

## HACCP Builder – Conducting A Hazard Analysis

This program provides guidance for determining food safety hazards in foods and/or food preparation processes at retail. Although the hazard analysis has been kept general for the purposes of developing your food safety management systems, it is still recommended that you consult with your regulatory authority or other food safety professional when conducting this procedural step.

### HOW DO YOU CONDUCT A HAZARD ANALYSIS?

The purpose of hazard analysis is to develop a list of food safety hazards that are reasonably likely to cause illness or injury if not effectively controlled. The process of conducting a hazard analysis involves two stages:

1. Hazard Identification
2. Hazard Evaluation

Hazard identification can be thought of as a brain storming session. This stage focuses on identifying the food safety hazards that might be present in the food given the food preparation process used, the handling of the food, the facility, and general characteristics of the food itself. During this stage, a review is made of the ingredients used in the product, the activities conducted at each step in the process, the equipment used, the final product and its method of storage and distribution, as well as the intended use and consumers of the product. Based on this review, a list of potential biological, chemical, or physical hazards is made at each stage in the food preparation process. In stage two, the hazard evaluation, each potential hazard is evaluated based on the severity of the potential hazard and its likely occurrence. The purpose of this stage is to determine which of the potential hazards listed in stage one of the hazard analysis warrant control in the HACCP plan. Severity is the seriousness of the consequences of exposure to the hazard. Considerations made when determining the severity of a hazard include understanding the impact of the medical condition caused by the illness, as well as the magnitude and duration of the illness or injury. Consideration of the likely occurrence is usually based upon a combination of experience, epidemiological data, and information in the technical literature. Hazards that are not reasonably likely to occur are not considered in a HACCP plan. During the evaluation of each potential hazard, the food, its method of preparation, transportation, storage, and persons likely to consume the product should be considered to determine how each of these factors may influence the likely occurrence and severity of the hazard being controlled.

Upon completion of the hazard analysis, a list of significant hazards that must be considered in the HACCP plan is made, along with any measure(s) that can be used to control the hazards. These measures, called control measures, are actions or activities that can be used to prevent, eliminate, or reduce a hazard. Some control measures are not essential to food safety, while others are. Control measures essential to food safety like proper cooking, cooling, and refrigeration of ready-to-eat, potentially hazardous foods are applied at critical control points (CCPs) in the HACCP plan. The term control measure is used because not all hazards can be prevented, but virtually all can be controlled. More than one control measure may be required for a specific hazard. Likewise, more than one hazard may be addressed by a specific control measure (e.g. proper cooking). The physical characteristics and composition of the food during and after preparation should be considered when determining the risk of a hazard. This means understanding the intrinsic and extrinsic factors of the food that would allow conditions that support the survival or growth of bacteria. Intrinsic factors are those that are inherent to the food and are not readily controlled by people in a retail establishment, such as water activity, nutrient content, and competitive microorganisms. Extrinsic factors are those that people can readily control, such as temperature, acidity, and availability of air. Once the significant biological hazards are identified for a food, there are several issues to consider when determining if conditions exist that would support their growth or survival, including:

- The nature of the food (ground or intact; plant or animal)

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- Whether the food is improperly cooled after cooking or improperly hot held, (*Clostridium perfringens* or *Bacillus cereus* could grow because their spores survive cooking and germinate)
- Whether the food is improperly cold held (*Listeria monocytogenes* and *Yersinia* will be a concern because they grow at refrigeration temperatures)
- Whether foods have a high salt content (*Vibrio* and *Staphylococcus aureus* are likely to grow because they are salt-tolerant)
- Whether air is unavailable, such as in the interior of a cooked food or a sealed modified-atmosphere package (*Clostridium botulinum* and *C. perfringens* will thrive when air is not present)
- Whether water activity is high (*Staphylococcus aureus* needs to have nutrients readily available in order to thrive, but it can produce a potent toxin in a food with a water activity that is lower than that needed by other organisms)

### **Several questions that you may ask yourself when assessing the food safety hazards in food include the following:**

- Does the food permit survival or multiplication of pathogens and/or toxin formation in the food before or during preparation?
- Will the food permit survival or multiplication of pathogens and/or toxin formation during subsequent steps of preparation?
- What has been the safety record for the product in the marketplace? Is there an epidemiological history associated with this food?
- Is the food served to a highly susceptible population?
- What is known about the time/temperature exposure of the food?
- What is the water activity and pH of the food?
- Have bare hands touched the food, or otherwise cross-contaminated it?
- Is the food from a safe source?
- Do food workers practice good personal hygiene, including frequent and effective hand washing?
- Has the food been exposed to unclean or unsanitized equipment?
- Does the preparation procedure or process include a step that destroys pathogens or their toxins? (Consider both vegetative cells and spores)
- Is the product subject to recontamination after cooking?

