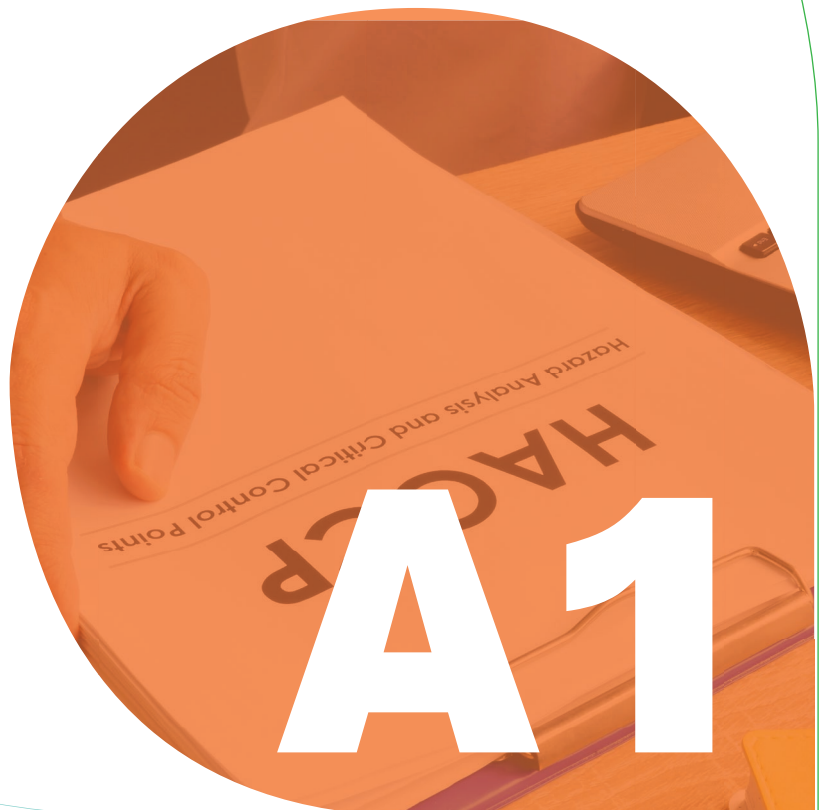


APPENDIX 1

Food Safety Management Systems



Overview

A food safety management system (FSMS) is a structured documented framework designed to identify, control and mitigate food safety hazards within a business's operations. The primary objective is to prevent contamination, reduce its impact when it occurs and prevent any increase in contaminants during the growing and production process. Food safety risks can occur through multiple pathways, as outlined in Figure A1.1. An effective FSMS implements controls to manage potential food safety risks in fresh produce, ensuring the integrity of the product and safety of consumers.

