FOOD
Safety & Hygiene

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Australian Food Safety Centre of Excellence

Food Safety: the essential ingredient

Welcome to the new look *Food Safety & Hygiene*

We have changed the design of this bulletin to reflect the involvement of the Australian Food Safety Centre of Excellence in its production.

The Australian Food Safety Centre of Excellence is a consortium of Food Science Australia and the Tasmanian Institute of Agricultural Research, which was formed as an initiative of the Federal Government's National Food Industry Strategy.

The Centre aims to build Australia's capability in food safety through organised programs of scientific research, education and knowledge dissemination to the food industry. Publishing Food Safety & Hygiene is one of the ways that the Centre will keep food businesses informed of developments in food safety.

Although this bulletin looks different from previous issues, it will continue to be produced three times a year and feature articles on food safety matters of interest in Australia and overseas.

More information about the Australian Food Safety Centre of Excellence is available from:

www.foodsafetycentre.com.au

Toolkit for hospitality and retail businesses

Help is at hand for those food service businesses that require assistance in developing and implementing food safety programs.

The Australian Food Safety Centre of Excellence, with the support of Food Science Australia, is producing a toolkit that is specifically designed to guide hospitality and retail businesses through the development of support programs, conducting hazard analyses and applying controls.

The Food Safety Toolkit™ will be suitable for businesses, consultants and as a training aid. It will be released in the first half of 2004. More information will be available in the next issue of this bulletin.

What's inside

Food safety programs in high risk sectors

The Australian and New Zealand Food Regulation Ministerial Council (ANZFRMC) agreed at its December 2003 meeting that food safety programs be made mandatory in highest risk food sectors. This resolution applies only to Australia as New Zealand currently reviews risk based management plans in the context of its own requirements.

The food businesses for which food safety programs will become mandatory are:

- food service in which potentially hazardous food is served to vulnerable populations (e.g. hospitals, nursing homes);
- producing, harvesting, processing and distributing raw oysters and other bivalves;
- catering operations serving food to the general public, and
- producing manufactured and fermented meat.

Implementation of mandatory food safety programs for these sectors will be required within two years after the amendments to the Food Standards Code are gazetted.

The selection of high risk food businesses for which a cost-benefit of implementing a food safety program could be demonstrated is largely in line with the findings of the National Risk Validation Project (*Food Safety & Hygiene*, November 2002). This study reviewed epidemiological data from local and overseas sources to identify those food businesses, and operations associated with those businesses, which are consistently linked with foodborne illness outbreaks.

The three most frequently encountered hazards based on the material reviewed are:

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- temperature misuse – this incorporates all forms of faulty temperature control of hazardous foods;
- inadequate handling – various forms of cross contamination but often poor worker hygiene; and
- contaminated raw material.

The project was undertaken in two parts with Food Science Australia conducting the risk validation step and Minter Ellison Consulting doing the cost-benefit part of the project. The project was supported by the NSW Department of Health and the Commonwealth Department of Health and Ageing.

Hepatitis A outbreaks associated with green onions

The recent widespread outbreak of Hepatitis A in the United States reinforces the potential hazard of fresh foods which are consumed without a terminal cooking process.

Hepatitis A outbreaks associated with raw or lightly cooked green onions in restaurants occurred in Tennessee, North Carolina, Georgia and Pennsylvania. At the time of writing, the exact source of the contamination had not been established but most of the green onions appear to have been imported from Mexico. Health officials say that approximately 600 cases including three deaths have been linked to this product (*Food Chemical News* 10 December, 2003).

Hepatitis A transmission is by the faecal-oral route but the primary site of viral replication is in the liver. When death does occur, which is rarely, the patient has usually been suffering from a pre-existing liver condition. It is particularly difficult to carry out epidemiological studies on Hepatitis A outbreaks because of the long incubation period for this virus (3–6 weeks).

Contaminated water or food, notably filter-feeding fish, frequently transmit Hepatitis A virus but other foods have also been implicated. Food handlers, including asymptomatic persons may transfer the virus to food during the incubation period for the disease. In this instance, however, it appears that the contamination occurred near the beginning of the production chain.

We have commented before on the difficulties posed in inactivating pathogens on fresh produce (see, for example, *Food Safety & Hygiene*, February 2002) and this is at least as true for viruses as it is for pathogenic bacteria. Where no terminal kill step is involved before a food is consumed, special emphasis has to be placed on through chain control of hazards including personal hygiene.

