

**To Participate in Polling Questions,
Scan the Poll EV QR Code Below**





Building Blocks for a Food Safety System

Produced by
FoodSafety
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Agenda:

Polling Questions & Introduction

Glenn Stolowski

Food Safety Training/Food Safety Culture-

Rebecca Guzy-Small company view,
Donna Schaffner-Large company view

Documentation/QMS/SOP's

Sharon Beals

SSOP's-

Sharon Beals

Pre-requisites/HACCP/Hazard Analysis-

Larry Keener

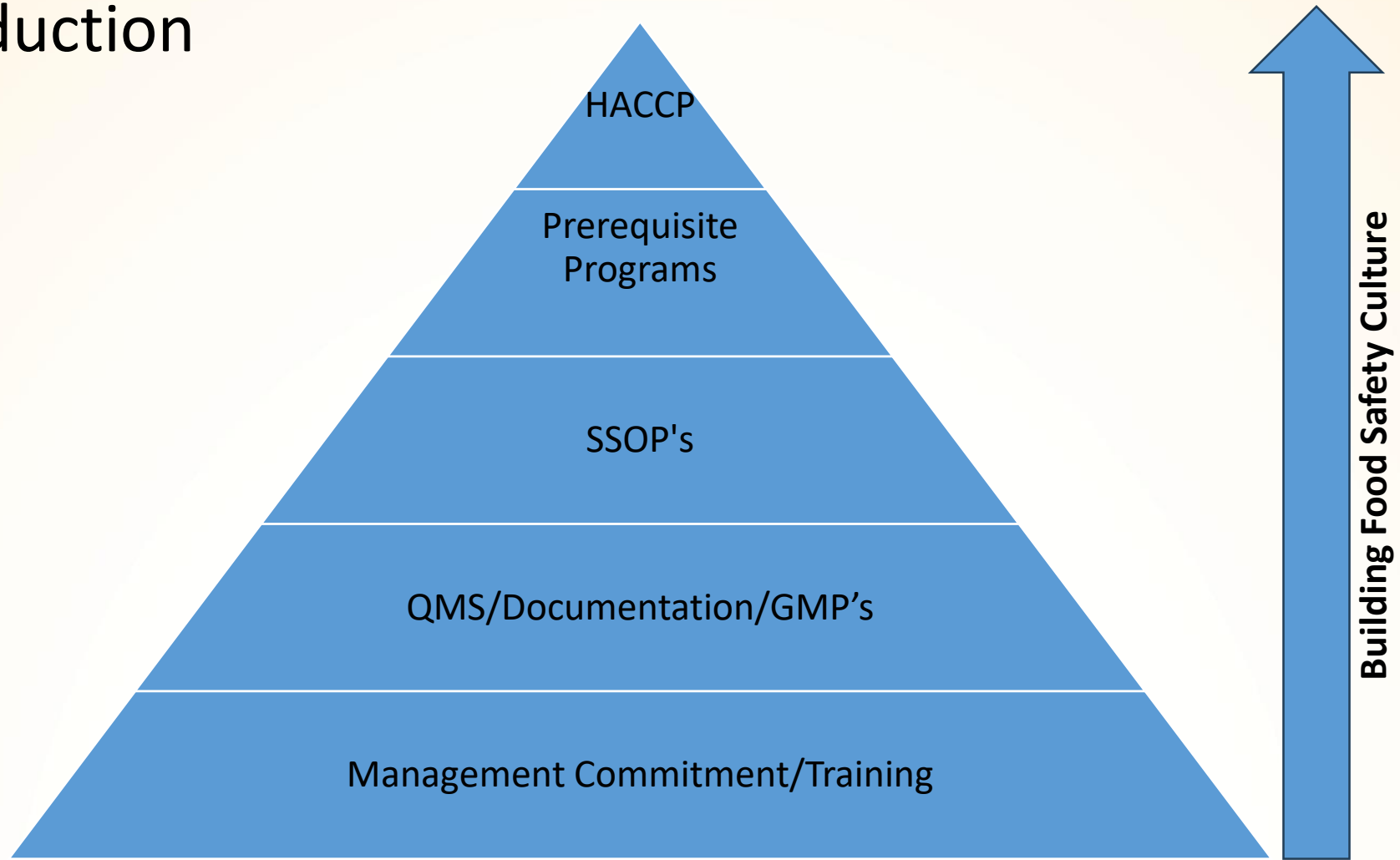


Polling Questions

- What industry sector do you represent?
 - Manufacturing
 - Retail
 - Food Service
 - Academia
- How many employees are in your company?
 - <200
 - 200 to 500
 - 500 to 2500
 - 2500 to 10000
 - >10000



Introduction





Food Safety Building Blocks Smaller Company Perspective

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Rebecca Guzy – Director of Research, Frick's Quality Meats



Food Safety Professionals in smaller companies – you have to wear all the hats...

As a food safety professional you may and/or will:

- Be the only scientist on staff.
- Have the broadest role encompassing many disciplines.
- Be looked to for answers on many broad subjects.
- Be expected to be the calm in the storm.
- Often be the bearer of bad news and need be expected to bring solutions.

