Final Report

AMPC
AUSTRALIAN MEAT PROCESSOR CORPORATION

# Cysticercus *bovis* risk management plan and verification arrangements


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Prepared by
Dr Andrew Pointon

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# Contents

# 1.0 Executive Summary

This Project addresses the translation of amendments to post-mortem inspection techniques (PMI) for Cysticercus *bovis* (CB) arising from a risk-based review of the meat inspection standard AS4696:2007. The changes to PMI for CB are based on a risk assessment that demonstrated equivalent public health protection.

In the amended AS4696:2023 (the standard) routine inspection for CB is comprised of incision of the heart but not masseter muscles, which are to be observed.

For high-risk stock, full carcase inspection (Schedule 2, Table 4) applies; *If cattle or buffalo have grazed where exposure to Cysticercus bovis (beef measles) may have occurred, procedures in Table 4 of this Schedule for C. bovis apply, otherwise observe masseter muscles.*

Consequently, a revised risk management framework (the framework) was developed to provide for cattle that have grazed land where recycled water that contains human effluent achieves adequate helminth egg reduction for safe use for irrigating pastures.

Development of the framework required extensive consultation and engagement with SAFEMEAT Partners to gain acceptance of revised risk management arrangements (i.e., CB status traceability) applied to livestock before slaughter, for the appropriate application of the amended PMI options for CB.

Considerable prior research included a public health risk assessment that estimated negligible risk remains from CB from beef produced in Australia.

Subsequently, new information on the level of contamination of human effluent for *Taenia saginata* eggs (source of CB in carcases) was provided by the recycled water sector. A risk assessment of *T. saginata* egg reduction in Waste-Water Treatment Plants (WWTP) provided “control” criteria whereby adequately treated effluent can be safely used for irrigated pasture production.

Additional information on the incidence of total carcases condemnation for CB from 2000-2018 supported the extremely low incidence of CB.

Analysis of this data, before and after implementation of the Australian Guideline on Recycled Water enacted in 2006, that is designed to reduce human parasite eggs in effluent, demonstrates additional mitigation of CB.

This information was then used to prepare a revised risk management framework supporting amended PMI for CB. This framework classifies of low and high-risk stock, where the latter is defined as *exposure to Cysticercus bovis (beef measles) may have occurred.*

Risk Management of Cysticercus *bovis* in Livestock Production Assurance (LPA) and National Livestock Identification Scheme (NLIS) for producers, saleyards, feedlots, processors, States and Territories, Integrity Standards Company (ISC) and LPA auditors and waste-water treatment plants is provided in a Fact Sheet with Flow Chart for the various scenarios. This may be found via https://www.ampc.com.au/getmedia/e9f2c334-efcf-4c84-89bf-4f9b18cbf743/ISC-C-*Bovis*-Fact-Sheet_FA_online.pdf.

The framework includes requirements and/or roles for:

- Producers with properties where stock are exposed to CB
- Producers receiving stock with CB status

- Safe use of recycled water containing human effluent water (recycled water) for pasture irrigation
- Release of property CB status
- Management of CB status animals at saleyards and feedlots
- Introduction and release of CB Warning alert for properties receiving CB status stock
- Processors will be able to see if a PIC they are purchasing from has a CBP or CBW status and further check if livestock being received have a CB status
- States and Territories
- ISC and Auditors
- Wastewater Treatment Plants.

The revised risk management arrangements facilitate the application of amended PMI options for CB based on risk. These PMI options were gazetted in the amended AS4696:2023 in March 2023.

These revised CB risk management arrangements:

- have been consulted with and endorsed by all SAFEMEAT Partners
- are published via the AMPC link above (to be published by ISC later in 2023)
- will be enacted via revisions to NLIS and LPA
- underpin amended CB post-mortem inspection provisions in AS4696:2023
- provide guidance to recycled water sector to value-add adequately treated recycled water, and
- when fully adopted, these revisions have the potential to increase profits for the Australian red meat processing industry by $30 million per year.

Increased use of adequately treated recycled water for pasture production is facilitated through publication of standards for such release by Waste-Water Treatment Plants, supported by documented supply agreements and national on-farm auditing arrangements via NLIS and LPA.

Verification arrangements have been developed and approved by SAFEMEAT Partners; and may be found via the APMC link above. While verification arrangements have been approved, it is now the role of ISC to further coordinate training of auditors and conduct extension of the revised risk management arrangements with supply chain stakeholders.

# 2.0 Introduction

This Final Report provides a risk management framework (the framework) to support 1) minimum post-mortem inspection for Cysticercus *bovis* (CB) in cattle and buffalo in the Australian Standard (AS4696:2023; Anon 2023) coupled with 2) consideration of grazing history.

The aim is to ensure an official risk management framework is in place to support public health outcomes and maintenance of market access to key export markets.

CB causes small cysts in the muscles and offal of cattle (beef measles). The presence of cysts can lead to all, or part of the carcase being condemned. Cattle get CB from ingesting crops and water contaminated by human wastewater that has not been effectively treated. Ingestion of viable cysts by consumers leads to gut tapeworms (*Taenia saginata*).

Current PMI standards for CB inspection require all cattle to be checked for cysts in the heart, and cheek by incision, even if there is a low risk of the animal being exposed to recycled water containing human effluent and pastures irrigated with such water (recycled water).

Once beef cheeks are incised, they are not suitable for sale for human consumption.

The new risk management framework will allow red meat processors to identify low-risk animals and avoid cutting cheek muscle, while still addressing CB risks to human health.

The framework considers evidence that validates “cattle grazing pastures irrigated with adequately treated recycled water” are equivalent to “cattle never exposed to high-risk land” i.e. grazing areas exposed to recycled water from wastewater that contains human faeces.

Previous research is summarised in Appendix 1 includes:

1. Quantitative risk assessment for human *Taenia saginata* infection from consumption of Australian beef (MLA Project V.RBP.0021)
    - Negligible incidence of consumer exposure to *T. saginata* from Australian produced beef
    - Negligible increase in consumer incidence when masseter muscles are observed and not incised routinely.
2. Risk Management Equivalence for CB Inspection (AMPC Project 2021 – 1186)
    - Analyses the mitigating effect of implementing the Australian Guidelines for Water Recycling from 2006 (AGWR) on the annual incidence CB rates of total carcase condemnation from 2001 – 2018
    - Evidence of continuing very low incidence of CB in Australian produced beef
3. Exposure of cattle to *Taenia saginata”* in Australia (AMPC Project 2022 – 1082)
    - *T. saginata* eggs are undetectable in raw human effluent from major cities
    - Effluent treatment criteria levels for *T. saginata* egg reduction that renders treated recycled water safe for irrigation of pasture.
4. Revised risk management framework to mitigate Cysticercus *bovis* infected meat entering the human food chain (current final report of AMPC Project 2022 – 1178)
    - Draws the foregoing technical data together, providing evidence for Equivalence Submissions to key export markets

- Survey of jurisdictions via SAFEMEAT regarding present animal health policies and protocols, underpinning legislation, and engagement with the WWTP licensing and auditing bodies.

Postmortem inspection (PMI) is regulated by the Australian Meat Regulation Group (AMRG) comprised of state and federal jurisdictions. AMRG has approved amendments of PMI for CB based on a public health risk assessment that estimated negligible adverse effects on public health by not incising masseter muscles, while retaining incision of heart muscles.

Subsequently, amendment of AS4696:2007 was gazetted as AS4696:2023 by Standards Australia in March 2023, with intended activation from 1 July 2023.

# 3.0 Project Objectives

## 3.1 Provide support to Steering Group convened by AMPC

## 3.2 Lead development of the Risk Management framework for C. *bovis*

## 3.3 Support engagement with key stakeholders to build a national system (Waste-Water utilities auditing, SAFEMEAT, ISC, AHC)

## 3.4. Assist with activities to address technical and regulatory gaps – project briefs, project roles as appropriate

## 3.5. Collaborate in the development of Equivalence Proposal to sensitive markets

## 3.6. Provide assistance to projects allied to these aims

## 3.7. Support development of supply chain verification pilots

# 4.0 Methodology

1. Provide support to Steering Group convened by AMPC

- Preparing technical updates
- Preparing agenda papers as required by the convenor
- Assisting with Minutes and Actions

2. Lead development of Risk Management framework

- Revise prior proposal to AHC considering the implementation of the Australian Guideline for Recycled Water in 2006 on the total carcase condemnation rate and national prevalence survey (Appendix 1) for C. *bovis*
- Consult with relevant jurisdictions as directed by Steering Group

3. Support engagement with key stakeholders to build a national system (Waste-Water utilities auditing, ISC, AHC, SAFEMEAT)

- Briefing papers, Agenda papers, “virtual” meetings

4. Assist with activities to address technical gaps

- Project briefs, project participation as appropriate
- Depending on aim, size and investigators, projects may need separate contracting e.gs. National Waste-water plant audit for Log Reduction Audit of helminth eggs enabling use for irrigating pasture and fodder crops

5. Collaborate in the development of Equivalence Proposal to sensitive markets

- Draft technical aspects
- Excludes market analysis e.gs. identifying key issues and current regulatory settings on a market-by-market basis (roles for DAWE)

6. Provide assistance to projects allied to these aims e.gs,

- Prepare briefings to assist liaison with state and federal jurisdictions regarding enabling legislative arrangements (AS4696:2023)
- Attend meetings to inform the need for more stringent traceability for livestock processed at export-listed establishments

7. Supply chain verification pilot

- Assist with design

# 5.0 Project Outcomes

## 5.1 Technical outputs

Key technical outputs from this project that underpin the CB risk management framework are presented in Appendix 1 include:

- Proposed risk management system to support minimum CB inspection
- Exposure of cattle to *Taenia saginata*
- Results of analysis of total carcase condemnation for CB from 2001-2018
- SAFEMEAT sanctioned CB Risk Management Survey of jurisdictions
- CB infection characteristics.

The extensive technical inputs regarding safe use of adequately treated recycled water from Dr Daryl Stevens, ATURA, are acknowledged at this point.

## 5.2 Risk management activities

Key risk management submissions, based on the technical outputs (Section 5.1; Appendix 1) were developed for consultation with SAFEMEAT Partners, listed here.

### 5.2.1 SAFEMEAT consultation papers

- SAFEMEAT Advisory Group agenda paper – 12 October 2022 - Approved
- Jurisdictional Task Group paper – November 2022 - Approved
- SAFEMEAT Partners briefing paper – 1 December 2022 - Endorsed
- Supply Chain Taskforce paper – 8 December 2022 – Approved

These papers are held by Australian Meat Regulators Group (AMRG), and SAFEMEAT. The development of these papers was largely led by Dr David Cusack, Chair AMRG.

### 5.2.2 Integrity Systems Company (ISC) support

To implement the risk management framework ISC modified of CB traceability and property classification accordingly, along with guidance on safe use of recycled water. ISC outputs include:

1. LPA standards revisions
2. NLIS C. *bovis* status revisions
3. Risk Management LPA & NLIS Fact Sheet for producers, auditors, processors, and recycled water sector
    a. Flow Chart for CB cattle and those with lost tags.

These specific documents are held by Integrity Systems Company (ISC). Preparation of these “official” revisions was led by Elizabeth Bradley, ISC.

