

HACCP Principle 1: Identification of Hazards and Associated Risk Categories

HACCP is a systematic way to help insure food safety — it will be discussed here in the context of food processing (manufacturing), with adaptations to other situations presented later.

HACCP is a system dealing with many details in food manufacturing. For an effective HACCP plan to be in place, prerequisites programs must be implemented. These include Good Manufacturing Practices (GMPs) and Sanitation Standard Operating Procedures (SSOPs) which were discussed in detail in the lecture preceding this one.

The first step in developing a HACCP plan is description of product composition and a flow diagram showing all steps (operations) in the manufacturing process.

HACCP is based on 7 principles ("pillars")

1. Identification of hazards and associated risk
2. Identification of Critical Control Points (CCP's)
3. Definition of Critical Limits (CL's) at each CCP
4. Description of monitoring CCP's
5. Definition of corrective actions (deviation responses) when CL's are exceeded
6. Establishment of recording procedures for HACCP plan
7. Establishment of procedures to ensure that HACCP is functioning adequately

HACCP Principle 1: Identification of hazards and associated risks

1. Chemical hazards

1.1 Chemicals used in food production

- Plant foods: Pesticides and fertilizers
- Foods of animal origin: Tranquilizers, antibiotics, other drugs, pesticides

1.2 Chemicals used in the food plant

- Intentional additives: Food additives and adjuvants
- Unintentional additives: Lubricants, detergents, disinfectants, pesticides

1.3 Naturally occurring toxic chemicals

- Toxic foods of animal origin: ciguatera, paralytic shellfish toxin, scombroid toxin, etc.
- Toxic plants: toxic mushrooms, cyanogenic plants
- Mycotoxins: aflatoxins, ochratoxin, patulin, etc.

1.4 Environmental pollutants: Heavy metals, pesticides, polychlorinated biphenyls, etc.

2. Physical hazards

2.1 Crops: insect fragments, feathers, stones, pieces of wood etc.

2.2 Foods of animal origin: bones, feathers, pieces of hide, broken injection needles etc.

2.3 Food processing: fragments of machinery (bolts, screws), plastic pieces, paper, glass, strings, jewelry, writing pens, etc.

2.4 Facilities: flaking paint, insulation material, tile fragments, rodent droppings, mold, insects, etc.

The most common consumer complaints are about physical hazards but their health implications are minor.

A HACCP plan is supposed to manage real risks to consumer health. Risk assessment comprises an estimate of the likelihood that a hazard will affect consumers and a perception of the severity of the hazard's effect.

3. Microbiological hazards

3.1 Classification

- Infectious organisms: bacteria, viruses, parasites
- Invasive infectious microorganisms (invade the lining of the intestine and may travel to other parts of the body): *Salmonella*, *Shigella*, *Toxoplasma*
- Toxicoinfectious microorganisms (colonize the intestine and produce toxic substances): *Clostridium botulinum* (infant botulism), *Bacillus cereus* (diarrheal type), *Clostridium perfringens*, shiga-like toxin (SLT) producing *Escherichia coli*
- Toxigenic microorganisms (grow in food and produce toxic substances before the food is eaten): *Bacillus cereus* (emetic type), *Clostridium botulinum*, *Staphylococcus aureus*

3.2 Severity

- Severe, direct (extensive spread not likely) with potential of causing life-threatening disease: *Clostridium botulinum*, *Listeria monocytogenes*, SLT *Escherichia coli*

- Moderate with potential for extensive spread: *Salmonella*, *Shigella*, *Vibrio parahaemolyticus*, certain enterotoxigenic or enteropathogenic *Escherichia coli*
- Moderate with limited spread: *Staphylococcus aureus*, *Clostridium perfringens*, *Bacillus cereus*
- To these classes is sometimes added a "low indirect" group of microorganisms that are indicators of fecal contamination: "generic" *Escherichia coli*

3.3 Food characteristics

- Special types of non-sterile foods intended for high risk populations
- Foods that contain microbiologically sensitive components
- Foods where processing does not eliminate pathogens
- Foods subject to recontamination
- Foods that have potential for recontamination
- Foods that are not heat processed after packaging

3.4 Risk categories

- VI. Non-sterile foods intended for high risk populations, types A - F
- V. Includes five types among B - F
- IV. Includes four types among B - F
- III. Includes three types among B - F
- II. Includes two types among B - F
- I. Includes one of the types B - F
0. No hazard

3.5 How do we find out what are the microorganisms that present a hazard in a given food?

- Study the literature on foodborne outbreaks associated with the food in question
- Study the literature on outbreaks caused by similar foods

Books are a good starting point:

Int. Assoc. Milk, Food and Envir. Sanitar. (1999) Procedures to investigate foodborne illness, Des Moines, Iowa.

Chin, J. 2000. Control of communicable diseases manual, 17th ed. American Public Health Association, Washington, DC.

Cliver, D. O., and Riemann, H. P., eds. 2002. Foodborne Diseases, 2d ed., Academic Press, London.

Delazari, I., Riemann, H.P., Hajmeer, M.N. (2006) Preharvest and animal production food safety. Ch. 19. In Foodborne infections and intoxications. 3rd Ed. Riemann, H. and Cliver, D.O. (Eds.) Academic Press, New York, NY. pp. 833-877.

Hui, Y.H., Pierson, M.D., Gorham, J.R. (2001) Foodborne Diseases Handbook. New York, NY, Marcel Dekker.

Labbe, R. G., and S. Garcia. 2001. Guide to foodborne pathogens. Wiley Interscience, New York.

Riemann, H. and Bryan, F.L. (1979) Foodborne Infections and Intoxications, 2d ed., Academic Press.

Hocking, A.D., Arnold, G., Jenson I., Newton, K. and Sutherland, P. (1997) Foodborne Microorganisms of Public Health Significance. AIFST (NSW Branch) Food Microbiology Group, Trenear Printing Service, Tempe, NSW, Australia. van der Heijden, K., Younes, M., Fishbein, L. and Miller, S. (1999) International Food Safety Handbook, Marcel Dekker, Inc.

Detailed information about growth potential of different pathogens in a food of a given composition and held at a defined temperature can be obtained using the computer software "Pathogen Modeling Program" produced by the US Department of Agriculture.