This is especially true of family owned smaller businesses, start-up and business that are younger in their business maturity.



Benefits of Smaller Companies

- Better understanding of pulse of the business and what is negotiable and what is not (Food Safety vs. Quality).
- Food Safety has even more of a seat at the table.
- Can't afford to be in a silo and neither can any other function.
- Quick decision making. Expectation that you can walk down the hall to talk through issues.
- Direct impact to the bottom line. Opportunity every day to speak to the ROI from Food Safety.



Challenges

- Critical decision making falls to a few
 - Must be a data driven decision making champion.
 - Broad shoulders and firm conviction required.
- Limited resources and technical knowledge
 - People and funds
- Culture, processes, procedures and people may not have grown up with the company and can be behind.
- You need to understand where your company is in regards to business maturity and “what you know” and “what you don’t know” about food safety.



Business Maturity and Food Safety Culture

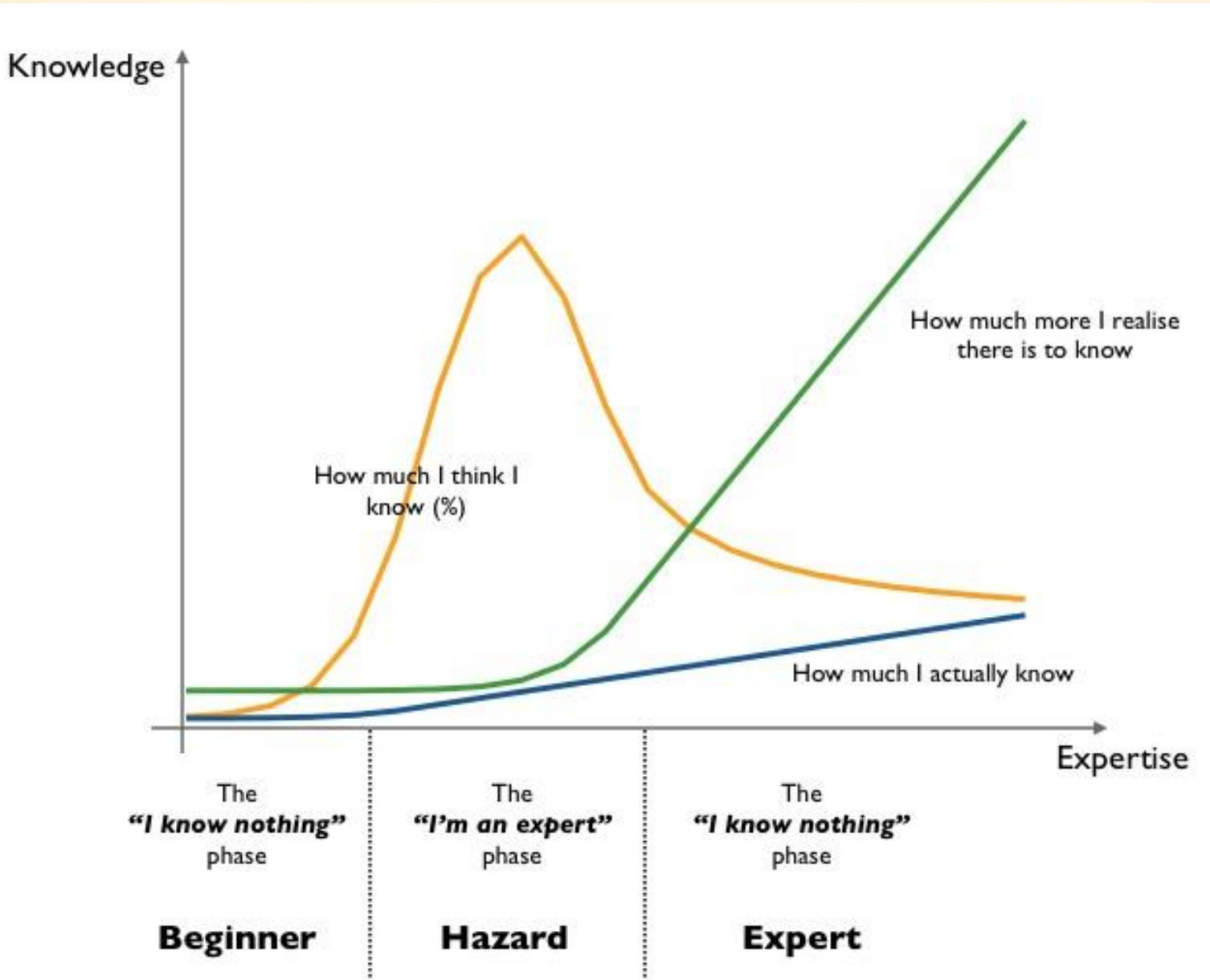
Business Maturity vs. Age of Company more greatly affect Food Safety Culture and the challenges you may encounter.

Food Safety Professionals wearing all the Food Safety hats are common in businesses that have a relatively small number of employees, < 300, and have demonstrated business success

May be anywhere in the business maturity continuum.

