Snapshot Report

Exposure of cattle to *Taenia saginata*

Mitigation of T. saginata exposure to cattle and incidence of C. bovis via official wastewater treatment in Australia

Project Code
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Prepared by
Dr Daryl Stevens and Dr Andrew Pointon

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Project Description

The objective was to prepare a situation report of relevant wastewater treatment plants (WWTPs) in Australia regarding the current controls documented for preventing exposure of cattle to *Taenia saginata* eggs when recycled water is used in the associated farming operation, preventing Cysticercus bovis (C. bovis) in cattle. The treatment systems that produce recycled water are predominantly centralised treatment of sewage (by volume treated), and potentially include on-site treatment (e.g. greywater, septic tank, on-site treatment systems). Recycled water can be exposed to cattle by irrigation of feed sources, supply of cattle drinking water, and incidental exposure pathways (e.g. sewage effluent released to surface waters that could be exposed to cattle, or poor operation of on-site systems).

The overall aims were to:

- document public health and environmental regulatory and guideline arrangements (through the supply chain) to prevent *T. saginata* exposure of cattle from treated wastewater (Recycled water),
- identify gaps in these regulatory arrangements, and
- assist in the interpretation of results from C. bovis detection data over the past 20 years.

This project was part of Phase 1 of Project 2021-1186, Risk Management Equivalence Case for C. bovis post-mortem inspection (PMI) changes (Figure 1).

