

***Import risk analysis: Camel (*Camelus dromedarius*) Meat for Human Consumption from Australia.***

**Biosecurity Authority  
Ministry of Agriculture and Forestry  
Wellington  
New Zealand**



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Approved for release

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## **Commodity Definition**

Chilled or frozen camel (*Camelus dromedarius*) meat (muscle, not including offals). The meat is prepared from feral camels slaughtered and processed in domestic licensed abattoirs.

All meat that is produced and commercially available for sale in Australia has been processed in accordance with Australia – New Zealand Food Authority (ANZFA) standards equivalent to those operating in New Zealand. That is, it has been slaughtered and processed in government licensed premises under official supervision and subject to ante-mortem and post-mortem inspection.

Camel meat covered by this risk analysis must be commercially packaged and identifiable as being of Australian origin. Containers of meat must be sealed with an official government seal (of the federal government or state meat authority) or company seal.

## **Introduction**

This import risk analysis is concerned with effectively managing the disease risks associated with the importation of camel meat for human consumption from Australia. In this context, risk is defined as the likelihood of a disease entering, establishing or spreading in New Zealand and its likely impact on animal or human health, the environment and the economy.

The meat would be derived from central Australian feral camels slaughtered and processed in domestic licensed abattoirs.

## **The risk analysis framework**

There are four components to a risk analysis:<sup>1</sup>

1. *Hazard Identification*, which involves identifying pathogenic agents that could potentially produce adverse consequences associated with the importation of a commodity.
2. *Risk Assessment*, which involves an assessment of the likelihood of, and the biological and economic consequences of, the entry, establishment or spread of a pathogenic agent.
3. *Risk Management*, which is a process of deciding upon and implementing measures to effectively manage the risks posed by a pathogenic agent.
4. *Risk Communication*, which is the process by which information and opinions regarding hazards and risks are gathered from potentially affected and interested parties, and by which the results of the risk assessment and proposed risk management measures are communicated to decision-makers and interested parties.

### *Hazard Identification*

A hazard is defined as any organism that could produce adverse consequences on the importation of a commodity. Hazard identification is a process of identifying pathogenic agents that could potentially be introduced in the commodity in question.

### *Risk Assessment*

Risk assessment is the process of evaluation of the likelihood and the biological and economic consequences of entry, establishment, or spread of a pathogenic agent within the territory of an importing country.

A risk assessment consists of four inter-related steps:

- i. *Release assessment*, which estimates the likelihood of camel meat harbouring potential hazards when imported into New Zealand. It describes the biological pathways necessary for an imported commodity to ‘release’ or introduce a pathogenic agent into a particular environment and estimates the probability of that occurring.
- ii. *Exposure assessment*, which describes the biological pathway(s) necessary for the exposure of susceptible animals in New Zealand to potential hazards and estimates the likelihood of these exposure(s) occurring.
- iii. *Consequence assessment*, which identifies the potential biological, environmental and economic consequences associated with the entry, establishment or spread of potential hazards and estimates the likelihood of these potential consequences.
- iv. *Risk estimation*, which involves summarising the results of the release, exposure and consequence assessment to produce a summary estimate of the risks associated with the potential hazards in camel meat.

The risk analysis may be concluded at the end of any of these steps if it is established that the likelihood of release, exposure or the potential consequences is negligible.

Where applicable, a release assessment and exposure assessment have been carried out for each identified hazard. It was not considered necessary to carry out a consequence assessment for any of the identified hazards. All of the hazards assessed were considered to pose a negligible risk during either the release assessment or exposure assessment steps and so further assessment was not required.

### *Risk Management*

Risk management is the process of identifying, selecting and implementing measures that can be applied to reduce risk to an acceptable level.

## Hazard Identification

The diseases considered in this risk analysis include those from the Office International des Epizooties (OIE) List A and List B<sup>2</sup> that affect camels. In addition, several other diseases potentially affecting camels are included. Epizootic haemorrhagic disease, Borna disease, melioidosis and *Salmonella* Typhimurium DT 104 are exotic to New Zealand. *Salmonella* Enteritidis and *Salmonella* Typhimurium DT 104 are considered to be of animal health and public health concern.

Table 1 lists the diseases that are considered, together with the status of Australia and New Zealand with respect to each disease.

Table 1: Diseases of Concern and the Health Status of Australia and New Zealand.

