products for human consumption derived from bovines (i.e. cattle, buffalo and domestic bison) born, raised and slaughtered in Canada and from bovines born and raised in the United States of America and legally imported into Canada. The United States is an approved country for the export of fresh beef and beef products to Australia.

To access the Australian market for fresh beef and beef products, applicant countries then undergo a three-part review process that identifies food safety and biosecurity risks and applies conditions that exporting countries must meet.

Food Standards Australia New Zealand (FSANZ), an independent statutory agency within the Australian Government's Health portfolio with responsibility for food safety, is responsible for assessing the level of risk posed by bovine spongiform encephalopathy (BSE) to the health of Australian consumers. In July 2024 FSANZ completed a BSE food safety risk assessment of Canada in line with FSANZ's published assessment guidelines. The Australian BSE committee agreed to assign Category 1 status for country BSE food safety risk to Canada. Category 1 status means there are comprehensive and well-established controls to prevent both the introduction and amplification of the BSE agent in a country's cattle population, and contamination of the human food supply with the BSE agent.

The Department of Agriculture, Fisheries and Forestry (the department) assesses the animal biosecurity risks associated with fresh beef and beef products for access to Australia. In this addendum, the department has assessed the animal biosecurity risks (excluding BSE, which is covered by the FSANZ assessment) of the proposed importation of fresh beef and beef products derived from bovines from Canada.

The final step in the process is for the department to complete a competent authority assessment to determine if Canada's official animal health, export control, and supervision systems will ensure that Australia's biosecurity and food safety requirements will be reliably met.

This addendum uses risk assessment methods consistent with those of the beef review and should be read in conjunction with the beef review. It adopts the following standards as the benchmark for the assessment of the unrestricted risk estimate associated with imported fresh beef and beef products from the applicant countries (relevant Australian standards):

- *AS 4696:2023 Australian Standard for the Hygienic Production and Transportation of Meat and Meat Products for Human Consumption (2023).*

- *Bovine spongiform encephalopathy (BSE): requirements for the importation of beef and beef products for human consumption – effective 1 March 2010* (Australian BSE food safety requirements) (FSANZ 2010).
- *Imported Food Control Act 1992* which requires imported food to comply with the *Australia New Zealand Food Standards Code* (Food Standards Code) and not pose a risk to human health.

Hazard identification

Hazard identification involves identifying the pathogenic or disease agents which could potentially produce adverse consequences associated with the importation of fresh beef and beef products.

Several significant bovine diseases and disease agents that are currently exotic to Canada and Australia were identified:

- Aujeszky's disease
- brucellosis (*Brucella melitensis*)
- contagious bovine pleuropneumonia (*Mycoplasma mycoides* subspecies *mycoides* small colony)
- Crimean-Congo haemorrhagic fever
- foot-and mouth-disease
- haemorrhagic septicaemia
- lumpy skin disease
- surra
- Rift Valley fever
- rinderpest
- theileriosis (*Theileria annulata* and *T. parva*)
- trypanosomiasis (Tsetse transmitted)
- vesicular stomatitis
- Wesselsbron disease

Aujeszky's disease and vesicular stomatitis are present in some of the applicant countries that were originally considered in the beef review. The beef review concluded that the risk of these diseases was negligible and did not recommend any risk management, including country freedom attestations. Therefore, no certification of country freedom is proposed for Aujeszky's disease and vesicular stomatitis for the importation of fresh beef and beef products from Canada.

The animal biosecurity risk of lumpy skin disease (LSD) transmission through meat flesh derived exclusively from bovine skeletal muscle (fresh bovine skeletal muscle meat) has been assessed in a separate addendum to the beef review (Department of Agriculture, Water and the Environment 2017). This found that the overall risk of lumpy skin disease associated with the import of fresh bovine skeletal muscle meat for human consumption is very low and achieves Australia's appropriate

level of protection (ALOP). Specific biosecurity risk management measures are not justified for LSD virus when bovine skeletal muscle meat is imported for human consumption into Australia from Canada. Country freedom certification for lumpy skin disease for import of fresh bovine skeletal muscle meat from Canada is not required to achieve Australia's ALOP. Country freedom certification for lumpy skin disease would still be required for other fresh beef and beef products that do not meet the definition of skeletal muscle meat.

Rinderpest was declared globally eradicated in 2011 and is therefore no longer identified as a hazard for trade in fresh beef and beef products and no risk management is required.

This addendum recommends that certification of country freedom is considered sufficient, reasonable and practical to address the risk of the importation of fresh beef and beef products from Canada for the following diseases and disease agents:

- brucellosis (*B. melitensis*)
- contagious bovine pleuropneumonia
- Crimean-Congo haemorrhagic fever
- foot-and-mouth disease
- haemorrhagic septicaemia
- surra
- Rift Valley fever
- theileriosis (*T. annulata* and *T. parva*)
- trypanosomiasis (Tsetse transmitted)
- Wesselsbron disease

Risk assessments

The following diseases (associated with the disease agents identified in the hazard identification stage) were identified in this addendum as requiring further assessment:

- anthrax
- bovine cysticercosis (*Taenia saginata*)
- bovine tuberculosis (TB) (*Mycobacterium bovis* and *M. caprae*)
- bovine viral diarrhoea
- brucellosis (*B. abortus* and *B. suis*)
- echinococcosis (*Echinococcus granulosus sensu stricto*, *E. ortleppi*, and *E. multilocularis*)
- paratuberculosis (*Mycobacterium avium* subspecies *paratuberculosis*)
- infection with *Salmonella enterica* serotype Typhimurium DT104

This addendum concludes that the risk of the diseases listed above associated with the importation of beef and beef products from Canada can achieve Australia's ALOP with respect to human and

animal biosecurity risks, including food safety requirements, provided that the imported fresh beef and beef products from Canada are produced in accordance with, or equivalent to, relevant Australian standards. Additional risk management for these diseases is not required in relation to fresh beef and beef products imported from Canada.

The proposed health certification for bovine TB will include a requirement that veterinary ante-mortem and post-mortem inspection is undertaken because bovine TB is exotic to Australia and presents a significant human and animal biosecurity risk.

The conclusions of the assessment for each of these diseases in terms of estimated risk from the importation of fresh beef and beef products are summarised below.

Anthrax

The animal biosecurity risk of anthrax associated with the importation of fresh beef and beef products from Canada is considered negligible and achieves Australia's ALOP.

Additional risk management for anthrax is therefore not required for the importation of fresh beef and beef products from Canada.

Bovine cysticercosis (*T. saginata*)

The animal biosecurity risk of bovine cysticercosis (*T. saginata*) associated with the importation of fresh beef and beef products from Canada is considered negligible and achieves Australia's ALOP.

Additional risk management for bovine cysticercosis is therefore not required for the importation of fresh beef and beef products from Canada.

Bovine tuberculosis (*M. bovis* and *M. caprae*)

The animal biosecurity risk from bovine TB associated with the importation of fresh beef and beef products from Canada is considered negligible and therefore achieves Australia's ALOP with respect to biosecurity risks.

Additional risk management for bovine TB is therefore not required for the importation of fresh beef and beef products from Canada. However, proposed certification will include a requirement that veterinary ante-mortem and post-mortem inspection is undertaken because bovine TB is exotic to Australia.

Bovine viral diarrhoea

The animal biosecurity risk from bovine viral diarrhoea virus associated with the importation of fresh beef and beef products from Canada is considered negligible and achieves Australia's ALOP.

Additional risk management for bovine viral diarrhoea virus is therefore not required for the importation of fresh beef and beef products from Canada.

Brucellosis (*B. abortus* and *B. suis*)

Given that reproductive organs, udders and products from non-domesticated bovines are excluded from importation under the scope of the beef review, the likelihood of entry of *B. abortus* or *B. suis* with imports from Canada of fresh beef and beef products derived from domesticated bovines which

passed ante-mortem and post-mortem inspection is considered negligible and achieves Australia's ALOP with respect to biosecurity risks.

Additional risk management for *B. abortus* or *B. suis* is not required for the importation of fresh beef and beef products from Canada.

Echinococcosis (*E. granulosus sensu stricto*, *E. ortleppi*, and *E. multilocularis*)

The animal biosecurity risk of echinococcosis associated with the importation of fresh beef and beef products from Canada is considered negligible and achieves Australia's ALOP.

Additional risk management for echinococcosis is therefore not required for the importation of fresh beef and beef products from Canada.

Paratuberculosis (*Mycobacterium avium* subspecies *paratuberculosis*)

The animal biosecurity risk from *M. avium* subspecies *paratuberculosis* associated with the importation of fresh beef and beef products from Canada is considered negligible and therefore achieves Australia's ALOP with respect to biosecurity risks.

Additional risk management for *M. avium* subspecies *paratuberculosis* is therefore not required for the importation of beef and beef products from Canada.

Infection due to *Salmonella enterica* serotype Typhimurium DT104

The animal biosecurity risk from *Salmonella enterica* serotype Typhimurium DT104 (*S. Typhimurium* DT104) associated with the importation of fresh beef and beef products from Canada produced in accordance with, or equivalent to, relevant Australian standards is considered negligible and therefore achieves Australia's ALOP.

Australia will require that listed establishments in Canada operate Hazard Analysis Critical Control Point Quality Assurance plans (HACCP-based QA plans), and have their satisfactory operation verified via a bacteriological testing program equivalent to that undertaken in Australia, in accordance with relevant Australian standards.

Verification that HACCP-based QA plans in Canada are operating as required to provide the necessary assurances will occur through a competent authority assessment.

Other considerations

FSANZ has previously considered the food safety risks associated with the proposed importation of fresh beef and beef products and has developed risk advice (in the form of risk statements) for the following foodborne hazards: Shiga toxin-producing *E. coli* (STEC), *Salmonella* spp. (including *S. Typhimurium* DT104) and *Campylobacter* spp. During the development of the beef review, FSANZ provided advice to the department that imports of fresh beef and beef products are considered to present a potential medium to high risk to public health for STEC and *Salmonella* spp.

To manage this risk, the beef review noted, and this addendum reiterates, that exporting countries will need to demonstrate competent authority oversight of the exporting establishments (where cattle are slaughtered, and where the meat derived from those animals is prepared, processed and/or stored), ensuring these facilities are operating through-chain Codex Alimentarius HACCP based food safety programs (approved and supervised by the relevant competent authority) which

control the risks associated with STEC and *Salmonella* spp. Consignments of fresh beef and beef products being exported will need to be certified by the competent authority and at-border verification testing will be applied. The meat is required to be compliant with standards equivalent to Australian food standards including microbiological, contaminant and residue standards. Any

Conclusion

The addendum found that the animal biosecurity risks associated with the importation of fresh beef and beef products from Canada to Australia can meet Australia's ALOP. The department considered submissions received on the draft policy review and has added a new section 1.4 Bovines legally imported into Canada from the United States. The department has now prepared this final addendum.

The addendum adds Canada as an applicant country to the 2017 beef review. The next step in the process are for the department to conduct the competent authority assessment to determine if Canada's official animal health, export control, and supervision systems will ensure that Australia's biosecurity and food safety requirements will be reliably met Before trade can commence Canada is provided with the import requirements it will need to comply with. On that basis health certificate negotiation is undertaken to establish an agreed Canadian health certificate that meets Australia's stated import requirements for fresh beef and beef products from Canada

1 Introduction

A rigorous, evidence-based and consultative process, consistent with Australia's international obligations, has been established by the Australian Government to assess countries seeking market access to Australia for fresh beef and beef products.

Australia's review of biosecurity import conditions for the importation of *Fresh (chilled or frozen) beef and beef products from Japan, the Netherlands, New Zealand, the United States and Vanuatu* (the beef review) was published in August 2017 (Department of Agriculture and Water Resources 2017). The beef review considered market access for fresh beef and beef products for human consumption from the above specified countries, referred to here as applicant countries.

The beef review and this addendum meet the requirements of Australia's *Biosecurity Act 2015* and follow procedures that align with those specified by the World Organisation for Animal Health (WOAH).

The risk assessment procedure advised in the WOAH Terrestrial Animal Health Code (Terrestrial Code) is consistent with the process defined in Australian legislation. Australia's appropriate level of protection (ALOP) from biosecurity risk is defined in the *Biosecurity Act 2015* as 'a high level of sanitary and phytosanitary protection aimed at reducing biosecurity risks to a very low level, but not to zero'.

1.1 Purpose of this addendum

The purpose of this addendum is to consider the biosecurity risk associated with the importation of fresh beef and beef products for human consumption from Canada into mainland Australia and Tasmania. The Australian External Territories are not considered in this addendum (consistent with the scope of the beef review).

This addendum should be read in conjunction with the 2017 beef review. Unless otherwise stated, the definitions and methods used in this addendum are consistent with those of the beef review.

1.2 Scope and commodity definition

Consistent with the beef review, beef and beef products included in this addendum are restricted to meat, bone and offal for human consumption from domestic American bison (*Bison bison*), domestic buffalo (*Bubalus bubalis*—water buffalo or Asian water buffalo), or domestic cattle (*Bos taurus* and *Bos indicus*), imported as fresh (chilled or frozen) beef and beef products. Domestic American bison, buffalo and cattle are collectively referred to in this addendum as bovines.

For the purpose of this addendum, offal means the heart, oesophagus, organs of the abdominal cavity (other than reproductive organs), the muscular tissues of the head, tissues of the diaphragm, the tail and tendons.

This addendum specifically excludes:

- brain, all pulmonary and reproductive organs, including udders (and associated lymph nodes)
- milk and dairy products

- gelatine and collagen derived from bovine skins and hides (including casings produced from this type of material)
- edible bovine fats or bovine tallow included as a minor ingredient of a processed product
- blood and blood products, excepting that which is naturally contained in meat flesh after slaughter and bleeding
- natural casings, heat-processed meat-based flavours and retorted beef and beef products for human consumption, as separate import requirements apply to these products.

In this addendum, the department assessed the animal biosecurity associated with the proposed importation of fresh beef and beef products from Canada. This excluded risks of bovine spongiform encephalopathy (BSE), as this is covered by Food Standards Australia New Zealand (FSANZ).

The Food Standards Code, under the *Food Standards Australia New Zealand Act 1991*, requires that beef and beef products must only be sourced from animals free from BSE. In addition, Australian BSE requirements only allow importation of beef and beef products from countries that have applied to Australia for a BSE assessment and have been assigned a Category 1 or Category 2 status by Australian authorities (FSANZ 2010). FSANZ conducts this BSE food safety risk assessment, which assesses the level of risk posed by BSE to the health of Australian consumers. FSANZ assigns a Category 1 status to countries assessed as meeting the 'negligible BSE risk' requirements defined by the World Organisation for Animal Health (WOAH). Category 2 is assigned to those countries assessed as meeting the 'controlled BSE risk' requirements defined by WOAH. In July 2024, FSANZ completed an assessment of Canada's BSE status, assigning a Category 1 status.

In the beef review, human health concerns, excluding via direct consumption, associated with the importation of fresh beef and beef products were assessed by the then Department of Health, while food safety risks were assessed by FSANZ.

Animal biosecurity risks from imported fresh beef and beef products from Canada were assessed after consideration of equivalent standards at slaughter and meat processing facilities. The department adopted the following standards (referred to as relevant Australian standards) as the benchmark for the assessment of the unrestricted risk estimates in the beef review and this addendum:

- *AS 4696:2023 Australian Standard for the Hygienic Production and Transportation of Meat and Meat Products for Human Consumption (2023).*
- *Bovine spongiform encephalopathy (BSE): requirements for the importation of beef and beef products for human consumption – effective 1 March 2010 (FSANZ 2010).*
- *Imported Food Control Act 1992* which requires imported food to comply with the Food Standards Code and not pose a risk to human health.

The original scope of the draft addendum (released on 11 December 2023) was beef derived from bovines born, raised and slaughtered in Canada. Since the release of the draft and before the release of this final addendum, the Canadian Food Inspection Agency (CFIA) requested an expanded scope to include beef derived from bovines legally imported into Canada from the United States.

The United States is already approved to export beef derived from bovines born, raised and slaughtered in the United States to Australia, having been included in the 2017 beef review and having undergone a successful competent authority assessment in 2019. This means that the biosecurity risks associated with beef derived from cattle born, raised and slaughtered in the United States have already been assessed to meet Australia's ALOP.

The department advised the CFIA that the scope can be amended to include beef derived bovines imported from the United States, but Australia requires certainty that these bovines have only resided in the United States or Canada and will assess this in detail during the competent authority evaluation.

1.3 Consultation and next steps

A draft version of this addendum was released on 11 December 2023 for an 80 day public consultation which closed on 28 February 2024. This process allowed stakeholders the opportunity to comment and draw attention to any scientific, technical, or other gaps in the data, misinterpretations and errors.

The department considered the submissions received on the draft addendum and in response has added section 1.4 Bovines legally imported into Canada from the United States. The department has also published a summary of stakeholder comments and departmental responses.

2 Method

The method used in this addendum followed the approach used in the beef review. Briefly, this involved:

- hazard identification
- risk assessment (made up of entry assessment, exposure assessment, consequence assessment and risk estimation)
- risk management
- risk communication.
- Hazard identification, risk assessment and risk management are sequential steps within a risk analysis. Risk communication is conducted as an ongoing process and includes both formal and informal consultation with stakeholders. The outcome is the development of import requirements included in a bilaterally negotiated health certificate, or certificates, for the export of fresh beef and/or beef products to Australia from Canada.

2.1 Hazard identification

Hazards were identified in the beef review using the hazard identification process described in the Terrestrial Code (Article 2.1.2). Hazard identification is a classification step undertaken to identify the pathogenic or disease agents which could potentially produce adverse consequences associated with the importation of beef and beef products (WOAH 2023i).

In the hazard identification step in the beef review, the department identified bovine diseases primarily affecting animal health and referred to the then Department of Health and FSANZ any additional disease agents that may primarily affect human health. The Director of Human Biosecurity can implement biosecurity measures to manage the risks to human life or health associated with the importation of beef and beef products.

In accordance with the Terrestrial Code, a disease agent was considered a hazard potentially present in fresh beef and beef products if it was assessed to cause:

- a disease or infection of cattle (*Bos taurus* and *Bos indicus*) or buffalo (*Bubalus bubalis*) or domesticated American bison (*Bison bison*) and
- a WOAHA-listed disease, an emerging disease, or a disease or infection capable of producing adverse animal biosecurity consequences in Australia.

2.1.1 Identification of additional hazards relevant for Canada

The hazard identification of the beef review considered all WOAHA-listed diseases and disease agents of bovines, as well as any emerging bovine diseases, or those with adverse consequences to Australia present in the applicant countries (Japan, the Netherlands, New Zealand, the United States and Vanuatu).

For the purposes of this addendum, diseases and disease agents currently known to affect bovines in Canada were reviewed, including ProMed posts since 2010. No relevant bovine diseases were

identified that were not considered in the beef review. The possibility of parasites, transmissible via beef, present in Canada was also investigated. No intermediate stages of parasites (e.g. cysts in muscle) were identified as of biosecurity concern that were not previously considered in the beef review.

The hazard list identified in the beef review was used for hazard refinement (Appendix B).

2.1.2 Hazard refinement

Following the methods used in the beef review, a hazard was retained for further review (hazard refinement) if:

- the disease or infection caused by the hazard is exotic to Australia (serotypes or strains considered exotic to Australia may meet this criterion), or if present is a nationally notifiable animal disease or subject to official control or eradication, and
- there is scientific evidence that the disease agent is present in, and potentially transmissible by, beef carcasses and carcase parts, and
- the disease agent is present, or may be present, in Canada.

As in the beef review, carcase was defined as “the body of a slaughtered animal after bleeding” and carcase parts were defined as “any tissue or structure removed from a carcase and includes, for example, the head, viscera, offal and blood”.

2.2 Risk assessment

Disease agents retained following the hazard refinement stage were subjected to scientific review to determine whether a full risk assessment would be required, in accordance with Chapter 2.1 of the Terrestrial Code (WOAH 2023i).

Risk assessment is the evaluation of the likelihood and the biological and economic consequences of entry, establishment and spread of a hazard within the territory of an importing country. As described in Chapter 2.1 of the Terrestrial Code, it consists of an entry assessment, exposure assessment, consequence assessment and risk estimation for each hazard.

The unrestricted risk estimate is defined as the level of risk that would be present if there were no safeguards in excess of standard practices. The department adopted the following standards as the benchmark for assessment of the unrestricted risk estimate (relevant Australian standards):

- *AS 4696:2023 Australian Standard for the Hygienic Production and Transportation of Meat and Meat Products for Human Consumption (2023).*
- *Bovine spongiform encephalopathy (BSE): requirements for the importation of beef and beef products for human consumption – effective 1 March 2010 (FSANZ 2010).*
- *Imported Food Control Act 1992* which requires imported food to comply with the Food Standards Code and not pose a risk to human health.

A review of the scientific literature was conducted concerning factors relevant to the entry, exposure and consequence assessment for each hazard retained for risk review.

2.2.1 Risk assessment framework

For each disease identified as requiring risk assessment, the evaluation of disease risk associated with the importation of fresh beef and beef products includes:

- the likelihood of the disease agent entering Australia via imported beef and beef products (entry assessment)
- the likelihood of susceptible animals being exposed to and infected with the disease agent via imported beef and beef products (exposure assessment)
- the likelihood of significant outbreaks occurring due to exposure (part of the consequence assessment)
- the potential impacts of any significant outbreaks (part of the consequence assessment).

As in the beef review, if any stage of the risk assessment demonstrated there was no significant risk, the risk assessment did not proceed further.

2.2.2 Entry assessment

Entry assessment describes the biological pathways necessary for importation to introduce disease agents into the importing country and estimating the probability of that process occurring. It considers biological factors of the pathogen and the species of origin; country factors including prevalence of infection and animal health systems in the country of export; and commodity factors such as the quantity to be imported, testing, treatment and/or processing.

The minimum requirement for the entry assessment was considered to be equivalency with the relevant Australian standards (the Australian Meat Standard, the Australian BSE food safety requirements and the *Imported Food Control Act 1992*) for sourcing of domesticated bison, buffalo or cattle, the production of beef and beef products for human consumption and their storage and transportation (Department of Agriculture, Fisheries and Forestry 2023b; FSANZ 2010).

The entry pathway evaluated the following seven factors affecting the presence of the disease agent:

- the herd of origin of the animal slaughtered
- the animal selected for slaughter
- ante-mortem inspection at the abattoir
- dressing of the carcass and carcass parts
- post-mortem inspection
- preparation and storage of fresh beef and beef products for transport to Australia
- clearance at the Australian border for entry into the food chain.

2.2.3 Exposure assessment

Exposure and consequence assessment was only required for *Salmonella enterica* serotype Typhimurium DT104 (*S. Typhimurium* DT104) in this addendum. Risk assessment for all other hazards concluded at the likelihood of entry assessment stage. A description of the approaches used for exposure assessment can be found in Section 3.2 of the beef review.

2.2.4 Estimation of the likelihood of entry and exposure

A description of the methods to estimate the likelihood of entry and exposure is provided in Section 3.3 of the beef review.

2.3 Consequence assessment

2.3.1 Consequence assessment

In accordance with the risk assessment process described above, a consequence assessment was only required for *S. Typhimurium* DT104.

The consequence assessment describes the relationship between exposures to the identified hazard and the consequences of those exposures. It assesses the likelihood of establishment and/or spread of the hazard and the potential impacts/effects of the disease (that is, the outbreak scenario).

A description of the approaches used for consequence assessment can be found in Section 3.4 of the beef review.

2.3.2 Risk estimation

Risk estimation is the process of combining the likelihood of entry and exposure with the likely consequences to produce a risk estimate using a risk estimation matrix (Table 1).

Table 1 Risk estimation matrix

Likelihood of pest entry, establishment and spread	Consequences of pest entry, establishment and spread					
	Negligible	Very low	Low	Moderate	High	Extreme
High	Negligible risk	Very low risk	Low risk	Moderate risk	High risk	Extreme risk
Moderate	Negligible risk	Very low risk	Low risk	Moderate risk	High risk	Extreme risk
Low	Negligible risk	Negligible risk	Very low risk	Low risk	Moderate risk	High risk
Very low	Negligible risk	Negligible risk	Negligible risk	Very low risk	Low risk	Moderate risk
Extremely low	Negligible risk	Negligible risk	Negligible risk	Negligible risk	Very low risk	Low risk
Negligible	Negligible risk	Negligible risk	Negligible risk	Negligible risk	Negligible risk	Very low risk

2.4 Risk management

The conclusions drawn from the risk assessments conducted for each hazard were used as the basis for risk evaluation in this addendum. A judgement was then made to determine whether risk management was warranted to achieve Australia’s ALOP.

Option evaluation is defined in the Terrestrial Code as the process of identifying, evaluating the efficacy and feasibility of, and selecting measures to reduce the risk associated with importation. The efficacy is the degree to which an option reduces the likelihood or magnitude of adverse health and economic consequences.

In this addendum, risk management options for each hazard retained for further review were evaluated and documented in Section 3.

Risk management options reduce to an acceptable level the likelihood that imported fresh beef and beef products would result in the entry of disease agents of biosecurity concern to Australia. Risk management options included certification of country freedom from disease and other relevant biosecurity measures and official systems of control relevant to reducing the likelihood of entry and/or exposure to achieve Australia's ALOP.

2.5 Risk communication

Risk communication is defined in the Terrestrial Code as “the interactive transmission and exchange of information and opinions throughout the risk analysis process concerning risk, risk-related factors and risk perceptions among risk assessors, risk managers, risk communicators, the general public and other interested parties.”

In conducting the beef review, the department consulted with the then Department of Health to ensure that public health considerations are included in the development of Australia's animal biosecurity policies. Furthermore, a formal process of consultation with external stakeholders is a standard procedure for all biosecurity import risk analyses and policy reviews to enable stakeholder assessment and feedback on draft conclusions and recommendations about Australia's animal biosecurity policies.