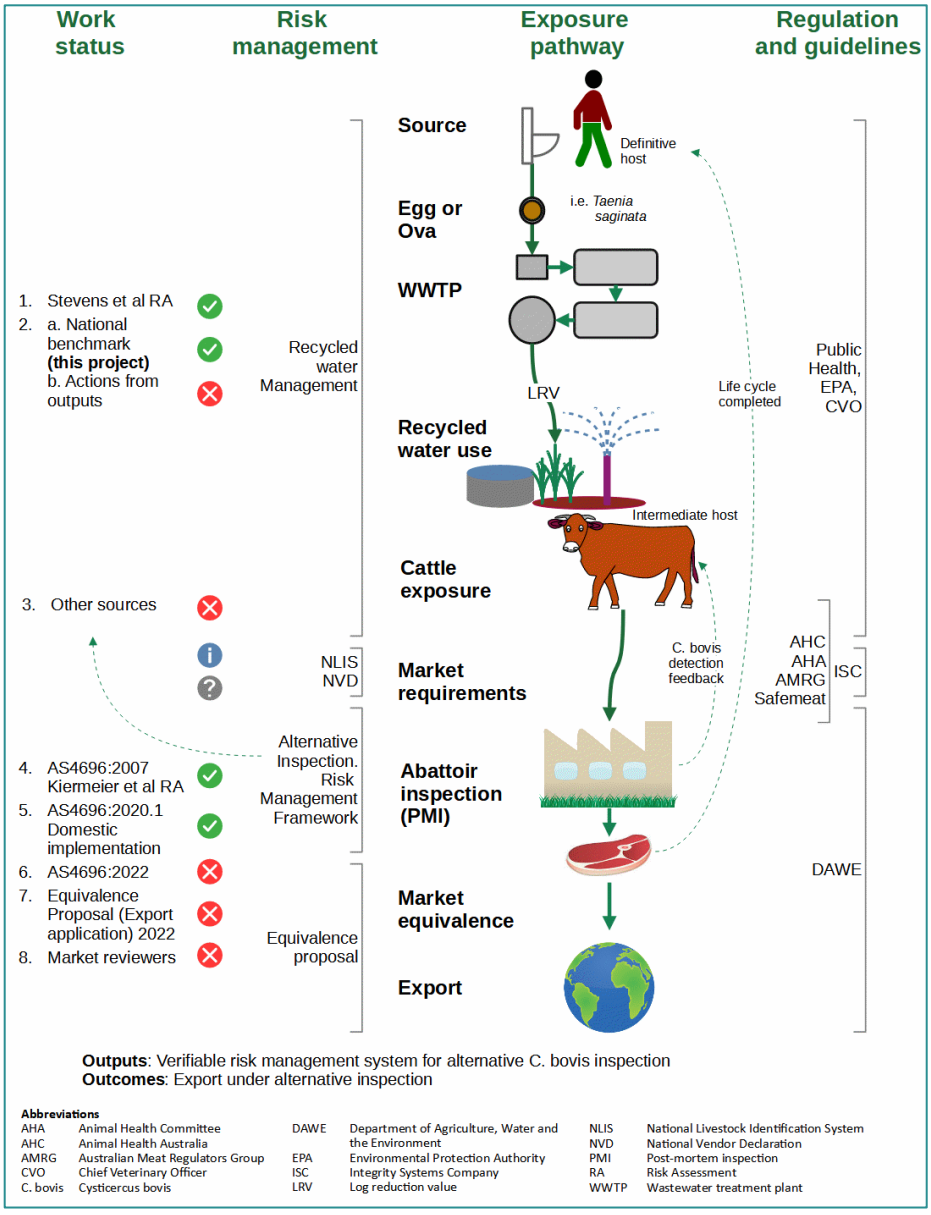

Figure 1 C. bovis Risk Management Project: Overview

Project Content

A desk-top situation report reviewed the regulation and guidance in states and territories of Australia to produce recycled water fit for the purpose of producing cattle feed (pasture and fodder) and cattle drinking water. Fit-for-purpose in this case refers to minimising the risk of detecting C. bovis in cattle by ensuring appropriate control measures are in place to manage *T. saginata* egg exposure to cattle via recycled water.

The Australia Guideline for Water Recycling (AGWR)(NRMMC et al., 2006) provides the risk management framework based on international standards, including a Hazard Analysis and Critical Control Point (HACCP) component, to assess and manage the risk of C bovis. These principles are used to manage helminth eggs in

recycled water with limited control measures identified in the AGWR. The performance criteria for helminth controls specify in the AGWR that a log removal value (LRV) of 4 is required. This is equivalent to a 99.99% removal performance by the treatment plant, or equivalent. Achievement of a LRV of 4 ensures the recycled water is fit for the purpose of cattle production. Post publication of the AGWR, these basic principles have also been utilised with knowledge from a number of recent scientific publications (2017 to 2021), to highlight additional treatments and on-site control options to provide additional options for minimising the risk of C. bovis in cattle.

The relevant guideline in states and territories of Australia now reflect the guidance for helminth management documented in the AGWR in 2006, and the AGWR have been implemented across Australia through various state and territory guidelines for water recycling. However, comparison of the documented risk management controls and audit requirements for helminth indicated that the risk may not be managed appropriately in the NT and SA, and the auditing could be improved in SA and Tas (Figure 2).

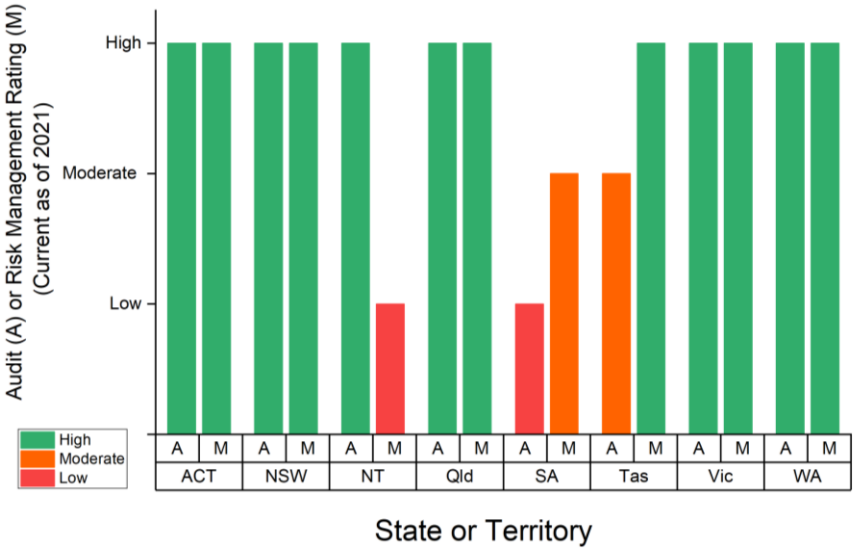

Figure 2 Comparison of most current documented audit or risk management rating for states and territories of Australia. High = Acceptable, Moderate = should be improved, Low = not appropriate.

The volume of recycled water produced from centralised WWTP was the highest for agricultural sector Pasture and animal husbandry. The use of recycled water in these sectors has not changed significantly from 2000 to 2019. The volume of recycled water used in this sector was estimated to expose 0.7% of the national cattle population to recycled water annually (an exposure rate of 7,000 $\times 10^{-6}$). This is a significantly higher frequency than C. bovis detection via PMI (an incidence rate of 0 to 4.28 $\times 10^{-6}$). This incident rate for C. bovis detection was from a recent survey of C. bovis in cattle via post-mortem inspection (PMI), indicating that C. bovis (PMI) is rarely detected. Such a low incidence rate, supported by the low number of *T. saginata* eggs found in sewage, indicated that the presence of *T. saginata* in the human population in Australia is very low.