Infant → Awkward Teenager → Mature Adult





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Culture is the foundation of everything...

A strong focus on Food Safety must come from the highest level.

At Frick's we believe our reputation is everything and “we are one recall away from shutting down”.

This mentality keeps us focused on foundational Food Safety.

While our company values don't specifically say the words Food Safety, they fit hand in glove with each other and are printed on our walls and central to our goals and performance evaluations.

At Frick's, we actively align with others who share our core values. These values guide our actions and are at the root of all our relationships



A Smaller Company Perspective

Knowing what you don't know...

HARPC/HACCP

Foundational Pre-requisite programs

Good Manufacturing Practices

Traceability and Recall

Sanitation Standard Operating Procedures (SSOPs)

Pest Control

Preventative Maintenance

Environmental Monitoring

Supplier Approval and Verification

Allergen Control Program

Additional must have's

Process Validation

Microbiological Support

Shelf Life Validation



Resource Gaps and How to Fill Them...

Expertise to cultivate or experts to have in your contacts:

Microbiology

Basic Science of Food

Thermal Processing

Sanitation

Regulatory Compliance

Statistics

Product Inspection Resources

Recall Firms



Resources

Laboratories

- Analytical laboratories
- Microbiological laboratories (acceptable labs may be specified by your regulators)
- Make sure they are accredited and you have copies of their accreditation.

University Subject Matter Experts

- Develop a network of experts that you can reach out to when needed. Food Chemistry, Food Microbiology, Agricultural Statisticians, Quality Assurance.

Trade Associations

- IAFP, IFT, GMA and NAMI provide great training and resources to members. Technical Support, Sanitary Design Assistance, Legal Guidance, Crisis Management Team, etc.



Resources, continued...

Processing Authorities

- There will be instances where your data and processes must be evaluated/interpreted by a Subject Matter Expert or Processing Authority.
- Necessary for thermal process validations, challenge studies, assistance with HACCP deviations, dealing with regulatory agencies.
- Develop these relationships before you need them for a deviation or crisis.
- Often your analytical laboratory, food safety ingredient supplier or University connections can recommend a Processing Authority.

Certified Sanitarians

- Consulting firms that specialize in sanitation. A web search on food sanitation consulting will give options.
- Can provide assistance in overall sanitation process, sanitation chemicals, sanitary design of equipment, seek and destroy methodology, etc.



Resources, continued...

Foreign Material Inspection Services

- Several companies exist that specialize in finished product inspection of individual packages and cases for a variety of contaminants.

Recall Assistance

- Even if you have all the programs in place, you may want additional support if you find yourself in a recall situation.
- Trade Associations can assist with crisis management, technical subject matter experts and assist with public relations.
- Several companies available that can also: serve as a member of your crisis team, help you communicate with regulators, serve as technical experts and help with public relations.
- As with all resources, it is best to cultivate your relationships and contact list ahead of a situation.



Food Safety Training

A multipronged approach:

- On-line training modules for the basics.
- Regular 1:1 interactions on the production line, spend time on the “WHY?”
- Hands on training with QA manager or Subject Matter Expert (SME) in small groups for key functions/roles
 - HACCP team
 - CCP monitoring
 - Internal and external auditing
 - Sanitation
- External courses for deeper understanding
 - Crisis Management
 - Regulatory Compliance
 - HACCP
 - Internal Auditor Training
 - Sanitary Design



Upping your Food Safety Game

Food Safety is always evolving.

Threats to the consumer, customer, business and brand come in many different forms.

How to keep updated on new and emerging issues?

Short and sweet:

Be curious

Read/Subscribe to blogs and USDA or FDA announcements and directives.

Monitor Bill Marler's posts.

Strive to be a Subject Matter Expert in at least one discipline.

Network

Surround yourself with great resources.

Give back to Food Safety.

Publish Food Safety information internally to your company or participate externally in forums and conferences.

Keep your Sr. Management updated on new/emerging issues.

Have a "never arrived" mentality



Thank you!

Questions/Follow-Ups:

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Building Blocks for Food Safety Systems

Food Safety Training & Food Safety Culture
– large company perspective

Presented by: *Donna F. Schaffner*



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Building Blocks for Food Safety Systems

Food Safety Training & Food Safety Culture – large company perspective

An important aspect of any Food Safety System is that it is UNDERSTOOD and IMPLEMENTED by all employees, regardless of the “size” of the employee population.

There are advantages (and sometimes disadvantages) to being in a larger food processing company or corporation, when it comes to the oversight and implementation of the Food Safety System.