Release of a draft version of this addendum for public comment was part of this process.

3 Hazard identification

The results of the hazard refinement process, including the reason for removal or retention of each identified hazard are summarised in Table 1 of the beef review. This hazard identification table has been updated for this addendum, after a review of Canada's status for each disease and disease agent (Appendix B).

The following diseases were retained for further review on the basis of the information provided in Appendix B:

- anthrax
- bovine cysticercosis (*T. saginata*)
- bovine tuberculosis (*M. bovis* and *M. caprae*)
- bovine viral diarrhoea
- brucellosis (*B. abortus*)
- echinococcosis
- paratuberculosis (*M. avium* subspecies paratuberculosis)
- infection due to *S. Typhimurium* DT104

The following diseases were identified as being associated with hazards on the basis of the information provided in Appendix B, but were not present in Canada, as discussed in Section 3.1:

- Aujeszky's disease
- contagious bovine pleuropneumonia
- brucellosis (*B. melitensis* and *B. suis*)
- Crimean-Congo haemorrhagic fever
- foot-and-mouth disease
- haemorrhagic septicaemia
- lumpy skin disease
- Rift Valley fever
- surra
- theileriosis (*T. parva* and *T. annulata*)
- trypanosomiasis (Tsetse transmitted)
- Wesselsbron disease
- vesicular stomatitis.

3.1 Diseases not present in Canada

The following diseases and disease agents are not present in Canada and were not retained for further risk review in this addendum. A brief summary of the disease agent, the status in Australia, its presence and transmissibility by beef carcasses and beef carcass parts and information about Canada's status is presented below. More detailed information on each disease agent can be found in the beef review.

3.1.1 Aujeszky's disease

Background

Suid herpesvirus 1 (SHV-1) causes Aujeszky's disease or pseudorabies, a condition that affects the central nervous and respiratory systems (WOAH 2018a). Aujeszky's disease is primarily a disease of pigs. However, infection with SHV-1 occurs sporadically in other species and Aujeszky's disease was first described in cattle in 1813 (Mettenleiter 2020).

There are numerous sub-strains of SHV-1 of differing pathogenicity within a single serogroup (APHIS 2008).

Aujeszky's disease has a wide geographical distribution, including Asia, Europe, Ireland, North Africa, South America and the United States. It is of primary economic importance to pig production (Constable et al. 2017).

Aujeszky's disease is a multiple species WOAHL-listed disease (WOAH 2023d). It is not present in Australia and is nationally notifiable (Department of Agriculture, Fisheries and Forestry 2023c).

Transmission of SHV-1 to pigs has been documented via consumption of tissues from heads of pigs that died acutely from Aujeszky's disease (Hahn et al. 1997). The study also showed that the consumption of tissues from heads of latently infected pigs did not result in transmission of the disease. Disease transmission to other species via consumption of pork offal has been documented (Hahn et al. 1997).

Suid herpesvirus 1 has been isolated from the brain, tonsil and skin of clinically affected cattle (Beasley et al. 1980; Matsuoka et al. 1987). Infection in cattle results in an acute, fatal course of disease.

Suid herpesvirus 1 could be present at the point of slaughter in parts of the carcass of an animal infected with the virus. However, the importation and consumption of beef and beef products from cattle sourced from Aujeszky's disease-endemic areas to countries or regions free of Aujeszky's disease has occurred for many years without evidence of transmission of SHV-1 to susceptible species.

WOAH does not recommend any risk management measures for SHV-1 for international trade in beef or beef products (WOAH 2018a).

Further information on Aujeszky's disease is included in Section 4.2 of the beef review.

Occurrence and control in Canada

Aujeszky's disease (also known as pseudorabies) has never been reported in Canada. Pseudorabies is a reportable disease under the Health of Animals Act 1990 and all cases must be reported to the

Canadian Food Inspection Agency (CFIA) (CFIA 2012c). More information on reportable diseases in Canada can be found in Appendix A.

Conclusion

There is no evidence that SHV-1 is present in Canada. Therefore, further risk assessment is not required. The beef review concluded that risk management in relation to Aujeszky's disease (SHV-1) is not applicable to imports of beef and beef products from the applicant countries, including countries where SHV-1 is present. No risk management is required in relation to Aujeszky's disease for imports of beef and beef products from Canada.

3.1.2 Brucellosis (*B. melitensis*)

Background

Brucellosis, an infectious disease characterised by abortion, infertility, decreased milk production and/or lameness, is caused by bacteria of the *Brucella* genus. The genus consists of small, gram-negative, aerobic, intracellular-reproducing coccobacilli and comprises a group of closely related bacteria (Cem Gul & Erdem 2015). Its classification into species is based mainly on the difference in host preference and pathogenicity. Three of six species that infect terrestrial animals can infect cattle, bison and/or buffalo; these are *B. abortus*, *B. melitensis* and *B. suis*. *B. abortus* primarily infects cattle, *B. melitensis* primarily infects goats and sheep and *B. suis* primarily infects pigs (Adams 2002).

Infection with *B. abortus*, *B. melitensis* or *B. suis* is a WOAHA-listed disease (WOAHA 2023d). Infection with these agents are nationally notifiable animal diseases in Australia (Department of Agriculture, Fisheries and Forestry 2023c).

As *B. abortus* and *B. suis* are suspected or present in Canada these hazards were retained for further review (Section 4.5). The remainder of this section considers *B. melitensis* (WOAHA 2022j).

Australia is free from brucellosis caused by *B. melitensis* and has never reported infection.

Brucellosis is a zoonotic disease of worldwide public health concern. It is a multisystem disease characterised by undulant fever, arthralgia and fatigue in over 75 per cent of cases (Cem Gul & Erdem 2015). Dairy products, especially those from unpasteurised milk, are a common source of human cases (Mailles et al. 2012). Occupational exposure among livestock handlers (Godfroid et al. 2005; Seleem, Boyle & Sriranganathan 2010) and zoonotic transmission of *B. suis* through recreational and occupational exposure to infected feral pigs in Australia has been reported (Irwin et al. 2009).

Further information on brucellosis, including *B. melitensis*, is included in Section 4.3 of the beef review.

Occurrence and control in Canada

Brucella melitensis is not present in Canada. Brucellosis (caused by *B. abortus*, *B. melitensis* and *B. suis*) is a reportable disease under the Health of Animals Act 1990 and all cases must be reported to the CFIA. *B. melitensis* is not present in Canada. Brucellosis (caused by *B. abortus*, *B. melitensis* and *B. suis*) is a reportable disease under the Health of Animals Act 1990 and all cases must be reported to the CFIA (CFIA 2012c). See Appendix A for more information on reportable diseases in Canada.

Conclusion

There is no evidence that *B. melitensis* is present in Canada. Therefore, further risk assessment is not required; however, risk management is necessary. Certification of country freedom from *B. melitensis* is considered sufficient, reasonable and practical to address the risk of the importation in beef and beef products from Canada.

3.1.3 Contagious bovine pleuropneumonia**Background**

Contagious bovine pleuropneumonia (CBPP) is an infectious bacterial disease of cattle and occasionally of water buffalo (*Bubalus bubalis*) caused by the bovine biotype of *Mycoplasma mycoides* subspecies *mycoides* small colony (SC). The disease can be acute, subacute or chronic, and is characterised by a serofibrinous pleuropneumonia and severe pleural effusion (Coetzer & Tustin 2004).

Contagious bovine pleuropneumonia is widespread in Africa with endemic infections extending throughout the pastoral herds of much of western, central, and eastern Africa, and in Angola and northern Namibia in southern Africa (WOAH 2023b).

Infection with *M. mycoides* subspecies *mycoides* SC is a WOAHL-listed disease (WOAH 2023d) and is a nationally notifiable animal disease in Australia (Department of Agriculture, Fisheries and Forestry 2023c). Infection was last reported in Australia in 1967 (WOAH 2022I). Australia declared freedom from the disease in 1972 (Newton 1992; Turner 2011). WOAHL recognises Australia as officially free from *M. mycoides* subspecies *mycoides* SC (WOAH 2023g).

Mycoplasma mycoides subspecies *mycoides* SC is primarily found in lungs; however, due to bacteraemia it may spread to other organs, including the liver and spleen. The organism can survive for more than ten years in frozen, infected pleural fluid (Thiaucourt, van der Lugt & Provost 2004).

Further information on CBPP is included in Section 3.1.1 of the beef review.

Occurrence and control in Canada

Canada is officially recognised free from infection with *M. mycoides* subspecies *mycoides* SC by WOAHL (WOAH 2022j). CBPP was eradicated from Canada in 1876. It is a reportable disease under the Health of Animals Act 1990 and all cases must be reported to the CFIA (CFIA 2012c). More information on reportable diseases in Canada can be found in Appendix A.

Conclusion

There is no evidence that *M. mycoides* subspecies *mycoides* SC is present in Canada. Therefore, further risk assessment is not required; however, risk management is necessary. Certification of country freedom from contagious bovine pleuropneumonia is considered sufficient, reasonable and practical to address the risk of the importation of *M. mycoides* subspecies *mycoides* SC in fresh beef and beef products from Canada.

3.1.4 Crimean-Congo haemorrhagic fever**Background**

Crimean-Congo haemorrhagic fever (CCHF) is a serious zoonotic viral disease. Infection in humans and rodents results in high mortality rates (Smirnova 1979), whereas infection in other mammalian hosts is subclinical. CCHF is caused by a single stranded RNA virus in the *Nairovirus* genus in the

family *Bunyaviridae* (Nichol et al. 2005). Crimean-Congo haemorrhagic fever virus is predominantly transmitted by ticks; however, direct animal-to-human and human-to-human transmission can also occur.

CCHF virus is widespread in Africa, Asia and the Middle East. It is currently considered endemic in Bulgaria and in recent decades has been recorded in other countries in south-eastern Europe and south-western regions of the Russian Federation (Maltezou et al. 2010). At the time of writing, recent outbreaks of CCHF have occurred in humans in Spain and Pakistan (ProMED Mail 2016a, b).

CCHF is a multi-species WOAHL-listed disease (WOAH 2022c). CCHF has never occurred in Australia (AHA 2023a) and is a nationally notifiable animal disease (Department of Agriculture, Fisheries and Forestry 2023c). CCHF is a multiple species WOAHL-listed disease (WOAH 2023d).

CCHF virus is distributed in the blood and tissues of infected animals including cattle (Smirnova 1979). It is readily transmitted to people who come in direct contact with infected blood and tissues (Maltezou et al. 2010; Swanepoel et al. 1985). Consumption of raw meat can be considered as a risk factor associated with CCHF virus infection (Fazlalipour et al. 2016; Sharifi-Mood et al. 2011). The virus is resistant to freezing but is inactivated by UV light, low pH or when cooked for 15 minutes at 60°C (Hoogstraal 1979).

Further information on CCHF is included in Section 3.1.2 of the beef review.

Occurrence and control in Canada

CCHF has never been reported in Canada (WOAH 2022j). However, CCHF is not listed as an immediately notifiable disease, a reportable disease or an annually notifiable disease in Canada (CAHSS 2023; CFIA 2012c, a, 2023a). More information on immediately notifiable, reportable and annually notifiable diseases in Canada can be found in Appendix A.

Conclusion

There is scientific evidence that CCHF virus may be transmitted via fresh beef or beef products. There is no evidence that CCHF virus is present in Canada. Therefore, further risk assessment is not required, however, risk management is necessary. Certification of country freedom from CCHF is considered sufficient, reasonable and practical to address the risk of the importation of CCHF virus in fresh beef and beef products from Canada. As CCHF is not a reportable disease in Canada, the department will engage with the Canadian government on the basis for certification for country freedom during discussions on health certification.

3.1.5 Foot-and-mouth disease

Background

Foot-and-mouth disease (FMD) is a highly contagious viral disease that primarily affects cloven-hoofed animals. FMD virus belongs to the family *Picornaviridae* and genus *Aphthovirus* (Knowles et al. 2011). FMD is present in most of Asia, Africa, the Middle East and parts of South America.

Foot-and-mouth disease is a multiple species WOAHL-listed disease (WOAH 2023d) and nationally notifiable in Australia (Department of Agriculture, Fisheries and Forestry 2023c). Disease has not been reported in Australia since 1872 when outbreaks of suspected FMD were reported (Auty 1998) (Bunn, Gerner & Cannon 1986). Australia is recognised by WOAHL as a country free from FMD without

vaccination. (WOAH 2022i). An AUSVETPLAN disease strategy, maintained by Animal Health Australia, provides a technical response plan to an incursion of FMD into Australia (AHA 2022b).

The transmission of FMD virus via meat or meat products is well documented. In Great Britain between 1954 and 1967, before introduction of restrictions on swill-feeding and the mandatory deboning and maturation of imported meat and meat products, at least 54 per cent of 179 primary outbreaks of FMD were traced to imported meat, bones and meat wrappers (Beynon 1968). The source of the FMD outbreak in England in 2001 was illegal swill-feeding of pigs (Valarcher et al. 2008). Valarcher et al. (2008) explain that in Europe, between 1985 and 2006, 37 outbreaks were reported in 14 countries. Although the origin of 22 outbreaks could not be confirmed, most appeared to be due to illegal imports of infected meat and meat products. One was attributed to imported beef certified as deboned, but investigations determined it to be bone-in. Ingestion of infected meat and meat products by pigs is regarded as the most likely route by which imported beef and beef products can initiate an outbreak.

The Terrestrial Code recommends that fresh meat or meat products be sourced from animals from FMD free countries or zones where vaccination is not practiced (WOAH 2022e). For country freedom from FMD, Australia refers to the current WOAH classification of the country, but also makes its own assessment due to the extreme consequences of an FMD outbreak in Australia. The department maintains an FMD-free approved country list which reflects this assessment (Department of Agriculture Fisheries and Forestry 2023a).

Further information on FMD is included in Section 3.1.3 of the beef review.

Occurrence and control in Canada

In accordance with WOAH procedure for official recognition of disease status, Canada is officially recognised free from FMD without vaccination. Canada is also recognised as free from FMD without vaccination by the Australian Government (Department of Agriculture Fisheries and Forestry 2023a).

Foot-and-mouth disease was last reported in Canada in 1952 and is listed as a reportable disease under the Health of Animals Act 1990 and all cases must be reported to the CFIA. (CAHSS 2023; CFIA 2012c). More information on reportable diseases in Canada can be found in Appendix A.

Conclusion

There is scientific evidence that FMD virus may be transmitted via fresh beef or beef products. There is no evidence that FMD virus is present in Canada. Therefore, further risk assessment is not required, however, risk management is necessary. As Canada has been assessed by the department as free from FMD without vaccination, certification of country freedom from FMD without vaccination is considered sufficient, reasonable and practical to address the risk of the importation of FMD virus in fresh beef and beef products from Canada.

3.1.6 Haemorrhagic septicaemia

Background

Haemorrhagic septicaemia (HS) is a highly fatal disease of predominantly cattle and water buffalo caused by the B:2 and E:2 serotypes of the bacterium *Pasteurella multocida*. Variable clinical signs are associated with HS, ranging from pyrexia, respiratory distress, nasal discharge and dependent oedema in the submandibular or brisket regions to recumbency and sudden death. Outbreaks are

associated with high morbidity and mortality rates. Close contact with infected animals or subclinical carriers is required for transmission by ingestion or inhalation of the organism.

Haemorrhagic septicaemia is a WOAHA listed disease (WOAHA 2022d). HS is present in tropical and subtropical regions including South-East Asia, India, the Middle East, regions of Africa, and southern and central Europe (Völker et al. 2014; WOAHA 2023e).

Haemorrhagic septicaemia has never been reported in Australia (AHA 2023a), and it is a nationally notifiable animal disease (Department of Agriculture, Fisheries and Forestry 2023c).

Haemorrhagic septicaemia causing strains of *P. multocida* have been identified in many tissues of clinically affected animals, including the spleen, liver, kidney, skeletal muscle, small intestine and subcutaneous tissue (Annas et al. 2014; Bastianello & Jonker 1981; Khin, Zamri-Saad & Noordin 2010; Lane et al. 1992). *P. multocida* HS-causing strains have also been detected in the respiratory, gastrointestinal and urinary tracts of carrier animals (Annas et al. 2014). Moist environmental conditions may prolong environmental survival and the bacteria may be able to survive in animal carcasses for a few days (de Alwis 1999).

Further information on HS is included in Section 3.1.4 of the beef review.

Occurrence and control in Canada

Haemorrhagic septicaemia has never been reported in Canada (WOAHA 2022j). Haemorrhagic septicaemia is an annually notifiable disease in Canada. More information on annually notifiable diseases in Canada can be found in Appendix A. (CFIA 2023a).

Conclusion

There is scientific evidence that HS may be present in fresh beef or beef products. There is no evidence that HS is present in Canada. Therefore, further risk assessment is not required, however, risk management is necessary. Certification of country freedom from HS is considered sufficient, reasonable and practical to address the risk of the importation of HS in fresh beef and beef products from Canada.

3.1.7 Lumpy skin disease

Background

Lumpy skin disease (LSD) is an infectious viral disease of cattle characterised by the eruption of nodules in the skin which may cover the whole of the animal's body. Lumpy skin disease virus belongs to the genus *Capripoxvirus* of the family *Poxviridae*, along with sheeppox and goatpox viruses (Skinner et al. 2011). These viruses are morphologically indistinguishable from each other but are adapted to different host species. The viruses are difficult to distinguish serologically, and cross protection does occur.

In the last decade, outbreaks have occurred in Africa, the Middle East and Europe (Beard 2016). Lumpy skin disease is a WOAHA-listed disease (WOAHA 2022c). Lumpy skin disease is a nationally notifiable disease (Department of Agriculture, Fisheries and Forestry 2023c) and is not present in Australia. An AUSVETPLAN disease strategy manual, maintained by Animal Health Australia, provides a technical response plan to an incursion of LSD into Australia (AHA 2023b).

Lumpy skin disease virus is transmitted primarily by biting insects. Lumpy skin disease virus is not readily spread by direct contact.

The animal biosecurity risk of LSD transmission through meat flesh¹ derived exclusively from bovine² skeletal muscle (fresh bovine skeletal muscle meat) has been assessed in a separate addendum to the beef review (Department of Agriculture Water and the Environment 2017) (the LSD addendum). This found that the overall risk of LSD associated with the import of fresh bovine skeletal muscle meat for human consumption is very low and achieves Australia's ALOP.

Further information on LSD is included in Section 3.1.5 of the beef review and Section 4 of the LSD addendum.

Canada

Occurrence and control in Canada

Lumpy skin disease has never been reported in Canada and it is listed as a reportable disease under the Health of Animals Act 1990 and all cases must be reported to the CFIA (CAHSS 2023; CFIA 2012c). Canada has been assessed by the department as being free from LSD. More information on reportable diseases can be found in Appendix A.

Conclusion

There is scientific evidence that LSD virus may be present and/or transmitted via certain fresh beef or beef products. Specific biosecurity risk management measures are not justified for LSD virus when bovine skeletal muscle meat is imported for human consumption into Australia from Canada. Country freedom certification for LSD for import of fresh bovine skeletal muscle meat from Canada is not required to achieve Australia's ALOP.

As Canada has been assessed by the department as free from LSD, country freedom certification for LSD is considered sufficient, reasonable and practical to address the risk of the importation of LSD in other fresh beef and beef products from Canada that do not meet the definition of skeletal muscle meat.

3.1.8 Rift Valley fever

Background

Rift Valley fever (RVF) virus is a zoonotic, arthropod-borne virus that causes disease characterised by mortality in young domestic ruminants and abortions in pregnant animals. RVF virus is an RNA virus in the genus *Phlebovirus* of the family *Bunyaviridae* (ARMCANZ 1996; Nichol et al. 2005).

Rift Valley fever is endemic in Africa south of the Sahara, including Madagascar (Clements et al. 2007; Fontenille, Mathiot & Coulanges 1985). The virus has also occurred in Egypt (Hoogstraal et al. 1979), Saudi Arabia and Yemen (Arishi et al. 2000; Gould & Higgs 2009; WOA 2023f).

Rift Valley fever is a WOA-listed disease affecting multiple species (WOAH 2023d). Rift Valley fever is a nationally notifiable disease (Department of Agriculture, Fisheries and Forestry 2023c) and is not

¹ Meat flesh is defined as "skeletal muscle of any slaughtered animal, and any attached rind, fat, connective tissue, nerve, blood and blood vessels".

² Bovines are defined as domesticated American bison (*Bison bison*), buffalo (*Bubalus bubalis*—water buffalo or domestic Asian water buffalo), or cattle (*Bos taurus* and *Bos indicus*).

present in Australia. Australia has been shown to have competent mosquito vectors for RVF transmission (Turell & Kay 1998). An AUSVETPLAN disease strategy manual, maintained by Animal Health Australia, provides a technical response plan to an incursion of RVF into Australia (AHA 2021b).

In humans, RVF virus can be transmitted by handling fresh meat and carcasses, and the disease can occur in occupational groups exposed to these products, for example farmers and abattoir workers (WHO 2018). Virus can also be transmitted via some carcass parts which contain significant quantities of blood or via organs which remain at or above a neutral pH for a prolonged time. Overall, the risk of transmission of RVF virus from imported meat and meat products is considered to be very low (ARMCANZ 1996; Swanepoel & Coetzer 2004a). Nevertheless, a risk remains for transmission by fresh beef or beef products.

The Terrestrial Code recommends that fresh meat or meat products be sourced from animals from RVF free countries or establishments (WOAH 2023f).

Further information on RVF is included in Section 3.1.6 of the beef review.

Occurrence and control in Canada

Rift Valley fever has never been reported in Canada and it is listed as a reportable disease under the Health of Animals Act 1990 and cases must be reported to the CFIA (CFIA 2012c). More information on reportable diseases in Canada can be found in Appendix A.

Conclusion

There is scientific evidence that RVF virus may be transmitted via fresh beef or beef products. There is no evidence that RVF virus is present in Canada. Therefore, further risk assessment is not required, however, risk management is necessary. Certification of country freedom from RVF is considered sufficient, reasonable and practical to address the risk of the importation of RVF virus in fresh beef and beef products from Canada.

3.1.9 Surra

Background

Surra is caused by the blood-borne protozoan parasite *Trypanosoma evansi*. *Trypanosoma evansi* is mechanically transmitted by biting insects such as tabanid and stomoxys flies. Transmission by ingestion of tissues from parasitaemic animals, vampire bat saliva and iatrogenesis has also been described. Surra occurs in camels, horses, buffalo, cattle, dogs, pig, sheep, goats and rodents. Acute disease is characterised by fever, emaciation, anaemia, and death which may occur within 24 hours of the onset of clinical signs. Chronic surra can lead to loss of condition and impaired reproductive performance. Subclinical carrier states also exist.

Surra is present in Africa, the Middle East, Southeast Asia, Central and South America. In most countries where *T. evansi* is endemic, infection is not considered pathogenic in cattle although they may act as reservoir of infection. Surra in cattle and buffalo is a particular concern in South East Asian countries, such as the Philippines (Mekata et al. 2013), where clinical signs of infection in cattle and the resultant economic impacts are more severe. Differences in strain virulence have been reported which may explain geographic variation in host susceptibility (Mekata et al. 2013).

Surra is a WOAHA listed disease that affects multiple species (WOAH 2023d). It is nationally notifiable in Australia (Department of Agriculture, Fisheries and Forestry 2023c). There is an AUSVETPLAN disease strategy manual for surra, which provides a technical response plan to an incursion of surra into Australia (AHA 2021c). In 1907, surra was diagnosed in a consignment of nine camels imported from India into Port Hedland in Western Australia, which were subsequently destroyed (AHA 2021c). There has been no further evidence of the disease in camels or any other species, in Australia (AHA 2023a).

Oral transmission of *T. evansi* from meat derived from parasitaemic animals has been demonstrated in dogs and mice (Raina et al. 1985). In addition, *T. evansi* is able to remain viable in equine muscle and liver for up to 12 hours at 27-28 °C, and in muscle for up to 66 hours at 6-12 °C (de Jesus 1962).

Further information on surra is included in Section 3.1.7 of the beef review.

Occurrence and control in Canada

Surra has never been reported in Canada (WOAH 2022j) and “trypanosomiasis (exotic to Canada)” is an immediately notifiable disease in Canada (CFIA 2012a). More information on immediately notifiable diseases in Canada is found in Appendix A.

Conclusion

There is scientific evidence that surra may be transmitted via fresh beef or beef products. There is no evidence that surra is present in Canada. Therefore, further risk assessment is not required, however, risk management is necessary. Certification of country freedom from surra is considered sufficient, reasonable and practical to address the risk of the importation of surra in fresh beef and beef products from Canada.

3.1.10 Theileriosis (*T. parva* and *T. annulata*)

Background

Theileriosis is a lympho-proliferative tick-borne disease of cattle and other bovids caused by obligate intracellular protozoan parasites *Theileria parva* and *T. annulata*. These two are considered to be the most economically significant of the *Theileria* spp. in cattle (Bishop et al. 2004). Cattle present with a variety of clinical signs including lymphadenopathy, fever, petechial haemorrhages on mucous membranes developing to anorexia, ocular and nasal discharge, dyspnoea and diarrhoea often leading to death. Disease due to *T. annulata* can also cause jaundice and anaemia. *T. parva* and *T. annulata* have not been shown to be hazardous to humans (WOAH 2022h).

T. parva occurs in Eastern and Southern Africa while *T. annulata* occurs in tropical regions of North Africa, southern Europe and Asia (WOAH 2018b).