There have been no documented outbreaks of C. bovis related to well managed recycled water schemes. However, the ongoing management of *T. saginata* egg in recycled water (baseload and outbreaks) provides an important control measure that breaks the life cycle of *T. saginata* and minimises the risk C. bovis in cattle.

The impact of the AGWR for the improvement of *T. saginata* egg removal and managed during the production of recycled water is supported by the C. bovis incidence rate. A significant decrease was found in the incidences of carcass condemnation from C. bovis pre- to post-publication of the AGWR. Given the calculated low incident rates, this link is not definitive and could be due to other factors. However, through in-the-field experience, we are aware of some recycled water scheme operations that have improved helminth management and awareness based on the AGWR.

Project Outcome

Overall guidance for WWTPs systems typically provides a robust system for managing helminth egg exposure to cattle in Australia. However, gaps in this guidance were identified for some states and territories. Promotion of the benefits for maintaining helminth egg control via centralised and on-site wastewater treatment systems is essential

to ensure those who regulate recycled water use are aware of the importance of this control measure. This awareness should ensure appropriate guidance is continued in future revisions of guidelines for recycled water use.

The project recommended that:

1. There is a trend for health departments (i.e. human health) to rate recycled water schemes that irrigation pasture and fodder as low risk (to humans). As a low-risk scheme, management is then simplified and may lead to *T. saginata* egg management oversites in the future. Such potential oversites need to be brought to the attention of relevant government departments to ensure the controls for helminth egg management is maintained in the future. For example, if recycled water that is fit-for-purpose was an integral part of the production quality assurance guideline for cattle production, this could trigger requirements for recycled water guidelines.
2. Amendments should be made to all on-site treatment guidelines for states and territories across Australia that do not specifically mention exclusion cattle from irrigation areas.
3. How well the documented guidance in states and territories of Australia are implemented practically for all relevant exposure pathways for cattle needs verification with the responsible government authority (e.g. Department of Health, Environmental Protection Authority).
4. Verification of the controls measures for *T. saginata* egg management in the AGWR and any modification and improvements should become integrated with PMI for C. bovis cysts. Current research suggests that helminth controls may be over-protective, leading to increased water treatment costs prohibiting access to recycled water for some sectors of the cattle industry. The most cost effective approach to meet supply chain requirements needs to be investigated.
5. Consideration of grazing history is not relevant for recycled water as it should be fit for the intended purposes of cattle production concerning helminth management if the AGWR guidance is followed, verified, and audited. However, if this quality assurance system for recycled is not used appropriately, then C. bovis detection in cattle could be considered to improve management. In this case, the grazing history related to recycled water exposure may be of use and the integration of the recycled water quality assurance system into the whole supply chain should be explored as an alternative C. bovis management system.

Benefit for Industry

The report will describe the public health and environmental systems that authorises the safe use of treated waste-water (recycled water) for irrigation of pasture and crops for stock feed. In doing so it:

- documented regulatory arrangements (through chain) to prevent *T. saginata* exposure of cattle from treated sewage and identify gaps in those arrangements,
- facilitated consultation with AHC, CCA, ISC, MLA and SAFEMEAT to define further work,
- assisted additional interpretation results of C. bovis detection data over the past 20 years,
- updated industry and jurisdictional stakeholders on related mitigations, and
- defined part of the work required in Phase 2 of AMPC Project No: 2021 – 1186 with the animal health jurisdictions.

An economic assessment conducted by MLA from the benefits of adoption risk based post-mortem procedures for beef resulting from potential to reduce inspection times, markdowns and condemnations reported a NPV = $103.17M (AMPC and MLA, 2020). The majority of this benefit is attributed to adoption of risk-based inspection for C. bovis.

Useful resources

The Australian Guideline for Water Recycling (AGWR)
www.waterquality.gov.au/guidelines/recycled-water

AMPC, MLA (2020) Food Safety Market Access Science 2019-20. Meat & Livestock Australia – Research Development & Innovation and Australian Meat Processor Corporation – Process Hygiene, Quality July 2020 2nd edition. Australian Meat Processor Corporation and Meat and Livestock Australia.
https://www.mla.com.au/globalassets/mla-corporate/research-and-development/program-areas/food-safety/documents/food-safety-achievement-report-19-20-2nd-edition.pdf