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Building Blocks for Food Safety Systems

Food Safety Training & Food Safety Culture – large company perspective

Typical for larger food processing companies or corporations:

1. Multiple departments involved in the system
2. More personnel resources available
3. More financial resources available



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Building Blocks for Food Safety Systems

Food Safety Training & Food Safety Culture – large company perspective

1. Multiple departments involved in the system
2. More personnel resources available
3. More financial resources available

Advantages:

- Cross-training of employees allow for creation of “back-up” personnel for performing critical functions and inspections of the Food Safety Systems
- Different job functions performed on different shifts & schedules, allowing for a more complete oversight of Food Safety Systems
- In corporate environments “teams” of employees from different production sites can serve as “internal auditors” to check that the FS System is operating as it should



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Building Blocks for Food Safety Systems

Food Safety Training & Food Safety Culture – large company perspective

1. Multiple departments involved in the system
2. More personnel resources available
3. More financial resources available

Disadvantages:

- Separate “departments” tend to form “silos” and often do not always communicate or cooperate well
- Different interpretations of the language used is made more complicated when employees come from diverse backgrounds with different native languages
- The more people and departments or areas involved, the more coordination of oversight and logistical concerns to be managed.



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Building Blocks for Food Safety Systems

Food Safety Training & Food Safety Culture – large company perspective

1. Multiple departments involved in the system
2. More personnel resources available
3. More financial resources may be available

Advantages:

- Larger employee pool allows selection/cultivation of Food Safety *champions* who influence co-workers to get on-board, take more personal responsibility
- More employee availability allows time for less-production-targeted activities: Food Safety **training** & employees understanding SOPs & SSOPs
- With more employees performing the same functions on a daily basis, they tend to become better at the mechanical skills and allows for more focus on the company culture; your Food Safety culture?



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Building Blocks for Food Safety Systems

Food Safety Training & Food Safety Culture – large company perspective

1. Multiple departments involved in the system
2. More personnel resources available
3. More financial resources may be available

Disadvantages:

- More people involved → more coordination / logistics for the supervisors and overseer of the Food Safety Systems
- Multi-input management groups tend to make systems more complicated, more difficult for line-level personnel to understand
- More people around leads to complacency and “someone else will take care of that” rather than the personal responsibility that is forced on employees who are the only one doing “that”



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Building Blocks for Food Safety Systems

Food Safety Training & Food Safety Culture – large company perspective

1. Multiple departments involved in the system
2. More personnel resources available (?)
3. More financial resources available

Advantages:

- A larger budget allows for more purchasing of updated equipment, testing supplies, and peripheral “stuff” to make Food Safety easier
- Management employees tend to be paid more in larger corporations, tend to have more education and experience that might include Food Safety, or at least the ability to learn it on the job
- A corporate environment often benefits from targeted expertise that is shared between production sites, often have “internal audit teams” rather than just relying on external audits to find gaps in the systems



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Building Blocks for Food Safety Systems

Food Safety Training & Food Safety Culture – large company perspective

1. Multiple departments involved in the system
2. More personnel resources available (?)
3. More financial resources available

Disadvantages:

- **???** Seriously?
- More layers of management involved → takes longer for the Food Safety Team to make changes in Systems, due to the inherent slow-down of “decisions by committee” [Food Safety Systems less “fluid”]
- Upper management of larger corporations are usually farther-removed from the day-to-day actions on the production floor, and the need for making a profit often takes funding away from Food Safety-related concerns when there are no recent lawsuits



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Building Blocks for Food Safety Systems

Food Safety Training & Food Safety Culture – large company perspective

Frequent mistake: Thinking that “Training” is a one-and-done proposition, going through the motions without looking at the effectiveness of employee implementation or the rigors needed to achieve effective oversight.

Companies will often run a series of training classes and focus on getting those sign-in sheets to satisfy auditors and regulators [make sure all the boxes are checked...] **without paying enough attention to whether the employees are actually understanding what was told to them, and that what employees are thinking is what the trainer actually meant!**



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Building Blocks for Food Safety Systems

Food Safety Training & Food Safety Culture – large company perspective

Larger companies often have employees from multiple backgrounds speaking multiple languages, and many of those employees “get by” through on-the-job informal translators who themselves may have a limited understanding of the SOPs or SSOPs or may not be proficient or even accurate at translation

Line workers often do not understand the importance of exactly following SOPs and SSOPs or how serious the Food Safety consequences can be if they short-cut or change something from the way it was written

More emphasis needs to be placed on the *WHY* of things, rather than just telling them to “follow the instructions and *do that thing this way*”



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Building Blocks for Food Safety Systems

Food Safety Training & Food Safety Culture – large company perspective

Management sets the tone: if supervisors are heard criticizing a new SOP or SSOP the line workers tend to just ignore it, assuming that it will just “go away” again with time (*because that often happened in the past*)

Everyone (except for QA ?) is held accountable for the amount of product that goes out the door, and people often try to “hide” defects, because it is “the bottom line” & company being profitable that keeps them employed.

More emphasis needs to be placed on Food Safety and actually following what is written into the Food Safety Systems as being MORE IMPORTANT than just “get the product out the door”.



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Building Blocks for Food Safety Systems

Food Safety Training & Food Safety Culture – large company perspective

“Food Safety Culture” is a current catch-phrase for describing if your employees are actively involved and understanding what is expected of them, after being “properly trained”.

Concepts introduced during training should be described in relation to each employee’s specific job functions, and their supervisors must be knowledgeable-enough to observe the employees at work and understand / verify if they are functioning correctly or are they are taking “short-cuts” in an effort to “save time” or make more product?