## 5.3 Approved CB Risk Management framework

Full details of the revised risk management arrangements and flow chart for CB may be found via https://www.ampc.com.au/getmedia/e9f2c334-efcf-4c84-89bf-4f9b18cbf743/ISC-C-*Bovis*-Fact-Sheet_FA_online.pdf

In overview:

- Producers who use recycled water for irrigation or cattle drinking water need to demonstrate the recycled water does not pose a risk to food safety
- This shall be demonstrated through conformity to Element 1 of LPA - Property Risk Assessment
- Producers being supplied with recycled water from a wastewater treatment plant need to:
    - Include recycled water use in their property risk assessment.
    - Indicate on their farm map where recycled water has been applied.
    - Obtain in writing from the wastewater treatment plant the treatment level of the recycled water (agreement or contract)
    - Demonstrate through the agreement that the recycled water is low risk and has been treated to achieve a:
        - Log Reduction Value (LRV) of 4.0 in *T. saginata* egg concentration or equivalent; or
        - LRV of 3.0 - only if the producer is supplying other fresh drinking water to cattle. The recycled water supplier must confirm that the sewage quality is ≤ 1 *T. saginata* egg/L, as part of the supply agreement.
- Producers verified as using inadequately recycled water will have a:
    - CBP status applied to their PIC in the NLIS Database.
    - CBA status applied to all cattle devices on their PIC.
- The **CBA** device status will remain on the device for the animal's lifetime to instruct the processor of the correct inspection procedure to follow at processing.
- The **CBP** status can only be removed from a PIC once an LPA auditor verifies it has been two years since inadequately treated recycled water use has ceased on the PIC or a state/territory official removes the status through a risk assessment.
- If cattle with a **CBA** device status reside on a property when the **CBP** status is removed, a **CBW** status will be applied to the PIC until all CBA devices are moved off the property.
- Using NLIS, feedlots will be able to see if a PIC they are purchasing from has a CBP or CBW status.
- If CB cattle are transferred onto a saleyard or feedlot PIC, the PIC will receive a CB Warning (**CBW**) status to indicate that cattle with a CB status have been moved onto the PIC.
- The saleyard, feedlot and any processor buying cattle can check if cattle have a CB status, the PIC has a **CBP** or **CBW** status.
- The **CBW** status will be removed automatically when all cattle with a CB status are moved off a PIC.

- Cattle that lose an NLIS identification device will assume the status of the animals of the lot it is being sent with, which is to be verified using NVDs.
- "Low risk" stock with no CB status is subjected to amended (**minimum**) PMI for CB i.e., the bulk of cattle and buffalo processed.
- Using NLIS, processors will be able to see if a PIC they are purchasing from has a CBP or CBW status and further check if livestock being received have a CB status.
- AS 4696:2023 details that a **full**, organoleptic postmortem inspection (PMI) is applied to animals for C. *bovis* where reasonable evidence of contamination (e.gs. suspect cyst found in incised heart) is provided. This consists of incision of hearts, masseters, tongue, diaphragm after removal of serous membranes and observation of all muscle surfaces.
- Where a device has a CB Status, or livestock have come from a CBP PIC, all material inspected at PMI suspected of being infected with CB is trimmed and condemned. If general carcase infestation is suspected, the entire carcase is condemned.
- Where no CB device status exists a routine post-mortem inspection PMI for CB will be applied according to AS 4696:2023. This will consist of routine heart incision to examine for evidence of suspect cyst with observation of masseter muscle (no mandatory incision required for routine PMI) to examine for evidence of cysts.
- Cattle that lose an NLIS identification device will assume the status of the animals of the lot it is being sent with, which is to be verified using NVDs.
- Identification of possible CB cysts in a carcase will result in Chief Veterinary Officer (CVO) notification in all cases, as CB is notifiable in all jurisdictions.

### 5.4.1 Associated outcomes enabled

1. Support to Export Standards Branch in notifying trading partners.
    - A notification of alternative port-mortem inspection (PMI) and disposition arrangements including alternative PMI for C. *bovis* was conducted by Export Standards Branch – all countries accepted all amendments to AS4696:2023.

2. However, for C. *bovis* an equivalence submission was sent to key markets in October 2022
    - US, EU, and UK – negotiations are ongoing. This project provided comments and publications to support the submissions.
    - Further information to assist response to EU queries has been provided to Export Standards Branch (Definitions - risk management animal and PIC Statuses)

3. Support to the Standards Australia process to officially gazette AS4696:2023 – Approved March 2023.
    - AS4696:2023, that includes alternative PMI and pre-slaughter risk management arrangements for C. *bovis* has been officially approved and gazetted.
    - The project was asked to verify the AS4696:2023 wording reflected the intent of the SAFEMEAT agreed C. *bovis* risk management arrangements.

4. It is also anticipated that opportunities to value-add recycled water will be extended to the recycled water industry that will enable a sustainability outcome as an added benefit of this project.
    - Technical guidance for compliance with safe supply of treated recycled water for pasture irrigation is provided in the Fact Sheet (AMPC link above).

# 6 Discussion

The project has provided a verifiable risk management system for assuring market access for beef produced under amended post-mortem inspection for C. *bovis*. These arrangements in revised NLIS and LPA have been endorsed by SAFEMEAT Partners and enables amended PMI provisions in AS4696:2023 that takes grazing history into consideration.

The framework defines high-risk cattle that are subject to full carcase PMI.

Revisions to NLIS and LPA enable processors to see if a PIC they are purchasing from has a CBP or CBW status and further check if livestock being received have a CB status that provides forewarning to adjust PMI resources accordingly.

ONLY the “high-risk” CBA lot from these CB status properties are subject to full PMI under these arrangements (refer to flow chart in the Fact Sheet).

Full inspection of CBA lots represents an increased stringency of PMI for CB under the amended AS4696:2023, thereby providing enhanced assurance to export markets.

Nonetheless, full carcase inspection remains unchanged if suspect gross abnormalities are detected in any carcase (AS4696:2023, Schedule 2, Table 4).

These arrangements provide the basis for Equivalence proposals for amended CB PMI to key markets of EU, UK, and US.

The framework also reflects existing CB regulation carried out by the jurisdictions; PIC quarantine for 2 years, or less subject to property risk assessment (i.e., seasonal heat, ploughing land). However, it leaves the cost of operating the framework to be borne by industry as the beneficiary.

Conversely, by identifying “low risk” animals that represent the bulk of production, processors will be able to sell and export intact masseters to international markets.

Integrity Systems Company is providing guidance to determine high-risk cattle and properties, and how these will be monitored, especially CB status cattle passing through the various pathways from property-of-origin to eventual slaughter.

An added benefit of the framework is that it provides clear guidance to recycled water sector to value-add adequately treated recycled water containing human effluent. This provides for an enhanced sustainability dividend for the recycled water sector and a valuable resource in the event of droughts.

# 7 Conclusions / Recommendations

Revised Risk management arrangements:

- have been consulted with and endorsed by all SAFEMEAT Partners
- are published by AMPC (to be published by ISC later in 2023)
- provide guidance to recycled water sector to value-add adequately treated recycled water containing human effluent
- are available to underpin revised CB post-mortem inspection upon activation of AS4696:2023 planned for 1 July 2023 (for markets that have accepted equivalence of CB post-mortem inspection)
- and when fully adopted these revisions have the potential to increase profits for the Australian red meat processing industry by $30 million per year.

While verification arrangements have been approved, it is now up to ISC to further coordinate training of auditors and conduct extension of the revised risk management arrangements with supply chain stakeholders.

The opportunity for increased use of adequately treated recycled water for pasture production is facilitated through publication of effective standards for such release by Waste-Water Treatment Plants, supported by documented supply agreements and national on-farm auditing arrangements.

# 8 Bibliography

Anon (2023). *Hygienic Production and Transportation of Meat and Meat Products for Human Consumption*. Australian Food Regulation Standing Committee Technical Report Series 3. AS 4696:2023. Standards Australia.

Comprehensive citations are provided throughout Appendix 1.

# 9 Acknowledgements

The author wishes to particularly thank Dr Daryl Stevens for expert technical contributions, Dr David Cusack for leading official consultations and Elizabeth Bradley for translation of revised risk management into official industry programs. Finally, the strategic guidance and peak stakeholder coordination provided by Dr Ann McDonald (AMPC) was critical in delivering these risk-based reform outcomes.

# 10 Appendices

## Appendix 1. Revised risk management framework to mitigate Cysticercus *bovis* infected meat entering the human food chain

Cysticercus *bovis* cysts in beef muscle

A. Pointon and D. Stevens

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Contents

## Abbreviations

| | |
|---|---|
| AGWR | Australian Guideline for Water Recycling |
| AMPC | Australian Meat Processing Corporation |
| AMRG | Australian Meat Regulators Group |
| AQIS | Australian Quarantine and Inspection Services |
| CB | Cysticercus *bovis* or C. *bovis* |
| CCA | Cattle Council Australia |
| CFIA | Canadian Food Inspection Authority |
| CVO | Chief Veterinary Officer |
| DAFF | Department of Agriculture, Fisheries and Forestry |
| DAWE | Department of Agriculture, Water and Environment |
| DPI | Department of Primary Industries |
| DPIR | Department of Department and Primary Industry and Resources |
| EPA | Environmental Protection Authority |
| HACCP | Hazard Analysis and Critical Control Point |
| HE | Helminth Egg |
| HRT | Hydraulic Retention Time |
| ISC | Integrity Standards Company |
| LGA | Local Government Area |
| LRV | Log Reduction Value of helminth eggs or other pathogens considered. |
| LT | Life-time traceable |
| MLA | Meat & Livestock Australia |
| NLIS | National Livestock Identification System |
| PCR | Polymerase Chain Reaction |
| PIC | Property Identification Code |
| PIRSA | Department of Primary Industries and Regions, South Australia |
| PMI | Post-mortem inspection |
| RMR | Risk management rating |
| WWTP | Wastewater Treatment Plant |

## Definitions

Recycled water is water recycled from wastewater that contains human faeces.

# Purpose

This discussion paper provides a risk management framework (the framework) to support minimum post-mortem inspection for Cysticercus *bovis* (CB) in cattle and buffalo in the pending Australian Standard (AS4696:2023) that will consider grazing history.

The framework also indicates that “cattle grazing pastures irrigated with adequately treated recycled water” are equivalent to “cattle never exposed to high-risk land”. Where recycled water refers to any water sourced from sewage effluent containing human faeces.

The aim is to ensure a harmonised risk management framework is in place to support key export market acceptance of Equivalence Submissions.

# Background

## Key projects, standards, and publications

The background to this project is supported by several key projects, renewed standards and publications:

5. Meat & Livestock Australia (MLA) has funded and managed a risk-based review of AS4696:2007 Australian Standard for the Production and Transportation of Meat and Meat Products for Human Consumption (Pointon *et al*., 2018).

6. Within that review, a food safety Quantitative Risk Assessment for CB found negligible risk from Australian beef for consumers in domestic and export markets (Kiermeier *et al*., 2019).

7. On that evidence, the Australian Meat Regulators Group (AMRG) approved minimum risk-based inspection for CB (comprised of routine incision of the heart but not masseters), the heart being the most commonly affected site. Full carcase inspection will be reserved for cattle with a National Livestock Identification System (NLIS) device indicating at-risk status, including incision of masseters and inspection of other sites (Schedule 2: Table 4).

8. The minimum inspection procedures for CB have been implemented domestically from 1 March 2020 via AMRG Guideline AS4696:2020.1 (AMRG, 2020), which is to be read in conjunction with AS4696:2007.