A report in *Morbidity Mortality Weekly Report* **52** 2003 47 1155 notes that the outbreak at one restaurant was particularly large. Contributing factors at this restaurant could have included multiple opportunities for mixing of uncontaminated and contaminated green onions in a common bucket for five days with the ice with which they were shipped. The report also notes that green onions require extensive handling during harvesting and preparation for packaging. Contamination could occur by contact with workers infected with the virus or by contact with contaminated water during irrigation, rinsing, cooling and icing.

More on foodborne viruses

The recent incident close to home of a Norovirus (formerly called Norwalk-like virus) outbreak on a cruise ship serves to illustrate some of the challenges posed by foodborne viruses. In this incident, approximately 200 of a total 1500 passengers became ill during a Pacific Islands cruise which returned to Sydney on December 27. The affected passengers became ill with vomiting, nausea, stomach cramps and diarrhoea. Tests conducted by the NSW Health Department confirmed Norovirus as the cause of illness.

Noroviruses (NoV) are transmitted by direct contact or indirectly by contaminated water, food or the environment. Many foodborne outbreaks which have been described have been caused by infected food handlers. NoVs are shed in large numbers during the initial stage of the illness and there is also some evidence of airborne transmission (*Food Safety & Hygiene*, February 2001).

Importantly, infectious virus can be transmitted not only at the time of illness but also during the incubation period and after recovery. In a current review of foodborne viruses (*International Journal of Food Microbiology* **90** 2004 23) the Dutch authors note that if viruses are present in foods after processing (or no processing is involved), they remain infectious in most circumstances and in most foods for several days or weeks especially if the food is kept cooled (4°C). They emphasise the need for stringent personal hygiene during food preparation and also the need to emphasise consideration of viruses in setting up food safety quality control and management systems including HACCP. The same important point was made by Australian reviewers reported in *Food Safety & Hygiene*, February 2002.

Resistance of NoV

In their review cited above, the Dutch workers point out that current food hygiene guidelines, most of which have been optimised for the prevention of bacterial infections, may be only partially (if at all) effective against viruses. Previously reported studies in *Food Safety & Hygiene*, February 2002 and May 2002, support this contention. In fact, relatively little is known about the resistance of NoVs to sanitizing treatments because of the lack of a tissue culture system or animal model. In our earlier reports, one group of workers had used human volunteers to study the effect of chlorine on NoV in water, while in the other study a feline calicivirus was used as a model for NoV since it belongs to the same family and grows rapidly in cell culture. This study showed that common chemical sanitizers had to be used at well above normal use concentrations to achieve a significant reduction of the calicivirus.

Prerequisite programs for HACCP

For a HACCP food safety system to be effective a number of prerequisite programs need to be in place. One of these prerequisites covers personal hygiene matters and in the Food Standards Code is addressed by Standard 3.2.2, Division 4 – Health and hygiene requirements.

Unfortunately, many of the procedures listed in 3.2.2 cannot be validated as can, for example, a chilling or heating process. The Standard may require that a food handler 'thoroughly clean his or her hands using soap or other effective means, and warm running water' but the effectiveness of this procedure is likely to vary on an individual basis.

Research in progress

Bivalve shellfish, such as oysters, clams and mussels are frequently implicated in incidents of foodborne viral disease throughout the world and in Australia, most commonly by the Norovirus (NoV) and the Hepatitis A virus.

Researchers at the Australian Food Safety Centre of Excellence are investigating the inactivation of Hepatitis A and feline calicivirus (a surrogate to non-culturable NoV) following treatment with high pressure. High pressure processing is a nonthermal process that can inactivate spoilage and pathogenic microorganisms, whilst having little effect on the sensory and nutritional qualities of foods.

The effectiveness of procedures to exclude human viruses from the food supply will largely be determined by management practices put in place throughout the production chain. Included in these practices will be the training of food handlers in matters of personal hygiene and their responsibility to report any signs of illness.

E. coli outbreak linked to contaminated building

Shiga-toxin producing *Escherichia coli* (STEC) is an important cause of gastrointestinal illness. It causes severe symptoms typical of foodborne illness and a percentage of cases develop haemolytic uraemic syndrome (HUS) which causes renal failure and can result in death.

Fortunately, it is relatively rare in Australia although serious foodborne incidents have occurred (*Food Safety & Hygiene*, February 1996). For the years 2000, 2001 and 2002, there were 38, 48 and 52 cases respectively reported in this country. It is not clear how many of these were foodborne (*Communicable Diseases Intelligence* **27** 2003).

It appears to be a more frequent problem in the United States where *E. coli* 0157, one variant of the toxin producing *E. coli*, causes approximately 70,000 illnesses and 60 deaths annually (*Emerging Infectious Diseases* **607** 1999). A number of serious incidents have been associated with consumption of undercooked hamburgers. Outbreaks have also been linked to contamination of surfaces touched by animals or railings in petting zoos. Person to person transmission may also occur.