Do the supervisors report to production managers who do not actually have Food Safety as their priority?



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Building Blocks for Food Safety Systems

Food Safety Training & Food Safety Culture – large company perspective

A disadvantage in some larger companies is an attitude that employees who are found to not be performing as expected should promptly be let-go and replaced, rather than taking the time to work with the employee to remediate the problem or re-train for better understanding.

The REAL COSTS of hiring new employees and training them is often misunderstood; more than just paying for the actual hours of non-production time spent on training is the very real possibility that Food Safety issues will go un-noticed before the new employee has enough knowledge or experience to know what is an “issue”.

How many food recalls, injuries and illnesses could have been prevented, if the people handling the food had understood Food Safety implications of their actions in the past ??? What about in YOUR COMPANY’S FUTURE?



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Food Safety Training & Food Safety Culture – large company perspective

Ensuring that Food Safety training is conducted by knowledgeable SMEs (Subject Matter Experts) who can correctly answer all of the employee's questions, and relate the "theory" to individual job functions is essential to having an effective Food Safety System.

Do not make the mistake of thinking that just because a person has an advanced degree or has a resume that says they are knowledgeable about Food Safety facts, that they are automatically a good communicator or lecturer or **teacher!** [When hiring consultants: Ask for references & actually CALL the references.]

Finding SMEs who can also relate to the employees attending training is perhaps the biggest challenge for many companies.



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Building Blocks for Food Safety Systems

Food Safety Training & Food Safety Culture – large company perspective

And that concludes my part of this presentation.
Any questions?



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Building Blocks for Food Safety Systems

Quality Management Systems
Sanitation Standard Operating Procedures
Good Manufacturing Practices

Presented by: *Sharon K. K. Beals*



Quality Management Systems (QMS) – Definition

Food QMS includes five managerial functions:¹

- Design (Customer Requirements)
- Control (Tolerances)
- Improvement (Reducing Errors)
- Assurance (Evaluating and Ensuring QMS performance)
- Quality Policy/Strategy (Long term food quality goals)



¹ <https://www.sciencedirect.com/science/article/abs/pii/B9780128054703000028>

Quality Management Systems (QMS) – what it isn't

- Stagnant
- Complex
- Elaborate
- IT dependent



Quality Management Systems (QMS) – what it is

- Written in clear, easy to understand language (and in all languages used within the facility)
- Has cross functional input and alignment
- Is accessible
- Is assessed on a routine basis for effectiveness and updated as needed to drive continuous improvement



Sanitation Standard Operating Procedures¹

- Introduced in 1996 with the Megareg for all USDA-FSIS Inspected establishments
- Purpose: to prevent direct product contamination or adulteration
- Encompasses multiple facets of the operation

¹[Sanitation Standard Operating Procedures \(usda.gov\)](http://usda.gov)



Sanitation Standard Operating Procedures

- Preoperational Sanitation Components
 - Sanitation procedures
 - How to clean
 - Chemicals used
 - Verification of sanitary conditions
 - Organoleptic
 - ATP/TPC/EB
 - Environmental Monitoring for pathogens



Sanitation Standard Operating Procedures

- Operational Sanitation Examples
 - Sanitary Dressing
 - Metal Detection
 - Condensation
 - Foreign Material
 - Product Reconditioning
 - Pest Control
 - Water Reuse
 - Waste Disposal
 - Employee Hygiene



Current Good Manufacturing Practices¹

- First introduced in 1969 in 21 CFR Part 110, then modernized and moved to new Part 117 in 2015.
- Purpose: to address personal hygiene practices, design/construction/maintenance of food plants including grounds, equipment, sanitary operations, facility sanitation, and production and process controls during the production of food.



¹[Current Good Manufacturing Practices \(CGMPs\) for Food and Dietary Supplements | FDA](#)

cGMPs – Foreign Material

How widespread?

| Non inherent FM recalls ¹ | FDA | USDA |
|--------------------------------------|-----|------|
| 2024 YTD | 10 | 3 |
| 2023 | 51 | 10 |



¹<https://www.foodindustryadvice.com/recalls/>



cGMPs – Foreign Material

What's everyone doing about it?

- Supplier Controls
- Employee Engagement
- GEMBA walks
- 5S
- Trash Bag Audits
- Inspection/Detection/Rejection
- Audience??????
- Panel??????



cGMPs – Foreign Material

Have you considered the FM Maturity Model?¹

- Industry driven initiative
- Many thanks to Cargill Meat Solutions, Hormel Foods Corporation, Kraft Foods, Land O’Frost, Maple Leaf Foods, OSI Group and Tyson Foods
- The model enables the organization to assess current status and determine where to focus their efforts
- The requirements are few, but the benefits are many



¹[FM Maturity Model Tool 8.21.23.pdf \(meatinstitute.org\)](https://meatinstitute.org)

Building Blocks for a Food Safety System



HAZARD ANALYSIS in an Integrated Food Safety System

Produced by
FoodSafety
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Larry Keener
International Product Safety Consultants LLC
"TheFoodSafetyProfessionals" (since 1996)



Session # W-3

5/7/24 12:30 – 2:30 PM

Hazard Analysis and Critical Control Points

HACCP

Vs.