9. A process is underway for AS4696:2007 Guideline:2020.1 to be officially declared as AS4696:2023 (the standard) containing minimum inspection for CB.

10. Risk management of CB has also been supported by the implementation of the Australian Guideline Water Recycling (2006), along with knowledge from recent scientific publications (Stevens *et al*., 2017, 2021a, 2021b). This provides additional treatments and on-site control options for minimising the risk of CB in cattle grazing land irrigated with adequately treated recycled water.

11. Since 1 July 2021, AMPC has undertaken activities bringing together opportunities presented by these developments as follows:

a. AMPC Project 2022 – 1082 focuses on current controls for preventing cattle exposure to *Taenia saginata* eggs when recycled water is used in the associated farming operation, preventing CB in cattle.

b. AMPC Project 2021 – 1186 analyses the mitigating effect of implementing the Australian Guidelines for Water Recycling from 2006 (AGWR) on the annual incidence CB rates of total carcase condemnation from 2001 – 2018 (Appendix 8.1).

c. AMPC Project 2022 – 1178 draws this technical data together, providing evidence for Equivalence Submissions to key export markets. This includes a survey of jurisdictions via SAFEMEAT regarding present animal health policies and protocols, underpinning legislation, and engagement with the WWTP licensing and auditing bodies (Appendix 8.2).

The technical outcome sought will be a verifiable risk management system that integrates CB meat safety programs across the supply chain, including PMI.

This overall approach is consistent with the general principles of meat hygiene in the Codex Alimentarius Code of Hygienic Practice for Meat (2005). Clause (iv) of Part 4 of the code states: “Meat hygiene requirements should control hazards to the greatest extent practicable throughout the entire food chain. The information available from primary production should be considered to tailor meat hygiene requirements to the spectrum and prevalence of hazards in the animal population from which the meat is sourced”.

## Consumer risk from CB from Australian beef

The risk that CB infected meat will enter the human food chain is managed under the pending Australian standard (AS4696:2023) by:

- Prohibiting or controlling the admission of animals grazed on areas treated with sewerage (sic) to an abattoir [Clause 6.7 (e)], and
- Post-mortem inspection [Section 10] to detect CB with the appropriate disposition of infected animals or animal parts.

The risk to domestic and overseas consumers of Australian beef has been assessed by Kiermeier *et al*., (2019). The Quantitative Risk Assessment estimated:

- That the risk of human *T. saginata* infection from consumption of Australian beef is very low.
- A median of 0.4 and 0.3 cases per 1 billion, portions consumed in the domestic and top 5 export markets (USA, Japan, Korea, China, and Canada), or equivalently 0.6 and 1.0 illnesses per year, respectively.
- Moving to reduced PMI, which only includes incisions of the heart, was estimated to result in a negligible increase in risk, equivalent to one additional infection every 12.5 and 33.3 years in the domestic and all export markets, respectively.
- Further reduction in PMI requirements, i.e., visual only PMI, was estimated to result in a small increase in risk to 0.7 and 1.1 illness per year - a median increase of about one additional case in domestic and export markets each per seven years.

Further exposure likelihood data supporting this negligible risk includes:

- These very low observed levels of <1/500,000 CB cattle (Pearse *et al*., 2010).
- The incidence rate of total carcase condemnation (2014 – 2018) following the implementation of the AGWR (2006) is reported as very low for Cow/Bull and negligible for Heifer/Steer (Appendix 8.1).
- Recent studies have indicated that the *T. saginata* eggs are not detectable in raw sewage in southern Australia (Stevens *et al*., 2021a).
- Subsequent information from the Australian public health sector has demonstrated that reducing *T. saginata* egg concentration by a Log Reduction Value (LRV) of 4.0 by WWTPs or equivalent ensures adequate protection for cattle. That is, where the cattle are exposed to recycled water in their drinking water and grazing pastures irrigated with recycled water.
- Lack of confirmed CB incidents reported by the jurisdictions over the past 5 years (Appendix 8.2).

## Data gaps

Limitations to the management of CB identified currently are:

1. A national list of individual recycled water scheme operations that currently achieve adequate Log Reduction Value (LRV) for helminth eggs in wastewater released for pasture irrigation and fodder production.
2. Consistent auditing procedures to confirm appropriate control measures (4.0 LRV or the equivalent) are in place to manage *T. saginata* in recycled water exposed to cattle (i.e., low risk land).
3. Sufficient information available to determine if cattle have been exposed to high-risk land.
4. The cost and implication for supply cattle to the abattoir from high-risk land need to be considered somewhere.

## Innovations

Innovation that should be recognised are:

1. Improvements to managing CB risk by integrating the wastewater treatment, exposure, and PMI to increase efficiencies and availability of water to the cattle industry.

The recommended table for proposed requirements (B. Table 5-1) allows the acceptance of cattle for slaughter that have been expose to raw sewage, and uses extensive carcase PMI for stock released under CVO permit (Schedule 2: Table 4) as the single control point that may result in total carcase condemnation or subject to further controls such as freezing (draft DAFF Decision Notes).

For Australia, were there are low *T. saginata* eggs (<1 HE/L) concentrations in sewage, the required 4.0 LRV can be achieved solely from a WWTP, or a combination of WWTP and exposure controls (Table 2-1). This is of significant benefit to the wastewater treatment industry as achieving a LRV of 3.0 (protection of human health, Table 2-1) can provide a significant cost saving.

An LRV of 3.0 from the WWTP and LRV of 1.0 from on-site exposure controls, with verification from PMI for export and domestic quality of meat should be considered low risk also. The AS4696:2023

indicates that any CB cyst detection in a carcase would restrict the carcase for export and allow qualified use for the domestic market (draft DAFF Decision Notes).

**Table 2-1 Log reduction value required and option to achieve them.**

| Protection of | LRV required | LRV options | | LRV achieved | Verification PMI | Reference |
|---|---|---|---|---|---|---|
| | | WWTP LRV | Exposure limitations on-site * | | | |
| **Export quality of meat** | 4.0 | 3.0 | 1.0 | 4.0 | Yes | This document (Stevens *et al*., 2021a) |
| | | 4.0 | Not required | 4.0 | Yes | |
| **Human health** | 3.0 | 3.0 | Not required | 3.0 | Yes | (Stevens *et al*., 2017) |

* No stock access to drinking of recycled water and sewage *T. saginata* egg concentration <1 HE/L, or equivalent on-site exposure limitation strategies accepted by the Chief Veterinary Officer (e.g. proposed by Stevens *et al*., (2021a)).

# Approved minimum CB post-mortem inspection

The minimum post-mortem inspection techniques in Schedule 2 for CB approved by the Australian Meat Regulators Group (AMRG) and proposed for AS4696:2023 are detailed in Table 3-1.

**Table 3-2 Current and pending post-mortem inspection techniques for Schedule 2 AS4696:2007 (Anon 2007; Guideline 2020.1) for CB in Cattle and Buffalo**

| AS4696:2007 | AS4696:2023 pending |
|---|---|
| Hearts - Palpate. Incise internal musculature three or four times in cattle and buffalo. | Hearts – Palpate. Incise internal musculature three to four times in cattle and buffalo. See note #5.<br>Refer to Table 2, Note #5 Palpate and incise musculature three to four times in cattle and buffalo, unless the animal has grazed properties where exposure to Cysticercus *bovis* (beef measles) may have occurred, whereby procedures in Table 4 should apply. |
| Masticatory muscles (internal and external) – incise. | Masticatory muscles (internal and external) Observe. See note #3.<br>Refer to Table 3 Note #3: If cattle or buffalo have grazed where exposure to Cysticercus *bovis* (beef measles) may have occurred, procedures in Table 4 of this Schedule for CB apply; otherwise, observe. |

Notwithstanding the negligible risk status of CB, all carcases will be subject to mandatory incision of the heart muscle as a continual risk monitoring step.

No amendments are proposed to Schedule 2 Table 4 through the revision of AS 4696. Consequently, this continues to act as a safeguard on suspect carcases. For example, cattle or buffalo exposed to CB infection would automatically be subject to invasive post-mortem inspection for CB (Table 4 of Schedule 2), as would a carcase where a cyst is suspected following a mandatory incision of the heart muscle. All suspect areas are trimmed and condemned, and if the carcase has a general infection, the whole carcase is condemned.

# Current risk management system

A survey was undertaken to identify any additional criteria for a risk management framework to establish the current risk management arrangements in place for CB across all jurisdictions (Appendix 8.2). Key findings relevant to the development of the framework include:

- The appropriate legislative framework for risk management of CB is in place nationally, as is the traceability framework via NLIS. While the legislative framework is in place, a market

access review would currently result in considerably different findings across the jurisdictions concerning processes to manage the use of recycled water.

- The current traceability arrangements provide the baseline to add additional assistance to facilitate minimum CB inspection under AS4696:2023, e.g. Early Warning notification for the incoming stock for processing to facilitate workforce scheduling has been suggested at a Steering Group meeting. This is a sensible addition. However, based on these data, it may not get much use.

- The respondents did not suggest the need to add a PIC Status for CB in NLIS for any CB risk management scenario encountered.

- While the time loss of viability of *T. saginata* eggs on pasture is commonly recognised as 2 years, there is provision for the period of site (PIC) quarantine to be much shorter, based on risk assessment of the site, including current weather conditions and possible mitigations.

    - The logic for the two years is most likely based on the recognised survival periods of *T. saginata* eggs in the soil. The best estimate is that 99% of eggs degrade in 180 (90, 360) days (Stevens *et al*., 2021a), and 720 days would provide a conservative approach.

- The time for cysts not to present a risk is not universally agreed upon. This has implications for the draft risk management framework report concerning cattle that have lost life-time traceable status in the NLIS.

- Apart from this latter uncertainty, the survey did not indicate any risk management issues associated with the adoption of minimum post-mortem inspection for CB as proposed for AS4696:2023.

- The survey identified all the components for a nationally harmonised approach for risk management of CB across the recycled water, livestock production and processing sectors. However, their integrated implementation varies between jurisdictions (e.g., some jurisdictions appear to have no engagement with recycled water authorities).

- Reporting on the use of recycled water for pasture production to animal health authorities appears limited. However, in one jurisdiction, the CVO is involved in approving and maintaining a documentation record.

- In addition, better reporting is especially relevant for the potential release of inadequately treated water into streams, in which the actual risk will be uncertain. Nonetheless, the jurisdictions did not report CB incidences attributable to exposures via streams. Such reporting may be part of a new framework as a contingency.

- Current arrangements in some jurisdictions recognise recycled water with an LRV $\geq$4.0 for *T. saginata* eggs to be classified as very low risk for irrigated pasture. In this case, cattle fed on this pasture do not require NLIS CB device-based status activation (i.e., not suspect). This provides a precedent for the framework whereby “cattle grazing pastures irrigated with adequately treated effluent” are recognised as equivalent to “cattle never exposed to high-risk land”.

- The infrequent CB incidence over the past 5 years reported by the jurisdictions, the very low total carcase condemnation rate (AMPC Project 2021 – 1186) and the negligible public health

risk (Keirmeier *et al*., 2019) provide consistent evidence of no adverse effect on risk arising from conducting routine minimum post-mortem inspection (pending AS4696:2023) "for cattle never exposed to high-risk land".

