Imported food risk statement
Cheese (production includes a heat treatment step) and staphylococcal enterotoxin

Commodity: Cheese that has undergone a heat treatment step during production. Examples of this type of product include cheese prepared from pasteurised or thermised milk (with additional hurdles) or those subject to a high temperature curd cook.

Microbial enterotoxin: Staphylococcal enterotoxin (SE)

Recommendation and rationale
Is SE in cheese that has undergone a heat treatment step during production a medium or high risk to public health*: ☐ *Yes* ☑ *No* ☐ *Uncertain, further scientific assessment required* **Rationale:** • Prevalence of *Staphylococcus aureus* in this category of cheese is low and there is limited evidence of staphylococcal food poisoning attributed to this product • Effective through chain controls include a heat treatment step sufficient to inactivate *S. aureus* • Although SE can survive the pasteurisation process, large numbers of *S. aureus* are required for SE production to occur *Provided that effective through chain controls are in place

General description
Nature of the microbial enterotoxin: *Staphylococcus* spp. are facultative anaerobic Gram-positive, non-spore forming spherical-shaped bacteria. They are commonly found in the environment, humans (nose and skin) and animals. Although several *Staphylococcus* species can produce SEs, including both coagulase-negative and coagulase-positive isolates, the majority of staphylococcal food poisoning (SFP) is attributed to SE produced by coagulase-positive *S. aureus* (FDA 2012; FSANZ 2013). Growth of *S. aureus* can occur at temperatures between 7 – 48°C, pH of 4.0 – 10.0 and a minimum water activity of 0.83 when other conditions are near optimum. SEs are resistant to heat inactivation and cannot be destroyed by cooking. SEs remain stable under frozen storage (FSANZ 2013).
Adverse health effects: SE is a moderate hazard as it generally causes illness of short duration and usually no sequelae (ICMSF 2002). People of all ages are susceptible to SFP. However, the severity of symptoms may vary depending on the amount of SE consumed and the general health status of individuals. The young and elderly are more likely to develop more serious symptoms (FSANZ 2013). SFP is characterized by rapid onset gastroenteritis that appears around three hours after ingestion (normal

range of 1 – 6 hours). Common symptoms of SFP include nausea, vomiting, abdominal cramps and diarrhea. Recovery is usually between 1 – 3 days (FSANZ 2013).

People become ill after exposure to very small quantities of SE (less than 1 µg). These levels of toxin are generally observed when *S. aureus* populations exceed 10^5 CFU/g of food (FDA 2012).

Consumption patterns:

In the 2007 Australian National Children's Nutrition and Physical Activity Survey, 71% of children aged 2 – 3 years and 67% of children aged 4 – 8 years reported consumption of this category of cheese (DOHA 2008). In the 2011 – 2012 Nutrition and Physical Activity Survey (part of the 2011 – 2013 Australian Health Survey), 43% of children aged 2 – 3 years, 39% of children aged 4 – 8 years and 31% of adults (aged 19 years and above) reported consumption of this category of cheese (ABS 2014). For both the 2007 and the 2011 – 2012 survey, mixed foods that contained cheese were excluded from the analysis. The 2007 survey derived data from two days of dietary recall data for each respondent (a respondent is counted as a consumer if the food was consumed on either day one or day two, or both days), compared with only one day of dietary recall data for the 2011 – 2012 survey. Using two days of data will result in a higher proportion of consumers compared to a single day only, meaning the results are not directly comparable.

Key risk factors:

S. aureus can be a contaminant of milk sourced from infected herds. Through chain controls, including effective heat treatment during cheese production, will negate this risk.

Post processing contamination of product with *S. aureus* can occur, although a number of processing factors and/or product characteristics influence the potential for growth of *S. aureus* in cheese including pH, salt concentration, water activity and maturation/ripening conditions (FSANZ 2006). Although pasteurisation will inactivate *S. aureus*, SE is heat stable and will not be effected by the pasteurisation process.

Risk mitigation:

Time and temperature abuse of food products should be avoided by applying good practices of temperature control in food manufacturing and handling. Good manufacturing practice and good hygienic practices in food manufacturing and handling also play a role in preventing SFP.

Pasteurisation of milk, or equivalent measures during production as specified under clause 16 of Standard 4.2.4 in the Australia New Zealand Food Standards Code (the Code), will inactivate *S. aureus*.