Theileriosis caused by *T. parva*, *T. annulata* or *T. orientalis* is a WOAHA listed disease of cattle (WOAH 2023d). *T. orientalis* is present in Australia (AHA 2023a) and has not been considered further in this assessment. Theileriosis caused by *T. parva* or *T. annulata* has never been reported in Australia (AHA 2023a) and is a nationally notifiable animal disease (Department of Agriculture, Fisheries and Forestry 2023c). The key tick vectors have not been identified in Australia (Roberts 1970) however it is uncertain to what extent domestic ticks have been tested for competence (Morrison 2015) and has not been considered further in this assessment.

Theileria spp. are transmitted in saliva of certain species of ixodid ticks. Once the protozoa have entered the host, the sporozoites transform and replicate within lymphocytes (*T. parva*) and macrophages/monocytes (*T. annulata*) (Bishop et al. 2004). Parasitised cells are present throughout the lymphoid system and other organs (Morrison 2015). There is no evidence of transmission of theileriosis by the consumption of affected tissues.

Further information on theileriosis, including *T. parva* and *T. annulata*, is included in Section 3.1.8 of the beef review.

Occurrence and control in Canada

Theileriosis (caused by *T. parva*, *T. annulata* or *T. orientalis*) has never been reported in Canada (WOAH 2022j). It is an immediately notifiable disease in Canada (CFIA 2012a). More information on immediately notifiable diseases in Canada is found in Appendix A.

Conclusion

There is scientific evidence that theileriosis caused by *T. annulata* or *T. parva* may be present in fresh beef or beef products. There is no evidence that *T. annulata* or *T. parva* are present in Canada. Therefore, further risk assessment is not required, however, risk management is necessary. Certification of country freedom from theileriosis caused by *T. annulata* or *T. parva* is considered sufficient, reasonable and practical to address the risk of the importation of theileriosis caused by *T. annulata* or *T. parva* in fresh beef and beef products from Canada.

3.1.11 Trypanosomiasis (Tsetse transmitted)

Background

Trypanosomes are blood-borne protozoan parasites in the family *Trypanosomatidae* which are transmitted by haematophagous arthropods. The trypanosome species *Trypanosoma vivax* and *T. congolense*, *T. simiae* and, to a lesser extent, *T. brucei brucei* cause trypanosomiasis (or trypanosomosis or nagana) in many mammals including cattle. Clinical signs include anaemia, intermittent fever, oedema, loss of body condition, emaciation, abortion and infertility. Trypanosomiasis is biologically transmitted by tsetse flies (*Glossina* spp.), and mechanically by biting flies (tabanids and stomoxys) for *T. vivax*. Iatrogenic spread has been reported.

Disease occurs predominantly in Africa, from the southern edge of the Sahara to Zimbabwe, Angola and Mozambique, where tsetse flies are present (WOAH 2021b). However *T. vivax* is also found beyond the tsetse belt in Africa, and in Central and South America, where it is transmitted mechanically by biting flies (Cadioli et al. 2012; Mekata et al. 2009; Oliveira et al. 2009; Thumbi et al. 2010; WOAH 2021b).

Trypanosomiasis (tsetse-transmitted) is a WOAH-listed disease of cattle (WOAH 2023d).

Trypanosomiasis is a nationally notifiable animal disease (Department of Agriculture, Fisheries and Forestry 2023c) and has never been recorded in Australia (AHA 2023a). However, non-pathogenic trypanosomes, which are thought to be distributed worldwide, have been reported in livestock in Australia. These include as *T. melophagium* in sheep (Callow 1984) and *T. theileri* in cattle in Queensland (Ward et al. 1984). In addition, native trypanosomes have been isolated from marsupials but to date have not been detected in domestic mammals including livestock (Thompson, Godfrey & Thompson 2014).

Experimental transmission of *T. brucei brucei* has been demonstrated by feeding infected goat carcasses to cats and dogs (Moloo, Losos & Kutuza 1973). Ingestion and gavaging of blood infected with *T. brucei brucei*, *T. vivax* or *T. congolense* has also been reported to transmit infection to mice (Clarkson & McCabe 1973).

Further information on trypanosomiasis (tsetse-transmitted) is included in Section 3.1.9 of the beef review.

Occurrence and control in Canada

T. vivax, *T. congolense*, *T. simiae* and *T. brucei brucei* have never been reported in Canada (WOAH 2022j) and “trypanosomiasis (exotic to Canada)” is an immediately notifiable disease in Canada (CFIA 2012a). More information on immediately notifiable diseases in Canada can be found in Appendix A.

Conclusion

There is scientific evidence that trypanosomiasis may be transmitted via fresh beef or beef products. There is no evidence that trypanosomiasis caused by *T. vivax*, *T. congolense*, *T. simiae* or *T. brucei brucei* is present in Canada. Therefore, further risk assessment is not required, however, risk management is necessary. Certification of country freedom from trypanosomiasis (caused by *T. vivax*, *T. congolense*, *T. simiae* or *T. brucei brucei*) is considered sufficient, reasonable and practical to address the risk of the importation of trypanosomiasis in fresh beef or beef products from Canada.

3.1.12 Vesicular stomatitis

Background

Vesicular stomatitis (VS) is an insect-transmitted viral disease that primarily affects horses, cattle, and pigs. Two serologically distinct serotypes exist, Indiana (IND) serotype (with three subtypes) and New Jersey (NJ) serotype (Reis et al. 2009; WOA 2022k).

Vesicular stomatitis is a nationally notifiable animal disease in Australia (Department of Agriculture, Fisheries and Forestry 2023c) and has never been reported in Australia (AHA 2023a). In 2014, the WOA General Assembly elected to remove VS from its notifiable disease list on the basis that it did not meet the listing criteria adopted in 2012 (WOA 2014). Australia considers it significant for trade reasons because clinically it is indistinguishable from FMD (Reis et al. 2009).

Vesicular stomatitis virus causes vesicular disease in equids (donkey, horse, mule), cattle and pigs. Goats and sheep are more resistant to clinical disease and are rarely affected (Reis et al. 2009). Antibodies to VS virus have been detected in a wide range of vertebrate species including primates (human and non-human), bovids, camelids, coyotes, foxes, dogs, hamsters, marsupials, rodents and birds (Jimenez et al. 1996; Johnson, Tesh & Peralta 1969). In addition, the virus has been isolated from many haematophagous and non-haematophagous insect species including sand flies, black flies, mosquitoes, culicoides, house flies, eye gnats and grasshoppers (Drolet, Stuart & Derner 2009; Rodriguez 2002). A component of the saliva of some insects (for example, black flies) may enhance VS virus replication and transmission (Reis et al. 2009). VS has not been reported in bison and buffalo.

VS is limited to the American continents although outbreaks have been described in Europe and South Africa from the late 1800s to mid-1900s associated with the export of horses from the United States (Reis et al. 2009; WOA 2022k).

The NJ and IND-1 serotypes are endemic in livestock in areas of southern Mexico, Central America, Bolivia, Venezuela, Colombia, Ecuador and Peru, with the NJ serotype causing the majority of the clinical cases. Sporadic activity of NJ and IND-1 serotypes has been reported in northern Mexico and the western United States. IND-2 has only been isolated in Argentina and Brazil and only from horses. IND-3 subtype has been identified sporadically in Brazil only where it is reported to cause disease more frequently in horses than cattle (Reis et al. 2009).

VS is zoonotic and can cause an influenza-like illness in humans who come into direct contact with infected livestock (Letchworth, Rodriguez & Barrera 1999; Reif et al. 1987).

Further information VS is included in Section 4.10 of the beef review.

Occurrence and control in Canada

VS was last diagnosed in Canada in 1949 (CFIA 2023c). Vesicular stomatitis is a reportable disease in Canada (CFIA 2012c) and all cases must be reported to the CFIA. More information on reportable diseases in Canada can be found in Appendix A.

Conclusion

There is no evidence that VS is present in Canada. Therefore, further risk assessment is not required. The beef review concluded that risk management in relation to VS is not applicable to imports of beef and beef products from the applicant countries, including countries where VS is present. No risk management is required in relation to VS for imports of beef and beef products from Canada.

3.1.13 Wesselsbron disease

Background

Wesselsbron disease (WD) is an arthropod-borne virus (Simmonds et al. 2011). The disease mainly affects sheep although clinical disease has been reported in cattle, pigs, horses and goats (Swanepoel & Coetzer 2004b). Disease in adult animals and calves is usually subclinical (Ali et al. 2012). Mortality in new-born lambs and kids is high. Abortion with foetal abnormalities is reported in pregnant ewes and less commonly in goats and cattle (Coetzer, Theodoridis & van Heerden 1978).

Wesselsbron virus has been isolated from arthropods or vertebrates in South Africa, Zimbabwe, Uganda, Kenya, Nigeria, Central African Republic, Senegal, Cameroon, Ivory Coast and Thailand (Swanepoel & Coetzer 2004b). Clinical disease is restricted to sub-Saharan Africa. There is no recent evidence that it is present outside of Africa (CFSPH 2017b).

WD is not a WOAHL-listed disease. It is however nationally notifiable animal disease in Australia (Department of Agriculture, Fisheries and Forestry 2023c) and it has never been reported in Australia (AHA 2023a).

Transmission is typically by *Aedes* spp. mosquitoes, but the virus has been isolated from other arthropods. Wesselsbron disease virus can be transmitted by handling fresh meat and carcasses. Disease in humans is subclinical or mild and may resemble influenza (Swanepoel & Coetzer 2004b). There is no evidence that Wesselsbron virus is transmitted between ruminants or other animals, except via mosquitoes (CFSPH 2017b).

Further information on WD is included in Section 3.1.10 of the beef review.

Occurrence and control in Canada

WD is not known to exist in North America and is an immediately notifiable disease in Canada. More information on immediately notifiable diseases in Canada is found in Appendix A.

Conclusion

There is scientific evidence that Wesselsbron virus may be transmitted via fresh beef or beef products. There is no evidence that Wesselsbron virus is present in Canada. Therefore, further risk assessment is not required, however, risk management is necessary. Certification of country freedom from WD is considered sufficient, reasonable and practical to address the risk of the importation of Wesselsbron virus in fresh beef and beef products from Canada.

4 Risk assessments

4.1 Anthrax

4.1.1 Background

Anthrax is an infectious bacterial disease of all mammals, including humans, and several species of birds. The causative agent is *Bacillus anthracis*—a large, spore forming, gram-positive, rod-shaped bacterium. Anthrax is characterised by rapidly fatal septicaemia with widespread oedema, haemorrhage and necrosis. Due to its effect on public health, wildlife and livestock production, and its potential for spread via international trade, anthrax is a multiple species WOAHL-listed disease (WOAH 2023d).

Herbivores, in particular domesticated and wild ruminants, are most susceptible to anthrax. Omnivores, for example, pigs, and carnivores tend to be more resistant to anthrax. Although *B. anthracis* occurs worldwide, outbreaks are most common in countries with poor surveillance and control programs especially in parts of Africa, Asia and the Middle East. Well-established surveillance and control programs reduced the incidence of anthrax to sporadic cases occurring mostly within defined geographical areas in Australia, Europe and the United States (CFSPH 2017a).

Anthrax is a nationally notifiable animal disease in Australia (Department of Agriculture, Fisheries and Forestry 2023c) and response to cases or outbreaks in animals is guided by the AUSVETPLAN for anthrax (AHA 2021a).

Vaccines are available for protection of animals against anthrax as are antibiotics for the treatment of anthrax. Vaccinated or treated animals should not be slaughtered until the appropriate withholding period has lapsed (FRSC 2007).

Outbreaks are effectively managed by rapid identification of the disease, quarantine and vaccination for prevention, antibiotics for direct treatment, and appropriate disposal of carcasses and disinfection of the premises (AHA 2015b).

Anthrax is a zoonotic disease of significant worldwide public health concern not only because of natural outbreaks but also its potential as a biological weapon. Humans generally acquire anthrax through handling infected animals, live or dead, or materials from infected animals such as carcasses, hides or bone. Reducing the occurrence of natural anthrax in humans relies largely on effective veterinary intervention of animal anthrax.

Further information on anthrax is included in Section 4.1 of the beef review.

4.1.2 Occurrence and control in Canada

Canada has reported sporadic cases of anthrax, and its six-monthly WOAHL reports indicates that diseases is suspected and is limited to one or more zones (WOAH 2022j). Anthrax is a reportable disease under the Health of Animals Act 1990 and all cases must be reported to the CFIA. More information on reportable diseases in Canada can be found in Appendix A.

In Canada, anthrax cases have occurred from Alberta to western Ontario, with repeated outbreaks in the Mackenzie Bison Range in the Northwest Territories and in Wood Buffalo National Park (WBNP) in northern Alberta (CFIA 2013).

4.1.3 Risk review

Canada is a WOA member and follows the recommended WOA risk management measures for *B. anthracis* for international trade in meat and meat products, that is, fresh meat or meat products be sourced from animals that are clinically free of disease and from anthrax free establishments (WOAH 2023a). Anthrax only occurs sporadically in both Canada and in Australia and is subject to surveillance and official control programs in both countries.

Based on the prevalence and existing control measures in Canada, the likelihood of entry of *B. anthracis* with imports of beef and beef products derived from domesticated bovines which passed abattoir admissions, ante-mortem and post-mortem inspection from Canada is considered negligible.

4.1.4 Conclusion

The risk of anthrax associated with the importation of these products from Canada is considered negligible and therefore achieves Australia's ALOP with respect to animal biosecurity risks. Therefore, a risk assessment for anthrax is not required in relation to beef and beef products imported from Canada in this review of conditions.

4.2 Bovine cysticercosis (*T. saginata*)

4.2.1 Background

Cysticercus bovis is the metacestode (the intermediate life stage) of the human intestinal parasite *Taenia saginata*, commonly known as "beef tapeworm". The parasite, *T. saginata*, is a member of the Family *Taeniidae*. Cattle are the intermediate hosts in the transmission of this parasite. *Cysticercus bovis* infection in cattle is referred to as "bovine cysticercosis" or "beef measles".

The condition in cattle was recognised by WOA as a reportable List B cattle disease until 2005. It has since been removed from WOA list of reportable diseases, however, is still addressed in WOA Manual in a combined chapter on Cysticercosis (cestodes of the Family *Taeniidae*) (WOAH 2021a). The Codex Alimentarius also has guidance on the control of *T. saginata* in domestic bovine meat (Codex Alimentarius Commission 2014) because of recognition of the economic impact of infection. The Guidelines for the Control of *Taenia Saginata* in Meat of Domestic Cattle notes the economic significance being the result of:

- the resources taken up in routine meat inspection to detect infection
- the impact of downgrading and condemnation of affected carcasses and inactivation treatments
- the increased controls needed in herds from which detections have occurred.

The parasite, *T. saginata*, is globally one of the most widely distributed human tapeworms, found in humans on all continents. Cabaret et al. (2002) summarised available data on human taeniasis (*T. saginata*) from published papers from 1973 to 2000 (Cabaret et al. 2002). The authors described country prevalences as being relatively low but highly variable within a country and between

countries, noting variability in prevalence is a result of personal hygiene, meat inspection quality, culinary habits and cultural behaviours. Incidence is usually estimated from the sale of taenical drugs (Dorny & Praet 2007).

A Joint Food and Agriculture Organization (FAO)/World Health Organization (WHO) Expert group, in providing advice and guidance to Codex Committee on Food Hygiene (CCFH) on 24 parasite-commodity combinations of particular concern, noted that despite global distribution of *T. saginata*, true prevalence in humans and cattle is underestimated because of imperfect diagnostic techniques, poor reporting systems and the largely asymptomatic nature of the disease in humans (FAO & WHO 2014).

Ito et al. (2008) point out that with the movement of people between the Asia Pacific and Africa, the Americas, Australia and New Zealand and Europe there is a need to re-evaluate the occurrence of *T. saginata* (Ito et al. 2008).

T. saginata is present in Australia (AHA 2023a) and is a nationally notifiable animal disease (Department of Agriculture, Fisheries and Forestry 2023c). The prevalence of bovine cysticercosis is extremely low. A national survey undertaken in 2008 of over 493,000 cattle subjected to standard post mortem procedures did not identify bovine cysticercosis (Pearse et al. 2010), however isolated outbreaks have been reported (Bailey 2017).

Further information on bovine cysticercosis is included in Section 4.6 of the beef review.

4.2.2 Occurrence and control in Canada

Cysticercosis is a reportable disease in Canada and all cases must be reported to the CFIA under the Health of Animals Act 1990. More information on reportable diseases in Canada can be found in Appendix A.

Bovine cysticercosis has been found in Canada. However, detections are rare. The last confirmed detection was in 2013 (CFIA 2015a).

The CFIA's National Cysticercosis Program is in place to protect human health through the detection of infected cattle and swine at slaughter. Carcasses are inspected at federally registered abattoirs under the CFIA meat hygiene program. All non-federally registered abattoirs must report any suspicion of cysticercosis to the CFIA for investigation.

If an infected animal is detected at slaughter, the CFIA, through its cysticercosis disease control program, would conduct an investigation at the farm level.

Infected carcasses are either condemned or may enter the food chain following treatment.

A CFIA factsheet notes that it “investigates all positive cases and takes the following actions (CFIA 2015a):

- Potential farms of origin, as well as all premises where the animals might have lived, are investigated.
- Premises determined to be the source of infection are immediately placed under the CFIA control.

- Under the oversight of the CFIA, owners are required to take certain actions (e.g. cleaning and disinfection, removal of contaminated feed, etc.) in order to remove the source of infection.
- Cattle or swine on the infected farms are moved under licence to a federally inspected abattoir for slaughter when they reach market weight.
- Severely infected carcasses are condemned and disposed of accordingly while carcasses that are not severely infected are temperature treated by freezing for 10 days at -10°C or heat treated to at least 60°C to kill the parasite. Treated carcasses can enter the food chain once treatment (heat or cold) is completed”.

The CFIA retains control of the infected premises until the source of infection has been eliminated and there is slaughter evidence that the herd is free of the parasite.

The CFIA maintains a database of herds infected with cysticercosis in Canada.

Cases of bovine cysticercosis in Canada are only sporadic and the prevalence is likely to be very low, like the situation in Australia.

4.2.3 Risk review

Bovine cysticercosis has been reported in Canada and Australia. Transmission of *T. saginata* through the exposure to or consumption of carcass and carcass parts containing viable *C. bovis* cysts is not known to occur in species other than humans, who are the definitive host of this parasite. The lifecycle of the parasite requires cattle to ingest *T. saginata* eggs passed in human faeces. These eggs subsequently develop into *C. bovis* cysts in the muscle of the cattle that ingest the eggs. Cattle do not develop *C. bovis* cysts by ingesting contaminated meat. Therefore, there is no direct animal biosecurity risk posed by the importation of beef and beef products containing viable cysts.

There is a food safety risk in that meat eaten raw or not fully cooked may lead to human infection. The lack of sensitivity of current post-mortem inspection regimes both in Australia and overseas, particularly in low prevalence environments, will mean that not all risk to the consumer is addressed through abattoir inspection. There is supporting evidence however that sensitivity can be increased by increased heart incision and inspection. There is also evidence that reducing the level of inspection to visual inspection only will increase risk associated with transmission of the parasite to humans.

Although accurate data on the prevalence of *C. bovis* and the effectiveness of meat inspection procedures is elusive, it is concluded from this review that Canada has a very low prevalence of *C. bovis* and therefore the risk to human health by the consumption of beef and beef products imported from Canada would be similar to the risk associated with the consumption of domestic beef in Australia.

4.2.4 Conclusion

Based on the information presented in the beef review and an assessment of the situation in Canada, there is no direct animal biosecurity risk associated with the importation of *C. bovis* contaminated beef and beef parts and therefore an animal biosecurity risk assessment is not required. Risk management measures may be warranted to meet human health and food safety requirements if

food safety risk assessment determines that Canada's disease prevalence and meat inspection programs do not meet Australian food standards.

The risk from bovine cysticercosis associated with the importation of beef and beef products from Canada is therefore considered negligible and achieves Australia's ALOP.

4.3 Bovine tuberculosis (*M. bovis* and *M. caprae*)

4.3.1 Background

Bovine TB is a chronic infectious bacterial disease affecting mainly cattle. The primary causal organism is *Mycobacterium bovis*, which can be transmitted to all warm-blooded vertebrates including humans (Constable et al. 2017). Bovine TB is a WOAHA-listed disease because of its effect on public health, wildlife and livestock production, and its potential for spread via international trade (WOAHA 2022a). The disease is nationally notifiable in Australia (Department of Agriculture, Fisheries and Forestry 2023c).

M. caprae, another member of the *M. tuberculosis* complex, has also been identified as a cause of bovine TB and a zoonosis (WOAHA 2022a). *M. caprae* infection in cattle is not regarded as significantly different to that caused by *M. bovis* with similar diagnostic tests used. *M. caprae* is isolated to continental Europe. A human case of *M. caprae* has been detected once in Australia in a person of European origin who had migrated to Australia (Sintchenko et al. 2006).

As a result of a successful national eradication program, the Brucellosis and Tuberculosis Eradication Campaign (BTEC), Australia declared freedom from bovine TB in accordance with the Terrestrial Code in December 1997. The last case of bovine TB in Australia in any animal species (including free-living species) was reported in 2002 (AHA 2015a). Since January 2005, abattoir submission of granulomas identified at post-mortem has continued at the discretion of meat inspectors. In 2011, bovine TB was classified as an emergency animal disease in Australia and included in the Emergency Animal Disease Response Agreement (AHA 2022a).

Direct contact with infected animals is the main route of infection, while animal to human transmission of *M. bovis* and *M. caprae* via unpasteurised milk is of public health importance (Cvetnic et al. 2007; Rodriguez et al. 2009). Human-to-human and human-to-animal transmission of *M. bovis* has occurred but is rare (Ayele et al. 2004; Fritsche et al. 2004).

Further information on bovine TB is included in Section 4.4 of the beef review.

4.3.2 Occurrence and control in Canada

Bovine TB is present in Canada. It is a reportable disease under the Health of Animals Act 1990 and all cases must be notified to the CFIA.

Canada reports that bovine TB is present in limited zones in domestic animals and suspected in limited zones for wild animals (WOAHA 2022j).

Canada has had a national bovine TB eradication program since 1923. As a result, infection is virtually eliminated except for the occurrence of rare cases in domestic animals.

The program's goal is to facilitate early detection and complete eradication of bovine TB from livestock in Canada (CFIA 2015b). Canada has a provincially based system for TB freedom, where a TB free status is given to a province with no cases identified during a 5-year surveillance period.

In the last 20 years there has been two reservoirs identified in Canada, in wild deer in Riding Mountain National Park (RMNP) in Manitoba, and in wild elk and wood bison in and up to 25 kilometres from WBNP in northern Alberta. Both of these areas are not fenced from surrounding areas, and only RMNP is heavily surrounded by agricultural areas. RMNP has been subject to various management and eradication activities and is now considered free of bovine TB by the CFIA.

Cases of bovine TB are detected sporadically every few years in the domestic cattle herd. The most recent case was detected at slaughter in a United States abattoir in February 2023. The CFIA was notified of the case by 23 February 2023, and subsequently traced the case to a property in the Canadian province of Saskatchewan (the animal was exported from Saskatchewan in September 2022 and was in a US feedlot until its slaughter). In June 2023, the CFIA announced the case publicly (Bedard 2023). The property of origin was quarantined and all cattle over 6 months of age were tested for bovine TB. All reactor animals were slaughtered and inspected for signs of bovine TB post-mortem. Two further cases of bovine TB were confirmed by PCR of lesions. The CFIA announced that it was planning to "trace the movement of animals to and from the infected herd during the past 5 years to identify and eliminate the source and any potential spread of the disease" (CFIA 2023b). The Saskatchewan Ministry of Environment is undertaking surveillance for bovine TB in white-tailed deer, mule deer, moose, and elk in response to this outbreak (Government of Saskatchewan 2023).

As of 16 August 2024, the one infected herd had been depopulated and all testing was complete, with 32 confirmed cases of bovine TB. The strain found in the infected herd was consistent with the strain detected in the index case (the infected animal in the United States that was traced back to the Saskatchewan herd). The CFIA has reported that the strain found in the infected herd is not a close match to any strain previously reported in livestock or wildlife in North America. The previous outbreak of bovine TB in the province of Alberta in 2016, involving 6 animals, was not linked to isolates present in wildlife also believed to be from an exotic source. It is not clear whether the 2016 and 2023 strains are related.

Ten herds were identified through tracing and were investigated to identify their bovine TB status. A single life line herd (herd traced from an infected animal in the infected herd) has been released from quarantine, with all herd testing completed. The single contact herd (herd that shared a fence line or may have co-mingled with the infected herd) has been released from quarantine, with all herd testing completed. The two trace-in herds (herds that provided animals to the infected herd) have been released from quarantine, with all herd testing completed. Six trace-out herds (herds that received animals from the infected herd) were identified. Five of these trace-out herds have been released from quarantine and the remaining trace-out herd will be retested in the (northern hemisphere) autumn. Further tracing is continuing to identify the extent of the infection (CFIA 2023b).

In 2003, the Riding Mountain Eradication Area surrounding RMNP was subject to increased management to reduce the spill-over of tuberculosis from wildlife in the park to livestock in surrounding areas. Extra measures included barrier fencing all feed storage areas/yards, a legislated ban on baiting and feeding wildlife, cervid population reductions, improved elk habitat within RMNP,

and on-farm livestock risk assessments. Surveillance in this area consisted of on-farm tuberculin testing of livestock, hunter harvesting of wildlife, wildlife culls and blood testing. The increased management around RMNP resulted in significantly decreased numbers of infected elk and deer to below detectable levels, with the last detections of tuberculosis in RMNP found in wild deer in 2009 and wild elk in 2014. Due to the program's success, the Riding Mountain Eradication Area has been removed, with general abattoir surveillance monitoring this higher risk population of cattle (CFIA 2019).