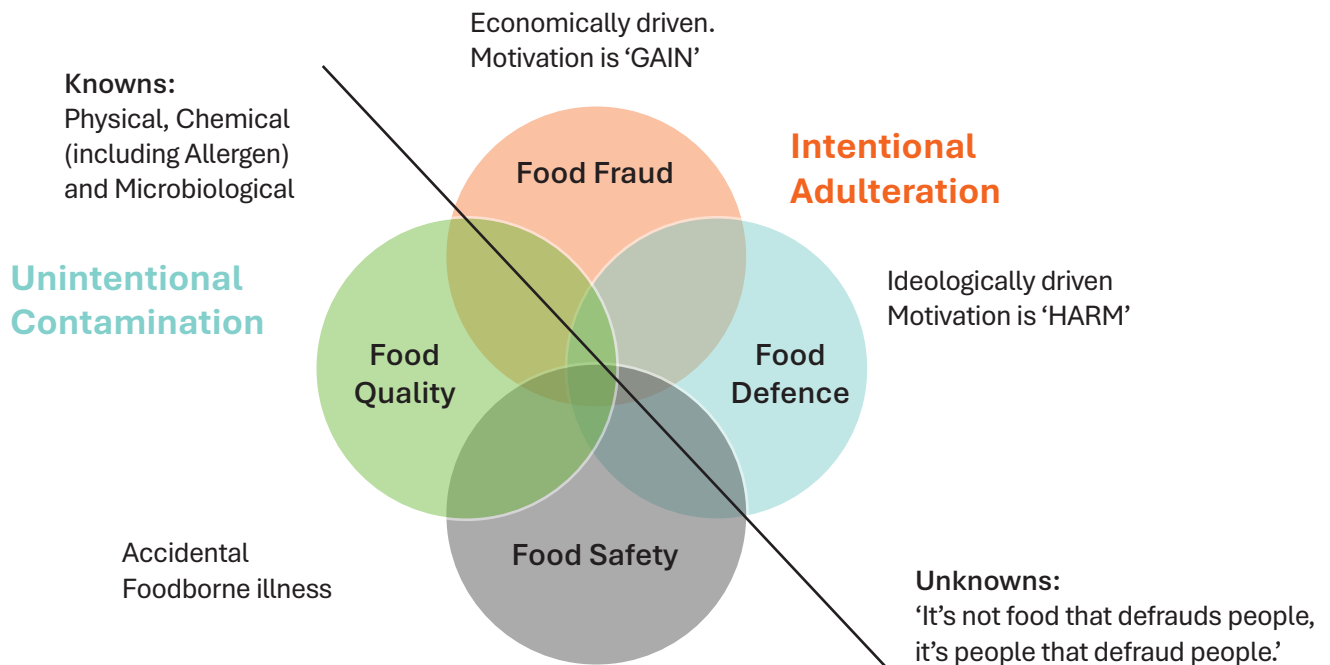


Figure A1:1 | Summary of food risk types and causes adapted from GFSI Position Paper on Food Fraud (2014).

A1.1 Hazard analysis and critical control point (HACCP) system

HACCP shifts control from reliance on end-point produce testing (i.e. prevent, eliminate or reduce hazards to an acceptable level). While some end-point verification testing remains necessary, the primary focus is on proactive management (i.e. the effective control of day-to-day potential hazards within a HACCP system is supported by prerequisite practices). These practices establish the fundamental environmental and operational conditions required for the production of safe produce, examples include:

- Good Agricultural Practices (GAP) for cultivation
- Good Hygienic Practices (GHP) for preharvest and postharvest handling

The cross functional HACCP team members should have sufficient working knowledge of the process, the product and the likely hazards to be able to contribute to the development and maintenance of the HACCP plan. Prior to commencing the hazard analysis, it is necessary to describe the product, identifying intended use or users and process (i.e. state the start and end points and define the hazards to be considered) [refer Chapter 3]:

- physical (e.g. wood, stones)
- chemical including Allergen (e.g. natural toxins, heavy metals, peanuts, soy)
- biological (e.g. microbiological - *Salmonella*, *Listeria*)

A food safety management system (FSMS) is a structured framework designed to control food safety hazards within a business's operations.

The process flow diagram should cover all relevant steps of the operation. Each step in the process should be numbered and clearly identify any inputs (e.g. ice, packaging), rework and outputs (e.g. waste). The HACCP team is responsible for verifying that the flow diagram accurately represents the process, which is typically achieved by walking through the operation from start to finish.

The seven principles of HACCP:

1. conduct a hazard analysis and identify control measures
2. determine the critical control points (CCPs)
3. establish validated critical limits
4. establish a system to monitor control of CCPs
5. establish corrective actions to be taken when monitoring indicates a deviation from a critical limit at a CCP has occurred
6. validate the HACCP plan and then establish procedures for verification to confirm that the HACCP system is working as intended
7. establish documentation concerning all procedures and records appropriate to these principles and their application.