Disease	Status in Australia	Status in New Zealand
<b>OIE List A Diseases</b>		
Foot and mouth disease	1871	0000
Vesicular stomatitis	0000	0000
Rinderpest	1923	0000
Rift Valley fever	0000	0000
Bluetongue	+?	0000
<b>OIE List B Diseases</b>		
Anthrax	+	1954
Aujeszky's disease	0000	1996
Echinococcosis/hydatidosis	+	1999
Heartwater	0000	0000
Leptospirosis	+	+
Q fever	+?	0000
Rabies	1867	0000
Paratuberculosis	+	+
Screw-worm	0000	0000
Bovine anaplasmosis	+	0000
Bovine babesiosis	+	0000
<i>Brucella abortus</i> infection	1989	1989
Tuberculosis ( <i>M. bovis</i> )	+	+
Dermatophilosis	+	+
Haemorrhagic septicaemia	0000	0000
Theileriosis	+?	+
<i>Brucella melitensis</i> infection	0000	0000
Contagious caprine pleuropneumonia	0000	0000
Equine encephalomyelitis (Eastern and Western)	0000	0000
Trypanosomosis including <i>Trypanosoma evansi</i>	0000	0000
<b>Other Diseases of Concern</b>		
Epizootic haemorrhagic disease	+	0000
Borna disease	0000	0000
Melioidosis ( <i>Burkholderia pseudomallei</i> )	+	0000
<i>Salmonella</i> Enteritidis	+	+
<i>Salmonella</i> Typhimurium DT 104	0000	0000

*Key to Table 1*

0000	Disease never reported
+	Disease reported as present or known to be present
+?	Serological evidence and/or isolation of the causal agent, but no clinical signs of disease
year	Date of the last reported occurrence of the disease in previous years

***Diseases Endemic in New Zealand***

The following diseases are endemic in New Zealand and not subject to any form of control. They will not be considered further in this risk analysis:

Paratuberculosis

Dermatophilosis

***Camel Meat as a Vehicle for the Introduction of Exotic Organisms***

The possibility for “hitchhiker pests”, such as insects and weed seeds, to be introduced in any imported good, such as inadvertently incorporated into the packaging, needs to be addressed.

Food safety and hygiene standards in Australia, which are equivalent to New Zealand standards, preclude such events occurring. All meat is inspected and passed as fit for human consumption before export. Insect control is mandatory in premises slaughtering animals for human consumption and any visible contaminants must be removed from meat products intended for human consumption in either Australia or New Zealand. The likelihood of hitchhiker pests being introduced by imported camel meat must be considered as being negligible.

For camel meat to serve as a vehicle for the introduction of exotic organisms, the following criteria must be met. As far as meat products are concerned, ingestion is the primary means of transmission of pathogens present in meat to animals or humans. Therefore, the main camel diseases of concern will be those that can be transmitted by ingestion of their meat by humans, omnivores (e.g. pigs) and carnivores (e.g. dogs, cats, mustelids).

*Criteria for introduction of exotic organisms:*

- a. The organism must be present in Australia.
- b. The organism must be present in or on the slaughtered camels (or the carcasses must have become contaminated during processing).
- c. The organism must persist in or on the carcass despite ante and post-mortem inspection procedures.
- d. The organism must survive storage and processing and be present at an infectious dose in the final product.
- e. The product must find its way into a susceptible animal of the appropriate species in New Zealand.

***Organisms Exotic to Australia***

The following disease-causing organisms are exotic to Australia and will not be considered further:

Foot and mouth disease  
 Vesicular stomatitis  
 Rinderpest  
 Rift Valley fever  
 Aujeszky's disease  
 Heartwater  
 Rabies  
 Screw-worm  
*Brucella abortus* infection  
 Tuberculosis (*M. bovis*) (Australia declared freedom from bovine tuberculosis in 1997.<sup>3</sup>  
 Only two cases were reported in 1999.<sup>2</sup>)  
 Haemorrhagic septicaemia  
*Brucella melitensis* infection  
 Contagious caprine pleuropneumonia  
 Equine encephalomyelitis (Eastern and Western)  
 Trypanosomosis including *Trypanosoma evansi*  
 Borna disease  
*Salmonella* Typhimurium DT 104 (*S. Typhimurium* DT 104 has not been isolated in  
 Australia.<sup>4</sup>)

### ***Organisms Transmitted by Insect Vectors***

A number of organisms are transmitted virtually exclusively by insect vectors and, as such, need not be considered further.