- However, limited awareness by animal health authorities of the Australian Guideline Recycled Water (2006) and associated documented water recycling guidelines at the jurisdictional level leaves open the opportunity to increase safe utilisation of this resource, delivering production and sustainability outcomes.
- Guidelines for Environmental Management of Biosolids - Land Application were provided by some jurisdictions.

Recommendations for Steering Group consideration

- Consider a supplementary survey of WWTP licensing, auditing, and reporting (WWTPs releasing water for pasture irrigation and associated PICs, effluent spillages) at the jurisdictional level.
- Preparing a fact sheet (extension program) for LRV ≥4.0 for very low-risk land warrants consideration – the targets for this are both the animal health jurisdictions as well as the recycled water sector (licensing and auditing jurisdictions at several levels, and WWTP entities nationally).
- Provide relevant information to DAFF to support Equivalence Proposals to key export markets e.g., supporting legislation links.
- Utilise these findings in preparing the risk management framework for alternative CB post-mortem inspection that encompasses utilisation of adequately treated recycled water for fodder production.
- Foster reporting systems between state agencies for WWTPs releasing treated water for irrigation of pasture, releasing untreated water into streams……

# Proposed risk management system to support minimum CB inspection

In anticipation of the pending AS4696:2023 (based on Guideline AS4696:2020.1), AMPC is **proposing a revised risk management framework** to underpin the minimum inspection procedures based on grazing history (AMPC Project 2022 – 1178). This approach uses the NLIS to identify cattle that have grazed on land potentially contaminated with *T. saginata* eggs (high risk land).

The framework also recognises cattle grazed on pastures irrigated with adequately treated recycled water as equivalent to cattle never exposed to high-risk land.

As detailed in Section 5:

- Cattle known to have been exposed to high-risk land at any time during their life will be subjected to the additional procedures for suspected CB prescribed in the Australian standard as above. These are the current arrangements as prescribed in pending AS4696:2023.

- Cattle not exposed to risk land will be eligible for a minimal risk inspection procedure.

- Because, irrespective of the risk category, the heart is the most reliable site to find CB (Kiermeier *et al*., 2019), all cattle will continue to have hearts incised and examined under this proposal. Under the minimal risk procedure, low risk cattle would not require the routine incision of their masticatory muscles.

- All suspect CB lesions will be submitted to the laboratory, where positive, the animal will be traced, and an epidemiological investigation will be undertaken to determine the infection's source (Appendix 8.2).

- Appropriate action will be taken to manage any CB risk from animals and land (Appendix 8.2).

This approach is consistent with the general principles of meat hygiene in the Codex Alimentarius Code of Hygienic Practice for Meat. Clause (iv) of Part 4 of the code states: 'Meat hygiene requirements should control hazards to the greatest extent practicable throughout the entire food chain. The information available from primary production should be considered to tailor meat hygiene requirements to the spectrum and prevalence of hazards in the animal population from which the meat is sourced.'

The proposed change is intended to deliver better food safety outcomes by:

- basing the level of inspection on exposure to risk factors, and

- reducing the potential for product cross-contamination from low-risk animals by minimising tissue manipulation (reviewed by Pointon *et al.*, 2018).

In addition to the publication of AS4696:2023, some of Australia's overseas beef markets (particularly the United States) will need to undergo an equivalence process to recognise that the changed procedure is equivalent to their domestic inspection requirements for the product to be eligible for import.

Ultimately, the proposal must be acceptable to export markets, whereby elements of the program may need to be modified to address concerns importing countries may raise during the equivalence determination process.

## The rationale behind the proposed CB post-mortem inspection model

The post-mortem inspection procedures of pending Australian Standard AS4696:2023 (based on Guideline AS4696:2020.1), will consider whether or not individual animals have been exposed to known on-farm risk factors.

1. Cattle exposed to 'risk land' at any time in their life:

   Cattle in this category are those in the population most likely to have viable and/or degenerated (non-infective) CB lesions. The former lesion is a food safety concern, while the latter is a wholesomeness or suitability issue. Early CB infection is characterised as large fluid-filled cysts that are more obvious.

As neither lesion is appropriate in product for human consumption, animals in this group will undergo additional inspection procedures. This includes incision and inspection of masseters and both the tongue and the diaphragm (after removal of the serous membranes) - in accordance with the Australian standard (Table 5-1).

Complete resorption of degenerated cysts may take 3 years, or longer and viable cysts may persist for at least 2 to 3 years, possibly for the host's life (Appendix 8.3). Therefore, it is important to confirm cysticercosis even in cases where suspect lesions are obviously degenerated and non-infective.

2. Cattle with lost Life-time traceability

Two lost life-time traceability scenarios were considered.

2.1 Cattle with lost life-time traceability potentially exposed to high-risk land in the last 2 years:

Under pending AS4696:2023, Schedule 2, Table 3 Note #3 (Section 4): If cattle or buffalo have grazed where exposure to Cysticercus *bovis* (beef measles) may have occurred, procedures in Table 4 of this Schedule for CB apply, otherwise observe.

This provides a safeguard by not applying minimal post-mortem inspection to this cohort with uncertain CB status.

This recommendation is consistent with feedback from jurisdictions whereby Device Based Status is assigned for the animal's life-time (Appendix 8.2).

2.2 Cattle with lost life-time traceability not exposed to high-risk land for greater than 2 years:

Degenerated (non-infective) cysts do not present a food safety hazard and are easier to detect than viable cysts. Cysts are estimated to remain viable in cattle for between 1 and 3 years. On this basis, the time from last exposure to high-risk land until it is likely that cysts have lost viability is taken to be 2 years (Appendix 8.3).

However, when the Steering Group reviewed results of the survey of CB risk management by jurisdictions (i.e., whereby Device Based Status is consistently assigned for the animal's lifetime: Appendix 8.2) and agreed that animals of uncertain CB exposure status should be classified as "suspect" and subject to procedures in the Australian Standard Schedule 2, Table 4.

| Cattle with lost lifetime traceability<br><br>If cattle have lost life-time traceability they must be regarded as suspect. This applies to both scenarios described. |
|---|

3. Cattle that have never been exposed to risk land at any time in their life:

Animals with life-time traceable status in NLIS and which have never grazed known risk land have a very low likelihood of infection and, therefore, minimal CB inspection procedure is applied (Table 5-1). This includes cattle that have grazed land irrigated with adequately treated recycled water. Under evidence presented in AMPC Project 2022 – 1082, when cattle graze land where recycled water is used for irrigating pastures achieves a helminth egg LRV of ≥4.0, this provides equivalence for these cattle with "Cattle never exposed to high-risk land" (Table 5-1: Inspection Scenario 4).

Equivalence of cattle grazing pastures where adequately treated recycled water used

When cattle graze land where recycled water is used for irrigating pastures achieves a helminth egg LRV of >=4.0, this provides equivalence for these cattle with "Cattle never exposed to high-risk land" which are subject only to minimum CB inspection i.e., NO Status allocated.

Post-mortem inspection options related to these exposure scenarios are presented in Table 5-1.

**Table 5.1 – Draft risk management framework for C. *bovis***

| AS4696 arrangements under 2007 and pending 2022 | Site inspected and type of inspection | | | | | |
|---|---|---|---|---|---|---|
| | Palpate and incise internal musculature of the heart (Table 2) | Incise internal and external masticatory muscles (Table 3) | Observe the exposed musculature of the carcase (Table 1) | Palpate the tongue (Table 3) | Incise the tongue (Table 4) | Incise the diaphragm after removal of serous membranes (Table 4) |
| **A:** Current requirements (AS4696:2007) | | | | | | |
| 1. Routine inspection § | Yes | Yes | Yes | Yes | | |
| 2. CB is suspected or detected. | Yes | Yes | Yes | Yes | Yes | Yes |
| **B.** Recommended table for **pr**oposed requirements § | | | | | | |
| 1. Cattle exposed to high-risk land ¥ | Yes | Yes | Yes | Yes | Yes | Yes |
| 2. Cattle with lost life-time traceability | Yes | Yes | Yes | Yes | Yes | Yes |
| 3. Cattle never exposed to high-risk land | Yes | Observe | Yes | Yes | | |

§ If CB lesions are detected in any organ or tissue, all sites will be inspected (Schedule 2, Table 4) - Incise masseter and heart muscles, tongue, and diaphragm after removal of serous membranes and observe all exposed muscle surfaces.

¥ High risk land = Where cattle are exposed to sewage or inadequately treated recycled water (from sewage containing human faeces) that does not achieve a low risk helminth egg log removal value (LRV), currently defined in the Australian Guideline for Water Recycling (AGWR) as an LRV of ≥4.0, or equivalent risk management approved by the relevant Chief Veterinary Officer (e.g. no access to recycled water for livestock to drink and < 1.0 *T. saginata* HE/L monitored monthly in source water). Examples of high-risk land are septic tank drainage areas and pasture irrigated with recycled water from a sewage treatment plant that does not achieve an LRV of 4.0 for helminth eggs without any other control measures considered.
If the recycled water achieves a helminth egg LRV of ≥4.0, this is equivalent to "Cattle never exposed to high-risk land."

## NLIS considerations

All parcels of land (holdings) grazed by cattle are allocated a unique Property Identification Code (PIC). PICs are also allocated to abattoirs and sale yards. All cattle moving off a holding must be identified by an NLIS device. Each NLIS device has a unique identification number, and cattle movements between PICs must be entered in (and recorded in) the NLIS database.

The NLIS database can record various statuses against PICs and individual NLIS devices. These statuses allow animals of interest to be flagged when they move to make it easy to identify them if some form of status-based intervention is required. Provision already exists in the database for a CB Device-base status, allowing risk animals to be easily identified at an abattoir.

Life-time traceable (LT) is another status that is automatically set by the NLIS database when the following criteria are met:

1. the NLIS device is a white breeder device, and
2. there are no apparent gaps in the history of transactions or movements of that animal.

Jurisdictions reported that device-based status is retained for the lifetime and is registered on state databases when they move between states (Appendix 8.2). This should apply to at-risk animals which have left a property before a problem was identified or where a particular group of individuals have been exposed to a source of infection.

It was also reported that when there is uncertainty regarding exposed stock in a PIC risk assessment following a detection, that Device-base status is allocated to all stock on the PIC.

No jurisdiction voluntarily raised the need to establish a CB PIC status category in NLIS (Appendix 8.2).

Jurisdictions did not voluntarily raise the need for PIC-based status for management of CB

Issues referred to Steering Group for consideration

- With SAFEMEAT approval, the NLIS database can be modified to apply CB status as proposed above, including being able to identify animals which have lost LT status within the last two years and are therefore ineligible for minimal risk inspection.
- It has also been proposed at the Steering Committee that a warning status may be utilised (i.e., attached to the Device-based Based status) so that there is a warning that inspection of these cattle may need to be changed.

## Identification of high-risk land

Risk land is land identified as having a significant likelihood of being contaminated with *T. saginata* eggs and which has the potential to be grazed by cattle. Land irrigated with effluent derived from sewage is considered to present the greatest risk to cattle.

Definition: High risk land = Where cattle are exposed to sewage or inadequately treated recycled water (from sewage containing human faeces) that does not achieve a helminth egg log removal value (LRV) ≥ 4.0, as defined in the AGWR, or equivalent risk management approved by the CVO. Examples of high-risk land are septic tank drainage areas and pasture irrigated with recycled water from a sewage treatment plant that does not achieve an LRV of 4.0 for helminth eggs (AMPC Project 2022-1082).