Two characteristics of this *E. coli* group are its low infective dose and its ability to survive in the environment.

A report has now been published in the United States which links airborne dispersion of the organism in a contaminated building as the most likely source of infection. There was no evidence to implicate specific foods or beverages (*Journal of the American Medical Association* **290** 2003 2709).

Following identification of a cluster of *E. coli* 0157 infections in the State of Ohio, government scientists conducted a case-control study of people who had attended a local fair. Case patients were defined as those who developed diarrhoea within seven days of attending the fair, had laboratory confirmed *E. coli* 0157 infection, HUS or bloody diarrhoea. Controls were persons who attended the fair during the relevant period and did not exhibit symptoms.

It was found that patients were more likely to have visited a specific building which was a multipurpose community facility located on the fairgrounds. They were more likely than controls to have eaten or drunk in the building, to have handled sawdust from the building's floor or to have attended a dance held in the building on the last night of the fair. The floor of the building was clay covered with up to 5 cm of sawdust. The building was used for auctions, exhibits, concerts, dances and animal shows year round but animals were never housed in the building. During the fair in question, cattle were in the building on all days as were other animals.

Laboratory investigations confirmed that 24 of 54 specimens taken from the building six weeks after the fair grew *E. coli* 0157:NM. Twelve isolates were tested further and found to be genetically identical with organisms isolated from ten patients.

Fourteen weeks after the fair ended, 8 of 16 specimens from the building grew *E. coli* 0157:NM including all four sawdust specimens. One of eight specimens from a rafter located approximately eight metres above the ground was also positive. Forty-two weeks after the fair ended, all six sawdust specimens tested were positive.

The authors note that this is the first reported outbreak of *E. coli* 0157 infection in which a contaminated building is implicated as the source of infection. They speculate that *E. coli* 0157 was dispersed through the air and patients became infected when they ate or drank without adequately washing their hands. It was also possible that some swallowed bacteria that landed directly into their mouths or onto their food or drink.

The report is interesting in its own right and also because it appears to confirm that the infectious dose for this group of pathogens may be very low indeed in susceptible individuals.

Tin in canned foods

Canned foods remain an important segment of the marketplace and have an outstanding safety record. Canned foods are those that are produced by the canning process which involves heating the product to inactivate microorganisms and enzymes and hermetically sealing the product in a package which prevents recontamination.

The container is usually a metal can but may be glass, plastic or other material having the required properties for the canning process. Glass has made a major recovery as a packaging medium with the growth of the sauce market.

The conventional metal can is basically steel, coated on both sides with tin. It combines the strength of steel with the resistance to corrosion and good appearance of tin. It has proved a safe and effective food container for many decades but the uptake of tin by food and beverages continues to occupy the interest of regulatory bodies, at least in Europe.

The Australian Food Standards Code sets a maximum limit for tin in all foods of 250 mg/kg. This is at some variance with Codex Alimentarius recommendations which are 250 mg/kg for solid foods and 150 mg/kg for beverages.

Plain internal tin-plate is normally used for certain foods in preference to lacquered cans where the presence of bare tin surface inside the can leads to protection of the flavour and appearance of the food. Oxidation of the tin surface occurs rather than oxidative degradation of the food. The canning industry is well aware of the potential of tin dissolution to limit shelf life of canned foods and changes in can-making technology, especially the elimination of soldered side seams, have done much to eliminate this problem. In the recently published *20th Australian Total Diet Survey* (Food Standards Australia New Zealand 2003) only two canned foods were analysed for tin – baked beans and tuna – and the readings in each case were extremely low, probably because the cans were internally lacquered. In the *19th Australian Total Diet Survey* (Australia New Zealand Food Authority 2001), the highest figure for tin was recorded by canned pineapple, 81 mg/kg, still well below the maximum permitted level. The age of the can was not given.

Toxicity of tin

In a recent review (*Food and Chemical Toxicology* **41** 2003 1651) English workers conclude that there is little if any evidence for an association between the consumption of food containing tin at concentrations up to 200 mg/kg and significant acute adverse gastrointestinal effects. At its 55th meeting, the FAO/WHO Joint Expert Committee on Food Additives (JECFA) assessed the available evidence on the acute toxicity of tin and concluded that it was insufficient to establish an acute reference dose or to derive maximum permissible levels in canned foods and beverages. However, they went on to reiterate their previously stated opinion that the limited human data available indicates that concentrations of 150 mg/kg in canned beverages or 250 mg/kg in other canned foods may produce 'acute manifestations of gastric irritation in certain individuals'. They seem to be on firmer ground when warning consumers not to store food in open tin-coated cans, a situation which leads to rapid dissolution of tin in the food.