WBNP appears to have a distinct isolate of *M. bovis*, which has not been implicated in spread to the domestic herd (Andrievskaia et al. 2023).

Any suspect cases must be reported to the CFIA. The CFIA then conducts an investigation to determine if the disease is present. If bovine TB is confirmed on a premises, the CFIA alerts the provincial health department and implements strict disease eradication measures to eliminate the infection and prevent further spread to livestock, humans, and wildlife. These measures include:

- implementing a quarantine and restricting the movement of animals and equipment
- humane destruction of all infected and susceptible exposed animals
- cleaning and disinfection of infected premises and equipment
- investigation and testing of all at-risk livestock herds which are epidemiologically associated with the infected premises (tracing)
- testing livestock and wildlife within a surveillance zone surrounding the infected premises, and
- testing any livestock herds that are re-stocked onto a premises where bovine TB was previously confirmed.

The CFIA's TB factsheet states that "Ongoing surveillance identifies any new infections maintaining Canada's current health status for bovine TB and helps maintain current and attract new market access opportunities for Canadian livestock and livestock products. Because 95% of all commercial animals slaughtered in Canada are sent to a federal abattoir, the CFIA's abattoir surveillance system looks primarily for tuberculosis-like lesions in the lymph nodes and lungs of slaughtered animals. In specific situations, abattoir surveillance is supplemented with [intradermal tuberculin testing]. Although it can be challenging to diagnose TB in live animals and tuberculin testing has limitations, this approach is recommended by [WOAH]".

Based on the Terrestrial Code Chapter 8.11 on bovine TB, where the prevalence has fallen to very low levels, the CFIA uses the abattoir surveillance system as a key control point to detect bovine TB in slaughtered animals.

In December 2021, the United States Department of Agriculture (USDA) classified Canada as Level I for both bovine TB and brucellosis based on APHIS evaluations for both diseases (Code of Federal Regulations 2020). The 9CFR 93.437 defines a level I region for tuberculosis as having a program that meets APHIS requirements for tuberculosis in accordance with § 93.438, and a prevalence of bovine TB in their domestic bovine herds of less than 0.001 percent over at least the previous 24 consecutive months.

4.3.3 Risk review

According to the Terrestrial Code, fresh meat and meat products from countries affected by bovine TB should be sourced from animals which have passed ante-mortem and post-mortem inspection. A core responsibility of the Veterinary Services is the control and/or reduction of biological hazards of animal and public health importance by ante-mortem and post-mortem meat inspection. The role of the Veterinary Services extends from the farm to the abattoir where veterinarians have a dual responsibility – epidemiological surveillance of animal diseases and ensuring the safety and suitability of meat. The education and training of veterinarians, which includes both animal health (including zoonoses) and food hygiene components, makes them uniquely equipped to play a central role in ensuring food safety, especially the safety of foods of animal origin (WOAH 2022b).

Bovine TB caused by *M. bovis* is present in Canada. However, the likelihood of entry of *M. bovis* or *M. caprae* with imports of beef and beef products is considered negligible on the basis that:

- *M. caprae*, if present in cattle or buffalo in Canada, would likely be detected through existing bovine TB surveillance programs
- *M. bovis* and *M. caprae* have rarely been detected in muscle tissue, even in generalised infection
- tissues which are the most common sites of bovine TB lesions are excluded from the scope of this review, in particular lungs and associated lymph nodes. These do not meet the definition of fresh beef or beef products
- existing low prevalence and surveillance or eradication controls for bovine TB in Canada reduce the likelihood of infected animals and animal product being presented for human consumption
- beef in Canada produced in export abattoirs is subject to processes equivalent to the Australian Meat Standard including ante-mortem and post-mortem inspection; and ensures that meat is wholesome and fit for human consumption
- veterinary supervision of qualified meat inspectors at abattoirs under the control of the veterinary authority enables detection of bovine TB lesions at post-mortem and appropriate disposition of affected carcasses.

4.3.4 Conclusion

Based on the information presented in the beef review and an assessment of the situation in Canada, risk assessment is not applicable. However, proposed health certification will include a requirement that veterinary ante-mortem and post-mortem inspection is undertaken because bovine TB is exotic to Australia.

4.4 Bovine viral diarrhoea

4.4.1 Background

Bovine viral diarrhoea (BVD) is caused by BVD virus (BVDV) which infects a range of ruminant species. Infection in cattle is associated with variable severity disease, ranging from the common subclinical disease to mild transient diarrhoea with pyrexia, or fatal acute bovine viral diarrhoea. Signs of reproductive failure, respiratory illness and gastrointestinal disease can also occur (Constable et al. 2017; Liebler-Tenorio, Ridpath & Neill 2004; Norton, Tranter & Campbell 1989; Taylor et al. 1997;

WOAH 2023c). BVDV can also result in mucosal disease which may occur in persistently infected animals.

BVDV is classified into two antigenically and phylogenetically distinct genotypes, BVDV-1 and BVDV-2 (Ridpath, Bolin & Dubovi 1994), which are now considered separate species (Thiel et al. 2005).

In Australia 34–56 per cent of cattle have serological evidence of having been infected with BVDV (Moore et al. 2015; Norton, Tranter & Campbell 1989). One study in Queensland beef and dairy herds found 89 per cent of cattle herds containing at least one seropositive animal (Taylor et al. 2006). BVDV-1c is the most common sub-genotype in Australia (Mahony et al. 2005; Ridpath 2010). BVDV-2 sub-genotypes have not been reported in Australia (Kirkland & Mackintosh 2006; Mahony et al. 2005) and infection with BVDV-2 is a nationally notifiable animal disease (Department of Agriculture, Fisheries and Forestry 2023c).

Further information on BVD is included in Section 4.5 of the beef review.

4.4.2 Occurrence and control in Canada

Both BVDV-1 and BVDV-2 are present in Canada (WOAH 2022j). BVD or mucosal disease is an annually notifiable disease in Canada (CFIA 2023a). More information on annually notifiable diseases in Canada can be found in Appendix A.

4.4.3 Risk review

BVDV-1 is present in Canada and Australia. BVDV-2 is present in Canada but has not been reported in Australia. While BVDV can be present in the fresh beef or beef products, there is no evidence that BVDV-1 or BVDV-2 has been transmitted via fresh beef or beef products after ante-mortem and post-mortem examination. In addition, the Terrestrial Code does not recommend any risk management measures for BVDV for international trade in meat and meat products.

4.4.4 Conclusion

The animal biosecurity risk from BVDV associated with the importation of beef and beef products from Canada is considered negligible and achieves Australia's ALOP with respect to animal biosecurity risks. Therefore, a risk assessment for BVDV is not required in relation to beef and beef products from Canada in this review of conditions. Additional risk management for BVDV is therefore not required for importation of beef and beef products from Canada.

4.5 Brucellosis (*B. abortus* and *B. suis*)

4.5.1 Background

Background information on brucellosis and *B. abortus* and *B. suis* can be found in Section 3.1.2 of this addendum and Section 4.3 of the beef review.

The infection with *B. abortus* and *B. suis* are nationally notifiable in Australia (Department of Agriculture, Fisheries and Forestry 2023c). Australia has been free of bovine brucellosis, caused by *B. abortus*, since 1989. This was a result of a national eradication campaign (BTEC – the Brucellosis and Tuberculosis Eradication Campaign), which began in 1970. Australia is also free from brucellosis caused by *B. melitensis* (never reported) but not *B. suis*, which is endemic in feral pigs in Queensland and also found in the feral pig population of northern NSW and in South Australia (Government of South Australia 2023). Spillover of *B. suis* to domestic pigs (Seddon & Albiston 1965), cattle (Cook &

Noble 1984) and horses (Cook & Kingston 1988) has occurred. Vaccination, often an effective and practical method of controlling *B. abortus* in cattle, is not permitted in Australia.

Although *Brucella* spp. are most commonly isolated from the udder, the supramammary lymph nodes and the genitalia of their host, the bacteria can also be isolated from numerous sites widely distributed through the carcasses of naturally and experimentally infected cattle, particularly in the lymph nodes (Sadler 1960).

There are no reports confirming brucellosis in animals as a result of exposure to meat and meat products; however, a recent study identified a possible link between feeding feral pig meat to dogs and transmission of *B. suis* (Mor et al. 2016). Swill containing offal of hunted hares infected with *B. suis* were suspected to be the cause of outbreaks of porcine brucellosis in domestic pigs in Denmark (EFSA 2009).

The Terrestrial Code does not recommend risk management measures for brucellosis for international trade in meat and meat products (WOAH 2022f).

4.5.2 Occurrence and control in Canada

Brucellosis (caused by *B. abortus*, *B. melitensis* and *B. suis*) is a reportable disease under the Health of Animals Act 1990 and all cases must be reported to the CFIA. More information on reportable diseases in Canada can be found in Appendix A.

Canada reports that *B. abortus* and *B. suis* are absent from domestic animals. *B. abortus* is suspected but not confirmed in wildlife and *B. suis* infection is present in wildlife limited zones (WOAH 2022j). Sporadic cases of *B. suis* have been detected in wildlife including caribou and muskoxen in the far north of the country such as the Western Canadian Archipelago (Tomaselli et al. 2019). These areas are distant from cattle-production regions in Canada.

Canada initiated an eradication program for bovine brucellosis in livestock in the 1940s, and self-declared freedom from the disease in 1985. Isolated cases of bovine brucellosis in livestock were subsequently identified, and the last case was reported a Saskatchewan cattle herd in 1989.

Vaccination of cattle for brucellosis is not permitted in Canada. In order to be considered officially free of brucellosis under the criteria established by WOA, a country cannot practise vaccination for the disease (CFIA 2016).

The CFIA collects data and information under its Bovine Surveillance System initiative to support Canada's claims for brucellosis freedom in cattle. Surveillance system components include abattoir surveillance, targeted surveillance, as well as official testing for import and export and artificial insemination programs. The abattoir surveillance involves randomised serological testing of cattle and approximately 3,000 animals are tested per year. Bison are also tested through abattoir surveillance and for export testing. Data on the number of cattle tested in this program are presented in Table 2 and Table 3, respectively.

B. abortus infection is known to be present in free-ranging bison herds in and around WBNP, which straddles the border between Alberta and the Northwest Territories.

Although the WBNP is not fenced from surrounding areas, there is limited agriculture surrounding the park and very few beef farms in the vicinity (CFIA 2023b). Targeted surveillance in the form of ongoing collection and testing of blood samples from cattle at auction or on community pastures in northern Alberta, within 400 kilometres of WBNP (CFIA 2023b). Bison outside of the national park are subjected to increased disease risk management and containment, to maintain geographical separation from healthy wild bison and livestock. This includes aerial surveillance, public reporting, and culling of wild bison free ranging outside of the national park that approach agricultural areas. Livestock surrounding the national park are subjected to increased testing at auction market (i.e., saleyards) in northern Alberta and north-eastern British Columbia. There are no known cases of spillover of bovine brucellosis from wildlife in the national park to livestock.

In addition, surveillance programs are carried out in the cattle, swine, farmed bison, and farmed elk and deer sectors. For cattle and swine, surveillance is done by surveying the national herds. Blood samples are collected from randomly selected animals at slaughter and tested in a CFIA laboratory.

Table 2 Number of cattle tested for brucellosis in Canada between 2016 and 2019 (USDA 2020)

Year	Total	Targeted surveillance			Export and artificial insemination testing
		near Wood Buffalo National Park	Market cattle testing	Abattoir testing	
2016	8,957	1,656	1,814	3,111	4,032
2017	7,240	1,527	2,041	2,400	2,799
2018	9,173	2,388	2,263	3,896	3,014
2019	10,359	2,376	2,183	4,023	4,153

Table 3 Number of bison tested for brucellosis in Canada between 2016 and 2019 (USDA 2020)

Year	Total	Abattoir	Export
2016	8,015	7,983	32
2017	6,916	6,893	23
2018	6,345	6,081	264
2019	6,409	6,301	108

4.5.3 Risk review

There is no evidence that *B. abortus* or *B. suis* are present in domestic livestock including cattle or buffalo in Canada.

Noting that reproductive organs and udders from all bovines and product from non-domesticated bison, buffalo and cattle are excluded under the scope of this risk assessment, the likelihood of entry of *B. abortus* or *B. suis* with imports from Canada of beef and beef products derived from domesticated bovines which passed ante-mortem and post-mortem inspection is considered negligible and achieves Australia's ALOP.

Additional risk management in relation to *Brucella* spp. is therefore not applicable to imports of beef and beef products from Canada provided that ante-mortem and post-mortem inspection and the other conditions specified for certification have been met.

4.5.4 Conclusion

Based on the preceding information, the likelihood of entry of *B. abortus* or *B. suis* with the importation of beef and beef products from Canada and derived from domesticated bovines which passed ante-mortem and post-mortem inspection, is considered negligible and achieves Australia's ALOP. A risk assessment is therefore not required.

4.6 Echinococcosis (*E. granulosus sensu stricto*, *E. ortleppi*, and *E. multilocularis*)

4.6.1 Background

Echinococcosis is a zoonotic disease caused by several species of the genus *Echinococcus*, cestode parasites in the family *Taeniidae* (Moro & Schantz 2009). Members of the genus *Echinococcus* have an indirect, two-host lifecycle (Jenkins, Romig & Thompson 2005).

Echinococcosis is a multiple species WOAHL-listed disease (WOAH 2023d). Within Australia, echinococcosis in animals is only notifiable in Tasmania and the Northern Territory.

Nine morphologically distinct species have been identified, but three predominantly cause disease in cattle: *E. granulosus sensu stricto*, *E. ortleppi* and *E. multilocularis*. The other species and strains of *Echinococcus* are host specific and have rarely been associated with disease in cattle, including *E. canadensis* (also known as *E. granulosus* genotype 8 and genotype 10) which is present in dogs and cervids (including moose) in Canada (Priest et al. 2021).

E. granulosus sensu stricto has an almost worldwide distribution including mainland Australia and are caused by genotypes 1 and 3 of *E. granulosus* (Thompson 2008). *E. granulosus* Genotype 2 was associated with sheep in Tasmania (Thompson 2008), however Tasmania has declared provisional freedom from echinococcosis and the disease is rare in the state (Department of Natural Resources and Environment Tasmania 2023). It is most prevalent in parts of Eurasia, North and East Africa, Australia and South America (AHA 2023a; McManus & Thompson 2003). There are no reports of *E. multilocularis* or *E. ortleppi* in Australia (AHA 2023a).

E. multilocularis (and the other species) rarely infect cattle, sheep and pigs and when exposure occurs the cysts may not be viable (WOAH 2022g). The most significant zoonotic species are *E. granulosus sensu stricto* and *E. multilocularis* (Jenkins, Romig & Thompson 2005).

The Terrestrial Code does not recommend any risk management measures for *Echinococcus* spp. for international trade in meat. However, the Terrestrial Code recommends post-mortem inspection in

abattoirs, and either disposal or inactivation of metacestodes in offal as part of any risk management measures for echinococcosis in meat products (WOAH 2022g).

Further information on Echinococcosis is included in Section 4.7 of the beef review.

4.6.2 Occurrence and control in Canada

Echinococcosis is present in Canada and echinococcosis or hydatidosis is an annually notifiable disease. More information on annually notifiable diseases in Canada can be found in Appendix A.

The two major species that have been found in Canada are *E. multilocularis* and *E. canadensis* (Alvi & Alsayeqh 2022). Reports indicate that *E. granulosus sensu stricto* has not been detected in Canada (Priest et al. 2021).

4.6.3 Risk review

There is evidence that *E. granulosus sensu stricto* and *E. ortleppi* can be transmitted via beef carcass parts.

E. granulosus sensu stricto is present in Australia. It has not been reported in cattle in Canada. Metacestodes in cattle are usually sterile and do not play a major role in transmission.

E. ortleppi is not known to be present in cattle in Canada or Australia (Thompson 2008).

E. multilocularis is present in Canada but is not present in Australia. Cattle, although sometimes exposed to infection, only develop small non-viable lesions of *E. multilocularis* and are therefore not involved in transmission (WOAH 2022g).

Post-mortem inspection of the carcass and carcass parts is an effective way of detecting echinococcosis. Under the Australian Meat Standard, affected organs would be condemned if echinococcosis was detected at post-mortem. Therefore, further risk assessment for *Echinococcus* spp. is not required in this review in relation to imports of beef carcasses and carcass products from the applicant countries.

4.6.4 Conclusion

Post-mortem inspection of the carcass is an effective way of detecting echinococcosis and reduces risks of it being in imported fresh beef and beef products. The importation of beef and beef products from Canada is unlikely to introduce *Echinococcus* spp. into Australia as meat would be produced under conditions equivalent to relevant Australian standards.

The risk from *Echinococcus* spp. associated with the importation of beef and beef products from Canada is therefore considered negligible and achieves Australia's ALOP with respect to animal biosecurity risks. Risk management in relation to *Echinococcus* spp. is not applicable to imports of beef and beef products from Canada.

4.7 Paratuberculosis (*M. avium* subspecies *paratuberculosis*)

4.7.1 Background

Mycobacterium avium subspecies *paratuberculosis* (*M. paratuberculosis*) is a bacterium which causes paratuberculosis or Johne's disease, a chronic enteritis and wasting disease of ruminants with a worldwide distribution (Buergelt, Bastianello & Michel 2004).

Paratuberculosis is a multiple species WOAHL-listed disease (WOAH 2023d). It is present in Australia and is a nationally notifiable animal disease (Department of Agriculture, Fisheries and Forestry 2023c). In 2009, the herd prevalence of paratuberculosis in south-eastern Australia was less than 1 per cent of beef herds and less than 20 per cent of dairy herds (AHA 2009). Up to and including 2016, approximately 1,150 cattle herds in Australia had been classified as infected. Paratuberculosis is most common in dairy herds, but it also occurs in beef cattle, goats and alpacas. The first case of paratuberculosis in deer was detected in Victoria in 1999 (AHA 2016). It is present in Australia and is a nationally notifiable animal disease (Department of Agriculture, Fisheries and Forestry 2023c). In 2009, the herd prevalence of paratuberculosis in south-eastern Australia was less than 1 per cent of beef herds and less than 20 per cent of dairy herds (AHA 2009). Up to and including 2016, approximately 1,150 cattle herds in Australia had been classified as infected. Paratuberculosis is most common in dairy herds, but it also occurs in beef cattle, goats and alpacas.

Australia has no relevant movement controls for paratuberculosis in beef and beef products within Australia.

At least one systematic review has recommended that the exposure of humans to *M. paratuberculosis* in meat (as well as milk, water and the environment) warranted further investigation (Wilhelm et al. 2009). Studies have shown that beef can be contaminated with *M. paratuberculosis* via the dissemination of the organism in infected tissues and that tissue distribution may be poorly correlated with clinical signs. The surface of carcasses can also be contaminated by *M. paratuberculosis* in faeces present on the hides of animals at slaughter (Eltholth et al. 2009). There is the suggestion that *M. paratuberculosis* is spread to extra-intestinal tissues via blood (Bower, Begg & Whittington 2011). Bacteraemia might be intermittent in the early stages of disease or undetectable in cows with advanced paratuberculosis (Mutharia et al. 2010).

It is generally agreed that the faecal-oral route is the most important natural route of exposure. Oral transmission of bovine strains of *M. paratuberculosis* obtained from homogenised infected tissue to cattle, goats, sheep, deer, chickens and laboratory animals, was demonstrated in numerous experiments and extensively reviewed (Begg & Whittington 2008; Hines et al. 2007).

Natural *M. paratuberculosis* infection is mainly transmitted to susceptible species via the oral route through pasture or livestock yards that are contaminated with faecal material containing *M. paratuberculosis*. The presence of *M. paratuberculosis* in carcass and carcass parts of sub-clinically infected cattle has been demonstrated from faecal contamination of the carcass, and/or disseminated from intestines, including offal and muscle (Gill, Saucier & Meadus 2011). The occurrence of paratuberculosis infection has been documented in wild swine and *M. paratuberculosis* has also been reported in the tissues of naturally infected pigs (Miranda et al.

2011). Transmission of *M. paratuberculosis* to other species via the consumption of raw or undercooked beef and beef products has not been investigated. However, numerous experiments have demonstrated transmission of *M. paratuberculosis* to cattle, goats, sheep, deer, chickens and laboratory animals, which were dosed by mouth with bovine strains obtained from culture or homogenised infected tissue (Begg & Whittington 2008; Hines et al. 2007).

Further information on paratuberculosis is included in Section 4.8 of the beef review.

4.7.2 Occurrence and control in Canada

Paratuberculosis is present in Canada (WOAH 2022j) and paratuberculosis (Johne's disease) is an annually notifiable disease in Canada (CFIA 2023a).

At slaughtering plants in Canada and the United States, *M. paratuberculosis* was detected on 54 to 80 per cent of cull dairy and beef cow hides and 1 to 6 per cent of feedlot cattle. However, the prevalence of *M. paratuberculosis* decreased during processing and the organism was thought to present little risk of contamination to prime cuts of beef (Meadus et al. 2008; Wells et al. 2009).

Based on a survey of cattle at slaughter, a prevalence of paratuberculosis was estimated in culled dairy cattle in Eastern Canada and Maine of 16 per cent. In a study of dairy cattle in New Brunswick, Nova Scotia, and Prince Edward Island, 2.6 per cent (1.8 to 3.9 per cent) of cows were positive for *M. paratuberculosis* and 16.7 per cent of herds had at least 2 positive cows. A more recent study reported estimates of 66 per cent for farms in Western Canada, 54 per cent in Ontario, 24 per cent in Québec, and 47 per cent in Atlantic Canada infected with paratuberculosis (Corbett et al. 2018).

4.7.3 Risk review

There is evidence that *M. paratuberculosis* can be transmitted via the beef carcass or carcass parts after ante-mortem and post-mortem examination.

Paratuberculosis is present in Canada and Australia.

Paratuberculosis is currently a nationally notifiable animal disease in Australia (Department of Agriculture, Fisheries and Forestry 2023c). The Terrestrial Code does not recommend any risk management measures for paratuberculosis for international trade in meat and meat products. Australia does not have domestic movement restrictions on beef or beef products in relation to paratuberculosis.

4.7.4 Conclusion

The risk from *M. paratuberculosis* infection associated with the importation of beef and beef products from Canada is considered negligible and therefore achieves Australia's ALOP with respect to animal biosecurity risks. Risk management measures additional to the veterinary ante-mortem and post-mortem inspections and certification as per the Australian Meat Standard are not required. A risk assessment for paratuberculosis is therefore not required.

4.8 Infection due to *Salmonella enterica* serotype Typhimurium DT104

4.8.1 Background

Salmonella enterica causes clinical and subclinical enteric infections in both livestock and humans, and non-typhoidal *Salmonella* is a leading cause of food-borne illness in Canada (John et al. 2022).

Serotypes of *Salmonella enterica* are emerging that have multiple antibiotic resistance. The prevalence of multiple antibiotic resistant *Salmonella enterica* serotypes in livestock raises concerns about the management of livestock destined for the food chain and the transmission of multi-resistant pathogens to humans via food (Adhikari et al. 2009; Habing, Lo & Kaneene 2012; Loudon et al. 2012; Marrero-Ortiz et al. 2012; Ray et al. 2007; Van Boxtael et al. 2012).

In the early 1990s, a distinct multi-drug resistant strain of *Salmonella enterica* serotype Typhimurium (*S. Typhimurium*) became prominent as a pathogen of both livestock and humans in the United States and western Europe (Foley et al. 1998; Poppe et al. 1998). The new strain, known as definitive type (DT) 104 R-ACSSuT displayed resistance to several antibiotics: ampicillin, chloramphenicol, streptomycin, sulphonamides and tetracycline (ACSSuT) and continued to spread internationally during the 1990s (Helms et al. 2005). *S. Typhimurium* DT104 R-ACSSuT is commonly abbreviated to DT104 and is now present in many countries (Glynn et al. 1998; Helms et al. 2005) including Canada (Leekitcharoenphon et al. 2016).

Although human cases have been identified in Australia (Helms et al. 2005), infection with *S. Typhimurium* DT104 has not been reported in Australian livestock or products derived from Australian livestock (Barlow & Gobius 2008). A number of studies examining *Salmonella* serovars in Australian cattle and meat have been unable to detect *S. Typhimurium* DT104 (Fearnley et al. 2011; Fegan et al. 2004; Izzo, Mohler & House 2011; Murray 1994). In addition, there is a low incidence of human *S. Typhimurium* DT104 infection in Australia, which when present is often associated with imported food or contracted overseas (Fisher et al. 2001; Helms et al. 2005). Australia imposes strict biosecurity measures on imported food and livestock, which may have contributed to the lack of establishment of *S. Typhimurium* DT104 in Australia (Helms et al. 2005).

Salmonellosis due to DT104 is not a WOAHL-listed disease (WOAHL 2023d). However, WOAHL recognises that multiple antibiotic resistant *Salmonella* spp. are of increasing concern in both public health and primary production (WOAHL 2023h).

Salmonellosis caused by *S. Typhimurium* DT104 is not a nationally notifiable animal disease in Australia (Department of Agriculture, Fisheries and Forestry 2023c). However, salmonellosis in animals in Victoria and Tasmania is notifiable. As it is a serious zoonosis (Radostits et al. 2007; WOAHL 2023d), salmonellosis is a nationally notifiable animal disease for humans (Department of Health and Aged Care 2023).