Historically, the most significant source of CB infection in Australia has been the grazing of cattle on land irrigated with water derived from sewage treatment works. The risk that effluent contains viable *T. saginata* eggs depends on the degree to which sewage is treated before its discharge. Effluent from the tertiary treatment of sewage or secondary treatment with disinfection is safe for use on land grazed by cattle.

Nearly every major township has its own effluent treatment plant. All of these are registered or licensed by state or local government instrumentalities. These authorities can provide information on the degree to which effluent is treated and whether it is discharged onto land which may be grazed by cattle, thereby enabling the identification of high-risk land.

One jurisdiction reported collaborating with licensing and auditing agencies to maintain a list of WWTPs that release water for pasture irrigation (Appendix 8.2). The CVO is consulted in the WWTP approval and licensing and maintains a record of approved WWTPs. Stock from the associated PICs is reported as not requiring device-based statuses (further confirmation from NLIS records sought with the jurisdiction).

The situation regarding approval for WWTPs to release recycled water for pasture irrigation remains uncertain in most jurisdiction. It is recommended these arrangements be included in a supplementary survey of WWTP auditing agencies to obtain further information.

An option suggested would be to conduct an extension program across the WWTP sector providing information on their obligations when releasing recycled water for pasture production.

It is likely that risk land will also be identified by tracing animals with CB lesions at slaughter back to their property(s) of origin. In addition to identifying risk land, the investigation to determine the source of the infection may also identify additional animals which need to be flagged in NLIS as having a risk of CB infection.

Other potential sources of infection include leaking septic tanks; sporadic human defecation; spreading of inadequately decontaminated sewage sludge; supplementary feed contaminated with *T. saginata* eggs; and proximity to sewage treatment plants, where it is suspected that birds have transferred viable eggs. In some outbreaks, a source has not been identified (McFadden *et al*., 2011). These risks appear to be variably managed in the various jurisdictions through extension material from the animal health agencies (Appendix 8.2). It is proposed that:

- general advisory material identifies these sources as potential CB risks, and
- affected land is only considered as risk land where it is related to a CB detection.

***Note:*** There needs to be a mechanism linked to the processes for identifying high risk land that establishes that the land (and animals on it) no longer presents a risk. Technical guidance is provided in Section 4, and current practices are in Appendix 8.2.

Mitigations currently practiced for “resolution: of high-risk land by some jurisdictions needs to be extended nationally.

## The Australian Standard for the Hygienic Production and Transportation of Meat and Meat Products for Human Consumption

The Australian standard is being amended to provide for “minimal risk inspection for *C. bovis*” (Section 1).

A process is underway to make this change. Minimal risk inspection for CB will mean that internal and external masticatory muscles do not need to be routinely incised in cattle, where it can be demonstrated that they are not known to have been exposed to risk land (Table 2: AS4696:2023 pending).

## Suspected CB lesions detected in an abattoir

Lesions suspected of being caused by CB will be submitted to a laboratory. Positive CB detection will be based on histopathology, or where histopathology is equivocal, by detecting CB DNA through Polymerase Chain Reaction (PCR) testing.

Current knowledge includes:

- The PCR test to be used in the program will need to be approved by the Sub-Committee on Animal Health Laboratory Standards.

- In 2008, a survey of 495,000 cattle undertaken to determine the prevalence of CB in Australia found only 23 animals (0.005%) with suspicious lesions (Pearse *et al*., 2010). Laboratory testing identified five as degenerated hydatid cysts, five were neoplasia, two were Actinomycosis/bacillosis with one "other". The remaining ten did not have sufficient DNA for CB testing to investigate. The interpretation is that these were degenerated and may have been viable CB cysts at one point but are not a biological hazard even if they were confirmed by PCR. Their detection is more reflective of the incidence of degenerated (non-viable) cysts.

- The residual incidence rate (Appendix 8.1) of observed CB in recent years (i.e., unconfirmed total carcase condemnation) is of the order of the rate attributed to different causes of similar lesions as reported by Pearse *et al*. (2010).

Considering these data, the very low incidence rate (Appendix 8.1), especially in Cow/Bull, may be due to hydatids and tumours.

> Is histopathology indicative of CB sufficient to confirm a diagnosis leading to risk management at the PIC level and activation of Device-based statuses?

## CB as a notifiable disease

CB is a notifiable disease in all jurisdictions (Appendix .8.2), and legislation allows water suppliers to manage the CB risk associated with grazing cattle on land irrigated with adequately treated effluent (recycled water) derived from human sewage.

These arrangements:

- assure overseas markets that the program is underpinned by disease control legislation at the state level,

- allay any concern that CB infections would remain unreported in the unlikely event that lesions are detected in a field investigation rather than at an abattoir,

- reinforce that company-employed meat inspectors are required to report suspected lesions,

- provide a legal basis for state authorities to allocate statuses to land within their jurisdiction,

- overcome issues associated with the disclosure of information by state authorities that may otherwise be confidential, and

- provide state authorities with authority to investigate where an owner may otherwise be uncooperative.

## Resource implications for States and territories

Under this proposal, States and Territories are being requested to:

- Identify risk land and allocate CB statuses within NLIS. In the first instance, this will require contacting the authorities responsible for licensing sewage treatment plants. Note that a process will

also be needed to ensure any amendments to this information are captured. – conducted variably (Appendix 8.2)

- Undertake trace-back and investigate positive CB detections arising from both domestic and export abattoirs and assess and appropriately manage any risk associated with either land and/or cattle – conducted routinely (Appendix 8.2)
- Provide advisory information of a general nature to cattle producers explaining the program and of a specific nature to the small number of directly affected producers – conducted variably (Appendix 8.2)
- Report annually on the implementation of the program - unknown
- Subject to agreement, undertake laboratory testing of lesions submitted from abattoirs – commonly conducted (Appendix 8.2)

Based on the very low incidence of CB detected at abattoirs (Pearse *et al*., 2010: Appendix 8.1; AMPC Project 2021 – 1186 – consultation report), it is likely that activities at the jurisdictional level will only be occasional.

DAFF does have records of whole or partial carcase condemnations at domestic abattoirs (Appendix 8.1), and suspect cases are notified to state jurisdictions (Appendix 8.2). It is uncertain if state authorities have access to this information within their jurisdiction. There is no apparent reason why there would be a significant difference in the number of CB detections at export and domestic establishments.

However, from a market access perspective, having these arrangements in place and documented at the jurisdictional level is an important component of a verifiable risk management framework across the beef supply chain.

## Recommendations - Pre-requisites for equivalence submission

- Risk management framework developed – Steering Group to consider
- Consultation with DAFF (AHC) and industry (CCA, SAFEMEAT)
- Technical gaps – effluent plant performance and use plan – define in a supplementary survey of the WWTP sector
    - Potentially for later step, perhaps in verification
    - Consult with WWTP sector and associated agencies
- ISC to implement additional status - CB PIC status and a CB PIC Warning Status (A CB Device Based Status is currently available on the NLIS Terms of Use Table 14.9).
    - AHC and SAFEMEAT to be consulted

## References key to the risk management system proposed

Anon (2007). Hygienic Production and Transportation of Meat and Meat Products for Human Consumption. Australian Food Regulation Standing Committee Technical Report Series 3. AS 4696:2007. Standards Australia.

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Pointon, A.M., Hamilton, D.H. and Kiermeier, A.K. (2018). Assessment of the post-mortem inspection of beef, sheep, goats, and pigs in Australia: Approach and qualitative risk-based results. Food Control, 90,222-232. https://doi.org/10.1016/j.foodcont.2018.02.037

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# Recommendations to Steering Group and results of considerations

The following issues and recommendation were considered by the Steering Group on 10th August. Actions arising where taken are included.

1) Harmonise current risk management effort:

    a) Mitigations currently practised for “resolution: of high-risk land by some jurisdictions need to be extended nationally.

    **Action**: To be confirmed (TBC)

    b) Share risk management practices and extension material between jurisdictions.

    **Action**: To be confirmed (TBC)

    c) Preparing a Fact Sheet (extension program) for LRV ≥4 as very low risk land warrants consideration – the targets for this are both the animal health jurisdictions as well as the recycled water sector (licensing and auditing jurisdictions at several levels, and WWTP entities nationally).

    **Action**: Follows acceptance by AHC of recycled water LRV ≥4 irrigated land as equivalent to never exposed to risk land.

    d) Utilise these findings in preparing the risk management framework for minimum CB post-mortem inspection that encompasses the utilisation of adequately treated recycled water for fodder production.

    **Action**: Prepare submissions to AHC and SAFEMEAT including key criteria identified in this section

    e) Foster reporting systems between state agencies for WWTPs releasing treated water for pasture irrigation, releasing untreated water into streams.

    **Action**: Follows acceptance by AHC of recycled water LRV ≥4 irrigated land as equivalent to never exposed to risk land.

2) DAFF:

    a) Change wording from “minimum CB inspection” to “equivalent CB inspection” to reflect the same risk, rather than allow for misrepresentation i.e., higher risk at lower cost as the outcome.

    **Action**: To be confirmed (TBC)

    b) Provide relevant information to DAFF to support Equivalence Proposals to key export markets, e.g., agreed (pending) Risk Management Framework, supporting legislation links.

    **Action**: Links in Appendix 8.2 provided to DAFF in this Milestone 2 Report. Further versions to be provided as developed and approved b Steering Group.

3) Traceability of risk cattle

    Several categories of risk cattle were identified and include:

a) Cattle exposed to high-risk land

b) Cattle with lost life-time traceability potentially exposed to high-risk land in the last 2 years

c) Cattle with lost life-time traceability not exposed to high-risk land for greater than 2 years

While the jurisdictions did not identify the need for a CB PIC status and a CB PIC Warning Status, industry members noted the need for this addition to cater for stock that may have lost Device Based Status ("removed" and replaced by "White Breeder Device") when sold and moved.

**Action**: Develop a CB PIC status and a CB PIC Warning Status (A CB Device Based Status is currently available on the NLIS Terms of Use Table 14.9).

Whilst it would be safer to have a CB PIC status, regardless of whether a PIC status is created or not, with a CB PIC Warning Status if animals with a CB status are moved to a clean PIC it would have a warning flag – "CBW" applied automatically by the NLIS database. It is then up to the establishment to check with the vendor to ascertain whether any animals with a CB status are in the consignment.

4) Cattle with lost life-time traceability not exposed to high-risk land for greater than 2 years:

a) While jurisdictions retain Device Based Status indefinitely, reflecting a precautionary approach to the persistence of cyst viability, one jurisdiction reported a "Two years minimum period after the last date of exposure" (Appendix 8.2).

**Action**: Addition by ISC of a CB PIC status and a CB PIC Warning Status as above #3) would include cattle of this uncertain risk status. The option of deleting this status after 2 years of safe grazing would prevent active cysts, it may not prevent persistence and detection of degenerated cysts, thereby presenting a recall situation. Consequently, it may be decided that full inspection (cutting masseters and Schedule 2, Table 4 procedures apply to this risk group.

That being the case, this matter would not be refereed to AHC for decision, just TO NOTE.

5) Equivalence of cattle grazing pastures where adequately treated recycled water is used:

a) When cattle graze land where recycled water is used for irrigating pastures achieve a helminth egg LRV of ≥4.0, this provides equivalence for these cattle with "Cattle never exposed to high-risk land", which are subject only to minimum CB inspection, i.e., NO Device-base status allocated.