& CCP



✓ A Process Control Strategy used to prevent, eliminate or reduce an identified *hazard* in a food or food process to acceptable levels consistent with public health protections

Key Takeaways

- ✓ If the process isn't right, the finished food can't be right!
- ✓ If the **Hazard Analysis** isn't right or it's incomplete, the finished food may be a **threat** to public health.
- ✓ When the process and its manufacturing supply chains don't anticipate both the **character** and **concentration** of an **inbound hazard**, that **hazard** will survive the process and manifest in the finished product.
- ✓ Accurate Hazard Analysis is fundamental and an imperative for achieving Food Safety
- ✓ Hazard Analysis requires **SPECIALIST SKILLS** and a cross-functional **TEAM**

Food Safety

“The physical, chemical, or biological status of a food that will allow its consumption without incurring an excessive Risk of injury, morbidity or mortality”



Food Safety

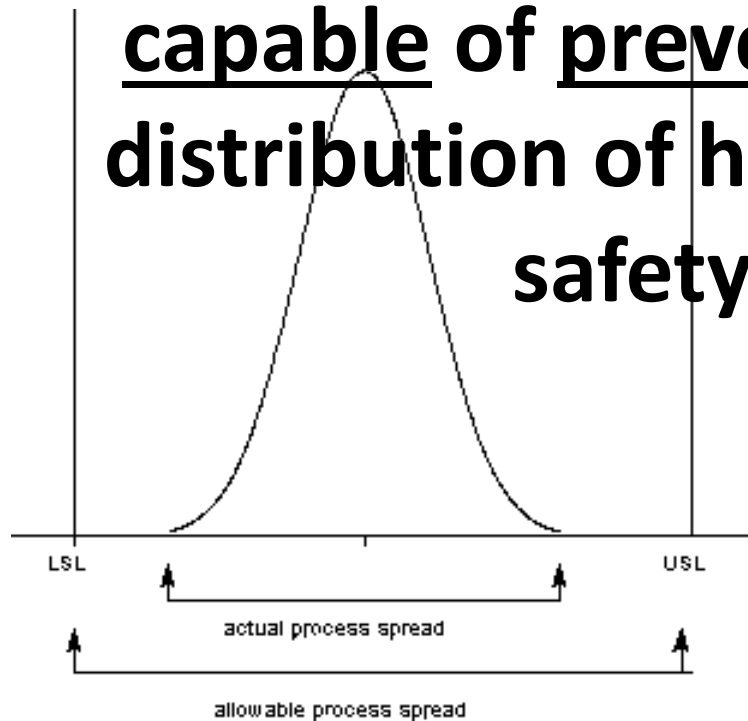
It's almost impossible to prove Food Safety

However

we can control specific **Hazards** occurring in a food or food processing operations with a high degree of confidence by using properly validated preventive control measures

Preventive Control

Process control measures, procedures or a device that has been validated and confirmed capable of preventing the manufacture and distribution of human foods containing food safety defects (**Hazards**)