The current Australian Meat Standard (*AS 4696:2023 Hygienic production and transportation of meat and meat products for human consumption*) requires:

- that an ante-mortem inspection is carried out within 24 hours prior to slaughter

- animals that are not clean are not passed for slaughter or are subject to conditions to prevent cross-contamination during slaughter, dressing, post-mortem and disposition
- slaughter and dressing to be performed in a manner that reduces the risk of contamination of carcasses and carcase parts, and ensures the food safety of meat and meat products
- a post-mortem inspection of each carcase and its carcase parts to be carried out by a meat safety inspector
- condemnation of the carcase and all carcase parts if evidence of salmonellosis (septicaemia or septic arthritis) is found during ante-mortem or post-mortem inspections
- handling, processing, package and storage procedures which reduce the risk of contamination of carcase and carcase parts, and ensure the food safety of meat and meat products.

The current Australian Meat Standard reduces but does not eliminate the presence of *Salmonella* spp. such as *S. Typhimurium* DT104 from meat and meat products.

There are biosecurity measures currently in place to manage the risk of *Salmonella* spp. in imported pig and chicken meat. These include cooking, country or zone freedom and testing in accordance with the Food Standards Code.

Further information on *S. Typhimurium* DT104 is included in Section 4.9 of the beef review.

4.8.2 Occurrence and control in Canada

There is scientific evidence that *S. Typhimurium* DT104 is present in cattle in Canada (Dore et al. 2004). There is scientific evidence that *S. Typhimurium* DT104 can be transmitted via beef and beef product (CFIA 2021).

4.8.3 Risk review

As there is scientific evidence that *S. Typhimurium* DT104 is present in Canada, and that it may be transmitted via beef and beef products, a risk assessment is required. This is consistent with the findings of the beef review for other applicant countries.

4.8.4 Conclusion

As there is scientific evidence that *S. Typhimurium* DT104 is present in Canada, and that it may be transmitted via beef and beef products, a risk assessment is required.

4.8.5 Risk assessment

Entry assessment

The following factors were deemed relevant to the possible presence of *S. Typhimurium* DT104 in imported beef and beef products:

- transport of cattle (for example to slaughter facilities) may cause stress, which may increase the faecal shedding of *Salmonella* spp. (Beach, Murano & Acuff 2002).
- faecal shedding of *Salmonella* spp. during transport and in holding pens before slaughter may result in contamination of hides of in-contact animals (Beach, Murano & Acuff 2002).

- clinically normal adult animals may shed *Salmonella* spp. in their faeces for up to 18 months (Evans & Davies 1996).
- ante-mortem inspection would possibly detect animals with acute or septicaemic forms of salmonellosis. Ante-mortem inspection would be less effective in detecting animals with chronic enteric disease
- *Salmonella* spp. may be present on beef carcass and carcass parts due to faecal or hide contamination or cross-contamination of equipment during processing
- carcass inspection will detect gross (visibly detectable) faecal contamination of carcasses but not microscopic contamination
- *Salmonella* spp. are common post-processing contaminants of beef carcass and carcass parts (Brichta-Harhay et al. 2011).
- *S. Typhimurium* DT104 and other *Salmonella* spp. are tolerant of adverse conditions such as chilling and/or freezing (Humphrey et al. 2011; Knudsen et al. 2011; Manios & Skandamis 2015).
- ground beef is prepared from carcass parts from multiple animals, and trimmings and may be subjected to cross-contamination during preparation. Ground beef is reported to have higher *Salmonella* spp. contamination than other beef products (Martínez-Chávez et al. 2015).
- physical inspection of packaged beef and beef products after arrival in Australia will not detect microscopic contamination
- small volumes of fresh beef and beef products are likely to be imported into Australia from the applicant countries.

Canada specific entry factors

- *S. Typhimurium* DT104 has been isolated increasingly from humans and animals in the United Kingdom and several other European countries and, more recently, in the United States and Canada (Poppe et al. 1998).
- The occurrence of *Salmonella* spp. in dairy cattle in Canada appears to be clustered by farms and provinces, with the most common serovars being Infantis and Typhimurium. Additionally, 21 per cent of the *Salmonella* isolates were resistant to at least one antimicrobial, with tetracycline resistance being the most common. Only one isolate was found to be resistant to a highly important antimicrobial (Fonseca et al. in press)
- In November 2023, the Public Health Agency of Canada (PHAC) reported an outbreak of extensively drug-resistant *Salmonella* infections in six provinces linked to raw pet food and contact with cattle (Public Health Agency of Canada 2023b).
- In its response to the Questionnaire for the evaluation of fresh beef and beef product exports to Australia from Canada the CFIA has advised that it does not test for *S. Typhimurium* DT104 specifically, but establishments eligible to export to the United States (and probably other markets) must conduct testing of products for *Salmonella* according to a written sampling program.

The USDA "Pathogen Reduction/HACCP Systems" Final Rule requires that certain types of meat products made in Food Safety and Inspection Service (FSIS) inspected establishments USDA "Performance Standards" for Salmonella published under sections 9CFR310.25(b) and 9CFR381.94(b) of the United States Federal Register. The FSIS performs unannounced sampling and testing of products manufactured in United States facilities in order to assess their compliance with the standards. If an establishment cannot produce meat which conforms with the prescribed Performance Standard, a process which can ultimately lead to the withdrawal of inspection is initiated. The FSIS will also use these test results to update baseline reference standards for Salmonella in United States products and to update the Performance Standards for Salmonella.

Canadian establishments eligible to export meat or meat products to the United States which are amenable to a USDA Performance Standard for Salmonella must manufacture these products in accordance with the applicable standard. In order to demonstrate this, the establishment shall conduct testing of products for Salmonella according to a written sampling program which meets the requirements set out in this annex.

The CFIA exercises government direction and oversight of establishments' Salmonella testing programs. If an establishment's testing shows that it is not manufacturing product which complies with the USDA Performance Standard for Salmonella, a process is initiated which may lead to the removal of the establishment from the list of eligible establishments.

The CFIA intends to eventually use Canadian Performance Standard for Salmonella. Pending their publication and acceptance, the Performance Standards published by the USDA will be used in Canadian establishments (CFIA 2021).

Verification that HACCP-based QA plans in the applicant country are operating as required to provide the necessary assurances will occur through an audit process (i.e. a competent authority assessment).

Conclusion

A proportion of beef and beef products imported from Canada could be contaminated with *S. Typhimurium* DT104.

Based on the proportion of product imported from Canada that is likely to be contaminated with viable *S. Typhimurium* DT104, and the estimated volume of trade, the likelihood of entry of *S. Typhimurium* DT104 with beef and beef product derived from Canada is considered to be high. This is consistent with the assessment of the likelihood of entry in the beef review for other countries where *S. Typhimurium* DT104 is present.

Exposure assessment

The exposure assessment is an estimate of the likelihood of susceptible animals in Australia being directly exposed to and infected with *S. Typhimurium* DT104 via contaminated imported beef and beef products not consumed by humans. It is based on the estimated proportion of imported contaminated product that would be exposed to susceptible animals leading to an incident case. The exposure assessment also describes the plausible biological pathways necessary for that exposure, including exposure of Australian animals to waste from imported beef and beef products from applicant countries.

The volume of trade of beef and beef products from Canada is expected to be small. This addendum assesses the likelihood of exposure through imported beef and beef products from Canada as equivalent to other applicant countries (e.g. Japan, the Netherlands and the United States) where *S. Typhimurium* DT104 is present.

Section 4.9.7 of the beef review provides a detailed explanation of the factors taken into consideration in the assessment of the likelihood of exposure from these countries. It concluded that imported contaminated beef and beef products:

- do not have a significant potential exposure pathway to domestic ruminants.
- do have a significant potential exposure pathway to domestic non-ruminants, especially backyard and/or small commercial piggeries, backyard poultry and companion animals (mainly cats and dogs).
- do have a significant potential exposure pathway to wild and feral animals.

The potential for exposure to domestic non-ruminants, wild and feral animals would be considerably lower for high value beef (for example, primal cuts) compared with ground beef and other lower value products.

The likelihood of exposure of domestic ruminants with imported contaminated beef and beef products leading to clinical cases is considered **negligible**.

The likelihood of exposure of imported contaminated beef and beef product to domestic non-ruminants, and wild and feral animals leading to a clinical case is considered **low**.

Consequence assessment

The consequence assessment considers both the likelihood and consequences (impacts) of establishment and spread of the disease as a result of exposure to contaminated imported product. Both direct and indirect effects (animal health, environmental and socioeconomic) are considered in assessing consequences.

The likelihood and consequences of establishment and spread of *S. Typhimurium* DT104 associated with imports of beef and beef products would not be affected by the country of origin of the product. The consequence assessment for imports of beef and beef products imported from Canada is therefore consistent with the assessment for other applicant countries. This is described in Section 4.9.7 of the beef review. It concluded that:

- In the event of infection of susceptible animals due to direct exposure to contaminated imported beef and beef products, there is a low likelihood of *S. Typhimurium* DT104 becoming established in Australia.
- The overall consequence of outbreaks in animals of *S. Typhimurium* DT104 in Australia is considered very low primarily associated with possible animal health, control, monitoring and surveillance strategies and programs and an adverse effect on domestic consumption.

4.8.6 Risk estimation

Risk estimation is the integration of likelihood of outbreaks of *S. Typhimurium* DT104 occurring as a result of the importation of beef and beef products, and the consequences of these outbreaks.

- The likelihood of entry of *S. Typhimurium* DT104 with imports of beef and beef products from Canada is considered to be **high**. The likelihood of entry would be higher with ground beef and low value mixed beef pieces compared to primal beef cuts.
- The likelihood of exposure of domestic ruminants with imported contaminated beef and beef products leading to clinical cases is considered **negligible**. However, there is a plausible exposure pathway of imported contaminated beef and beef product to domestic non-ruminants, and wild and feral animals, especially backyard and/or small commercial piggeries, backyard poultry and companion animals (mainly cats and dogs). The likelihood of exposure of an imported contaminated beef or beef product to these exposure groups leading to a case is considered to be **low**.
- Based on the estimated likelihood of entry and the likelihood of exposure, the likelihood of entry and exposure of *S. Typhimurium* DT104 with imports of beef and beef products from Canada is considered to be **negligible** for ruminants and **low** for non-ruminants. The potential for exposure to domestic non-ruminants, and wild and feral animals would be considerably lower for high value beef (for example, primal cuts) compared with ground beef and other lower value products. However, ground beef may be less likely to lead to waste than higher value products.
- In the event of infection of susceptible animals due to direct exposure to contaminated imported product, there is potential for *S. Typhimurium* DT104 becoming established in Australia.
- The likelihood for *S. Typhimurium* DT104 to establish and spread in Australia following an individual case is considered to be **low**.
- Based on an estimated low likelihood of entry and exposure and the low likelihood of establishment and spread, the likelihood for *S. Typhimurium* DT104 becoming established in Australia due to imports of beef and beef products from Canada is considered to be **very low**.
- The overall consequence of outbreaks in animals of *S. Typhimurium* DT104 is considered **very low** primarily associated with possible animal health, control, monitoring and surveillance strategies, and programs, and adverse effects on domestic consumption.

Using Table 1, the overall likelihood of outbreaks occurring (very low) was combined with the consequences of the outbreaks (very low), which resulted in a risk estimation of **negligible**.

4.8.7 Management of human health risks

S. Typhimurium DT104 is a significant pathogen of humans. The final beef review took into account advice from the then Department of Health that Australia's ALOP is achieved with respect to this pathogen when produced in accordance with or equivalent to relevant Australian standards (e.g. the Food Standards Code and the Australian Standard for the hygienic production and transportation of meat and meat products for human consumption AS4696:2007).

As for other applicant countries where *S. Typhimurium* DT104 is endemic in cattle, Australia will require that listed establishments in Canada operate Hazard Analysis Critical Control Point Quality Assurance plans (HACCP-based QA plans), and have their satisfactory operation verified via a

bacteriological testing program equivalent to that undertaken in Australia in accordance with relevant Australian standards.

Risk management is also required to manage food safety concerns associated with *Salmonella* spp. (including DT104). Exporting countries will need to demonstrate competent authority oversight of the beef exporting establishments ensuring these facilities are operating through-chain HACCP based food safety programs which control the risks associated *Salmonella* spp. Consignments of beef being exported will need to be certified by the competent authority and at-border verification testing will be applied.

Verification that HACCP-based QA plans in Canada are operating as required to provide the necessary assurances will occur through an audit process (i.e. competent authority assessment).

4.8.8 Conclusion

The risk of *S. Typhimurium* DT104 associated with the importation of fresh beef and beef products from Canada is considered negligible and therefore achieves Australia's ALOP with respect to animal biosecurity risks. No specific *S. Typhimurium* DT104 risk management measures are warranted for beef and beef products imported from Canada to address animal biosecurity concerns.

As mentioned above, to manage human health risks, Australia will require HACCP-based QA plans, and have their satisfactory operation verified via a bacteriological testing program equivalent to that undertaken in Australia in accordance with relevant Australian standards.

5 Risk management

5.1 Compliance or equivalence with Australian standards

Compliance with relevant Australian standards (described in Sections 1.2 and 2.2) or an equivalence determination as appropriate, is required to determine whether Canada may be eligible to export beef and beef products to Australia.

FSANZ undertakes assessments of countries to ensure compliance with Australian BSE food safety requirements and advises the department of the BSE risk management measures required before beef and beef products can be imported. FSANZ also monitors assessed countries for any change in BSE status that may impact on a favourable BSE categorisation that was issued after finalising a BSE Food Safety Risk Assessment Report for that country. In July 2024, FSANZ completed an assessment of Canada's BSE status, assigning a Category 1 status.

An applicant country's ability to meet the Australian Meat Standard and the *Imported Food Control Act 1992* is determined by the department through an competent authority evaluation before fresh beef and beef products can be imported.

5.2 Competent authority evaluation and health certification

Evaluation of the competent authority and its application of relevant risk management measures is an integral component of an assessment of the biosecurity risk associated with imports from a particular country.

Canada, as an applicant country, would become an approved country once it has been fully assessed for the importation of this commodity into Australia. This includes a successful evaluation of the competent authority and its ability to meet import requirements.

The department takes into account the following criteria, as well as any other relevant information, when considering the approval of countries to export animals and their products to Australia:

- the animal health status of the country
- the effectiveness of veterinary services and other relevant certifying authorities
- legislative controls over animal health, including biosecurity policies and practices
- the standard of reporting to WOA of major contagious disease outbreaks
- the effectiveness of veterinary laboratory services, including compliance with relevant international standards
- the effectiveness of systems for control over certification/documentation of products intended for export to Australia.

5.3 Proposed risk management measures for the importation of fresh beef and beef products from Canada

5.3.1 Recognition of country free status

This addendum recommends that certification of country freedom is considered sufficient, reasonable and practical to address the risk of the importation of fresh beef and beef products from Canada for the following diseases and disease agents:

- brucellosis (*Brucella melitensis*)
- contagious bovine pleuropneumonia
- Crimean-Congo haemorrhagic fever
- foot-and-mouth disease
- haemorrhagic septicaemia
- Rift Valley fever
- surra
- theileriosis (*Theileria annulata* and *T. parva*)
- trypanosomiasis (Tsetse transmitted)
- Wesselsbron disease
- Aujeszky's disease and vesicular stomatitis are present in some of the applicant countries considered in the beef review. The beef review concluded that the risk of these diseases was negligible and did not recommend any risk management, including country freedom attestations. Therefore, no certification of country freedom is proposed for these diseases for the importation of fresh beef and beef products from Canada.

The animal biosecurity risk of LSD transmission through meat flesh derived exclusively from bovine skeletal muscle (fresh bovine skeletal muscle meat) has been assessed in a separate addendum to the beef review (Department of Agriculture, Fisheries and Forestry 2023d). This found that the overall risk of LSD associated with the import of fresh bovine skeletal muscle meat for human consumption is very low and achieves Australia's ALOP. Specific biosecurity risk management measures are not justified for LSD virus when bovine skeletal muscle meat is imported for human consumption into Australia from Canada. Country freedom certification for LSD for import of fresh bovine skeletal muscle meat from Canada is not required to achieve Australia's ALOP. Country freedom certification for lumpy skin disease would still be required for other fresh beef and beef products that do not meet the definition of skeletal muscle.

No risk management is required for rinderpest as the disease was declared globally eradicated in 2011.

5.3.2 Origin of the bovines

CFIA requested an expanded scope to include beef derived from bovines legally imported into Canada from the United States. The United States is already approved to export beef derived from

bovines born, raised and slaughtered in the United States to Australia. This means that the biosecurity risks associated with beef derived from cattle born, raised and slaughtered in the United States have already been assessed to meet Australia's ALOP.

Certification about the origin of the cattle is required to address the risk of the importation of fresh beef and beef products from Canada, including cattle imported from the US. The official veterinary health certificate issued by CFIA will require an attestation to confirm that the cattle from which the meat was derived have been continuously resident in Canada and/or the United States since birth.

5.3.3 Additional biosecurity measures

The risk assessment determined that the risk of the following diseases with the importation of fresh beef and beef products from the applicant countries was considered negligible, provided there is compliance or equivalence with relevant Australian standards (describe in Sections 1.2 and 2.2):

- anthrax
- bovine cysticercosis
- bovine tuberculosis
- bovine viral diarrhoea
- brucellosis (*B. abortus* and *B. suis*)
- echinococcosis
- paratuberculosis
- infection due to *S. Typhimurium* DT104

As mentioned earlier, Australia will require that listed establishments in the applicant countries operate HACCP-based QA plans, and have their satisfactory operation verified via a bacteriological testing program equivalent to that undertaken in Australia in accordance with relevant Australian standards.

This risk management also addresses food safety concerns associated with STEC and *Salmonella* spp. Taking into account the preliminary advice from FSANZ that imports of fresh beef and beef products are considered to present a potential medium to high risk to public health for STEC and *Salmonella* spp., as outlined in the beef review.

Canada will need to demonstrate competent authority oversight of the beef exporting establishments ensuring these facilities are operating through-chain HACCP based food safety programs which control the risks associated with STEC and *Salmonella* spp. Consignments of beef being exported will need to be certified by the competent authority and at-border verification testing will be applied. Verification that HACCP-based QA plans in the applicant country are operating as required to provide the necessary assurances will occur through an audit process (i.e. competent authority assessment). Any additional food safety controls required to address food safety risks identified in these assessments will be advised by the relevant area within this department when available.

5.4 Meeting Australia's food standards

Imported food for human consumption must satisfy Australia's food standards. Australian law requires that all food, including imported food such as beef and beef products, meets the standards set out in the Food Standards Code. FSANZ is responsible for developing and maintaining the Food Standards Code, including Standard 1.4.2, maximum residue limits, available on the [Legislation](#) website. The standards apply to all food in Australia, irrespective of whether it is grown domestically or imported.

5.5 Proposed biosecurity requirements

Proposed biosecurity requirements, including health certification, for the importation of fresh beef and beef products for human consumption from Canada would be consistent with those for other applicant countries. These are described in Section 5.1.5 of the beef review.

6 Conclusion and next steps

This addendum concludes that the animal biosecurity risks associated with the importation of fresh beef and beef products from Canada can be managed to achieve Australia's ALOP. A draft version of this addendum was released for 80 days public consultation to give stakeholders the opportunity to provide technical comment. Stakeholder submissions were be considered when finalising the addendum.

With the finalisation of the draft addendum, Canada may become an approved country for export of fresh beef and beef products once it has been fully assessed for the importation of this commodity into Australia. This includes a successful evaluation of the competent authority and its ability to meet import requirements. Health certification would also need to be agreed before trade could commence.

References

- Adams, LG 2002, 'The pathology of brucellosis reflects the outcome of the battle between the host genome and the *Brucella* genome', *Veterinary Microbiology*, vol. 90, no. 1-4, pp. 553-61, available at <http://www.sciencedirect.com/science/article/B6TD6-46SG2NK-4/2/e6fae1b827923aefd67c3bd6d16ba856>, accessed 11 December 2023.
- Adhikari, B, Besser, TE, Gay, JM, Fox, LK, Davis, MA, Cobbold, RN, Berge, AC, McClanahan, R & Hancock, DD 2009, 'Introduction of new multidrug-resistant *Salmonella enterica* strains into commercial dairy herds', *Journal of Dairy Science*, vol. 92, no. 9, pp. 4218-28, available at doi: 10.3168/jds.2008-1493, accessed 11 December 2023.
- AHA 2009, *Bovine tuberculosis case response manual: managing an incident of bovine tuberculosis*, 2nd edn, Primary Industries Ministerial Council, Canberra, available at <https://animalhealthaustralia.com.au/our-publications/ausvetplan-manuals-and-documents/>, accessed 11 December 2023.
- -- 2015a, *Animal health in Australia 2014*, Animal Health Australia, Canberra, available at <https://www.animalhealthaustralia.com.au/our-publications/animal-health-in-australia-report/>, accessed 11 December 2023.
- -- 2015b, *Disease strategy: anthrax (version 4.0)*, Australian Veterinary Emergency Plan (AUSVETPLAN), National Biosecurity Committee, Canberra, ACT, available at <https://www.animalhealthaustralia.com.au/download/9794/>, accessed 11 December 2023.
- -- 2021a, *Response strategy: Anthrax*, Version 5.0, edition 5 edn, Australian Veterinary Emergency Plan (AUSVETPLAN), Animal Health Australia, Canberra, ACT, available at https://animalhealthaustralia.com.au/wp-content/uploads/dlm_uploads/2020/09/AUSVETPLAN-Manuals_Response_Anthrax.pdf, accessed 11 December 2023.
- -- 2021b, *Response strategy: Rift Valley fever*, Version 5.1, edition 5 edn, Australian Veterinary Emergency Plan (AUSVETPLAN), Animal Health Australia, Canberra, ACT, available at https://animalhealthaustralia.com.au/wp-content/uploads/dlm_uploads/2021/11/AUSVETPLAN-Manuals_Response_Rift-Valley-fever.pdf, accessed 11 December 2023.
- -- 2021c, *Response strategy: Surra*, Version 5.0, edition 5 edn, Australian Veterinary Emergency Plan (AUSVETPLAN), Animal Health Australia, Canberra, ACT, available at https://animalhealthaustralia.com.au/wp-content/uploads/dlm_uploads/2015/11/AUSVETPLANResponseStrategy_Surra_V5.pdf, accessed 11 December 2023.
- -- 2022a, 'Government and livestock industry cost sharing deed in respect of emergency animal disease responses', *Animal Health Australia*, Animal Health Australia, Australia, available at https://animalhealthaustralia.com.au/wp-content/uploads/dlm_uploads/2015/09/EADRA_web_updated_221017.pdf, accessed 11 December 2023.
- -- 2022b, *Response strategy: Foot-and-mouth disease*, Version 5.0, edition 5 edn, Australian Veterinary Emergency Plan (AUSVETPLAN), Animal Health Australia, Canberra, ACT, available at https://animalhealthaustralia.com.au/wp-content/uploads/dlm_uploads/2022/12/AVP_FMD_v5.0_2022.pdf, accessed 11 December 2023.
- -- 2023a, 'Animal Health in Australia Annual Report 2022', Animal Health in Australia, Canberra, available at <https://animalhealthaustralia.com.au/ahia/>.
- -- 2023b, 'Response strategy Lumpy skin disease (version 5.1)', *Australian Veterinary Emergency Plan AUSVETPLAN*, Animal Health Australia, Australia, available at

- <https://animalhealthaustralia.com.au/wp-content/uploads/2022/08/Lumpy-Skin-Disease.pdf>, accessed 11 December 2023.
- Ali, H, Ali, AA, Atta, MS & Cepica, A 2012, 'Common, emerging, vector-borne and infrequent abortogenic virus infections of cattle', *Transboundary and Emerging Diseases*, vol. 59, no. 1, pp. 11-25, available at <http://dx.doi.org/10.1111/j.1865-1682.2011.01240.x>.
- Alvi, MA & Alsayeqh, AF 2022, 'Food-borne zoonotic echinococcosis: A review with special focus on epidemiology', *Frontiers in Veterinary Science*, vol. 9, pp. 1-16, available at <https://www.frontiersin.org/articles/10.3389/fvets.2022.1072730/full>, accessed 11 December 2023.
- Andrievskaia, O, Shury, T, Garceac, A, Lloyd, D, Arnold, K & Duceppe, MO 2023, 'Complete Genome Sequence of an Endemic Mycobacterium bovis Strain from Wood Bison in Wood Buffalo National Park, Canada.', *Microbiology Resource Announcements*, vol. 12, no. 5, available at <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10190567/>, accessed 11 December 2023.
- Annas, S, Zamri-Saad, M, Jesse, FFA & Zunita, Z 2014, 'New sites of localisation of Pasteurella multocida B:2 in buffalo surviving experimental haemorrhagic septicaemia', *BMC Veterinary Research*, vol. 10, pp. 88, available at doi: 10.1186/1746-6148-10-88, accessed 11 December 2023.
- APHIS 2008, *Pseudorabies (Aujeszky's disease) and its eradication: a review of the U.S. experience*, Technical bulletin, 1923, United States Department of Agriculture, Animal and Plant Health Inspection Service, Washington, available at http://www.aphis.usda.gov/publications/animal_health/content/printable_version/pseudo_rabies_report.pdf, accessed 11 December 2023.
- Arishi, H, Ageel, A, Rahman, MA, Hazmi, AA, Arishi, AR, Ayoola, B, Menon, C, Ashraf, J, Frogusin, O, Sawwan, F, Hazmi, M, As-Sharif, A, Al-Sayed, M, Ageel, AR, Alrajhi, ARA, Al-Hedaithy, MA, Fatani, A, Sahaly, A, Ghelani, A, Al-Basam, T, Turkistani, A, Al-Hamadan, N, Mishkas, A, Al-Jeffri, MH, Al-Mazroa, YY & Alamri, MMA 2000, 'Outbreak of Rift Valley fever - Saudi Arabia, August-October, 2000', *Morbidity and Mortality Weekly Report*, vol. 49, no. 40, pp. 905-8
- ARMCANZ 1996, *Disease strategy: Rift Valley fever*, Australian Veterinary Emergency Plan (AUSVETPLAN), Agriculture and Resource Management Council of Australia and New Zealand, Canberra, available at <https://www.animalhealthaustralia.com.au/our-publications/ausvetplan-manuals-and-documents/>, accessed 11 December 2023.
- Department of Agriculture and Water Resources 2017, 'Fresh (chilled or frozen) beef and beef products from Japan, the Netherlands, New Zealand, the United States and Vanuatu – final review', available at <https://www.agriculture.gov.au/sites/default/files/sitecollectiondocuments/biosecurity/risk-analysis/current-animal/fresh-beef-review.pdf>, accessed 11 December 2023.
- Auty, JH 1998, 'Foot-and-mouth disease in Australia', *Australian Veterinary Journal*, vol. 76, no. 11, pp. 763-4, available at <http://www3.interscience.wiley.com/journal/120745064/abstract>, accessed 11 December 2023.
- Ayele, WY, Neill, SD, Zinsstag, J, Weiss, MG & Pavlik, I 2004, 'Bovine tuberculosis: an old disease but a new threat to Africa', *The International Journal of Tuberculosis Lung Disease*, vol. 8, pp. 924-37
- Bailey, G 2017, *Cysticercus bovis: background to the NSW program and review of cases*, NSW Department of Primary Industries,, available at <https://www.flockandherd.net.au/cattle/ireader/cysticercus-bovis.html>, accessed 11 December 2023.
- Barlow, R & Gobius, K 2008, *Pilot survey for antimicrobial resistant (AMR) bacteria in Australian food: prepared for the Australian Government Department of Health and Ageing*, Department of Health and Ageing, Canberra, available at [http://foodregulation.gov.au/internet/fr/publishing.nsf/Content/784616537FC3F1C3CA25806A007C5D5C/\\$File/pilot%20survey%20AMR%20part%201.pdf](http://foodregulation.gov.au/internet/fr/publishing.nsf/Content/784616537FC3F1C3CA25806A007C5D5C/$File/pilot%20survey%20AMR%20part%201.pdf), accessed 11 December 2023.