Bluetongue and epizootic haemorrhagic disease are caused by closely related orbiviruses which are transmitted only by various species of *Culicoides* biting midges.<sup>5</sup>

Bovine anaplasmosis is mainly transmitted by ticks. However, blood-sucking insects (such as certain species of biting flies) and the mechanical transfer of blood by vaccination or other veterinary procedures can also transmit the disease.<sup>6</sup>

*Babesia* and *Theileria* species are transmitted by ticks as well as by the mechanical transfer of blood, similar to anaplasmosis.<sup>5, 6</sup>

### **Potential Hazards for Further Consideration in the Risk Assessment**

The conclusion of the hazard identification process is based on whether or not the commodity under consideration is a potential vehicle for the introduction of the organism. If it is, then the organism is considered to be a potential hazard requiring further consideration in the risk assessment. The following will be considered in this assessment:

Bacillus anthracis (anthrax)  
 Echinococcus granulosus (echinococcosis/hydatidosis)  
 Leptospira interrogans (leptospirosis)  
 Coxiella burnetii (Q fever)

Burkholderia pseudomallei (melioidosis)  
Exotic strains of *Salmonella*

## **Risk Assessment**

### **1. Anthrax**

#### *1.1 Release Assessment*

Sporadic outbreaks of anthrax occur in well-defined areas in Victoria and New South Wales.<sup>3</sup> Occasional outbreaks have occurred in other states.<sup>3</sup> During 2000, anthrax was reported only in New South Wales.<sup>3</sup> Camels to be slaughtered for the New Zealand market would be sourced from central Australia i.e. western Queensland, the Northern Territory and South Australia. Anthrax was last recorded in South Australia in 1914 and in Queensland in 1993. The disease has never been reported in the Northern Territory.<sup>3</sup>

Animals and their byproducts are important sources of anthrax infection.<sup>6</sup> However, the rarity of the disease in Australia means that it is extremely unlikely that camel meat would be sourced from animals infected with anthrax. In addition, ante-mortem and post-mortem inspection procedures would detect affected animals, as the clinical signs of anthrax are obvious.

The likelihood of camel meat introducing anthrax into New Zealand is negligible.

#### *1.2 Risk Management*

Because the likelihood of release is negligible, no specific safeguards are required.

### **2. Echinococcosis/hydatidosis**

#### *2.1 Release Assessment*

*Echinococcus granulosus* is endemic in southeastern Australia, but under-reporting limits the understanding of its exact distribution. Three strains of *E. granulosus* are recognised in Australia. One strain cycles between the dingo and macropod marsupials, and the other two (one continental and the other confined to Tasmania) are confined to the dog-sheep-dog cycle.<sup>7</sup> The parasite has been found in feral pigs and foxes, but their role in its transmission is unclear.<sup>8</sup> By contrast, hydatids has been eradicated from New Zealand.

Certain organs, such as liver and lungs, serve as vehicles to transmit the cystic larval stage to a carnivorous primary host such as the dog.<sup>6</sup> Virtually all hydatid cysts are found in offal and ante-mortem and post-mortem procedures are likely to detect infected animals. However, this risk analysis deals only with meat, not offals (see Commodity Definition).

The likelihood of viable hydatid cysts being present in camel meat is negligible.

#### *2.2 Risk Management*

Because the likelihood of release is negligible, no specific safeguards are required.

### 3. *Leptospirosis*

#### 3.1 *Release Assessment*

Infection with leptospirosis is widespread and common in New Zealand. However, some serovars not present here have been isolated in Australia.

A recent review of leptospirosis in Australia<sup>9</sup> made no mention of the infection in camels in that country. However, the same review cites reports of seroprevalences ranging from 2% to 44% in camels in some middle eastern countries.

In infected animals, leptospire may localise in the kidneys.<sup>6</sup> However, the commodity under consideration is meat (see Commodity Definition) and, as meat has never been implicated as a vehicle for leptospire, the likelihood of introduction in Australian camel meat is negligible.

#### 3.2 *Risk Management*

Because the likelihood of release is negligible, no specific safeguards are required.