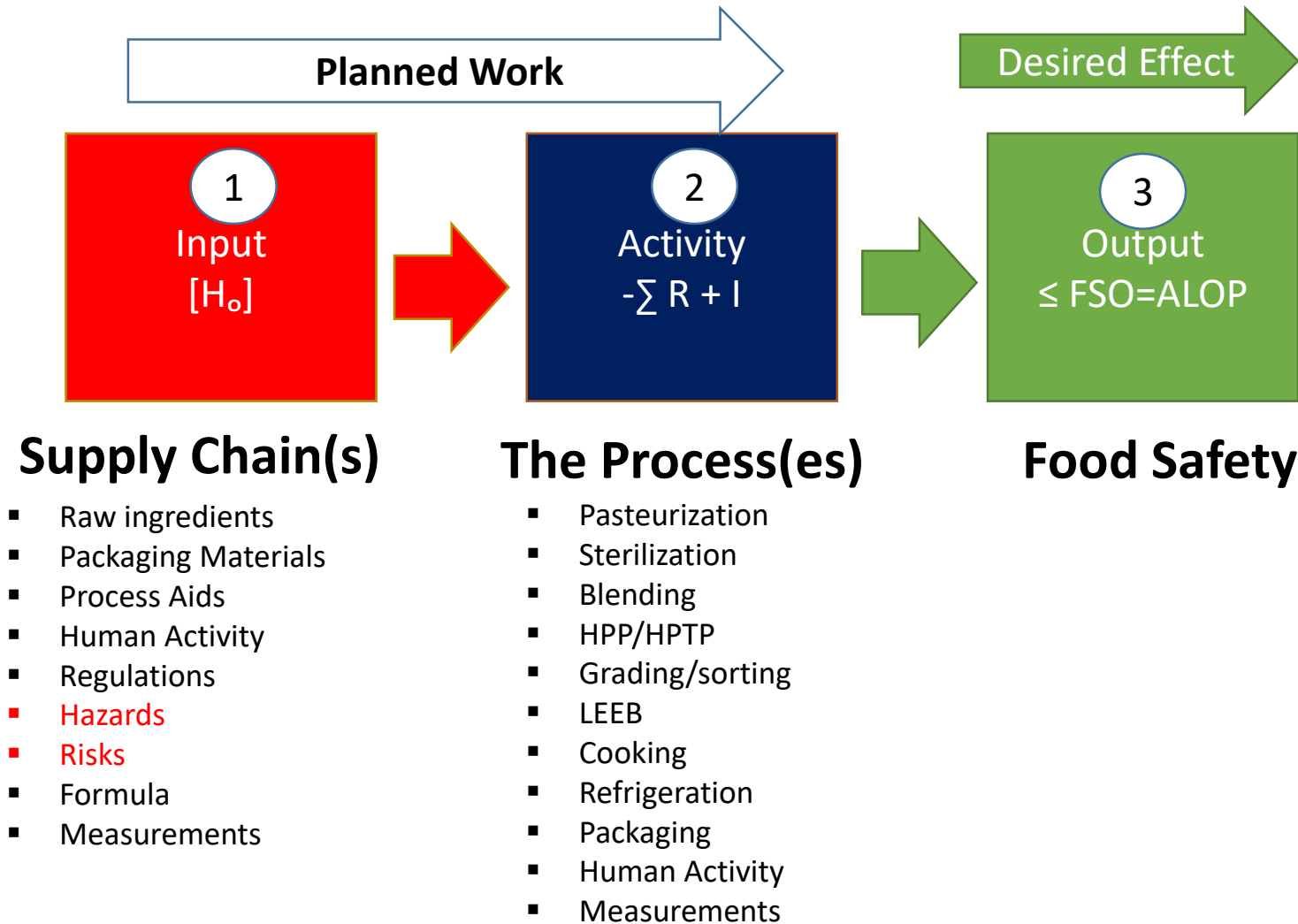
Food Safety Assurance

The deliberate act of rendering an item of food, safe and fit for human consumption.

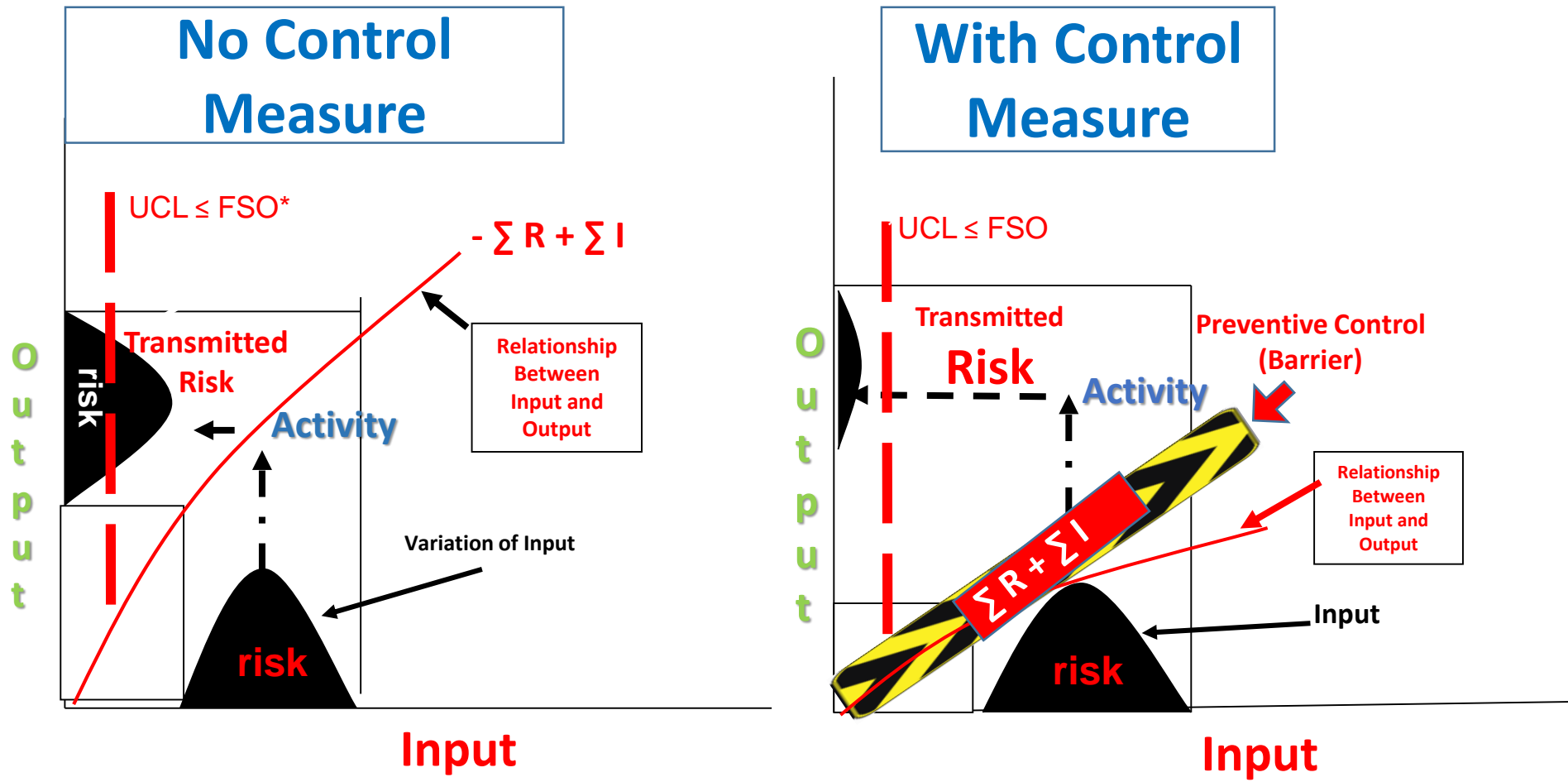
Implementation of science-based methods, processes or other procedures specifically designed to eliminate or reduce *hazards*, in the food, to acceptable levels, consistent with public health protections.