- Bastianello, SS & Jonker, MR 1981, 'A report on the occurrence of septicaemia caused by *Pasteurella multocida* type E in cattle from Southern Africa', *Journal of the South African Veterinary Association*, vol. 52, no. 2, pp. 99-104.
- Beach, JC, Murano, EA & Acuff, GR 2002, 'Prevalence of *Salmonella* and *Campylobacter* in beef cattle from transport to slaughter', *Journal of Food Protection*, vol. 65, no. 11, pp. 1687-93, available at <http://www.ingentaconnect.com/content/iafp/jfp/2002/00000065/00000011/art00001>, accessed 11 December 2023.
- Beard, PM 2016, 'Lumpy skin disease: a direct threat to Europe', *The Veterinary Record*, vol. 178, no. 22, pp. 557-8, available at <http://www.ncbi.nlm.nih.gov/pubmed/27235496>, accessed 11 December 2023.
- Beasley, V, Crandell, R, Buck, W, Ely, R & Thilsted, J 1980, 'A clinical episode demonstrating variable characteristics of pseudorabies infection in cattle', *Veterinary Research Communications*, vol. 4, no. 1, pp. 125-9, available at <http://dx.doi.org/10.1007/BF02278490>, accessed 11 December 2023.
- Bedard, D 2023, *Bovine TB turns up Saskatchewan herd*, AGCanada.com, available at <https://www.agcanada.com/daily/bovine-tb-turns-up-in-saskatchewan-herd>, accessed 11 December 2023.
- Begg, DJ & Whittington, RJ 2008, 'Experimental animal infection models for Johne's disease, an infectious enteropathy caused by *Mycobacterium avium* subsp. *paratuberculosis*', *The Veterinary Journal*, vol. 176, no. 2, pp. 129-45.
- Benger, A, Rennie, RP, Roberts, JT, Thornley, JH & Scholten, T 1981, 'A human coenurus infection in Canada' (in eng), *The American Journal of Tropical Medicine and Hygiene*, vol. 30, no. 3, pp. 638-44.
- Bergevin, MD, Ng, V, Menzies, P, Ludwig, A, Mubareka, S & Clow, KM 2023, 'Cache a Killer: Cache Valley virus seropositivity and associated farm management risk factors in sheep in Ontario, Canada' (in en), *PLOS ONE*, vol. 18, no. 8, p. e0290443.
- Beynon, AG 1968, 'Foot and mouth disease in Great Britain', *Proceedings, annual meeting of the United States Animal Health Association, TBA, 1968*, United States Animal Health Association, United States of America, pp. 197-210.
- Bishop, R, Musoke, A, Morzaria, S, Gardner, M & Nene, V 2004, 'Theileria: intracellular protozoan parasites of wild and domestic ruminants transmitted by ixodid ticks', *Parasitology*, vol. 129, no. 7, pp. S271-S83.
- Bower, KL, Begg, DJ & Whittington, RJ 2011, 'Culture of *Mycobacterium avium* subspecies *paratuberculosis* (MAP) from blood and extra intestinal tissues in experimentally infected sheep', *Veterinary Microbiology*, vol. 147, no. 1-2, pp. 127-32.
- Buergelt, CD, Bastianello, SS & Michel, AL 2004, 'Paratuberculosis', in JAW Coetzer & RC Tustin (eds), *Infectious diseases of livestock*, 2nd edn, Oxford University Press, Oxford, pp. 1994-2008.
- Bunn, CM, Gerner, MG & Cannon, RM 1986, 'The 1872 outbreak of foot-and-mouth disease in Australia why didn't it become established?', *Australian Veterinary Journal*, vol. 76, no. 4, pp. 262-9.
- Cabaret, J, Geerts, S, Madeline, M, Ballandonne, C & Barbier, D 2002, 'The use of urban sewage sludge on pastures: the cysticercosis threat', *Veterinary Research*, vol. 33, no. 5, pp. 575-97.
- Cadioli, FA, de Athayde Barnabé, P, Machado, RZ, Teixeira, MCA, André, MR, Sampaio, PH, Fidélis, OL, Jr., Teixeira, MMG & Marques, LC 2012, 'First report of *Trypanosoma vivax* outbreak in dairy cattle in São Paulo state, Brazil', *Revista Brasileira de Parasitologia Veterinária*, vol. 21, pp. 118-24.
- CAHSS 2023, *Reportable & Notifiable Diseases Canadian Animal Health Surveillance System*, available at <https://cahss.ca/cahss-tools/reportable--notifiable-diseases>, accessed 11 December 2023.
- Callow, LL 1984, *Protozoal and rickettsial diseases*, Australian Government Publishing Service, Canberra.

- Cem Gul, H & Erdem, H 2015, 'Brucellosis (Brucella Species)', in JE Bennett, R Dolin & MJ Blaser (eds), *Mandell, Douglas, and Bennett's principles and practice of infectious diseases*, 8th edn, Elsevier, Philadelphia, PA, pp. 2584-9.
- CFIA 2010, 'Reportable Diseases, Immediately Notifiable and Annually Notifiable Diseases', *Canadian Food Inspection Agency*, available at <http://www.inspection.gc.ca/english/anima/disejala/guidee.shtml>, accessed 11 December 2023.
- -- 2012a, *Immediately notifiable diseases*, Canadian Food Inspection Agency, Canada, available at <https://inspection.canada.ca/animal-health/terrestrial-animals/diseases/immediately-notifiable/eng/1305670991321/1305671848331>, accessed 11 December 2023.
- -- 2012b, *Protecting Canadian Livestock From the Schmallenberg Virus*, Canadian Food Inspection Agency, Canada, available at <https://www.canada.ca/en/news/archive/2012/04/protecting-canadian-livestock-schmallenberg-virus.html>, accessed 11 December 2023..
- -- 2012c, *Reportable diseases: Terrestrial animals*, Canadian Food Inspection Agency, Canada, available at <https://inspection.canada.ca/animal-health/terrestrial-animals/diseases/reportable/eng/1303768471142/1303768544412>, accessed 11 December 2023.
- -- 2013, *Anthrax - Fact sheet*, available at <https://inspection.canada.ca/animal-health/terrestrial-animals/diseases/reportable/anthrax/fact-sheet/eng/1375205846604/1375206913111>, , accessed 11 December 2023.
- -- 2014, *Anaplasmosis - Fact Sheet*, available at <https://inspection.canada.ca/animal-health/terrestrial-animals/diseases/immediately-notifiable/Anaplasmosis/fact-sheet/eng/1329525231981/1329525339802>, accessed 11 December 2023.
- -- 2015a, *Cysticercosis - Fact Sheet*, available at <https://inspection.canada.ca/animal-health/terrestrial-animals/diseases/reportable/cysticercosis/fact-sheet/eng/1329807596298/1329808582354>, accessed 11 December 2023.
- -- 2015b, *National bovine tuberculosis eradication program*, Canadian Food Inspection Agency, available at <https://inspection.canada.ca/animal-health/terrestrial-animals/diseases/reportable/bovine-tuberculosis/eradication-program/eng/1449178375257/1449178376132>, accessed 11 December 2023.
- -- 2016, *Fact Sheet - Brucellosis*, Canadian Food Inspection Agency, available at <https://inspection.canada.ca/animal-health/terrestrial-animals/diseases/reportable/brucellosis/fact-sheet/eng/1305673222206/1305673334337>, , accessed 11 December 2023.
- -- 2019, *Riding Mountain Eradication Area is no longer required by the CFIA for the management of bovine tuberculosis*, Canadian Food Inspection Agency, available at <https://inspection.canada.ca/animal-health/terrestrial-animals/diseases/reportable/bovine-tuberculosis/overview/eng/1354387734000/1354388556118>, accessed 11 December 2023..
- -- 2021, *Annex U: USDA Performance Standards for Salmonella*, Canadian Food Inspection Agency, Canada, available at <https://inspection.canada.ca/exporting-food-plants-or-animals/food-exports/requirements/export-requirements-for-meat-and-poultry-products/annex-u/eng/1371663720505/1371663913885>, accessed 11 December 2023.
- -- 2023a, *Annually notifiable diseases*, Canadian Food Inspection Agency, Canada, available at <https://inspection.canada.ca/animal-health/terrestrial-animals/diseases/notifiable-diseases/eng/1305672292490/1305672713247>, accessed 11 December 2023.
- -- 2023b, *Bovine Tuberculosis (bovine TB) Trace-In Activities*, Canadian Food Inspection Agency, available at <https://inspection.canada.ca/animal-health/terrestrial-animals/diseases/reportable/bovine-tuberculosis/trace-in-activities/eng/1496361145780/1496361146178>, accessed 11 December 2023.
- -- 2023c, *Vesicular Stomatitis - Fact sheet*, Canadian Food Inspection Agency, Canada, available at <https://inspection.canada.ca/animal-health/terrestrial->

- [animals/diseases/reportable/vesicular-stomatitis/factsheet/eng/1306640102681/1306848592941](#), accessed 11 December 2023.
- CFSPH 2017a, *Anthrax*, The Center for Food Security and Public Health, Iowa State University, available at <https://www.cfsph.iastate.edu/Factsheets/pdfs/anthrax.pdf>, accessed 11 December 2023.
- -- 2017b, 'Wesselsbron disease', *Institute for International Cooperation in Animal Biologics*, vol. 1, no. 1, pp. 1-5, available at <https://www.cfsph.iastate.edu/Factsheets/pdfs/wesselsbron.pdf>, accessed 11 December 2023.
- Clarkson, MJ & McCabe, WJ 1973, 'Oral transmission of trypanosomes', *Transactions of the Royal Society of Tropical Medicine and Hygiene*, vol. 67, no. 1, p. 12.
- Clements, ACA, Pfeiffer, DU, Martin, V & Otte, MJ 2007, 'A Rift Valley fever atlas for Africa', *Preventive Veterinary Medicine*, vol. 82, no. 1-2, pp. 72-82.
- Code of Federal Regulations 2020, *Tuberculosis status of foreign regions*, available at <https://www.ecfr.gov/current/title-9/chapter-I/subchapter-D/part-93/subpart-D/subject-group-ECFReb37de9e5f6952d/section-93.437>, accessed 11 December 2023.
- Codex Alimentarius Commission 2014, *Guidelines for the control of Taenia saginata in meat of domestic cattle*, FAO/WHO Food standards, Food and Agriculture Organization, Rome, available at https://www.fao.org/input/download/standards/13756/CXG_085e_2014.pdf, accessed 11 December 2023.
- Coetzer, JAW, Theodoridis, A & van Heerden, A 1978, 'Wesselsbron disease, pathological, haematological and clinical studies in natural cases and experimentally infected new-born lambs', *Onderstepoort Journal of Veterinary Research*, vol. 45, no. 2, pp. 93-106
- Coetzer, JAW & Tustin, RC (eds) 2004, *Infectious diseases of livestock*, 2nd edn, Oxford University Press, Oxford, UK.
- Constable, PD, Hinchcliff, KW, Done, SH & Gruenberg, W 2017, *A textbook of the diseases of cattle, horses, sheep, pigs, and goats*, 11th edn, Saunders Elsevier, New York.
- Cook, DR & Kingston, GC 1988, 'Isolation of *Brucella suis* biotype 1 from a horse', *Australian Veterinary Journal*, vol. 65, no. 5, pp. 162-3.
- Cook, DR & Noble, JW 1984, 'Isolation of *Brucella suis* from cattle', *Australian Veterinary Journal*, vol. 61, no. 8, pp. 263-4.
- Corbett, CS, Naqvi, SA, Bauman, CA, De Buck, J, Orsel, K, Uehlinger, F, Kelton, DF & Barkema, HW 2018, 'Prevalence of Mycobacterium avium ssp. paratuberculosis infections in Canadian dairy herds', *Journal of Dairy Science*, vol. 101, no. 12, pp. 11218-28.
- Currie, A, Honish, L, Cutler, J, Locas, A, Lavoie, MC, Gaulin, C, Galanis, E, Tschetter, L, Chui, L, Taylor, M & Jamieson, F 2012, 'Outbreak of Escherichia coli O157:H7 Infections Linked to Mechanically Tenderized Beef and the Largest Beef Recall in Canada, 2012', *Journal of food protection*, vol. 82, no. 9, pp. 1532-8.
- Cvetnic, Z, Katalinic-Jankovic, V, Sostaric, B, Spicic, S, Obrovac, M, Marjanovic, S, Benic, M, Kirin, BK & Vickovic, I 2007, 'Mycobacterium caprae in cattle and humans in Croatia', *International Journal of Tuberculosis Lung Disease*, vol. 11, no. 6, pp. 652-8
- de Alwis, MCL 1999, *Haemorrhagic Septicaemia*, Australian Centre for International Agricultural Research (ACIAR), Canberra.
- de Jesus, Z 1962, 'Resistance of *Trypanosoma evansi* determined by its relative viability in surra blood and meat', *Philippine Journal of Veterinary Medicine*, vol. 1, pp. 3-9
- Department of Agriculture Fisheries and Forestry 2023a, *FMD-Free Country List*, Canberra, available at <https://www.agriculture.gov.au/sites/default/files/documents/10.FMD-Free%20country%20list-List%20FINAL.pdf>, accessed 11 December 2023.
- --2023b, *Meat Notice - Implementation of the new Australian Standard for the Hygienic Production and Transportation of Meat and Meat Products for Human Consumption (AS4696:2023) (Australian Meat Standard)*, available at <https://www.agriculture.gov.au/biosecurity-trade/export/controlled-goods/meat/elmer-3/notices/2023/mn23-02>, accessed 11 December 2023.

- -- 2023c, 'National list of notifiable animal diseases as of April 2019', Canberra, available at <http://www.agriculture.gov.au/pests-diseases-weeds/animal/notifiable#national-notifiable-animal-diseases-list-at-november-2014>, accessed 11 December 2023.
- -- 2023d, *Risk of lumpy skin disease via fresh (chilled or frozen) bovine skeletal muscle meat from applicant countries*, available at <https://www.agriculture.gov.au/biosecurity-trade/policy/risk-analysis/animal/fresh-chilled-frozen-beef/reports>, accessed 11 December 2023.
- Department of Agriculture Water and the Environment 2017, 'Fresh (chilled or frozen) beef and beef products from Japan, the Netherlands, New Zealand, the United States and Vanuatu – final review', available at <https://www.agriculture.gov.au/biosecurity-trade/policy/risk-analysis/animal/fresh-chilled-frozen-beef/reports>, accessed 11 December 2023.
- Department of Health and Aged Care 2023, 'List of nationally notifiable diseases', Canberra, Australia, available at <https://www.health.gov.au/health-topics/communicable-diseases/nationally-notifiable-diseases/list>, accessed 11 December 2023.
- Department of Natural Resources and Environment Tasmania 2023, *Tasmanian Animal Biosecurity Manual*, 1.1.1., Tasmanian Government, Tasmania, available at <https://nre.tas.gov.au/Documents/Tasmanian%20Animal%20Biosecurity%20Manual.pdf>.
- Dore, K, Buxton, J, Henry, B, Pollari, F, Middleton, D, Fyfe, M, Ahmed, R, Michel, P, King, A, Tinga, C & Wilson, JB 2004, 'Risk factors for Salmonella typhimurium DT104 and non-DT104 infection: a Canadian multi-provincial case-control study', *Epidemiology & Infection*, vol. 132, no. 3, pp. 485-93.
- Dorny, P & Praet, N 2007, 'Taenia saginata in Europe', *Veterinary Parasitology*, vol. 149, no. 1-2, pp. 22-4.
- Drolet, BS, Stuart, MA & Derner, JD 2009, 'Infection of *Melanoplus sanguinipes* grasshoppers following ingestion of rangeland plant species harboring vesicular stomatitis virus', *Applied and Environmental Microbiology*, vol. 75, no. 10, pp. 3029-33.
- EFSA 2009, 'Porcine brucellosis (*Brucella suis*)', *The EFSA Journal*, vol. 1144, pp. 1-111
- Eltholth, MM, Marsh, VR, Van Winden, S & Guitian, FJ 2009, 'Contamination of food products with Mycobacterium avium paratuberculosis: a systematic review', *Journal of Applied Microbiology*, vol. March 30, pp. 1-11.
- FAO & WHO 2014, *Multicriteria-based ranking for risk management of food-borne parasites*, Microbiological risk assessment series, Food and Agriculture Organisation, Rome, available at <http://www.fao.org/3/a-i3649e.pdf>, accessed 11 December 2023.
- Fazlalipour, M, Baniasadi, V, Mirghiasi, SM, Jalali, T, Khakifirouz, S, Azad-Manjiri, S, Mahmoodi, V, Naderi, HR, Zarandi, R & Salehi-Vaziri, M 2016, 'Crimean-Congo Hemorrhagic Fever due to consumption of raw meat: case reports from east-north of Iran', *Japanese Journal of Infectious Diseases*, vol. 69, no. 3, pp. 1-5.
- Fearnley, E, Raupach, J, Lagala, F & Cameron, S 2011, 'Salmonella in chicken meat, eggs and humans; Adelaide, South Australia, 2008', *International Journal of Food Microbiology*, vol. 146, no. 3, pp. 219-27.
- Fegan, N, Vanderlinde, P, Higgs, G & Desmarchelier, P 2004, 'Quantification and prevalence of Salmonella in beef cattle presenting at slaughter', *Journal of Applied Microbiology*, vol. 97, no. 5, pp. 892-8.
- Fisher, I, Andersson, Y, de Jong, B, O'Grady, K & Powling, J 2001, 'International outbreak of Salmonella typhimurium DT104 - update from Enter-net', *Eurosurveillance*, vol. 5, no. 32, pp. 1705.
- Foley, P, Hemsley, C, Muller, K, Maroske, G & Ritchie, S 1998, 'Importation of Aedes Albopictus in Townsville, Queensland', *Communicable Diseases Intelligence*, vol. 22, no. 1, pp. 3-4.
- Fonseca, M, Heider, LC, Stryhn, H, McClure, JT, Léger, D, Rizzo, D, Dufour, S, Roy, JP, Kelton, DF, Renaud, DL & Barkema, HW in press, 'Frequency of isolation and phenotypic antimicrobial resistance of fecal Salmonella enterica recovered from dairy cattle in Canada', *Journal of Dairy Science*.

- Fontenille, D, Mathiot, C & Coulanges, P 1985, 'Les cycles arbovirus-vecteurs-vertèbres dans les forêts malgaches' (The arbovirus-vectors-vertebrates cycles in the Malagasy forests), *Archives de l'Institut Pasteur de Madagascar*, vol. 52, no. 1, pp. 171-80, pp. Article 1.
- Fritsche, A, Engel, R, Buhl, D & Zellweger, J-P 2004, 'Mycobacterium bovis tuberculosis: from animal to man and back', *The International Journal of Tuberculosis Lung Disease*, vol. 8, no. 7, pp. 903-4.
- FRSC 2007, *Australian standard for the hygienic production and transportation of meat and meat products for human consumption*, FRSC Technical Report no. 3, AS 4696:2007, CSIRO Publishing and Food Regulation Standing Committee (FRSC), Victoria, available at <http://www.publish.csiro.au/pid/5553.htm>, accessed 11 December 2023.
- FSANZ 2010, *Bovine spongiform encephalopathy (BSE): requirements for the importation of beef and beef products for human consumption - effective 1 March 2010*, Food Standards Australia New Zealand, available at <http://www.foodstandards.gov.au/industry/bse/bseimports/Pages/default.aspx>, accessed 11 December 2023.
- Gill, CO, Saucier, L & Meadus, WJ 2011, 'Mycobacterium avium subsp. paratuberculosis in dairy products, meat, and drinking water', *Journal of Food Protection*, vol. 74, no. 3, pp. 480-99, available at <http://www.ingentaconnect.com/content/iafp/jfp/2011/00000074/00000003/art00021?token=004712b38e383a4b3b2570507b467a6c6a427c2b63472a726e2d2954496f642f466f0b0>, accessed 11 December 2023.
- Glynn, MK, Bopp, C, Dewitt, W, Dabney, P, Mokhtar, M & Angulo, FJ 1998, 'Emergence of multidrug-resistant *Salmonella enterica* serotype Typhimurium DT104 infections in the United States', *The New England Journal of Medicine*, vol. 338, no. 19, pp. 1333-9.
- Godfroid, J, Cloeckert, A, Liautard, JP, Kohler, S, Fretin, D, Walravens, K, Garin-Bastuji, B & Letesson, JJ 2005, 'From the discovery of the Malta fever's agent to the discovery of a marine mammal reservoir, brucellosis has continuously been a re-emerging zoonosis', *Veterinary Research*, vol. 36, no. 3, pp. 313-26, available at <http://www.vetres.org/index.php?option=article&access=standard&Itemid=129&url=/articles/vetres/abs/2005/03/v4056/v4056.html>, accessed 11 December 2023.
- González-Fernández, VD, Tórtora Pérez, JL, García Flores, MM, Aguilar Setián, JÁ & Ramírez Álvarez, H 2020, 'First evidence of bovine immunodeficiency virus infection in Mexican cattle' (in en), *Transboundary and Emerging Diseases*, vol. 67, no. 5, pp. 1768-75.
- Gould, EA & Higgs, S 2009, 'Impact of climate change and other factors on emerging arbovirus diseases', *Transactions of the Royal Society of Tropical Medicine and Hygiene*, vol. 103, no. 2, pp. 109-21.
- Government of Alberta 2023, *Malignant catarrhal fever*, <https://www.alberta.ca/malignant-catarrhal-fever-notifiable>, accessed 11 December 2023.
- Government of Saskatchewan 2023, *Bovine tuberculosis in wildlife* <https://www.saskatchewan.ca/residents/environment-public-health-and-safety/wildlife-issues/fish-and-wildlife-diseases/bovine-tuberculosis-in-wildlife>, accessed 11 December 2023.
- Government of South Australia 2023, *Brucella suis*, Department of Primary Industries and Regions, https://pir.sa.gov.au/biosecurity/animal_health/animal_species/pigs/brucella_suis, accessed 11 December 2023.
- Habing, GG, Lo, Y & Kaneene, JB 2012, 'Changes in the antimicrobial resistance profiles of *Salmonella* isolated from the same Michigan dairy farms in 2000 and 2009', *Food Research International*, vol. 45, no. 2, pp. 919-24.
- Hahn, EC, Page, GR, Hahn, PS, Gillis, KD, Romero, C, Anelli, JA & Gibbs, EPJ 1997, 'Mechanisms of transmission of Aujeszky's disease virus originating from feral swine in the USA', *Veterinary Microbiology*, vol. 55, no. 1-4, pp. 123-30.