**Action**: Refer matter to AHC for acceptance.

6) ISC:

**Actions**: As noted in previous points above

7) WWTP sector:

a) The situation regarding approval for WWTPs to release recycled water for pasture irrigation remains uncertain in most jurisdictions.

b) Consider a supplementary survey of WWTP licensing, auditing, and reporting (WWTPs releasing water for pasture irrigation and associated PICs, effluent spillages) at the jurisdictional level.

c) An option suggested would be to conduct an extension program across the WWTP sector providing information on their obligations when releasing recycled water for pasture production.

**Action**: Defer decisions until AHC and SAFEMEAT responses provided. May be a part of the verification trial. Opportunity to link with release of AGWR (AMPC Project 2022- 1082). Opens the involvement of animal health jurisdictions in approval of assured safe use of recycled water for pasture production (Appendix 8.2, Table 1)

8) Diagnosis:

a) Is histopathology indicative of CB sufficient to confirm a diagnosis leading to risk management at the PIC level and activation of device-based statuses?

**Action**: Not discussed. Protocol uncertain (Appendix 8.2); histopathology with PCR testing for confirmation of uncertain cases. To be supported in submission to AHC.

9) Pre-requisites for equivalence submission:

**Actions**

a) Risk management framework – DAFF advised and consulted via Steering Group membership

b) Consultation with AHC, CCA, SAFEMEAT, AMRG – on issues identified above as appropriate

c) Technical gaps – effluent plant performance and use plan – define in a supplementary survey of the WWTP sector – pending Advice from AHC

d) Implement CB PIC status and a CB PIC Warning Status by ISC after consultation with AHC, SAFEMEAT and AMRG.

Acknowledgement

This discussion paper utilises a prior draft (2020) prepared by Dr John Langbridge and Dr Bob Barwell foreshadowing minimum post-mortem inspection for C. *bovis*, now made possible by risk assessments enabling the revision of AS4696:2023 (pending). They are thanked for their foresight and durability.

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# Appendix 8.1 – Risk Management Equivalence for CB Inspection (AMPC Project 2021 – 1186 Snapshot)

## Project description

The project provides initial technical information that supports modernisation of post-mortem inspection (PMI) of beef, prioritised in the *Meat Modernisation Program*.

Humans are the primary host of the tapeworm *Taenia saginata* whose eggs are passed in human faeces. Viable eggs can be ingested by cattle from contaminated feed sources and form *CB* cysts in their muscles. Humans develop the tapeworm by eating viable CB cysts in inadequately cooked beef.

Post-mortem inspection for CB in beef carcases is a trade-sensitive issue.

Alternative CB PMI comprises routine incision of the heart but not masseters. It has been approved domestically since 1 March 2020 because of a risk-based review of Australia's meat inspection standard AS4696:2007.

The purpose of the project is to capitalise on alternative PMI by providing further evidence for export markets to accept the equivalence of alternative CB inspection. This will be published in the pending AS4696:2023.

Implementation of alternative CB PMI in export establishments depends on acceptance of "equivalence" by importing countries. This project provides extensive technical data that supports the preparation of an equivalence proposal to beef export markets.

The provision of data from the Department of Agriculture, Water and Environment (DAWE) on annual incidence CB rates of total carcase condemnation from 2001 – 2018 provided key data for the project.

That data enabled a deeper interrogation of the mitigating effect of the implementation of the Australian Guidelines for Water Recycling, implemented nationally from 2006 (AGWR). The AGWR targets removal of human *T. saginata* tapeworm eggs in effluent (i.e., eggs causing CB cysts in beef following ingestion of contaminated pasture/fodder).

The outputs provide a technical platform for consultation with a range of key stakeholders, development of a risk management framework and preparation of an equivalence submission needed for the pathway to adoption.

Those activities are recommended to be overseen by a Steering Group whose membership, scope and terms of reference reflect the opportunities arising from the novel information reported here.

## Project content

Results of analysis of total carcase condemnation for CB from 2001-2018 include:

- A significant reduction of 80-90% in CB incidence rate for Cow/Bull (C/B) and Heifer/Steer (H/S) since the implementation of the Australian Guidelines for Water Recycling in 2006.
- The "observed" CB C/B incidence rate for total carcase condemnation has remained consistently low since the AGWR became effective at one affected carcase condemned per million inspected.

- C/B are responsible for the bulk of total carcase condemnations, while H/S have a consistently negligible incidence rate. This reflects the extended exposure period of the older C/B population.
- However, the importance of vendor declarations for feed ingredients to ensure safety is aptly demonstrated by the “Cysticercosis storm” reported in lot-fed H/S in 2010 attributed to a contaminated feed ingredient.
- The use of recycled water in pasture and animal husbandry has not changed significantly from 2000 to 2019, i.e., reduction of CB is not associated with reduced use of recycled water for pasture irrigation.
- When taken together these data provide evidence of a durable and major mitigation of CB nationally associated with AGWR.
- This provides a substantial public health benefit through the prevention of *T. saginata* infection of beef consumers in domestic and export markets and verifies negligible risk of Australian beef reported in 2019.
- There is a data gap of individual recycled water scheme operations listed nationally that currently achieve adequate Log Reduction Value (LRV) for helminth eggs in wastewater released for pasture irrigation and for potential use for fodder production in a drought.

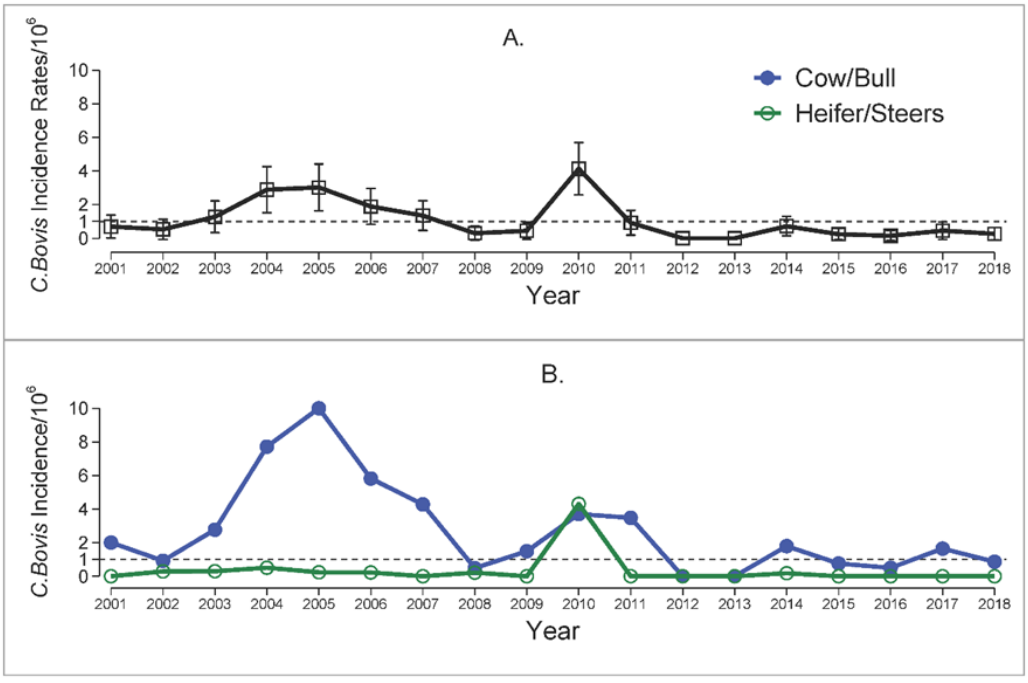


Figure 2A. Combined Heifer/Steer and Cow/Bull total carcase condemnation rates due to observed CB from 2001 – 2018.

Figure 2B. Separate Heifer/Steer and Cow/Bull total carcase condemnation rates due to observed CB from 2001 – 2018.

This report provides information on the effectiveness of public health mitigations via wastewater treatment, that better explain the incidence rate of CB over the past 20 years.

This data provides a technical basis for development of a verifiable risk management system to support alternative CB PMI in the pending AS4696:2023.

The report provides direction for the establishment of a Steering Group convened by AMPC in Stage 2 of the CB program as the final pathway to delivery of benefits from alternative CB PMI.

The proposed scope of activities of the Steering Group is to build a verifiable risk management system, that includes:

- Communication of the results of this project to key stakeholders
- Overseeing the development of a risk management framework for C. *bovis*
- Engaging with key stakeholders to build a national system (Wastewater utilities auditing, ISC, AHC)
- Advising on work to address gaps – WWTP performance i.e., LRV for helminth eggs in recycled water released for pasture irrigation
- Overseeing collaboration to develop an Equivalence Proposal for sensitive markets
- Advising and coordinating liaison with state and federal jurisdictions to enable legislative arrangements (AS4696:2023) and certification compliance
- Advising on supply chain verification pilots
- Identifying other issues related to establishing a verifiable risk management system for alternative CB inspection.

## Benefit for industry

Technical support for sustaining market access under alternative CB PMI. This CB information:

- demonstrates the public health benefits arising from the Australian Guideline for Water Recycling (2006), that is likely to deliver a major proportion of CB mitigation across the beef supply chain.
- provides additional risk-based data that supports alternative PMI of beef carcases for CB in the pending AS4696:2023; comprised of routine incision of the heart but not masseters.
- provides evidence consistent with the negligible risk of CB for consumers of Australian beef, both domestically and in overseas markets reported by MLA.
- supports the development of Equivalence proposals to export destinations for alternative PMI of beef carcases for C. *bovis*.

## Economic benefits

The outcome of the alternative PMI procedures for beef will result in a higher value product, with incised beef cheeks potentially contributing up to $80 M in lost opportunity in the current market. This is particularly relevant in an industry where margins are tight, and where competitive pressure from emerging economies (Brazil and Argentina) in the cost of operating is increasing. These proposals will

give Australian meat processors an economic advantage in marketing a superior product (un-incised cheeks) in an extremely competitive market.

## Useful resources

Post-Mortem Meat Inspection – Australian Meat Regulators Group, Guideline 2020:1 for AS4696:2007. Department of Primary Industries, Sydney, New South Wales, Australia. https://www.foodauthority.nsw.gov.au/sites/default/files/2020-02/AMRG%20Guideline%202020_1_Alternative%20techniques%20guideline.pdf

*C. bovis*:beef Fact Sheet 2.7 explaining the rationale, quantitative approach and data on which equivalence was assessed available via https://www.mintrac.com.au/docs/pages/175/Sched%202_7.%20Fact%20Sheet_Cattle%20and%20Buffalo%20C.%20*bovis*%20inspection.pdf

# Appendix 8.2 – SAFEMEAT CB Risk Management Survey AMPC Project 2022 - 1178

## Background

A key milestone of AMPC Project 2022-1178 is to develop a risk management framework (the framework) for Cysticercus *bovis* (C. *bovis*; CB).

It was decided by the Steering Group that SAFEMEAT Partners should be consulted in the development of the framework to support alternative meat inspection arrangements for CB.

Accordingly, a letter from AMPC to Andrew Henderson, Chair SAFEMEAT, was then forwarded by him to all jurisdictions providing an update to SAFEMEAT Advisory Group members regarding progress in the development of the risk management framework.

The letter also sought the nomination and assistance of jurisdictional representative members to provide current information, by way of a survey, required to draft the framework.

