HACCP 101 Part II-Principle 1. Hazard Analysis

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"A hazard is any factor that may be present in a food product that can cause harm to the consumer either through injury or illness." (Mortimer and Wallace, 1994).

What types of hazards are considered?
There are three categories of hazards that are considered in a HACCP plan.

These are: biological,
chemical or
physical.

All types of hazards can enter a food product at any stage during processing. Biological hazards include pathogenic bacteria, viruses, parasites and protozoa, and mycotoxins produced by molds. Chemical hazards include cleaning chemicals, pesticides (including those not applied in or around food processing establishments), allergens, toxic metals, nitrites and nitrates (when added to the product), plasticizers and packaging migration, veterinary residues (when animals are involved), and chemical additives (when added). Physical hazards include a wide variety of foreign materials but are only included in a hazard analysis when they can cause injury or illness in the consumer. Sand may be an undesirable foreign material in a prepared salad but it is not likely to cause human illness. Physical hazards include glass, metal, stones, wood, plastic, or pests (typically larger pests).

Where should you begin?
The following are suggestions for how you might approach a hazard analysis of your product.

1. Describe your product or product category and its intended use.
This includes a written description including both the product name(s) and common name. For example, "Pentelope's Perfectly Peachy Pie" is a Peach Pie. Intended use would indicate whether the product is to be sold at retail, to food service or as an ingredient for another food item. Note if the product is specifically intended for use by susceptible populations

including infants and young children, the elderly, or immune compromised individuals.

2. Define the scope of your hazard analysis.
If you are new to HACCP it is particularly important to define and possibly limit the scope of your hazard analysis so that it doesn't overwhelm your HACCP team. You may wish initially to focus on one part of your process or on one of the hazard types until your HACCP team is familiar with performing a hazard analysis. Later you can follow up with the other hazard types or other parts of the process. Ask the following questions:

- Will the hazard analysis cover a single product or a group of similar products?
- Will the hazard analysis cover the whole process or only part of the process?
- Will all biological, chemical, or physical hazards be identified or will the focus be on one category at this time?
- Will the hazard analysis end in your facility or will it continue through distribution and retail?

3. Develop a flow diagram of the process for your product or product category.
During this step a Process Flow Diagram is prepared detailing all of the steps in the process from incoming raw materials through the finished product and product distribution. Raw materials should be identified as well as all processing activities. Time and temperature profiles including those for storage and distribution are important. The more information you can provide on your flow diagram, the easier it will be to assess the potential hazards at each step. It may also be useful to include a floor plan that details product flow through the facility.

4. Verify your flow diagram.
At this stage the HACCP team should verify the flow diagram by walking through the processing facility and observing each step in the process while it is in operation.

5. Identify hazards at each step in the process.
This initially involves brainstorming to develop a list all potential hazards that could be introduced or increased at each processing step. Without brainstorming assumptions may be made and hazards may be missed. This step involves the expertise and perspective of all team members. It should also involve reference materials on HACCP, on microbiology, or on the product or product category. Every effort should be made to have a thorough and up-to-date file on the product or product category especially with respect to outbreaks or recalls and the reasons for them. We should learn from our own AND other's problems or mistakes. Industry associations, research associations, universities, and regulatory authorities are often good sources of this information.

The following items should be considered:

- Raw materials;
- Facility, equipment and process design;
- Integral product factors such as pH, water activity, additives that could reduce or create microbial hazards;
- Personnel and personnel practices;
- Packaging;
- Storage and distribution.

6. Evaluate the hazards identified at each step in the process.
Each hazard identified during brainstorming must be evaluated with respect to its severity and its likely occurrence in your operation. This is known as risk assessment. If the risk of the hazard is low or if it is unlikely to occur it can be eliminated from further consideration. However, it is essential to document the thought process behind eliminating a particular hazard. Depending upon the expertise of the HACCP team, this step may require the opinion of experts.

7. Identify preventive measures.
Preventative measures, if available, should be identified for each hazard. Biological hazards due to pathogenic microorganisms might be controlled by preventing their growth through acidification of the product (e.g., acidifying garlic prior to adding it to oil). Physical hazards due to metal fragments might be prevented by a metal detector.
The results of the hazard analysis should be summarized in a tabular form (Table 1). All of the documents related to the hazard analysis should become a permanent part of the HACCP plan .

Table 1. Examples of the results of a Hazard Analysis (various products are represented).

Point of Occurrence	Identified Hazard	Preventative Measure
Raw garlic (for use in flavored oil)	*Clostridium botulinum* (may produce toxin and cause botulism)	Proper acidification prior to adding to oil
Chopped lettuce (for use in salad)	Glass (may cause cuts)	GMP audits exclusion of glass from processing facility; regular preventative maintenance
Various equipment (may cause cuts)	Metal fragments	GMP audits, regular preventative maintenance, magnets, metal detector