- Helms, M, Ethelberg, S, Mølbak, K & DT104 Study Group 2005, 'International Salmonella Typhimurium DT104 infections, 1992-2001', *Emerging Infectious Diseases*, vol. 11, no. 6, pp. 859-67.
- Hines, ME, II, Stabel, JR, Sweeney, RW, Griffin, F, Talaat, AM, Bakker, D, Benedictus, G, Davis, WC, de Lisle, GW, Gardner, IA, Juste, RA, Kapur, V, Koets, A, McNair, J, Pruitt, G & Whitlock, RH 2007, 'Experimental challenge models for Johne's disease: A review and proposed international guidelines', *Veterinary Microbiology*, vol. 122, no. 3-4, pp. 197-222.
- Hoogstraal, H 1979, 'The epidemiology of tick-borne Crimean-Congo hemorrhagic fever in Asia, Europe and Africa', *Journal of Medical Entomology*, vol. 15, no. 4, pp. 307-417.
- Hoogstraal, H, Meegan, JM, Khalil, GM & Adham, FK 1979, 'The Rift Valley fever epizootic in Egypt 1977-1978 2. Ecological and entomological studies', *Transactions of the Royal Society of Tropical Medicine and Hygiene*, vol. 73, no. 6, pp. 624-9.
- Humphrey, S, Clark, LF, Humphrey, TJ & Jepson, MA 2011, 'Enhanced recovery of Salmonella Typhimurium DT104 from exposure to stress at low temperature', *Microbiology*, vol. 157, no. 4, pp. 1103-14.
- Iqbal, A, Janecko, N, Pollari, F & Dixon, B 2018, 'Prevalence and molecular characterization of Toxoplasma gondii DNA in retail fresh meats in Canada', *Food and Waterborne Parasitology*, vol. 13, e00031.
- Irwin, MJ, Massey, PD, Walker, B & Durrheim, DN 2009, 'Feral pig hunting: a risk factor for human brucellosis in north-west NSW', *NSW Public Health Bulletin*, vol. 20, no. 11-12, pp. 192-4.
- Ito, A, Sako, Y, Nakao, M, Nakaya, K, Okamoto, M, Wandra, T, Kandun, N, Anantaphruti, MT, Waikagul, J, Li, T & Qiu, D 2008, 'Molecular and immunological diagnosis of taeniasis and cysticercosis in Asia and The Pacific', *Southeast Asian Journal of Tropical Medicine and Public Health*, vol. 39 (suppl 1), pp. 37-47.
- Izzo, MM, Mohler, VL & House, JK 2011, 'Antimicrobial susceptibility of Salmonella isolates recovered from calves with diarrhoea in Australia', *Australian Veterinary Journal*, vol. 89, no. 10, pp. 402-8.
- Jenkins, DJ, Romig, T & Thompson, RCA 2005, 'Emergence/re-emergence of Echinococcus spp.-a global update', *International Journal for Parasitology*, vol. 35, no. 11-12, pp. 1205-19.
- Jimenez, AE, Jimenez, C, Castro, L & Rodriguez, L 1996, 'Serological survey of small mammals in a vesicular stomatitis virus enzootic area', *Journal of Wildlife Diseases*, vol. 32, no. 2, pp. 274-9.
- John, P, Varga, C, Cooke, M & Majowicz, SE 2022, 'Incidence, Demographic, and Seasonal Risk Factors of Infections Caused by Five Major Enteric Pathogens', *Foodborne pathogens and disease*, vol. 19, no. 4, pp. 248-58.
- Johnson, KM, Tesh, RB & Peralta, PH 1969, 'Epidemiology of vesicular stomatitis virus: some new data and a hypothesis for transmission of the Indiana serotype', *Journal of the American Veterinary Medical Association*, vol. 155, no. 12, pp. 2133-40.
- Khin, MN, Zamri-Saad, M & Noordin, MM 2010, 'Pathological changes in the lungs of calves following intratracheal exposure to Pasteurella multocida B:2', *Pertanika Journal of Tropical Agricultural Science*, vol. 33, no. 1, pp. 113-7.
- Kirkland, PD & Mackintosh, SG 2006, *Ruminant pestivirus infections*, Australian and New Zealand Standard Diagnostic Procedures for Animal Diseases, Sub-Committee on Animal Health Laboratory Standards for Animal Health Committee, available at http://www.scahls.org.au/_data/assets/pdf_file/0004/1280839/pestiviruses.pdf, accessed 11 December 2023.
- Knowles, NJ, Hovi, T, Hyypia, T, King, AMQ, Lindberg, AM, Pallansch, MA, Palmenberg, AC, Simmonds, P, Skern, T, Stanway, G, Yamashita, T & Zell, R 2011, 'Picornaviridae', in *Virus taxonomy: classification and nomenclature of viruses: ninth report of the international committee on taxonomy of viruses*, Elsevier, London, pp. 855-80.
- Knudsen, GM, Sommer, HM, Sørensen, ND, Olsen, JE & Aabo, S 2011, 'Survival of Salmonella on cuts of beef carcasses subjected to dry aging', *Journal of Applied Microbiology*, vol. 111, no. 4, pp. 848-54.

- Lane, EP, Kock, ND, Hill, FWG & Mohan, K 1992, 'An outbreak of haemorrhagic septicaemia (septicaemic pasteurellosis) in cattle in Zimbabwe', *Tropical Animal Health and Production*, vol. 24, no. 2, pp. 97-102.
- Leekitcharoenphon, P, Hendriksen, R., Le Hello, S, Weill, F, Baggesen, D, Jun, S, Ussery, D, Lund, O, Crook, D, Wilson, D & Aarestrup, F 2016, 'Global genomic epidemiology of *Salmonella enterica* serovar Typhimurium DT104', *Applied and environmental microbiology*, vol. 82, no. 8, pp. 2516-26.
- Letchworth, GJ, Rodriguez, LL & Barrera, JDC 1999, 'Vesicular stomatitis', *The Veterinary Journal*, vol. 157, pp. 239-60.
- Liebler-Tenorio, EM, Ridpath, JF & Neill, JD 2004, 'Distribution of viral antigen and tissue lesions in persistent and acute infection with the homologous strain of noncytopathic bovine viral diarrhoea virus', *Journal of Veterinary Diagnostic Investigation*, vol. 16, pp. 388-96.
- Louden, BC, Haarmann, D, Han, J, Foley, SL & Lynne, AM 2012, 'Characterization of antimicrobial resistance in *Salmonella enterica* serovar Typhimurium isolates from food animals in the U.S.', *Food Research International*, vol. 45, no. 2, pp. 968-72.
- Mahony, TJ, McCarthy, FM, Gravel, JL, Corney, B, Young, PI & Vilcek, S 2005, 'Genetic analysis of bovine viral diarrhoea viruses from Australia', *Veterinary Microbiology*, vol. 106, no. 1-2, pp. 1-6.
- Mailles, A, Rautureau, S, Le Horgne, JM, Poinet-Leroux, B, d'Arnoux, C, Denetiere, G, Faure, M, Lavigne, JP, Bru, JP & Garin-Bastuji, B 2012, 'Re-emergence of brucellosis in cattle in France and risk for human health', *Eurosurveillance*, vol. 17, no. 30, 20227.
- Maltezou, HC, Andonova, L, Andraghetti, R, Bouloy, M, Ergönül, Ö, Jongejan, F, Kalvatchev, N, Nichol, S, Niedrig, M, Platonov, A, Thomson, G, Leitmeyer, K & Zeller, H 2010, 'Crimean-Congo hemorrhagic fever in Europe: current situation calls for preparedness', *Eurosurveillance*, vol. 15, no. 10, pp. 1-4.
- Manios, SG & Skandamis, PN 2015, 'Effect of frozen storage, different thawing methods and cooking processes on the survival of *Salmonella* spp. and *Escherichia coli* O157:H7 in commercially shaped beef patties', *Meat Science*, vol. 101, pp. 25-32.
- Marrero-Ortiz, R, Han, J, Lynne, AM, David, DE, Stemper, ME, Farmer, D, Burkhardt, W, III, Nayak, R & Foley, SL 2012, 'Genetic characterization of antimicrobial resistance in *Salmonella enterica* serovars isolated from dairy cattle in Wisconsin', *Food Research International*, vol. 45, no. 2, pp. 962-7.
- Matsuoka, T, Iijima, Y, Sakurai, K, Kurihara, T, Kounosu, Y, Tamiya, K, Oki, M, Haritani, M & Imada, T 1987, 'Outbreak of Aujeszky's disease in cattle in Japan', *Japanese Journal of Veterinary Science*, vol. 49, no. 3, pp. 507-10.
- McManus, DP & Thompson, RCA 2003, 'Molecular epidemiology of cystic echinococcosis', *Parasitology*, vol. 127, no. Suppl. S1, pp. S37-S51.
- Meadus, WJ, Gill, CO, Duff, P, Badoni, M & Saucier, L 2008, 'Prevalence on beef carcasses of *Mycobacterium avium* subsp. *paratuberculosis* DNA', *International Journal of Food Microbiology*, vol. 124, no. 3, pp. 291-4.
- Mekata, H, Konnai, S, Mingala, CN, Abes, NS, Gutierrez, CA, Dargantes, AP, Witola, WH, Inoue, N, Onuma, M, Murata, S & Ohashi, K 2013, 'Isolation, cloning, and pathologic analysis of *Trypanosoma evansi* field isolates', *Parasitology Research*, vol. 112, no. 4, pp. 1513-21.
- Mekata, H, Konnai, S, Witola, WH, Inoue, N, Onuma, M & Ohashi, K 2009, 'Molecular detection of trypanosomes in cattle in South America and genetic diversity of *Trypanosoma evansi* based on expression-site-associated gene 6', *Infection, Genetics and Evolution*, vol. 9, no. 6, pp. 1301-5.
- Mettenleiter, TC 2020, 'Aujeszky's Disease and the Development of the Marker/DIVA Vaccination Concept', *Pathogens*, vol. 9, p. 563.
- Miranda, C, Matos, M, Pires, I, Ribeiro, P, Álvares, S, Vieira-Pinto, M & Coelho, AC 2011, '*Mycobacterium avium* subsp. *paratuberculosis* infection in slaughtered domestic pigs for

- consumption detected by molecular methods', *Food Research International*, vol. 44, no. 10, pp. 3276-7.
- Moloo, SK, Losos, GJ & Kutuza, SB 1973, 'Transmission of *Trypanosoma brucei* to cats and dogs by feeding on infected goats', *Annals of Tropical Medicine and Parasitology*, vol. 67, no. 3, pp. 331-4.
- Moore, SJ, O'Dea, MA, Perkins, N & O'Hara, AJ 2015, 'Estimation of nasal shedding and seroprevalence of organisms known to be associated with bovine respiratory disease in Australian live export cattle', *Journal of Veterinary Diagnostic Investigation*, vol. 27, no. 1, pp. 6-17.
- Mor, SM, Wiethoelter, AK, Lee, A, Moloney, B, James, DR & Malik, R 2016, 'Emergence of *Brucella suis* in dogs in New South Wales, Australia: clinical findings and implications for zoonotic transmission', *BMC Veterinary Research*, vol. 12, no. 1, pp. 199.
- Moro, P & Schantz, PM 2009, 'Echinococcosis: a review', *International Journal of Infectious Diseases*, vol. 13, no. 2, pp. 125-33.
- Morrison, WI 2015, 'The aetiology, pathogenesis and control of theileriosis in domestic animals', *Scientific and Technical Review*, vol. 34, no. 2, pp. 599-611.
- Murray, CJ 1994, 'Salmonella serovars and phage types in humans and animals in Australia 1987-1992', *Australian Veterinary Journal*, vol. 71, no. 3, pp. 78-81.
- Mutharia, LM, Klassen, MD, Fairles, J, Barbut, S & Gill, CO 2010, '*Mycobacterium avium* subsp. *paratuberculosis* in muscle, lymphatic and organ tissues from cows with advanced Johne's disease', *International Journal of Food Microbiology*, vol. 136, no. 3, pp. 340-4.
- Newton, LG 1992, 'Contagious bovine pleuropneumonia in Australia: some historic highlights from entry to eradication', *Australian Veterinary Journal*, vol. 69, no. 12, pp. 306-17.
- Nichol, ST, Beaty, BJ, Elliott, RM, Goldbach, R, Plyusnin, A, Schmaljohn, CS & Tesh, RB 2005, 'Bunyaviridae', in CM Fauquet, MA Mayo, J Maniloff, U Desselberger & LA Ball (eds), *Virus taxonomy: classification and nomenclature of viruses: eighth report of the International Committee on the Taxonomy of Viruses*, Elsevier, San Diego, pp. 695-716.
- Norton, JH, Tranter, WP & Campbell, RSF 1989, 'A farming systems study of abortion in dairy cattle on the Atherton Tableland: 2. the pattern of infectious diseases', *Australian Veterinary Journal*, vol. 66, no. 6, pp. 163-7.
- Oliveira, JB, Hernandez-Gamboa, J, Jimenez-Alfaro, C, Zeledon, R, Blandon, M & Urbina, A 2009, 'First report of *Trypanosoma vivax* infection in dairy cattle from Costa Rica', *Veterinary Parasitology*, vol. 163, no. 1-2, pp. 136-9.
- Pearse, BH, Traub, RJ, Davis, A, Cobbold, R & Vanderlinde, PB 2010, 'Prevalence of *Cysticercus bovis* in Australian cattle', *Australian Veterinary Journal*, vol. 88, no. 7, pp. 260-2.
- Poppe, C, Smart, N, Khakhria, R, Johnson, W, Spika, J & Prescott, J 1998, 'Salmonella typhimurium DT104: a virulent and drug-resistant pathogen', *The Canadian Veterinary Journal*, vol. 39, no. 9, pp. 559-65.
- Priest, JM, McRuer, DL, Stewart, DT, Boudreau, M, Power, JW, Conboy, G, Jenkins, EJ, Kolapo, TU & Shutler, D 2021, 'New geographic records for *Echinococcus canadensis* in coyotes and moose from Nova Scotia, Canada', *International Journal for Parasitology: Parasites and Wildlife*, vol. 16, no. 285-288.
- ProMED Mail 2016a, *Crimean-Congo hemorrhagic fever - Pakistan (17): (Balochistan, Punjab) New cases*, ProMED mail, International Society for Infectious Diseases, available at <http://www.promedmail.org/post/4475883>, accessed 11 December 2023.
- -- 2016b, *Crimean-Congo hemorrhagic fever - Spain (02): (Madrid)*, ProMED Mail, International Society for Infectious Diseases, available at <http://www.promedmail.org/post/4466392>, accessed 11 December 2023.
- Public Health Agency of Canada 2018, *Cryptosporidiosis (Cryptosporidium): Symptoms and treatment*, Government of Canada, Canada, available at <https://www.canada.ca/en/public-health/services/diseases/cryptosporidiosis.html>, accessed 11 December 2023.

- -- 2021, *Campylobacter jejuni*, available at <https://www.canada.ca/en/public-health/services/food-poisoning/campylobacter-jejuni.html>, accessed 11 December 2023.
- -- 2023a, *Pathogen Safety Data Sheets: Infectious Substances – Listeria monocytogenes*, available at <https://www.canada.ca/en/public-health/services/laboratory-biosafety-biosecurity/pathogen-safety-data-sheets-risk-assessment/listeria-monocytogenes.html>, accessed 2023.
- -- 2023b, *Public Health Notice: Outbreak of extensively drug-resistant Salmonella infections linked to raw pet food and contact with cattle*, Canada, available at <https://www.canada.ca/en/public-health/services/public-health-notice/2023/outbreak-salmonella-infections-under-investigation.html>, accessed 11 December 2023.
- Radostits, OM, Gay, CC, Hinchcliff, KW & Constable, PD 2007, *Veterinary medicine: a textbook of the diseases of cattle, horses, sheep, pigs and goats*, 10th edn, Saunders Elsevier, Edinburgh.
- Raina, AK, Kumar, R, Rajora, VS, Sridhar & Singh, RP 1985, 'Oral transmission of Trypanosoma evansi infection in dogs and mice', *Veterinary Parasitology*, vol. 18, no. 1, pp. 67-9.
- Ray, KA, Warnick, LD, Mitchell, RM, Kaneene, JB, Ruegg, PL, Wells, SJ, Fossler, CP, Halbert, LW & May, K 2007, 'Prevalence of antimicrobial resistance among Salmonella on midwest and northeast USA dairy farms', *Preventive Veterinary Medicine*, vol. 79, no. 2-4, pp. 204-23.
- Reif, JS, Webb, PA, Monath, TP, Emerson, JK, Poland, JD, Kemp, GE & Cholas, G 1987, 'Epizootic vesicular stomatitis in Colorado, 1982: infection in occupational risk groups', *The American Journal of Tropical Medicine and Hygiene*, vol. 36, no. 1, pp. 177-82.
- Reis, JL, Jr., Mead, D, Rodriguez, LL & Brown, CC 2009, 'Transmission and pathogenesis of vesicular stomatitis viruses', *Brazilian Journal of Veterinary Pathology*, vol. 2, no. 1, pp. 49-58.
- Ridpath, J 2010, 'The contribution of infections with bovine viral diarrhoea viruses to bovine respiratory disease', *The Veterinary Clinics of North America. Food Animal Practice*, vol. 26, no. 2, pp. 335-48.
- Ridpath, JF, Bolin, SR & Dubovi, EJ 1994, 'Segregation of bovine viral diarrhoea virus into genotypes', *Virology*, vol. 205, pp. 66-74.
- Roberts, FHS 1970, *Australian ticks*, Commonwealth Scientific and Industrial Research Organisation, Canberra.
- Rodriguez, E, Sanchez, LP, Perez, S, Herrera, L, Jimenez, MS, Samper, S & Iglesias, MJ 2009, 'Human tuberculosis due to *Mycobacterium bovis* and *M. caprae* in Spain, 2004-2007', *International Journal of Tuberculosis Lung Disease*, vol. 13, no. 12, pp. 1536-41.
- Rodriguez, LL 2002, 'Emergence and re-emergence of vesicular stomatitis in the United States', *Virus Research*, vol. 85, pp. 211-9.
- Sadler, WW 1960, 'Present evidence on the role of meat on the epidemiology of human brucellosis', *American Journal of Public Health*, vol. 50, no. 4, pp. 504-14.
- Seddon, HR & Albiston, HE 1965, *Diseases of domestic animals in Australia: part 5. bacterial diseases*, 2nd edn, Department of Health, Canberra.
- Seleem, MN, Boyle, SM & Sriranganathan, N 2010, 'Brucellosis: a re-emerging zoonosis', *Veterinary Microbiology*, vol. 140, no. 3-4, pp. 392-8.
- Sharifi-Mood, B, Metanat, M, Hashemi-Shahri, SM, Mardani, M, Hashemi, SA & Fayyaz-Jahani, FF 2011, 'Crimean-congo hemorrhagic fever following consumption of uncooked liver: case series study', *Iran Journal of Clinical Infectious Disease*, vol. 6, no. 3, pp. 128-30.
- Simmonds, P, Becher, P, Collett, MS, Gould, EA, Heinz, FX, Meyers, G, Monath, T, Pletnev, A, Rice, CM, Stiasny, K, Thiel, H-J, Weiner, A & Bukh, J 2011, 'Flaviviridae', in *Virus taxonomy: classification and nomenclature of viruses: ninth report of the international committee on taxonomy of viruses*, Elsevier, London, pp. 1003-20.
- Sintchenko, V, Jelfs, P, Dally, M, Crighton, T & Gilbert, GL 2006, 'A case of urinary tuberculosis due to *Mycobacterium bovis* subspecies *caprae*', *Pathology*, vol. 38, no. 4, pp. 376-8.
- Skinner, MA, Buller, RM, Damon, IK, Lefkowitz, EJ, McFadden, G, McInnes, CJ, Mercer, AA, Moyer, RW & Upton, C 2011, 'Poxviridae', in *Virus taxonomy: classification and nomenclature of*

- viruses: ninth report of the international committee on taxonomy of viruses, Elsevier academic press, London.
- Smirnova, SE 1979, 'A comparative study of the Crimean hemorrhagic fever-Congo group of viruses', *Archives of Virology*, vol. 62, no. 2, pp. 137-43.
- Swanepoel, R & Coetzer, JAW 2004a, 'Rift Valley fever', in JAW Coetzer & RC Tustin (eds), *Infectious diseases of livestock*, 2nd edn, Oxford University Press, Oxford, pp. 1037-70.
- -- 2004b, 'Wesselsbron disease', in JAW Coetzer & RC Tustin (eds), *Infectious diseases of livestock*, 2nd edn, Oxford University Press, Oxford, pp. 987-94.
- Swanepoel, R, Shepherd, AJ, Leman, PA, Shepherd, SP & Miller, GB 1985, 'A common-source outbreak of Crimean-Congo haemorrhagic fever on a dairy farm', *South African Medical Journal*, vol. 68, no. 9, pp. 635-7.
- Taylor, LF, Black, PF, Pitt, DJ, Mackenzie, AR, Johnson, SJ & Rodwell, BJ 2006, 'A seroepidemiological study of bovine pestivirus in Queensland beef and dairy herds conducted in 1994/95', *Australian Veterinary Journal*, vol. 84, pp. 163-8.
- Taylor, LF, Janzen, ED, Ellis, JA, van den Hurk, JV & Ward, P 1997, 'Performance, survival, necropsy, and virological findings from calves persistently infected with the bovine viral diarrhoea virus originating from a single Saskatchewan beef herd', *The Canadian Veterinary Journal*, vol. 38, no. 1, pp. 29-37.
- Thiaucourt, F, van der Lugt, JJ & Provost, A 2004, 'Contagious bovine pleuropneumonia', in JAW Coetzer & RC Tustin (eds), *Infectious diseases of livestock*, 2nd edn, Oxford University Press, Oxford, pp. 2045-59.
- Thiel, HJ, Collett, MS, Gould, EA, Heinz, FX, Houghton, M, Meyer, G, Purcell, RH & Rice, CM 2005, 'Flaviviridae', in CM Fauquet, MA Mayo, J Maniloff, U Desselberger & LA Ball (eds), *Virus taxonomy: classification and nomenclature of viruses: eighth report of the International Committee on the Taxonomy of Viruses*, Elsevier, San Diego, pp. 981-98.
- Thompson, CK, Godfrey, SS & Thompson, RC 2014, 'Trypanosomes of Australian mammals: a review', *International Journal for Parasitology: Parasites and Wildlife*, vol. 3, no. 2, pp. 57-66.
- Thompson, RCA 2008, 'The taxonomy, phylogeny and transmission of Echinococcus', *Experimental Parasitology*, vol. 119, no. 4, pp. 439-46.
- Thumbi, SM, Jung'a, JO, Mosi, RO & McOdimba, FA 2010, 'Spatial distribution of African animal trypanosomiasis in Suba and Teso districts in Western Kenya', *BMC Research Notes*, vol. 3, p6.
- Tomaselli, M, Elkin, B, Kutz, S, Harms, NJ, Nymo, HI, Davison, T, Leclerc, LM, Branigan, M, Dumond, M, Tryland, M & Checkley, S 2019, 'A Transdisciplinary Approach to Brucella in Muskoxen of the Western Canadian Arctic 1989–2016', *EcoHealth*, vol. 16, pp. 488-501.
- Turell, MJ & Kay, BH 1998, 'Susceptibility of selected strains of Australian mosquitoes (Diptera: Culicidae) to Rift Valley fever virus', *Journal of Medical Entomology*, vol. 35, no. 2, pp. 132-5
- Turner, A 2011, 'Endemic disease control and regulation in Australia 1901-2010', *Australian Veterinary Journal*, vol. 89, no. 10, pp. 413-21.
- USDA 2020, 'APHIS Evaluation of Canada for Bovine Brucellosis (Brucella abortus) Classification', in AaPHI Service (ed), pp. 1-26, available at <https://downloads.regulations.gov/APHIS-2020-0071-0003/content.pdf>, accessed 11 December 2023.
- Valarcher, J-F, Leforban, Y, Rweyemamu, M, Roeder, PL, Gerbier, G, Mackay, DKJ, Sumption, KJ, Paton, DJ & Knowles, NJ 2008, 'Incursions of foot-and-mouth disease virus into Europe between 1985 and 2006', *Transboundary and Emerging Diseases*, vol. 55, no. 1, pp. 14-34.
- Van Boxstael, S, Dierick, K, Van Huffel, X, Uyttendaele, M, Berkvens, D, Herman, L, Bertrand, S, Wildemauwe, C, Catry, B, Butaye, P & Imberechts, H 2012, 'Comparison of antimicrobial resistance patterns and phage types of Salmonella Typhimurium isolated from pigs, pork and humans in Belgium between 2001 and 2006', *Food Research International*, vol. 45, no. 2, pp. 913-8, available at <http://dx.doi.org/10.1016/j.foodres.2011.05.025>.