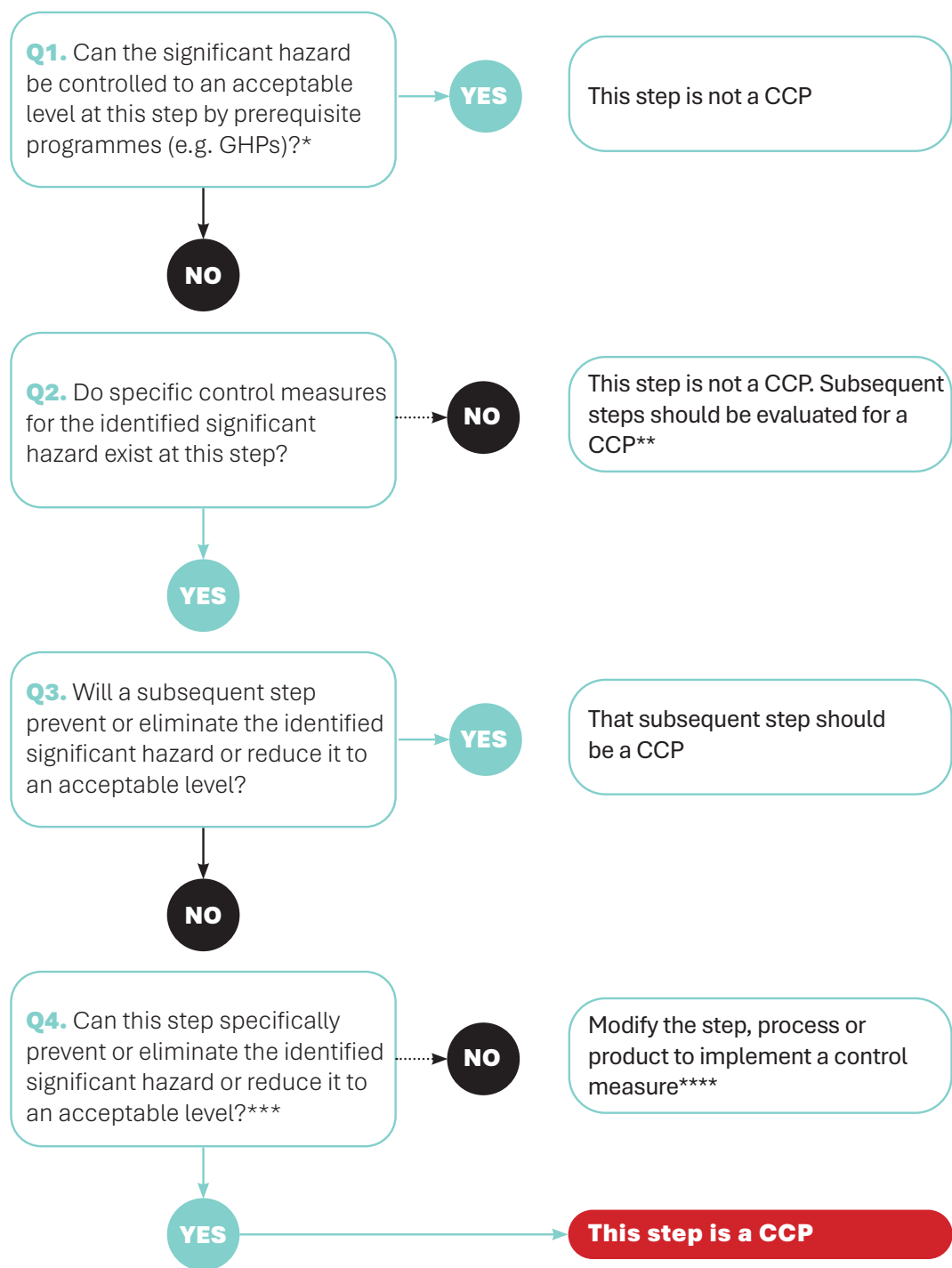
Hazard analysis consists of identifying potential hazards and evaluating these hazards, which involves evaluating the potential severity, likelihood and overall significance of risk for each identified hazard within the business's operational processes. The scoring system is one approach to determine the significance of a hazard, assigning scores for severity and likelihood and multiplying together. Figure A1:2 provides an examples of a five point scoring systems. This calculation establishes whether a risk is classified as significant (i.e. requiring controls) or not significant. The severity of many food safety hazards are known. It is the likelihood of hazard occurrence that many fresh produce businesses need to determine.

