

be thoroughly implemented through careful training to ensure full understanding and compliance and be regularly checked to ensure it is being adhered to.

For shared lines and equipment, cleaning is a possibility, but it must be ensured that cleaning is fully effective and validated, can be consistently performed to the same standard, will not leave levels of residues that will present an allergen hazard in the subsequent product and can be fully visually inspected after the clean is complete. For many complex confectionery processes, especially those that are dry-cleaned, this can be very difficult to achieve.

Sequencing of production runs is another option, so that there is follow on of the allergen-containing products, hence reducing the number of major allergen cleans required.

Where labelling of the allergen as an ingredient or via a precautionary warning is necessary, it is imperative that the labelling is done clearly and legibly on the wrapper. This can be a challenge for confectionery, especially for small products where there is minimal room on the wrapper, or where the information may need to be presented in a number of languages. The packaging needs to be carefully designed to ensure that the consumer can easily find this critical food safety information. When the wrapping material is being changed it is of great importance to ensure that the allergen information is thoroughly checked and is verified to be correct before use on finished product. Also, systems must be in place in the factory for product changeovers, to ensure that the correct packaging material with its correct labelling is always in use.

Conclusions

This chapter has presented an outline of the different categories of food safety hazards that must be considered during the manufacture and processing of chocolate. It is hoped that this has given the reader a general overview of the different hazards, and their potential sources, that must be considered, and also some ideas on control measures.

All food safety hazards should be carefully evaluated for each product and manufacturing process through the HACCP approach, including good manufacturing practice programmes, to ensure that such hazards are effectively controlled, enabling the confectionery industry to continue to produce safe and pleasurable products.

References

- Barrile, J., Ostovar, K., Keeney, P. (1971) Microflora of cocoa beans before and after roasting at 150 °C. *Journal of Milk Food Technology*, **34**(7), 369–371.
- Baylis, C.L., MacPhee, S., Robinson, A.J., Griffiths, R., Lilley, K., Betts, R.P. (2004) Survival of *Escherichia coli* O157:H7, O111:H– and O26:H11 in artificially contaminated chocolate and confectionery products. *International Journal of Food Microbiology*, **96**, 35–48.

- Bell, C., Kyriakides, A. (2002) *Salmonella – A Practical Approach to the Organism and its Control in Food*. Blackwell Science, London, pp. 160–163.
- Carr, S.C. (2010) Effects of the peanut recall on a confectionery manufacturer. *The Manufacturing Confectioner*, **2010**(October).
- CDR-HPA (2006). *CDR-HPA Database*. Available at: <http://webarchive.nationalarchives.gov.uk/20140714084352/http://www.hpa.org.uk/cdr/archives/2006/cdr2606.pdf> (accessed 2 January 2016).
- Codex (1985) *General Standard for the Labelling of Prepackaged Food*. Codex STAN 1-1985. Codex Alimentarius, Rome.
- Codex (2013) *Recommended International Code of Practice for the Prevention and Reduction of Ochratoxin A Contamination in Cocoa*. CAC/RCP/72-2013. Codex Alimentarius, Rome.
- Copetti, M.V., Iamanaka, B.T., Pitt, J.I., Taniwaki, M.H. (2014) Fungi and mycotoxins in cocoa: From farm to chocolate. *International Journal of Food Microbiology*, **178**, 13–20.
- Cordier, J.-L. (1994) HACCP in the chocolate industry. *Food Control*, **5**(3), 171–175.
- D'Aoust, J.Y. (1977) Salmonella and the chocolate industry. A review. *Journal of Food Protection*, **40**(10), 718–727.
- Doncheva, I., Dikova, T. (1992) Aflatoxin B1 in cocoa beans and products made from them. *Khranitelna Promishlenost*, **41**(4), 12–13.
- Elson, R. (2006) Outbreak control team. National increase in human *Salmonella* Montevideo infections in England and Wales: March to June 2006. *Euro Surveillance*, **11**(26): pii=2985. Available at: <http://www.eurosurveillance.org/ViewArticle.aspx?ArticleId=2985> (accessed 2 January 2016).
- Engel, D., MacDonald, D., Nash, C. (2001) Living with chemicals. In: *Putting Microbes in Writing 81: Managing Food Safety*. Chadwick House Group Limited, London, pp. 131–135.
- EU (2011) EU Regulation No. 1169/2011 on the provision of food information to consumers. *Official Journal of the European Union*, L304.22.11.2011.
- Fischer, W., Tritshler, A., Schilter, B., Stadler, R. (2011) Contaminants of milk and dairy products. In: *Encyclopedia of Dairy Sciences*, vol. **1** (Fuquay, J.W., Fox, P.F., McSweeney, P.L.H., eds). Academic Press, London, pp. 887–905.
- George, R.M. (2004) *Foreign Bodies in Foods: Guidelines for their Prevention, Control and Detection*, 2nd edn. Guideline No. 5. Campden and Chorleywood Food Research Association Group, Chorleywood.
- Harker, K.S., Lane, C., Gormley, F.J., Adak, G.K. (2013) National outbreaks of *Salmonella* infection in the UK, 2000–2011. *Epidemiology and Infection*, **142**, 601–607.
- ICMSF (2000) Cocoa, chocolate and confectionery. *Micro-Organisms in Food 6: Microbial Ecology of Food Commodities*. Blackie Academic and Professional, Edinburgh, p. 382.
- IFST (2013) *Information Statement – Food Allergy*. Institute of Food Science and Technology, London.
- IJO (2005) *IJO Standard 98/01*, rev. 2005. International Jute Study Group, Paris
- IOCCC (1991) *The IOCCC Code of Hygienic Practice Based on HACCP for the Prevention of Salmonella Contamination in Cocoa, Chocolate and Confectionery Products*, 1st edn. The International Office of Cocoa, Chocolate and Sugar Confectionery, Paris.
- IOCCC (1993) *Specific GMP for the Cocoa, Chocolate and Confectionery Industry*. The International Office of Cocoa, Chocolate and Sugar Confectionery, Paris.
- ISO (2005) *ISO 22000:2005 Food Safety Management Systems – Requirements for Any Organisation in the Food Chain*. International Organisation for Standardisation, London.
- Krapf, T., Gantenbein-Demarchi, C. (2009) Thermal inactivation of *Salmonella* spp. during conching. *LWT Food Science and Technology*, **43**, 720–725.
- Lund, B., Baird-Parker, T., Gould, G. (2000) Sugars, honey, cocoa, chocolate and confectionery products, *The Microbiological Safety and Quality of Food*, vol. **1** (ed. Cordier, J.-L.). Aspen Publishers, New York, pp. 951–955.