- Van De Weyer, LM, Hendrick, S, Rosengren, L & Waldner, CL 2011, 'Leptospirosis in beef herds from western Canada: Serum antibody titers and vaccination practices', *The Canadian Veterinary Journal*, vol. 52, no. 6, pp. 619-26.
- Völker, I, Kehler, W, Hewicker-Trautwein, M, Seehusen, F, Verspohl, J, Bilk, S & Baumgärtner, W 2014, 'Re-emergence of haemorrhagic septicaemia in ungulates in Lower-Saxony in Germany', *The Veterinary Record*, vol. 175, no. 18, p. 460.
- Ward, WH, Hill, MWM, Mazlin, ID & Foster, CK 1984, 'Anaemia associated with a high parasitaemia of *Trypanosoma theileri* in a dairy cow', *Australian Veterinary Journal*, vol. 61, no. 10, pp. 324.
- Wells, JE, Bosilevac, JM, Kalchayanand, N, Arthur, TM, Shackelford, SD, Wheeler, TL & Koohmaraie, M 2009, 'Prevalence of *Mycobacterium avium* subsp. *paratuberculosis* in ileocecal lymph nodes and on hides and carcasses from cull cows and fed cattle at commercial beef processing plants in the United States', *Journal of Food Protection*, vol. 72, no. 7, pp. 1457-62.
- WHO 2018, *Rift Valley fever*, World Health Organization, available at <https://www.who.int/news-room/fact-sheets/detail/rift-valley-fever>, accessed 11 December 2023.
- Wilhelm, B, Rajic, A, Waddell, L, Parker, S, Harris, J, Roberts, KC, Kydd, R, Greig, J & Baynton, A 2009, 'Prevalence of zoonotic or potentially zoonotic bacteria, antimicrobial resistance, and somatic cell counts in organic dairy production: current knowledge and research gaps', *Foodborne Pathogens and Disease*, vol. 6, no. 5, pp. 525-39.
- WOAH 2014, *82nd General Session Final Report*, World Organisation for Animal Health, Paris, available at http://www.oie.int/fileadmin/Home/eng/About_us/docs/pdf/A_FR_2014_public.pdf, accessed 11 December 2023.
- -- 2018a, *Aujeszky's disease (infection with Aujeszky's disease virus)*, WOA Health Terrestrial Manual 2018, World Organisation for Animal Health, Paris, France, available at https://www.woah.org/fileadmin/Home/eng/Health_standards/tahm/3.01.02_AUJESZKYS.pdf, accessed 11 December 2023.
- -- 2018b, 'Theileriosis in cattle (infection with *Theileria annulata*, *T. orientalis* and *T. parva*)', in WOfA Health (ed) *OIE Terrestrial Manual 2018*, Paris, France, pp. 1185 - 210, available at https://www.woah.org/fileadmin/Home/eng/Health_standards/tahm/3.04.15_THEILIERIOSI_S.pdf, accessed 11 December 2023.
- -- 2021a, 'Cysticercosis (including infection with *Taenia solium*)', in WOfA Health (ed) *WOAH Terrestrial Manual* Paris, France, available at https://www.woah.org/en/what-we-do/standards/codes-and-manuals/terrestrial-code-online-access/?id=169&L=1&htmfile=chapitre_anthrax.htm, accessed 11 December 2023.
- -- 2021b, *Trypanosomosis (Tsetse-transmitted)*, OIE Technical Disease Card: Trypanosomosis (tsetse-transmitted), World Organisation for Animal Health, available at <https://www.woah.org/app/uploads/2021/03/trypano-tsetse-1.pdf>, accessed 11 December 2023.
- -- 2022a, 'Bovine tuberculosis', *Diseases*, World Organisation for Animal Health, Paris, available at <https://www.oie.int/en/animal-health-in-the-world/animal-diseases/bovine-tuberculosis/>, accessed 11 December 2023.
- -- 2022b, 'Control of biological hazards of animal health and public health importance through ante- and post-mortem meat inspection', in *Terrestrial Animal Health Code*, World Organisation for Animal Health, pp. 1-4, available at https://www.woah.org/fileadmin/Home/eng/Health_standards/tahc/current/chapitre_control_bio_hazard.pdf, accessed 11 December 2023.
- -- 2022c, 'Diseases, infections and infestations listed by the OIE' (version adopted in 2022), in *Terrestrial Animal Health Code (2022)*, World Organisation for Animal Health, Paris, available at <https://www.woah.org/en/what-we-do/standards/codes-and-manuals/terrestrial-code-online-access/>, accessed 11 December 2023.
- -- 2022d, 'Diseases, infections and infestations listed by the OIE' (version adopted in 2022), in *Terrestrial Animal Health Code*, World Organisation for Animal Health, Paris, France, pp. 1-4,

- available at https://www.woah.org/en/what-we-do/standards/codes-and-manuals/terrestrial-code-online-access/?id=169&L=1&htmfile=chapitre_oie_listed_disease.htm, accessed 11 December 2023.
- -- 2022e, 'Foot and mouth disease (infection with foot and mouth disease virus)' (version adopted in May 2022), in *Manual of Diagnostic Tests and Vaccines for Terrestrial Animal 2022*, World Organisation for Animal Health, Paris, available at <https://www.woah.org/en/what-we-do/standards/codes-and-manuals/terrestrial-manual-online-access/>, accessed 11 December 2023.
- -- 2022f, 'Infection with *Brucella abortus*, *B. melitensis* and *B. suis*' (version adopted in 2018), in *Terrestrial Animal Health Code (2021)*, World Organisation for Animal Health, Paris, available at <https://www.woah.org/en/what-we-do/standards/codes-and-manuals/terrestrial-code-online-access/>, accessed 11 December 2023.
- -- 2022g, 'Infection with *Echinococcus granulosus*', in *Terrestrial Animal Health Code*, World Organisation for Animal Health, Paris, France, available at https://www.woah.org/en/what-we-do/standards/codes-and-manuals/terrestrial-code-online-access/?id=169&L=1&htmfile=chapitre_echinococcus_granulosus.htm, accessed 11 December 2023.
- -- 2022h, 'Infection with *Theileria annulata*, *T. orientalis* and *T. parva*', in *Terrestrial Animal Health Code*, World Organisation for Animal Health, Paris, France, available at https://www.woah.org/en/what-we-do/standards/codes-and-manuals/terrestrial-code-online-access/?id=169&L=1&htmfile=chapitre_theileriosis.htm, accessed 11 December 2023.
- -- 2022i, 'Official disease status', *Foot and mouth disease*, World Organisation for Animal Health, Paris, available at <https://www.woah.org/en/disease/foot-and-mouth-disease#ui-id-2>, accessed 11 December 2023.
- -- 2022j, *Six-monthly report on the notification of OIE-listed disease, infections and infestations*, World Organisation for Animal Health Paris, France, available at <https://wahis.woah.org/#/report-smr/view?reportId=159085&period=SEM01&areald=38&isAquatic=false>, accessed 11 December 2023..
- -- 2022k, 'Vesicular stomatitis', in WOFA Health (ed) *WOAH Terrestrial Manual*, Paris, France, available at [https://www.woah.org/fileadmin/Home/eng/Health_standards/tahm/3.01.24_VESICULAR STOMATITIS.pdf](https://www.woah.org/fileadmin/Home/eng/Health_standards/tahm/3.01.24_VESICULAR_STOMATITIS.pdf), accessed 11 December 2023.
- -- 2022l, 'World Animal Health Information System (WAHIS)', World Organisation for Animal Health, Paris, available at <https://wahis.woah.org/#/home>, accessed 11 December 2023.
- -- 2023a, *Anthrax*, last adopted version 2011 edn, *Terrestrial Animal Health Code* Paris, France, available at http://www.oie.int/index.php?id=169&L=0&htmfile=chapitre_1.8.1.htm, accessed 11 December 2023.
- -- 2023b, 'Application for official recognition by WOA free status for contagious bovine pleuropneumonia', in *WOAH Terrestrial Manual*, World Organisation for Animal Health, Paris, France, available at https://www.woah.org/en/what-we-do/standards/codes-and-manuals/terrestrial-code-online-access/?id=169&L=1&htmfile=chapitre_selfdeclaration_CBPP.htm, accessed 11 December 2023.
- -- 2023c, 'Bovine viral diarrhoea', in *Terrestrial Manual* Paris, France, available at https://www.woah.org/fileadmin/Home/eng/Health_standards/tahm/3.04.07_BVD.pdf, accessed 11 December 2023.
- -- 2023d, 'Diseases, infections and infestations listed by WOAH' (version adopted in 2023), in *Terrestrial Animal Health Code*, World Organisation for Animal Health (WOAH), Paris, France, available at <https://www.woah.org/en/what-we-do/standards/codes-and-manuals/terrestrial-code-online-access/>

- [access/?id=169&L=1&htmfile=chapitre_oielisted_disease.htm](#), accessed 11 December 2023.
- -- 2023e, *Haemorrhagic septicaemia*, World Organisation for Animal Health, Paris, France, available at https://www.woah.org/en/document/oielisted_disease-card-haemorrhagic-septicaemia/, accessed 11 December 2023.
- -- 2023f, *Infection with rift valley fever virus*, World Organisation for Animal Health, Paris, France, available at https://www.woah.org/en/what-we-do/standards/codes-and-manuals/terrestrial-code-online-access/?id=169&L=1&htmfile=chapitre_rvf.htm, accessed 11 December 2023.
- -- 2023g, *List of free contagious bovine pleuropneumonia members*, World Organisation for Animal Health, Paris, France, available at <https://www.woah.org/en/disease/contagious-bovine-pleuropneumonia/#ui-id-2>, accessed 11 December 2023.
- -- 2023h, *Prevention and control of Salmonella in commercial bovine production systems*, Terrestrial Animal Health Code, Chapter 6.13., Paris, France, available at https://www.woah.org/en/what-we-do/standards/codes-and-manuals/terrestrial-code-online-access/?id=169&L=1&htmfile=chapitre_salmonella_bovine.htm, accessed 11 December 2023.
- -- 2023i, *Terrestrial Animal Health Code*, World Organisation of Animal Health, Paris, France, available at https://www.woah.org/en/what-we-do/standards/codes-and-manuals/terrestrial-code-online-access/?id=169&L=1&htmfile=chapitre_import_risk_analysis.htm, accessed 11 December 2023.
- Zhang, M, Hill, JE, Fernando, C, Alexander, TW, Timsit, E, van der Meer, F & Huang, Y 2019, 'Respiratory viruses identified in western Canadian beef cattle by metagenomic sequencing and their association with bovine respiratory disease', *Transboundary and Emerging Diseases*, vol. 66, no. 3, pp. 1379-86.

Appendix A Further information on disease classification in Canada

Terrestrial animal diseases

To protect human and animal health, the CFIA conducts inspections and has monitoring and testing programs in place to prevent and control the spread of diseases to the livestock and poultry sectors. The CFIA carries out programs related to animal health and production to guard against the entry of foreign animal diseases and to prevent the spread of certain domestic animal diseases.

Animal diseases are categorised as:

- Reportable diseases (CFIA 2012c)
- Immediately notifiable diseases (CFIA 2012a)
- Annually notifiable diseases (CFIA 2023a)

Reportable diseases

Reportable diseases are outlined in the [Health of Animals Act 1990](#) and [Reportable Diseases Regulations](#) and are usually of significant importance to human or animal health or to the Canadian economy.

Animal owners, veterinarians and laboratories are required to immediately report the presence of an animal that is contaminated or suspected of being contaminated with one of these diseases to a CFIA district veterinarian. Section 5(2) of the Health of Animals Act 1990 requires any veterinarian who has any suspicion of the existence of reportable disease in Canada to immediately report such suspicion to a veterinary inspector.

Immediately notifiable diseases

In general, immediately notifiable diseases are diseases exotic to Canada for which there are no control or eradication programs.

The CFIA can undertake control measures for such diseases when notified of their presence in Canada. This category also includes some rare indigenous diseases. A herd or flock of origin must be certified as being free from these diseases in order to meet import requirements of trading partners.

Only laboratories are required to contact the CFIA regarding the suspicion or diagnosis of one of these diseases.

Annually notifiable diseases

In general, annually notifiable diseases are present in Canada, but are not classified as reportable or immediately notifiable. For those diseases listed by the World Organisation for Animal Health (WOAH), Canada must submit a biannual report to WOAH indicating their occurrence.

All veterinary laboratories are required to comment on Canada's report to WOAH, when requested.

Appendix B Hazard identification and refinement

Table 4 Hazard identification and refinement for Canada (adapted from the beef review)

Disease <i>Disease agent</i>	Susceptible species	WOAH-listed disease emerging disease or adverse consequences in Australia	Exotic, nationally notifiable or under official control in Australia	Present in and transmissible by beef carcass and carcass parts	Present in Canada	Outcome	Reference(s)
Akabane disease <i>Akabane virus</i>	Cattle, sheep and goats	No	No	No	No	Not retained.	(CFIA 2010)
Anthrax <i>Bacillus anthracis</i>	Cattle, bison, buffalo and multiple other species including humans	Yes	Yes	Yes	Yes	Retained for further review. Refer to Section 4.1.	(WOAH 2022j)
Aujeszky's disease (Pseudorabies) <i>Suid herpesvirus 1</i>	Cattle, bison, pigs (main host) and other mammals excluding humans and apes.	Yes	Yes	Yes	No	Not retained. Refer to Section 3.1.1.	(CFIA 2010)
Bluetongue <i>Bluetongue virus</i>	Cattle, bison, buffalo, sheep, goats and deer	Yes	Yes	No	Yes	Not retained.	(WOAH 2022j)

Disease <i>Disease agent</i>	Susceptible species	WOAH-listed disease emerging disease or adverse consequences in Australia	Exotic, nationally notifiable or under official control in Australia	Present in and transmissible by beef carcass and carcass parts	Present in Canada	Outcome	Reference(s)
Bovine anaplasmosis <i>Anaplasma marginale</i>	Cattle	Yes	Yes	No	Yes	Sporadic cases reported in Canada. Not retained.	(CFIA 2014)
Bovine babesiosis <i>Babesia bovis</i> <i>Babesia bigemina</i>	Cattle and buffalo	Yes	Yes	No	No	Not retained.	
Brucellosis <i>Brucella abortus</i> <i>Brucella melitensis</i> <i>Brucella suis</i>	Cattle, bison, buffalo, horses, deer, elk, camels, llamas, alpacas and humans	Yes	Yes	Yes	Yes	<i>B. melitensis</i> not present in Canada. Not retained. Refer to Section 3.1.2. <i>B. abortus</i> and <i>B. suis</i> present in Canada. Retained for further review.	(WOAH 2022j)

Disease <i>Disease agent</i>	Susceptible species	WOAH-listed disease emerging disease or adverse consequences in Australia	Exotic, nationally notifiable or under official control in Australia	Present in and transmissible by beef carcass and carcass parts	Present in Canada	Outcome	Reference(s)
						Refer to Section 4.5.	
Bovine cysticercosis (<i>Cysticercus bovis</i>) <i>Taenia saginata</i>	Cattle	Yes	Yes	Yes	Yes	Retained for further review.	(CFIA 2015a)
						Refer to Section 4.2.	
Bovine ephemeral fever <i>Bovine ephemeral fever virus</i>	Cattle and buffalo	Yes	No	No	No	Not retained.	(CFIA 2012a)
Bovine genital campylobacterio sis <i>Campylobacter fetus</i> subsp. <i>venerealis</i> <i>Campylobacter fetus</i> subsp. <i>fetus</i>	Cattle	Yes	No	No	Yes	Not retained.	(WOAH 2022j)

Disease <i>Disease agent</i>	Susceptible species	WOAH-listed disease emerging disease or adverse consequences in Australia	Exotic, nationally notifiable or under official control in Australia	Present in and transmissible by beef carcass and carcass parts	Present in Canada	Outcome	Reference(s)
Bovine immunodeficiency disease <i>Bovine immunodeficiency virus</i>	Cattle	No	No	No	Yes	Not retained.	(González-Fernández et al. 2020)
- <i>Bovine parvovirus</i>	Cattle	No	No	No	Yes	Not retained.	(Zhang et al. 2019)
- <i>Bovine respiratory syncytial virus</i>	Cattle, sheep and goats	No	No	No	Yes	Not retained.	(Zhang et al. 2019)
Bovine spongiform encephalopathy (BSE)	Cattle, bison, cats, zoo felidae, antelope and humans	Yes	Yes	Yes	Category 1 status assessed by FSANZ in July 2024	Considered through FSANZ assessment of Canada's BSE status – Category 1 status assigned July 2024	

Disease <i>Disease agent</i>	Susceptible species	WOAH-listed disease emerging disease or adverse consequences in Australia	Exotic, nationally notifiable or under official control in Australia	Present in and transmissible by beef carcass and carcass parts	Present in Canada	Outcome	Reference(s)
Bovine tuberculosis <i>Mycobacterium bovis</i> <i>M. caprae</i>	Cattle, bison, buffalo and multiple other species including humans	Yes	Yes	Yes	Yes	Retained for further review. Refer to Section 4.3.	(WOAH 2022j)
Bovine viral diarrhoea <i>Bovine viral diarrhoea virus</i>	Cattle, sheep, goats, and cervids	Yes	Yes BVDV-2 exotic and nationally notifiable	Yes	Yes	Retained for further review. Refer to Section 4.4.	(WOAH 2022j)
Cache Valley fever <i>Cache Valley virus</i>	Cattle, deer, sheep (primary), horses and humans	Yes	Yes	No	Yes	Not retained.	(Bergevin et al. 2023)
Campylobacter enteritis <i>Campylobacter jejuni</i> <i>C. coli</i>	Cattle and multiple other species including humans	No	No	Yes	Yes	Not retained.	(Public Health Agency of Canada 2021)
Coenurosis	Cattle, sheep (primary), goats,	Yes	Yes	No	No.	Isolated human case reported in	(Benger et al. 1981)

Disease <i>Disease agent</i>	Susceptible species	WOAH-listed disease emerging disease or adverse consequences in Australia	Exotic, nationally notifiable or under official control in Australia	Present in and transmissible by beef carcass and carcass parts	Present in Canada	Outcome	Reference(s)
<i>Coenurus cerebalis</i> <i>Taenia multiceps</i> <i>Taenia serialis</i>	horses, pigs, dogs and cervids					Canada. Not retained.	
Contagious bovine pleuropneumonia <i>Mycoplasma mycoides</i> subsp. <i>mycoides SC</i>	Cattle, buffalo, sheep and goats	Yes	Yes	Yes	No	Not present in Canada. Refer to Section 3.1.3.	(WOAH 2022j)
Crimean-Congo haemorrhagic fever <i>Crimean-Congo haemorrhagic fever virus</i>	Cattle, sheep, goats, hares, dogs, mice, ostriches and humans	Yes	Yes	Yes	No	Not present in Canada. Refer to Section 3.1.4.	(WOAH 2022j)
Cryptosporidiosis <i>Cryptosporidium parvum</i>	Cattle, sheep and humans	No	No	No	Yes	Not retained.	(Public Health Agency of Canada 2018)

Disease <i>Disease agent</i>	Susceptible species	WOAH-listed disease emerging disease or adverse consequences in Australia	Exotic, nationally notifiable or under official control in Australia	Present in and transmissible by beef carcass and carcass parts	Present in Canada	Outcome	Reference(s)
Echinococcosis <i>Echinococcus granulosus sensu stricto</i> <i>E. ortleppi</i> <i>E. multilocularis</i>	Cattle and multiple other species including humans	Yes	Yes	Yes	Yes	Retained for further review. Refer to Section 4.6.	(WOAH 2022j)
Enzootic bovine leukosis (bovine leukaemia) <i>Bovine leukaemia virus</i>	Cattle and sheep (experimental)	Yes	Yes	No	Yes	Not retained.	(WOAH 2022j)
Epizootic haemorrhagic disease (including Ibaraki disease) <i>Epizootic haemorrhagic disease virus</i>	Cattle and deer	Yes	Yes	No	Suspected	Not retained.	(WOAH 2022j)

Disease <i>Disease agent</i>	Susceptible species	WOAH-listed disease emerging disease or adverse consequences in Australia	Exotic, nationally notifiable or under official control in Australia	Present in and transmissible by beef carcass and carcass parts	Present in Canada	Outcome	Reference(s)
Foot-and-mouth disease <i>Foot-and-mouth disease virus</i>	Cattle and other cloven-hoofed animals	Yes	Yes	Yes	No	Not retained. Refer to Section 3.1.5.	(WOAH 2022j)
Haemorrhagic colitis <i>Escherichia coli</i> O157:H7	Cattle and multiple other species including humans	No	No	Yes	Yes	Not retained.	(Currie et al. 2012)
Haemorrhagic septicaemia <i>Pasteurella multocida</i> serotypes B:2 & E:2	Cattle, buffalo, sheep, goats, pigs, camels, equids, yaks, deer and other wild ruminants	Yes	Yes	Yes	No	Not retained. Refer to Section 3.1.6.	(WOAH 2022j)
Heartwater <i>Ehrlichia ruminantium</i>	Cattle and multiple other species	Yes	Yes	No	No	Not retained.	(WOAH 2022j)
Infectious bovine rhinotracheitis / infectious	Cattle	Yes	No	No	Yes	Not retained.	(WOAH 2022j)

Disease <i>Disease agent</i>	Susceptible species	WOAH-listed disease emerging disease or adverse consequences in Australia	Exotic, nationally notifiable or under official control in Australia	Present in and transmissible by beef carcass and carcass parts	Present in Canada	Outcome	Reference(s)
pustular vulvovaginitis <i>Bovine herpesvirus 1</i>							
Influenza D <i>Influenzavirus D</i>	Cattle, pigs	Yes	No	No	Yes	Not retained.	(Zhang et al. 2019)
Jembrana disease <i>Jembrana disease virus</i>	Cattle	No	Yes	Yes	No	Not retained.	
Leptospirosis <i>Leptospira spp.</i>	Cattle and multiple other species including humans	Yes	Yes	No	Yes	Not retained.	(Van De Weyer et al. 2011)
Listeriosis <i>Listeria monocytogenes</i>	Cattle and multiple other species including humans	No	Yes	Yes	Yes	Not retained.	(Public Health Agency of Canada 2023a)
Louping ill <i>Louping ill virus</i>	Cattle, sheep (primary), goats, horses, cervids, pigs and dogs	Yes	Yes	No	No	Not retained.	(CFIA 2012a)

Disease <i>Disease agent</i>	Susceptible species	WOAH-listed disease emerging disease or adverse consequences in Australia	Exotic, nationally notifiable or under official control in Australia	Present in and transmissible by beef carcass and carcass parts	Present in Canada	Outcome	Reference(s)
Lumpy skin disease <i>Lumpy skin disease virus</i>	Cattle and buffalo	Yes	Yes	Yes	No	Not present in Canada. Refer to Section 3.1.7.	(WOAH 2022j)
Malignant catarrhal fever <i>Ovine herpesvirus-2</i> <i>Alcelaphine herpesvirus-1</i>	Cattle, bison, buffalo, sheep, wildebeest and deer	No	Yes	No	Yes	Ovine herpesvirus 2 is present in Canada. Not retained.	(Government of Alberta 2023)
Paratuberculosis <i>Mycobacterium avium</i> subsp. <i>paratuberculosis</i> cattle & sheep strains	Cattle, buffalo, sheep, goats, camelids and cervids	Yes	Yes	Yes	Yes	Retained for further review. Refer to Section 4.7.	(WOAH 2022j)
Q-fever <i>Coxiella burnetti</i>	Cattle and multiple other species including humans.	Yes	Yes	No	Yes	Not retained.	(WOAH 2022j)

Disease <i>Disease agent</i>	Susceptible species	WOAH-listed disease emerging disease or adverse consequences in Australia	Exotic, nationally notifiable or under official control in Australia	Present in and transmissible by beef carcass and carcass parts	Present in Canada	Outcome	Reference(s)
Rabies <i>Rabies virus</i>	Cattle and other mammals including humans	Yes	Yes	No	Yes	Not retained.	(WOAH 2022j)
Rift Valley fever <i>Rift Valley fever virus</i>	Cattle, buffalo, sheep, goats and camelids	Yes	Yes	Yes	No	Not retained. Refer to Section 3.1.8.	(WOAH 2022j)
Rinderpest <i>Rinderpest virus</i>	Cattle and buffalo	Yes	Yes	Yes	No	Not retained. Globally eradicated in 2011.	(WOAH 2022j)
- <i>Salmonella enterica</i> serotype Typhimurium DT104 and other <i>Salmonella</i> spp.	Cattle and multiple other species including humans	Yes	Yes	Yes	Yes	Retained for further review. Refer to Section 4.8	(John et al. 2022)
- <i>Schmallenberg virus</i>	Cattle, bison, sheep, goats, deer, dogs, alpacas,	Yes	Yes	No	No	Not retained.	(CFIA 2012b)

Disease <i>Disease agent</i>	Susceptible species	WOAH-listed disease emerging disease or adverse consequences in Australia	Exotic, nationally notifiable or under official control in Australia	Present in and transmissible by beef carcass and carcass parts	Present in Canada	Outcome	Reference(s)
	mouflons and wild boar						
Screw worm fly <i>Cochliomyia hominivorax</i> <i>Chrysomya bezziana</i>	Cattle and other mammals including humans	Yes	Yes	No	No	Not retained.	(WOAH 2022j)
- <i>Staphylococcus spp.</i>	Cattle and multiple other species including humans	No	No	Yes	Yes	Not retained.	
Surra <i>Trypanosoma evansi</i>	Cattle, buffalo, horses, mules, donkeys, camels, llamas, pigs, sheep, goats, dogs and cats	Yes	Yes	Yes	No	Not retained. Refer to Section 3.1.9.	(WOAH 2022j)
Theileriosis <i>Theileria annulata</i> <i>Theileria orientalis</i>	Cattle buffalo, yaks and camels	Yes	Yes	Yes	No	Not retained. Refer to Section 3.1.10.	(WOAH 2022j)

Disease <i>Disease agent</i>	Susceptible species	WOAH-listed disease emerging disease or adverse consequences in Australia	Exotic, nationally notifiable or under official control in Australia	Present in and transmissible by beef carcass and carcass parts	Present in Canada	Outcome	Reference(s)
<i>Theileria parva</i>							
Toxoplasmosis <i>Toxoplasmosis gondii</i>	Cattle and multiple other species including humans	No	No	Yes	Yes	Not retained.	(Iqbal et al. 2018)
Trichomoniasis <i>Trichomonas foetus</i>	Cattle	Yes	No	No	Suspected.	Not retained.	(WOAH 2022j)
Trypanosomiasis <i>Trypanosoma congolense</i> <i>Trypanosoma brucei</i> <i>Trypanosoma simiae</i> <i>Trypanosoma vivax</i>	Cattle, sheep, goats, pigs, horses, deer, dogs and camels	Yes	Yes	Yes	No	Not retained. Refer to Section 3.1.11.	(WOAH 2022j)
Vesicular stomatitis <i>Vesicular stomatitis virus</i>	Cattle, horses, pigs and humans	Yes	Yes	Yes	No	Not retained. Refer to Section 3.1.12.	(CFIA 2023c)

Disease <i>Disease agent</i>	Susceptible species	WOAH-listed disease emerging disease or adverse consequences in Australia	Exotic, nationally notifiable or under official control in Australia	Present in and transmissible by beef carcass and carcass parts	Present in Canada	Outcome	Reference(s)
Wesselsbron disease <i>Wesselsbron virus</i>	Cattle, sheep, goats, cats, dogs and humans	Yes	Yes	Yes	No	Not retained. Refer to Section 3.1.13.	(CFIA 2012a)
West Nile fever <i>West Nile virus</i>	Cattle, birds, sheep and other mammals including humans	Yes	Yes	No	Yes	Disease suspected. Not retained.	(WOAH 2022j)