Likelihood		Severity	
1	Improbable event (once every 5 years)	1	Not significant
2	Remote possibility (once per year)	2	Customer complaint
3	Occasional event (once per month)	3	Product recall
4	Probable event (once per week)	4	Serious illness
5	Frequent event (once per day)	5	Fatality

5x5	Likelihood				
Severity	1	2	3	4	5
5	5	10	18	20	25
4	4	8	12	16	20
3	3	6	9	12	15
2	2	4	6	8	10
1	1	2	3	4	5

Figure A1:2 | Example food safety 5x5 risk matrix.

The next action for the HACCP team is to consider what control measures can be applied to each significant hazard. Control measures are those actions that are required to prevent, eliminate or reduce the occurrence of the hazard to acceptable levels. The identification of a CCP for a control of a hazard requires a logical approach, this maybe aided by a decision tree (Figure A1:3).



* Consider the significance of the hazard (i.e. the likelihood of occurrence in the absence of control and the severity of impact of the hazard) and whether it could be sufficiently controlled by prerequisite programmes such as GHPs. GHPs could be routine GHPs that require greater attention to control the hazard (e.g. monitoring and recording).

** If a CCP is not identified at questions 2–4, the process or product should be modified to implement a control measure and a new hazard analysis should be conducted.

*** Consider whether the control measure at this step works in combination with a control measure at another step to control the same hazard, in which case both steps should be considered at CCPs.

**** Return to the beginning of the decision tree after a new hazard analysis.

Figure A1:3 | CCP decision tree (FAO and WHO, 2023).

Critical limits establish whether a CCP is in control and in doing so separates acceptable products from unacceptable products. Critical limits should be measurable (e.g. contact time and chemical concentration) and scientifically validated to provide evidence that are capable of controlling hazards to an acceptable level, if properly implemented.

Monitoring is a planned sequence of measurements or observations at a CCP relative to the defined critical limits. The monitoring system and frequency should be capable of timely detection of any failure to remain within critical limits, to allow timely isolation and evaluation of affected produce.

Specific written corrective actions should be developed for each CCP in the HACCP system. Corrective actions taken in response to a deviation should ensure the CCP is brought back under control and that any potentially unsafe produce is appropriately managed to prevent produce from reaching consumers. Any CCP deviation should be investigated and timely remedial action taken.

Process step	CCP no.	Significant hazards and cause/ source	Control measures	Critical limit	Monitoring (what, how, when & who)	Corrective action	Verification activities	Records

Figure A1:4 | Example of a HACCP worksheet adapted from the FAO and WHO, 2023.

The HACCP plan should be validated prior to implementation. The main objective of validation is to ensure that the hazards identified in the study are complete and correct and that selected controls and frequency of monitoring of these hazards are suitable. Validation could include review of scientific literature, using mathematical models, conducting trials and/or using guidance developed by authoritative sources.

After the HACCP system has been implemented, procedures should be established to confirm the HACCP system is working effectively. Verification activities included observation, internal and external auditing, calibration of equipment, analysis of customer complaint trends, targeted sampling/testing and systematic record review. Verification should be carried out by someone other than the person who is responsible for performing and monitoring and completing corrective actions.

HACCP team members should be trained, at least annually in HACCP principles to ensure they understand food safety hazards and their role in developing, implementing and maintaining a food safety management system.

Accurate record keeping is essential to the successful application of HACCP. Examples of HACCP documentation include:

- HACCP team composition
- pre-requisites programmes
- HACCP plan
- CCP monitoring
- CCP deviations and corrective actions
- root cause analysis reports
- verification procedures performed
- HACCP team member training.

A1.2 Root cause analysis

When a food safety control failure occurs, the root cause should be identified so that further failures can be prevented. Always start by creating a clear, concise problem statement. Records, data trends, customer complaints or a food safety incident may alert the business to loss of control in the FSMS. For example, equipment failures, out- of-specification produce or training deficiencies all have a root cause that will need to be addressed. There are various methods to undertake root cause analysis such as the Ishikawa (Fishbone) technique that assesses the effects of people, equipment, materials, methods, environment, and measurement on a problem (Figure A1.5) and the “5 Whys” technique (Figure A1.6). Each method provides root cause analysis, informs preventative controls and contributes to continuous improvement.