Minimum post-mortem inspection (PMI) for low-risk animals has been endorsed and implemented as AS4696:2007 AMRG Guideline 2020.1 from 1 March 2020 for use domestically. The alternative, the minimum procedure is to observe the masseters, with retention of incision of the heart.

Development of the framework is timed to be delivered to support the pending declaration of AS4696:2023 that is based on the approved AMRG Guideline implemented domestically.

It is also intended to support the development of Equivalence Proposals to key export markets, whereby acceptance will lead to implementation in export listed establishments.

## Aim and outcome

The aim of this survey is to establish the current risk management arrangements in place for *CB* across all jurisdictions.

The desired outcome is to ensure a harmonised risk management framework is in place to meet export market reviewer requirements for an alternative CB PMI and utilisation of adequately treated recycled water for fodder production.

## Methodology

The survey was divided into three sections:

1. Animal health policies and protocols for responding to CB detection at PMI
2. Animal health risk management programs (Is there a register of the use of recycled water (treated sewage effluent) where it is exposed to cattle, e.g., pasture irrigation?)
3. Relevant enabling legislation and regulations.

Representatives from each state animal health agency were nominated.

In some jurisdictions, contributions from the recycled water licensing and auditing agencies were obtained and reported.

In each jurisdiction, the survey was answered by veterinarians in animal health branches managed by CVOs.

Initial responses were reviewed by Daryl Stevens for queries prompted by the answers. Representatives were then interviewed to clarify information provided and obtain further information.

## Results and interpretations

A summary of responses for key operational questions are provided in Table 1 to facilitate comparison of implementation of key risk management criteria for consensus and any differences between jurisdictions. The information is provided in a deidentified manner to highlight any issues requiring further discussion.

Full responses will be provided only to the Steering Group as separate documents to facilitate confidentiality. Any wider circulation of this report is subject to Steering Group advice.

Key findings and interpretations for Steering Group consideration include:

1. Major CB incidents are not reported to have occurred over past 5-10 years in any jurisdiction. There are some reports of minor incidents attributed to undisciplined exposures (field workers, campers). Incidents associated with farm septics were not specifically reported, though one jurisdiction has records of 10 accidental effluent spillages over the past 5 years. Use of diagnostic PCR testing is reported by some jurisdictions with negative results. Separately, OPVs report some suspect solitary cases submitted for histopathology have amendments in muscle tissue consistent with parasite exposure. These cases are reported as solitary and from widely dispersed PICs; hydatids is always a plausible differential diagnosis (Pearse *et al.*, 2010).

2. There is some variation in current operational arrangements

    a. Variation in time to resolve risk land – standard 2 years is not consistently applied, with, variation according to site risk assessment reported by some jurisdictions i.e., hot, and dry conditions or reduced by soil mitigations (ploughing, cropping)

    b. Views varied on cyst viability persistence but were mostly considered indefinitely viable, reflecting a precautionary approach.

3. Extension arrangements have probably languished in some jurisdictions due to very low likelihood (i.e., few notifications, solitary incidence when detected).

4. No current scenario was raised to warrant the application of a PIC-based status. Based on risk assessment of suspicious PICs, a device-based status is only applied to exposed stock e.g., to those that may have been exposed to a domestic septic effluent.

5. If uncertainty remains over the extent of exposed stock on a PIC from the risk assessment, all stock moved from the PIC are assigned a devise-based status.

6. Risk Management of CB is enabled by current legislation and is a Notifiable Disease in all jurisdictions.

7. All jurisdictions apply NLIS arrangements as per the rules for CB i.e., device-based status applied to exposed stock as determined by risk assessment of the PIC. However, the incidence data supplied by jurisdictions indicates very limited need for assigning status over recent years.

8. Device-based statuses are reported as being retained for life for cattle moving within and between jurisdictions.

9. Victoria, South Australia, and Tasmania (by default) have agencies that allow for Wastewater Treatment Plant (WWTP) effectiveness of Log Reduction Value for helminth eggs (LRV ≥4) in classifying risk land and the subsequent use or not of device-based Status.

10. Applying LRV to define very low risk land is an opportunity that may be under-utilised by WWTPs and/or under-recognised by animal health authorities.

11. Coordination between animal health and public health/EPA/Water jurisdictions is highly variable.

12. A Fact Sheet (extension program) for LRV ≥4 for very low risk land warrants consideration – the targets for this are both the animal health jurisdictions as well as the recycled water sector (licensing and auditing jurisdictions at several levels, and WWTP entities nationally).

13. There is farm-level and WWTP extension material on the web from some jurisdictions that provides resources for wider extension.

14. WWTP sector:

    a. Engagement by animal health with licensing and auditing agencies is highly variable, from no engagement to CVOs retaining lists of WWTPs releasing recycled water for fodder production.

    b. Reporting use of treated water is mostly general in nature and periodic.

    c. There is a paucity of shared lists of WWTPs that release treated water for fodder production and listing of exposed PICs.

    d. There is awareness of various regulations and guidelines – Australian Guideline Water Recycling (2006).

    e. The survey provided some awareness of risk management plans (water for fodder), auditing (performance standards) and verification of the implementation of regulations at the jurisdictional level

    f. Auditing responsibilities seem to vary with large WWTPs audited by central agencies (EPA, Health), with smaller and regional WWTPs the responsibility of Local Government Areas (LGAs). There is also variation between states.

    g. A supplementary survey of licensing/auditing bodies and potentially the WWTP sector to validate needs and the likelihood of HE exposure should be considered, considering Taenia *saginata* is undetectable in untreated and treated effluent (Stevens *et al*., 2021), and outbreaks of CB are not reported by jurisdictions over the past 5 years.

## Conclusions and recommendations - Implications for CB risk management framework

The appropriate legislative framework for risk management of CB is in place nationally, as is the traceability framework via NLIS. While the legislative framework is in place, a market access review would currently result in considerably different findings across the jurisdictions in relation to processes to manage use of recycled water.

The current traceability arrangements provide the baseline on which to add any additional assistance to facilitate minimum CB inspection under AS4696:2023 e.g. Early Warning notification for incoming stock for processing to facilitate workforce scheduling has been suggested at a Steering Group meeting. This is a sensible addition. However, based on these data it may not get a lot of use.

The respondents did not suggest the need to add a PIC Status for CB in NLIS for any CB risk management scenario encountered.

While the time loss of viability of *T. saginata* eggs on pasture is commonly recognised as 2 years, there is provision for the period of site (PIC) quarantine to be much shorter, based on risk assessment of the site, including current weather conditions and possible mitigations. What is not universally agreed upon is the time for cysts not to present a risk. This has implications for the draft risk management framework report in relation to cattle that have lost life-time traceable status in NLIS.

Apart from this latter uncertainty, the survey did not indicate any risk management issues associated with the adoption of minimum PMI for CB as proposed for AS4696:2023.

While the survey did identify all the components exist for a nationally harmonised approach for risk management of CB across the recycled water, livestock production and processing sectors, their integrated implementation varies between jurisdictions (e.g., some jurisdictions appear to have no engagement with recycled water authorities).

Reporting of the use of recycled water for pasture production to animal health authorities appears limited; however, in one jurisdiction, the CVO is involved in the approval and maintains a record of documentation.

In addition, better reporting is especially relevant for the potential release of inadequately treated water into streams, in which risk will be uncertain. Nonetheless, the jurisdictions did not report CB incidences attributable to exposures via streams. However, such reporting may be part of a new framework as a contingency.

Current arrangements in some jurisdictions recognise recycled water with LRV $\geq$4 for *T. saginata* eggs (LRV) to be classified as very low risk for irrigated pasture, whereby cattle that have fed on this pasture do not require NLIS CB device-based status activation (i.e., not suspect). This provides a precedent for the framework whereby “cattle grazing pastures irrigated with adequately treated effluent” are recognised as equivalent to “cattle never exposed to high-risk land”.

The infrequent CB incidence over the past 5 years reported by the jurisdictions, the very low total carcase condemnation rate (AMPC 2021 – 1186) and the negligible public health risk (Keirmeier *et al*., 2019), provide consistent evidence of no adverse effect on risk arising from conducting routine minimum PMI (pending AS4696:2023) "for cattle never exposed to high-risk land”.

However, limited awareness by animal health authorities of the Australian Guideline Recycled Water (2006) and associated documented water recycling guidelines at the jurisdictional level, leaves open the opportunity to increase safe utilisation of this resource, delivering production and sustainability outcomes.

### Recommendations for Steering Group consideration

Consider a supplementary survey of WWTP licensing, auditing, and reporting (WWTPs releasing water for pasture irrigation and associated PICs, effluent spillages) at the jurisdictional level.

Preparing a Fact Sheet (extension program) for LRV >4 for very low risk land warrants consideration – the targets for this are both the animal health jurisdictions as well as the recycled water sector (licensing and auditing jurisdictions at several levels, and WWTP entities nationally).

Provide relevant information to DAFF to support Equivalence Proposals to key export markets e.g., supporting legislation links.

Utilise these findings in preparing the risk management framework for alternative CB PMI that encompasses the utilisation of adequately treated recycled water for fodder production.

**Table 8-3 Summary of key risk management response from the seven jurisdictions in Australia.**

| Question | NSW | NT | Qld | SA | Tas | Vic | WA |
|---|---|---|---|---|---|---|---|
| How many CB detections, PIC quarantines or device-based statuses have been used over the past 5 years by your jurisdiction? | Estimate approx. 4 suspect CB lesions over last 12 months (nil confirmed by PCR).<br>Usually single case from a PIC.<br>May have transited multiple PICs in multiple states. | Nil. | CB Detections: Nil<br>PIC quarantines: Nil<br>Device-based status: Nil for the last 5 years. | No CB device-based statuses have been applied by PIRSA in the last 5 years. | 1 herd due to exposure to raw sewage from a pipe break at the time of the spill. Plus, status applied to two pet animals not intended for slaughter that are grazed on land irrigated with Class 2 recycled water with insufficient Hydraulic Retention Time (HRT). | 10 suspect cases at abattoirs reported in last 5 years.<br>10 Incidents of accidental sewerage exposure reported over past 5 years. | 0 from 18 diagnostic investigations from export abattoirs. |
| What is the period of quarantine for risk land to be Resolved (i.e., time for *T. saginata* eggs to become unviable)? | Is dependent on risk assessment of site e.g., hot dry<br>A minimum of 12-month decontamination period required following removal of source of *T. saginata*<br>If source cannot be confidently removed, quarantine will remain indefinitely. | Unknown. | <1 year | Three months over summer has been used in the past. | 2 years - this is based on Tas Recycled Water Guidelines, Use of recycled water December 2002.pdf (epa.tas.gov.au) | Current quarantine period is 2 years. Consideration being made to reduce period to 8 to 10 months depending on season of exposure and opportunity to plough soil and sow a break crop. | It is a declared pest control category – management.<br>A confirmed detection would be traced to the property of origin and epidemiology investigated. If a practice was detected that confirmed an exposure risk to cattle, the property may be placed under a Pest Control Notice with requirements to exclude cattle from grazing an affected area of land until the exposure risk was resolved. Exposed cattle may be identified and given a status in the NLIS database. |
| Once a CB device status is applied to cattle in the NLIS Database, what period must cattle not be exposed to contaminated land (i.e., be on 'clean' | If applied, a device-based status would remain indefinitely. | Would assess what protocols other jurisdictions have implemented. | Current practice is to keep the status on the individual device for the whole of life. | CB status is not removed, it remains with the animal for the rest of its life. | CB status is not removed, it remains with the animal for the rest of its life. | Two years minimum period after last date of exposure. | To be determined in relation to exposure risk and cattle management at the time of identification of the risk. |