### 4. *Q fever*

#### 4.1 *Release Assessment*

Q fever, caused by the organism *Coxiella burnetii*, is present in Australia. New Zealand is free of Q fever. Camels may be infected with the organism.<sup>6</sup> Although Q fever is not considered to be of clinical importance in livestock, the disease is a zoonosis.<sup>6</sup>

The agent is maintained in a wildlife reservoir primarily involving rodents and birds. Infection is transmitted by ticks to domestic animals, particularly sheep and cattle.<sup>6</sup>

During the bacteraemic phase of the disease, the agent is carried to all organ systems.<sup>6</sup> In a study of bovine carcasses, *C. burnetii* was found in lymph nodes, udder, muscle, spleen, liver and kidney.<sup>10</sup> In contaminated meat stored under refrigeration, the organism may survive up to 30 days.<sup>11</sup> However, in most infected animals, *C. burnetii* localises in the udder and the uterus.<sup>12</sup> The likelihood of localisation in muscle is low. Indeed, one authoritative review fails to mention localisation in muscle at all, listing only placenta, liver, spleen, brain, adrenal glands, lungs, kidneys, heart, lymph nodes, intestinal tract, mammary gland and skin.<sup>13</sup>

As a matter of consistency, it should be noted that importation of beef and sheepmeat is already permitted from Australia, and the likelihood of introducing *C. burnetii* in camel meat cannot be any different from that of any other meat currently imported.

#### 4.2 *Exposure Assessment*

Humans are usually infected with *C. burnetii* by inhalation.<sup>5, 14</sup> Slaughterhouse workers are particularly at risk from Q fever, but their exposure usually occurs by inhalation. Infection may also occur through skin abrasions when handling infected organs.<sup>7, 15, 16</sup> However, this risk analysis deals only with meat, not offals (see Commodity Definition).

Some studies suggest that humans can occasionally become infected by the ingestion of contaminated milk.<sup>5, 14</sup> Seroconversion, but not disease, has occurred following ingestion of raw milk.<sup>17</sup> Ingestion is a poor route for infection with *C. burnetii*. Transmission from domestic animals to humans occurs through direct occupational contact with parturient ruminants or animal products and possibly by consumption of infected milk. However, in an authoritative review of Q fever, consumption of meat is not reported as a means of exposure.<sup>18</sup> Meat is not considered to pose a risk of *C. burnetii* infection.

The risk of exposure of humans and animals to *C. burnetii* in imported camel meat is negligible.

#### 4.3 Risk Management

Because the risk of release is low and exposure is negligible, no specific safeguards are required.

### 5. *Melioidosis*

#### 5.1 Release Assessment

Melioidosis is a bacterial disease caused by *Burkholderia pseudomallei*. Infection results in multiple abscesses in a wide variety of tissues and organs. The organism has been isolated from southwest Australia.<sup>5</sup>

The normal habitat of the organism is moist, tropical clay soils. The organism is an opportunistic pathogen. Infection is transmitted from the environment rather than from animal to animal. Outbreaks originating from soil-borne infection occur primarily during or after heavy rainfall or flooding in regions with high humidity or temperature.<sup>5</sup>

Melioidosis does not appear to have ever been recorded in animals or humans in central Australia and this is probably because it is not normally associated with dry, arid conditions. In addition, it is unlikely that an infected animal would pass post-mortem inspection procedures. Therefore, the likelihood of release (i.e. introduction) of melioidosis in imported camel meat is negligible.

#### 5.2 Risk Management

Because the likelihood of release is negligible, no specific safeguards are required.

### 6. *Exotic strains of Salmonella*

#### 6.1 Release Assessment

The status of Australia with respect to *Salmonella* is very similar to New Zealand.

A study of feral pig and kangaroo carcasses in Queensland found 15 different *Salmonella* serotypes.<sup>19</sup> Samples collected during wet weather were contaminated with more salmonellae than samples collected during drier weather.<sup>19</sup>

The occurrence of salmonella infection in livestock is closely related to husbandry methods. Intensive systems in particular favour the spread of infection. Extensively raised animals, such as cattle and sheep, are a less important source of infection for humans than pigs and poultry.<sup>20</sup> Salmonellae are only found to occur at low levels on Australian beef and sheep carcasses.<sup>21</sup> The harvesting of feral camels is comparable to extensive sheep and cattle farming. Camels to be slaughtered to obtain meat for export to New Zealand would be located in the dry, arid interior of central Australia.

Australia has introduced process controls based on hazard analysis critical control points (HACCP) into meat processing establishments to complement meat inspection and to minimise microbiological contamination in meat.<sup>22</sup>

## 6.2 Risk Management

Camel meat traded in Australia must conform to ANZFA standards. As all meat products in Australia are processed in accordance with systems equivalent to New Zealand systems, no specific safeguards are required to protect animal health.

It should be noted that the Ministry of Health has indicated that it will need to investigate the public health risks of *Salmonella* species that could be present on camel meat. Depending on whether or not Australia can provide comprehensive data on this issue, the Ministry of Health may carry out microbiological testing of the product on arrival in New Zealand.

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