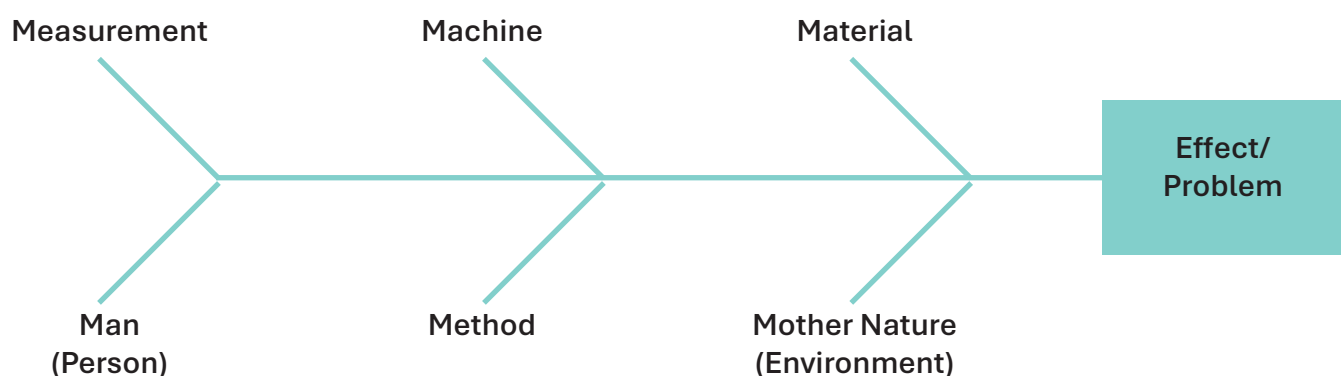


Figure A1:5 | Ishikawa (Fishbone) leading to root cause of a problem.

Define the problem:

Why is it happening?

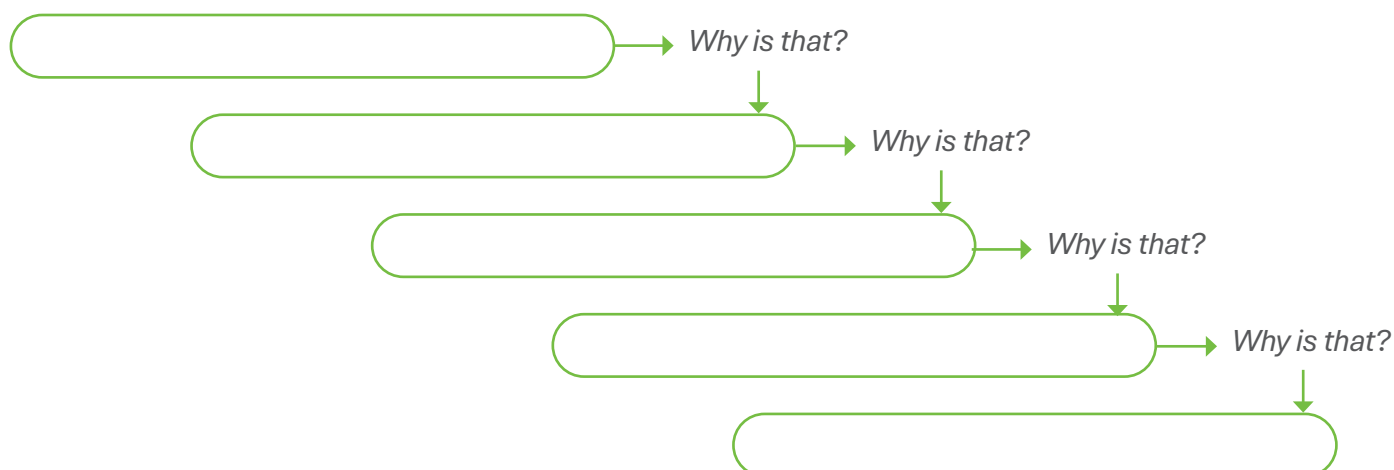


Figure A1:6 | The 5-Whys leading to root cause of a problem.