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The English reviewers concede that despite the absence of recent reports of verified tin-induced illness, the potential for rare adverse acute gastrointestinal effects following ingestion of foods containing 200 mg/kg cannot be totally discounted. They recommend well defined clinical studies to advance the discussion.

In the same issue of *Food and Chemical Toxicology*, an international group of researchers have combined to conduct such a study which is a comparative assessment of gastrointestinal irritant potency in man of tin (II) chloride and tin which has actually migrated from tin-plate containers.

The results obtained in this detailed study show, according to the authors, that the chemical form of tin and not the elemental concentration determines the severity of any adverse effects. Both soluble and insoluble tin (II) complexes are formed as unlacquered tin-plate on the inside of cans dissolves into foods. A small number of controlled clinical studies on acute and short-term effects of tin ingested via foods or beverages containing tin which has migrated from the container have been published previously. None of these showed any acute toxic effect associated with the ingestion of foods or beverages containing up to 730 mg/kg of tin, implying a threshold concentration for adverse effects greater than this figure.

This has been difficult to reconcile with many of the reported incidents involving canned foods and beverages for which only approximate estimates of the tin level were obtained.

The international group found in their study, in which tin (II) chloride as analytical grade reagent, was added to tomato juice that elevated tin concentrations may cause gastrointestinal disorders in humans. In the second part of their study, the group selected tin which had migrated from tomato soup in cans as the tin species of interest. The absence of adverse affects attributable to this species of tin suggests that gastrointestinal irritation is determined by chemical speciation of the tin rather than simply by its total concentration. The proportion of tin species present in foods will vary with a number of factors. Tin associated with solid contents of food appears quite resistant to acid extraction and enzymatic hydrolysis and may not be released in appreciable quantity before gastric emptying.

The authors conclude that tin levels up to 267 mg/kg in canned foods cause no adverse effects in healthy adults and support current legislative levels. The Codex Alimentarius Committee on Food Additives and Contaminants is currently working on a Code of Practice for the Prevention and Reduction of Tin Contamination in Foods.

European Union food hygiene legislation

In the June 2003 issue of *Food Safety & Hygiene* under the heading, 'HACCP and small businesses in the UK', it was reported that draft European Union (EU) food hygiene legislation would require that food businesses have a full seven point HACCP plan as described in the Codex Alimentarius basic hygiene texts.

This was opposed by the UK through its Food Standards Agency (FSA). FSA had funded a number of studies (*Food Safety & Hygiene*, March 2003) to measure the cost effectiveness of legislation introduced under the UK Food Safety (General Food Hygiene) Regulations in 1995. Their stated aim was to safeguard the interests of consumers in relation to food. It was also necessary that any controls proposed under European legislation were proportionate to risk and not burdensome to food business operators of any size or sector, or to the relevant enforcement bodies.

As a result of further negotiation the UK agency believes that modified European draft legislation represents a significant improvement based on its own experience. In its December 2003 / January 2004 newsletter, FSA reports that, from their point of view, significant improvements to the European legislation include:

- The principle that food safety management procedures should be based on HACCP principles rather than full HACCP be operated. In theory at least, this will enable a flexible approach to be adopted by those businesses for which the full rigour of the HACCP system would not be appropriate.
- Prescriptive time limits for the retention of documentation have also been removed.
- Requirements for primary production have been clarified. The role of guides to good practice has been augmented so that it is now clear these can describe hazards and the means of controlling them in a generic way.

In the UK, since the implementation of the General Food Hygiene Regulations in 1995, food businesses including retail and catering businesses have been required to analyse and control hazards on the basis of applying five of the seven HACCP principles.

The new European proposals contain the requirement for all food businesses to verify procedures. The proposals also require that all food businesses currently operating under General Food Hygiene law will have to keep documentary records of the procedures in place.

As was noted in one of the FSA studies (*Food Safety & Hygiene*, March 2003), without a verification and recording step, enforcement officers have difficulty in proving non-compliance with the existing hazard analysis requirement in UK legislation.

The HACCP system consists of the following seven principles:	
Principle 1	Conduct a hazard analysis.
Principle 2	Determine the Critical Control Points (CCPs).
Principle 3	Establish critical limit(s).
Principle 4	Establish a system to monitor control of the CCP.
Principle 5	Establish the corrective action to be taken when monitoring indicates that a particular CCP is not under control.
Principle 6	Establish procedures for verification to confirm that the HACCP system is working effectively.
Principle 7	Establish documentation concerning all procedures and records appropriate to these principles and their application.

Codex Alimentarius, 1997

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