Imported food risk statement
Cheese (production includes a heat treatment step) and Shiga toxin-producing *Escherichia coli*

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.

Microorganism: Shiga toxin-producing *Escherichia coli* (STEC)

Recommendation and rationale
Is STEC 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:** • Effective through chain controls include a heat treatment step sufficient to inactivate STEC • Limited evidence for this category of cheese being contaminated with STEC or causing illness in humans *Provided that effective through chain controls are in place

General description
Nature of the microorganism: *E. coli* are facultative anaerobic, Gram-negative, rod-shaped bacteria. They are found in warm-blooded animals and humans as part of the normal intestinal flora (FSANZ 2013). The majority of *E. coli* are harmless, however some have acquired specific virulence attributes, such as Shiga toxin-producing *E. coli* (STEC), which can cause severe diarrheal disease in humans (FDA 2012). Major foodborne pathogenic STEC strains include O26, O45, O103, O111, O121, O145, O157 (FDA 2012) and O104 (ECDC/EFSA 2011). The major animal reservoir of STEC is ruminants. STEC can also colonise other animals and birds, although the incidence of STEC is lower than in ruminants (FSANZ 2013; Meng et al. 2013). Growth of *E. coli* can occur at temperatures between 7 – 46°C, pH of 4.4 – 10.0 and a minimum water activity of 0.95 when other conditions are near optimum. Some STEC strains are able to survive at pH 2.5 – 3.0 for over 4 hours. STEC is able to survive frozen storage at -20°C, however, it is readily inactivated by cooking (FSANZ 2013; Meng et al. 2013).
Adverse health effects: STEC is a severe hazard as it can cause life threatening illness or substantial chronic sequelae (ICMSF 2002). People of all ages are susceptible to infection with STEC. However, the young and the elderly are more susceptible and are more likely to develop serious symptoms (FSANZ 2013).

Symptoms include diarrhoea, abdominal pain, vomiting and fever. The onset of illness is typically 3 – 8 days after infection and most patients recover within 10 days of the initial onset of symptoms. Acute STEC infections (haemorrhagic colitis) are characterised by severe abdominal cramps and bloody diarrhoea. In some cases, patients develop haemolytic uraemic syndrome (HUS) which can lead to kidney failure. HUS can also have neurological effects and cause seizures, stroke and coma. Approximately 3 – 7% of haemorrhagic colitis cases develop HUS. The fatality rate of HUS is 3 – 5% (FDA 2012; FSANZ 2013).

It is generally accepted that very low levels (10 – 100 cells) of STEC can cause illness. However, depending on the food matrix and strain of STEC, illness may occur at exposure to even lower levels of STEC (FSANZ 2003; 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:

STEC 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 can occur, although a number of processing factors and/or product characteristics influence the potential for growth of STEC in cheese including pH, salt concentration, water activity and maturation/ripening conditions (FSANZ 2006).

Risk mitigation:

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 STEC. Good hygienic practices in food manufacturing and food handling will minimise STEC contamination of cheese.

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:

The imported food compliance data sourced from the Imported Food Inspection Scheme of the Australian Department of Agriculture for January 2007 – January 2014 showed that of the 1882 generic *E. coli* tests applied to this category of cheese there were 53 fails (*E. coli* levels >10 CFU/g), a 3% failure rate. The failed samples were various types of cheese of this category including Gorgonzola and Perl Las cheese from multiple countries.

There has been one notification on the European Commission's Rapid Alert System for Food and Feed (RASFF) for the presence of STEC in cheese from France during the period January 2007 – January 2014 (it was not stated if the production included heat treatment). There have been three notifications on RASFF for excessive levels of generic *E. coli* in cheese from Bulgaria and Mozzarella from Italy during the period January 2007 – January 2014 (it was not stated if the production included heat treatment). The generic *E. coli* levels ranged from 1.4×10^3 – 1.5×10^6 CFU/g.

There were nine food recalls in Australia for this category of cheese due to the presence of *E. coli* from January 2007 – January 2014. Eight of these recalls were for domestic product including Camembert, Feta and

goats cheese. The other recall was for smoked cheese imported from Bosnia.

Surveillance information:

Infection with STEC is a notifiable disease in all Australian states and territories, with a reported incidence rate in 2013 of 0.8 cases per 100,000 population (179 cases), which includes both foodborne and non-foodborne cases. This is an increase from the previous five year mean of 0.5 cases per 100,000 population per year (ranging from 0.4 – 0.6 cases per 100,000 population per year). The most common STEC serotype identified in Australia in 2010 was O157 (58.8% of cases), O111 was the next most common serotype. There was 1 case of STEC-associated HUS reported in Australia in 2010 (FSANZ 2013; NNDSS 2014).

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

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 STEC outbreaks associated with consumption of this category of cheese

- Outbreak in the United States in 2007, 135 cases of illness linked to consumption of pasteurised American cheese. STEC O121, STEC O26 and STEC O84 were all implicated (CDC 2014)

Prevalence of STEC in cheese (production includes a heat treatment step)

A literature search with the EBSCO Discovery Service and other published literature during the period 1990 – September 2014 identified that surveys of this category of cheese have detected STEC in 0 – 8.9% of samples (Fach et al. 2001; Civera et al. 2007). Examples of surveys are listed below:

- Survey in Italy, where STEC was not detected in cheese samples made with pasteurized milk (n=60) collected at cheese-making plants (Civera et al. 2007)
- Survey in Italy in 2000 – 2001, where STEC was not detected in buffalo milk Mozzarella samples (n=501) collected predominantly from processing/dairy plants, and also at retail and from the farm (Conedera et al. 2004; FSANZ 2006)
- Survey in France, where STEC was detected in 8.9% of pasteurised cheese samples (n=45) (Fach et al. 2001)

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)
- 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 *E. coli* in cheese made from pasteurised milk (European Commission 2007; Health Canada 2008).

Other considerations

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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