| Question | NSW | NT | Qld | SA | Tas | Vic | WA |
|---|---|---|---|---|---|---|---|
| land) before the device-based status can be removed? | | | | | | | Most likely two years to enable time for the death of cyst to resolve in infected cattle. |
| Does your agency allow for WWTP treatment effectiveness in classifying risk land and subsequent use or not of device-based Status? | No<br><br>No - use of the current device-based status on NLIS is triggered by detection of suspect carcase on-plant. | No | No – In saying that we currently have not allocated a status in Qld all the Qld located device statuses are from livestock moved to Qld. | SA uses a 4 LRV or 25-day effluent pond retention. In addition, regarding recycled wastewater usage, we routinely use the VIC:- Agricultural Notes Feb 2003 AG1089 ISSN 1329-8062 Reclaimed water use – use in cattle production & Agricultural Notes Feb 2003 AG1090 ISSN 1329-8062 | Yes, with appropriate withhold.<br>Log Reduction Value (LRV) - Our recycled water schemes are either lagoon systems which achieve the 25 days HRT or mechanical plants without Helminth filters which do not.<br>Recycled water guidelines require 2 years withholding if insufficient treatment at WWTP. | Yes<br>LRV 4 log reduction<br>Page 20<br>https://www.epa.vic.gov.au/about-epa/publications/1910-2<br>Device Werribee and 6 other sites release LRV4 water.<br>Confirmation enquiry pending from JP on not assigning Device-Based statuses for these PICs | Not applied |
| Is CB a notifiable disease in your jurisdiction? | Yes. | Yes. | Yes. | Yes. | List B notifiable. | Yes. | Yes |
| What engagement is there with human sewage management and Wastewater Treatment Plant (WWTP) sector in relation to managing risk associated with irrigation of pasture with effluent? | NSW EPA regulate this activity. NSW DPI meets quarterly with the NSW EPA to discuss biosecurity. If there was an urgent issue, the relevant DPI and EPA would contact each other to resolve the issue. | Nil. | Qld is not aware that any WWTP situations graze livestock.<br><br>Where livestock graze such sites, engagement would be one of one with the management of the WWTP. | PIRSA Biosecurity is in regular touch with SA Water and receives monthly updates on monitoring activities from their facilities + notifications of Level 1 incidents (including chemical, cyanobacteria and microbial issues). | Reports often come from TasWater to Biosecurity Tasmania when they are managing an event.<br>Only lagoon based WWTPs with >25day HRT are approved for irrigation and grazing by cattle. This is monitored by TasWater through annual audit program. | Engagement with EPA Victoria in development of guidelines on waste recycling (2018 to 2020)<br>WWTPs advise AgVic of sewerage spillage/overflow incidents. | WWTP and Recycled water schemes are approved to construct by Department of Health, water unit. Recycled water Guideline gives criteria that can be used to determine the risk level of each recycled water scheme. Agriculture irrigation (non-edible crops) falls into low-risk category. |
| Do WWTP's have licence conditions or parameters that relate to use of effluent for livestock pasture irrigation? | Uncertain – advise follow up with water regulators. From information received, human and environmental risks need to be managed to | No. | Question for DES. | Yes, WWTP's in SA are required to meet the legislative conditions under Section 32 of the | Yes, EPA Permit conditions require discharge to reuse in accordance with Management Plans. Management Plans refer to | Yes. EPA Water recycling guidelines – checklist if CVO approval is required. | Yes. Guidelines for the Non-Potable Uses of Recycled Water in Western Australia sets |

| Question | NSW | NT | Qld | SA | Tas | Vic | WA |
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| | gain approval for use of recycled water, so assumption is yes. | | | Livestock Act 1997 – a person must not allow practices that may cause livestock to be infected with a notifiable disease. | Recycled Water Guidelines (environmental management plan approved by EPA/TasWater). Audited annually by 3rd party. | | out the recycled water quality parameters. |
| Does your jurisdiction have a list of WWTPs releasing recycled water (effluent) which may be exposed to cattle through pasture irrigation/production or to surface water where cattle could be exposed to the effluent by drinking? | I do not believe so- suggest check with water regulators. | No. | DES holds this information. There is a web page that describe release method and locations. | SA Health responsibility as above. | Recycled Water scientists – 30 odd reuse schemes around the state. TasWater maintains a list of recycled customers. Annual audits include farming practices. It is expected (required) surface water is not contaminated by recycled water | Yes.<br>CVO Approval letters on file<br>(6 x WWTPs including Werribee based on 4LRV criteria) | DOH does have a list of recycling schemes. However no (known) schemes irrigate to pasture. But fodder cropping occurs e.g., Broome North WWTP<br><br>DOH requires all ponds to be fenced. |
| Does your jurisdiction have a list of PICs/properties that currently use recycled water?<br>If yes – who manages the list and where is it housed? | I do not believe so. | No. | No. | PIRSA Biosecurity keeps records of all livestock producers that use recycled wastewater from WWTP's that meet legislative requirements. This includes recycled wastewater use by cattle but precludes pigs in SA. | Internal – Taswater – environmental performance team (environmental scientists). | No. | Yes<br>Department of Health, Water Unit. |
| What reporting of effluent releases from WWTP's to waterways or for use for irrigation is available? | Suggest following up with water regulators and NSW EPA. | Unknown. | Question for DES. | Internal agency reports mainly.<br>The DoH, EPA & PIRSA would meet to discuss the need for press releases or contacting at risk producers and consumers. | Monthly flow data to EPA TasWater are required to prepare an Annual Environmental Review for submission to EPA by Permit conditions for each WWTP. Including flows to environmental discharge and/or reuse. | Unsure. Need to refer to EPA.<br>Notified of spillages (and of some deliberate releases) by WWTPs.<br>A further survey with state auditing agency may be required how often deliberate releases of partially treated effluent occur. | Recycled water scheme Annual reports |

| Question | NSW | NT | Qld | SA | Tas | Vic | WA |
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| Does your jurisdiction have CB prevention extension materials, especially to cover management of household effluent/wastewater treatment on farms? | Primefact<br>Being updated.<br>Information generic apart from contact and agency logo. | No. | Not such but C *Bovis* is on web pages concerning notifiable disease for Qld. Notifiable diseases \| Department of Agriculture and Fisheries, Queensland (daf.qld.gov.au). | In SA the DoH & EPA have good extension material (paper and web based). PIRSA Biosecurity has contributed to the development of the South Australian Recycled Water Guidelines and other national guidelines for industry. | Septic sludge (controlled waste) is not permitted to be discharged to land.<br>A domestic scale on-site wastewater treatment system could discharge effluent to pasture in this case regulation would fall to Local Government.<br><br>Relevant links:<br>Use of recycled water December 2002.pdf (epa.tas.gov.au) Tasmanian Biosolids Reuse Guidelines June 2020<br>Recycled Water \| TasWater) | CVO Unit policy document only.<br>Chief Veterinary Officer's Position Statement on recycled water treatment requirements (2018) - draft doc<br><br>Relevant links:<br>Guidance to WWTPs on use of recycled water is available https://www.epa.vic.gov.au/about-epa/publications/1910-2 . | No. |

# Appendix 8.3 – CB infection characteristics

Cysticercus *bovis* (CB) affects cattle and is the intermediate stage of the human parasite *Taenia saginata.* Tapeworm eggs are passed in human faeces. Ingestion of viable eggs results in the development of cysts in the muscle of cattle. The life cycle is completed if meat containing infective cysts is ingested by humans. CB is the name given to cysts in the muscle of cattle irrespective of whether the cysticerci are viable or not.

The persistence of observable CB lesions and their viability has been reviewed by Scandrett (2007) as follows:

2.5.1 Detection of Taenia saginata cysticerci by post-mortem carcase inspection

Control measures currently instituted for bovine cysticercosis by the Canadian Food Inspection Authority (CFIA) rely on the detection of cysts in affected carcases during routine gross (organoleptic) post-mortem inspection procedures.

Cysts can be viewed grossly as early as 11 days post-infection, at which time they are about 2.5 mm in diameter (McIntosh and Miller, 1960). The inspection protocol involves incision and/or palpation of the tongue, internal and external masseters, oesophagus, heart, and diaphragm, and observation of superficial and cut surfaces of the carcase exposed during routine dressing procedures (CFIA Meat Hygiene Manual of Procedures, Section 4.6.1, 2007). This is similar to inspection protocols implemented for this parasite in the USA (Snyder and Murrel, 1986; Saini *et al*., 1997) and Europe (Kyvsgaard *et al*., 1990).

These “traditional” inspection sites are easily accessed during routine slaughter, result in minimal carcase damage, and are presumed to be “predilection” sites for the parasite. However, whether this parasite truly has a predilection for particular sites is controversial, and numerous studies have yielded inconsistent results (Mango and Mango, 1972; Juranek *et al*., 1976; Hammerberg at al., 1978; Sewell and Harrison, 1978a, b; 1978b; Pugh and Chambers, 1989; Oryan *et al*., 1995; Maeda *et al*., 1996). It has been proposed that a variety of factors, such as muscle activity, breed, age, and geographic area may affect the localisation of cysts (Kearney, 1970).

The heart is widely regarded to be an apparent predilection site for cysticerci; paradoxically, cysts in cardiac muscle degenerate earlier, and the resulting lesions may persist longer, than in other skeletal muscle sites (Soulsby, 1963; Gallie and Sewell, 1983; Harrison *et al*., 1984; Smith *et al*., 1991; Lloyd, 1998a). Although 13 viable mature cysts elicit minimal host reaction (Silverman and Hulland, 1961), degenerating *T. saginata* cysticerci incite a host inflammatory response (Sterba *et al*., 1979a), that makes them more obvious grossly than viable cysts. As well, since the heart is traditionally one of the more thoroughly examined inspection sites (CFIA Meat Hygiene Manual of Procedures, Section 4.6.1, 2007), degenerated cardiac lesions are among those most frequently detected by meat inspectors.

Since cattle can harbour both viable (infective) and degenerate cysts concurrently, recovery of only degenerate cysts does not imply that no infective cysts remain in the carcase, or in Herd mates. Complete resorption of degenerated cysts may take 3 years or longer (Penfold and Penfold, 1937) and viable cysts may persist for at least 2 to 3 years, and possibly for the life of the host (Penfold, 1937; Dewhirst *et al*., 1963; Froyd *et al*., 1964; Urquhart and Brocklesby, 1965; Van den Heever, 1967). Therefore, it is important to confirm cysticercosis even in cases where suspect lesions are obviously degenerated and non-infective.

It has been demonstrated that the current inspection protocol has a sensitivity of ≤50 %.

Source: W.B. Scandrett. (2007) Improved post-mortem diagnosis of *Taenia saginata* cysticercosis. A Thesis Submitted to the College of Graduate Studies and Research in Partial Fulfilment of the Requirements for the Degree of Master of Science in the Department of Veterinary Microbiology. University of Saskatchewan, Saskatoon.

The use of the heart for the detection of lesions is also supported by Scandrett *et al*., (2009).