A1.3 Food defence

While GAP and HACCP are concerned with food safety hazards that can be unintentionally introduced, there are other risks related to intentional threats/attacks aimed at causing harm to consumers, businesses or disrupting the supply chain. Procedures and activities to control such threats are food defence measures.

As defined by the Global Food Safety initiative (GFSI), food defence is: ‘the process to ensure the security of food, food ingredients, feed or food packaging from all forms of intentional malicious attack including ideologically motivated attack leading to contamination or unsafe product’.

Attacks can vary in their impact, potentially affecting public health, consumer confidence and business. Attacks come in different forms, for example, malicious contamination, extortion and cybercrime. One example is the intentional introduction of needles into strawberries sold in Australia and New Zealand in 2018.

Attackers can be an organised criminal, a disgruntled individual including disgruntled employee or ex- employee, an extremist, extortionist or a cybercriminal. For instance, a disgruntled team member might attempt to introduce harmful substances onto fresh produce or an external attacker might seek to disrupt a company’s operations by tampering with packaging or raw materials.

Controls to mitigate such threats include:

- restricting access to sensitive areas
- securing the site using fences
- installing lights and surveillance and alarm systems
- implementing tamper-evident seals on packaging
- using suitable information system and network controls.

Food defence threat assessment can be conducted using appropriate methods, such as a simple risk matrix to prioritise measures aimed at reducing the risk of intentional attacks or at least detecting them before a food safety incident occurs.

Creating awareness across the business, especially among key team members on-site ensures that everyone understands the importance of these measures. Awareness training and clear communication about reporting suspicious activities, recognising potential threats and responding effectively can significantly strengthen a company’s ability to prevent or at least detect food defence attacks. By fostering a culture of vigilance and continuous improvement, businesses in the fresh produce industry can reduce threats and ensure a more secure supply chain [refer Chapter 20].

A1.4 Food fraud prevention

Food Fraud is another aspect that HACCP and GAP is not designed to control.

According GFSI, food fraud is ‘A collective term encompassing the deliberate and intentional substitution, addition, tampering or misrepresentation of food, food ingredients, feed, food packaging or labelling, product information or false or misleading statements made about a product for economic gain that could impact consumer health’.

It involves deliberate deception for economic gain. Fraudulent activities, such as substitution, mislabelling, counterfeiting or dilution, can undermine consumer trust and safety.

Food fraud incidents vary widely. Examples include:

- mislabelling lower grade produce as premium
- bulking a commodity with a similar commodity of lesser value
- using false certifications to sell non-compliant goods
- selling diluted or counterfeit pesticides.

Such actions can lead to reduced consumer confidence, economic losses and in some cases, direct harm to public health. Food fraud can also introduce allergens to a product (e.g. the addition of ground peanut and almond shells to ground cumin).

Those committing food fraud may include dishonest suppliers, organised crime groups or individuals within the supply chain. For example, a supplier might knowingly provide substandard packaging or fertilisers and misrepresent them as compliant or a dishonest trader may falsify documentation to sell goods that do not meet regulatory or safety standards.

Preventive measures against food fraud include:

- establishing supplier approval and monitoring processes
- conducting regular audits and authenticity testing
- verifying supplier certifications
- maintaining full traceability of products and materials
- product authentication systems
- traceability solutions
- data analysis techniques to identify and deter fraudulent activities.

Raising awareness among team members about the risks of food fraud and how to detect signs of it is equally important. Ongoing training, clear reporting channels and transparent communication encourage team members to speak up if they encounter questionable practices [refer Chapter 20]. Collaborating and exchanging information among growers about suppliers, fraud incidents and effective preventive measures fosters a collective protection against food fraud across the entire industry. By integrating these prevention efforts into their operations, businesses in the fresh produce industry can protect their brands, maintain consumer trust and help ensure a fair and secure market.

Resources

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