In Australia Standard 4.2.4 of the Code sets out a number of food safety requirements for primary production and processing of dairy products, including the implementation of documented food safety programs for dairy primary production, collection, transportation and processing.

Compliance history:

Imported cheese of this category are not currently required to be tested for coagulase positive staphylococci and therefore no compliance data is available from the Imported Food Inspection Scheme of the Australian Department of Agriculture.

There has been one notification on the European Commission's Rapid Alert System for Food and Feed (RASFF) for the presence of SE in Mozzarella cheese from Germany during the period January 2007 – January 2014. There were no notifications for the presence of *S. aureus*.

There have been no food recalls in Australia due to the presence of SE or *S. aureus* in imported or domestic cheese of this category from January 2007 – January 2014.

Surveillance information:

SFP is not a notifiable disease in Australia. While it is generally recognised that there may be significant under reporting of SFP due to the short duration of illness and self-limiting symptoms, there was one reported outbreak in Australia in 2012 and two outbreaks reported in 2011. Mixed foods including fried rice and

chicken were associated with these outbreaks. Factors that may have contributed to the outbreaks include the role of infected food handlers and temperature abuse of food. In Australia it is estimated that *S. aureus* accounts for 1% of foodborne illness caused by known pathogens (OzFoodNet 2012; FSANZ 2013; Pillsbury et al. 2013).

Illness associated with consumption of cheese (production includes a heat treatment step) contaminated with SE

A search of the scientific literature via the EBSCO Discovery Service and the US CDC Foodborne Outbreak Online Database during the period 1990 – September 2014, identified there are limited reports of SFP outbreaks associated with consumption of this category of cheese:

- Outbreak in the United States in 2001, 3 cases of SFP linked to consumption of cheese in a restaurant (not stated if the cheese had a heat treatment step during processing) (Florida Health 2013; CDC 2014)

Prevalence of *S. aureus* in cheese (production includes a heat treatment step)

A literature search with the EBSCO Discovery Service during the period 1990 – September 2014 and other published literature identified that surveys of this category of cheese have isolated *S. aureus* in 0 – 6% of samples (FSANZ 2006; Rosengren et al. 2010). Examples of surveys are listed below:

- Survey in 2005 in Sweden, where *S. aureus* was isolated in 6% of pasteurised cheese samples (n=96) collected from farm dairies. Also, 1 sample had a *S. aureus* count of between 10^3 – 10^5 CFU/g (Rosengren et al. 2010)
- Survey in the United Kingdom in 2004 – 2005, where unsatisfactory levels of *S. aureus* (≥10^3 CFU/g) were isolated in 0.1% of ripened soft cheese (n=1622) and 0.2% of semi-hard cheese (n=584). All unripened soft (fresh) cheese had satisfactory levels of *S. aureus (*<10^2 CFU/g) (n=412). All samples were made from pasteurised milk and collected at retail (Little et al. 2008)
- Surveys in Australia in 2003 – 2004, where *S. aureus* was not detected in pasteurized cheese samples collected by industry and submitted to Dairy Australia (n=5039) (FSANZ 2006)

Other relevant standards or guidelines

- Codex general principles of food hygiene *CAC/RCP 1 – 1969* provides key hygiene controls from primary production through to final consumption (Codex 2003)
- Codex code of hygienic practice for milk and milk products *CAC/RCP 57-2004* covers additional hygienic provisions for the production, processing and handling of milk and milk products (Codex 2004)
- FSANZ guidelines for the microbiological examination of ready-to-eat food have a satisfactory level for coagulase positive staphylococci of <10^2 CFU/g. Food is deemed potentially hazardous if levels are ≥10^4 CFU/g or staphylococcal enterotoxin is detected
- There are *E. coli* limits in Standard 1.6.1 of the Code for all cheeses. Generic *E. coli* is used as an indicator of process hygiene (ICMSF 2011)

Approach by overseas countries

Many countries, such as the European Union, the United States and Canada, have HACCP-based measures in place for production of this commodity.

Canada and the EU have microbiological criteria for *S. aureus* and coagulase-positive staphylococci, respectively, in cheese made from pasteurised milk (European Commission 2007; Health Canada 2008).

Other considerations
Testing for high levels of coagulase-positive staphylococci is an indicator test for the presence of SE. Quarantine restrictions apply to products under this commodity classification. Refer to the ICON database.

This risk statement was compiled by FSANZ in: July 2015

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