Hazard identification, in conjunction with risk and severity estimation, provides a rational basis for determining hazards of significance. There may be differences of opinion, even among experts, as to the risk of a hazard and one may need to consult reliable information published in peer-reviewed literature or recognized experts in the field. The hazards must at least include those that are commonly associated with a specific product. A list of specific food safety hazards found in common products follows. As pointed out in Procedural Step 3, each of these food safety hazards

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belong to more general categories of hazards that may be used as you develop your food safety management system:

- *Salmonella* and *Campylobacter jejuni* in raw poultry
- *Salmonella* Enteritidis in undercooked eggs
- *E. coli* O157:H7 in raw ground beef
- *Listeria monocytogenes* in ready-to-eat foods, such as hot dogs and deli meat
- Bacterial pathogens associated with unpasteurized juice or milk
- *Staphylococcus aureus* toxin formation in ready-to-eat products that are contaminated and later temperature-abused, such as cooked ham
- *Bacillus cereus* spore survival and toxin formation in cooked rice
- *Clostridium perfringens* and *B. cereus* spore survival and subsequent growth in cooked meat/meat products

**Table 1. Selected Biological and Chemical Hazards Found at Retail, Associated Foods, and Control Measures**
**(Bacteria related hazards)**

Hazards	Associated Foods	Control Measures
<i>Bacillus cereus</i> (intoxication caused by heat-stable, preformed emetic toxin or toxicoinfection caused by heat-labile, diarrheal toxin)	Meat, poultry, starchy foods (rice, potatoes), puddings, soups, cooked vegetables	Cooking, Cooling, Cold Holding, Hot Holding
<i>Campylobacter jejuni</i>	Poultry, raw milk	Cooking, Handwashing, Prevention of Cross-contamination
<i>Clostridium botulinum</i> (intoxication caused by preformed heat-labile toxin)	Vacuum-packed foods, reduced oxygen packaged foods, under-processed canned foods, garlic-in-oil mixtures, time/temperature abused baked potatoes/sautéed onions	Thermal Processing (Time + Pressure), Cooling, Cold Holding, Hot Holding, Acidification and Drying, etc.
<i>Clostridium perfringens</i>	Cooked meat and poultry, Cooked meat and poultry products including casseroles, gravies	Cooling, Cold Holding, Reheating, Hot Holding
<i>E. coli</i> O157:H7 (other shiga toxin-producing <i>E. coli</i> )	Raw ground beef, raw seed sprouts, raw milk, unpasteurized juice, foods contaminated by infected food workers via fecal-oral route	Cooking, No Bare Hand Contact with RTE Foods, Employee Health Policy, Handwashing, Prevention of Cross-contamination, Pasteurization or Treatment of Juice
<i>Listeria monocytogenes</i>	Raw meat and poultry, fresh soft cheese, Pate, smoked seafood, deli meats, deli salads	Cooking, Date Marking, Cold Holding, Handwashing, Prevention of Cross contamination
<i>Salmonella spp.</i>	Meat and poultry, seafood, eggs, raw seed sprouts, raw vegetables, raw milk, unpasteurized juice	Cooking, Use of Pasteurized Eggs, Employee Health Policy, No Bare Hand Contact with RTE foods, handwashing, Pasteurization or Treatment of Juice
<i>Shigella spp.</i>	Raw vegetables and herbs, other foods contaminated by infected workers via fecal-oral route	Cooking, No Bare Hand Contact with RTE Foods, Employee Health Policy, Handwashing
<i>Staphylococcus aureus</i> (intoxication caused by preformed heat-stable toxin)	RTE PHFs touched by bare hands after cooking and further time/temperature abused	Cooling, Cold Holding, Hot Holding, No Bare Hand Contact with RTE Food, Handwashing
<i>Vibrio spp.</i>	Seafood, shellfish	Cooking, Approved Source, Prevention of Cross-contamination

**(Parasite related hazards)**

Hazards	Associated Foods	Control Measures
<i>Anisakis simplex</i>	Various fish (cod, haddock, fluke, pacific salmon, herring, flounder, monkfish)	Cooking, Freezing
<i>Taenia spp.</i>	Beef and pork	Cooking
<i>Trichinella spiralis</i>	Pork, bear and seal meat	Cooking

**(Viruses related hazards)**

Hazards	Associated Foods	Control Measures
Hepatitis A and E	Shellfish, any food contaminated by infected worker via fecal-oral route	Approved Source, No Bare Hand Contact with RTE Food, Minimizing Bare Hand Contact with Foods Not RTE, Employee Health Policy, Handwashing
Other Viruses (Rotaviruses, Noroviruses, Reoviruses)	Any food contaminated by infected worker via fecal-oral route	No Bare Hand Contact with RTE Food, Minimizing Bare Hand Contact with Foods Not RTE, Employee Health Policy, Handwashing

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**Table 2: Example - Foods that might be served raw or undercooked**

Raw Animal Food	Menu Items	Hazards
Beef	Steak Tartare Carpaccio Lasagna Burgers	<i>Salmonella</i> spp. <i>Escherichia coli</i> O157:H7
Poultry	Duck	<i>Salmonella</i> spp. <i>Campylobacter jejuni</i>
Eggs	Quiche, hollandaise sauce, Eggs Benedict, homemade mayonnaise, meringue pie, some puddings and custards, Monte Cristo sandwich, mousse, tiramisu, chicken croquettes, rice balls, stuffing, lasagna, french toast, crab cakes, egg nog, fish stuffing, Caesar salad, ice cream	<i>Salmonella</i> Enteritidis
Raw Fish/Finfish	Lightly cooked fish, sushi, raw-marinated, coldsmoked fish, ceviche, tuna carpaccio  Reef fish (barracuda, amberjack, horse-eye jack, black/jack, other large species of jack, king mackerel, large groupers, large snappers)	<i>Anisakis simplex</i> <i>Diphyllobothrium</i> spp. <i>Pseudoterranova decipiens</i> <i>Vibrio parahaemolyticus</i>  <i>Ciguatera</i> toxin
Shellfish	Oysters Clams	<i>Vibrio vulnificus</i> <i>Vibrio</i> spp. Hepatitis A Norovirus
Raw Dairy Products	Raw or unpasteurized milk, some soft cheeses like Camembert, Brie, etc.	<i>Listeria monocytogenes</i> <i>Salmonella</i> spp. <i>Campylobacter jejuni</i> <i>E. coli</i> O157:H7