$$[H_o] - \sum R + \sum I \leq FSO$$

Generalized Food Manufacturing Process



Transmission of Hazards & Preventive Controls



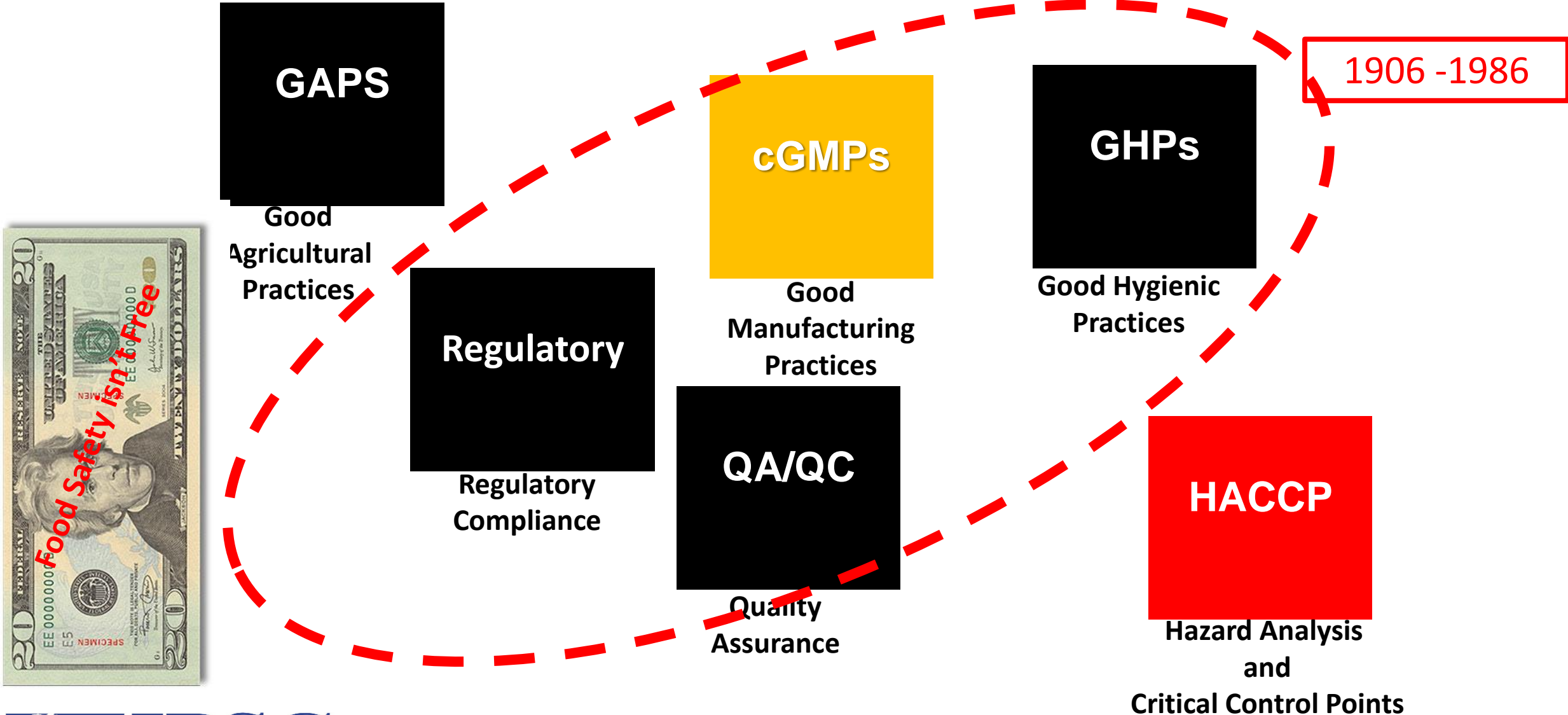
Input Activity Output

$$* [H_o] - \sum R + \sum I \leq FSO = UCL = ALOP$$

Source: After Global Harmonization Task Force 1996

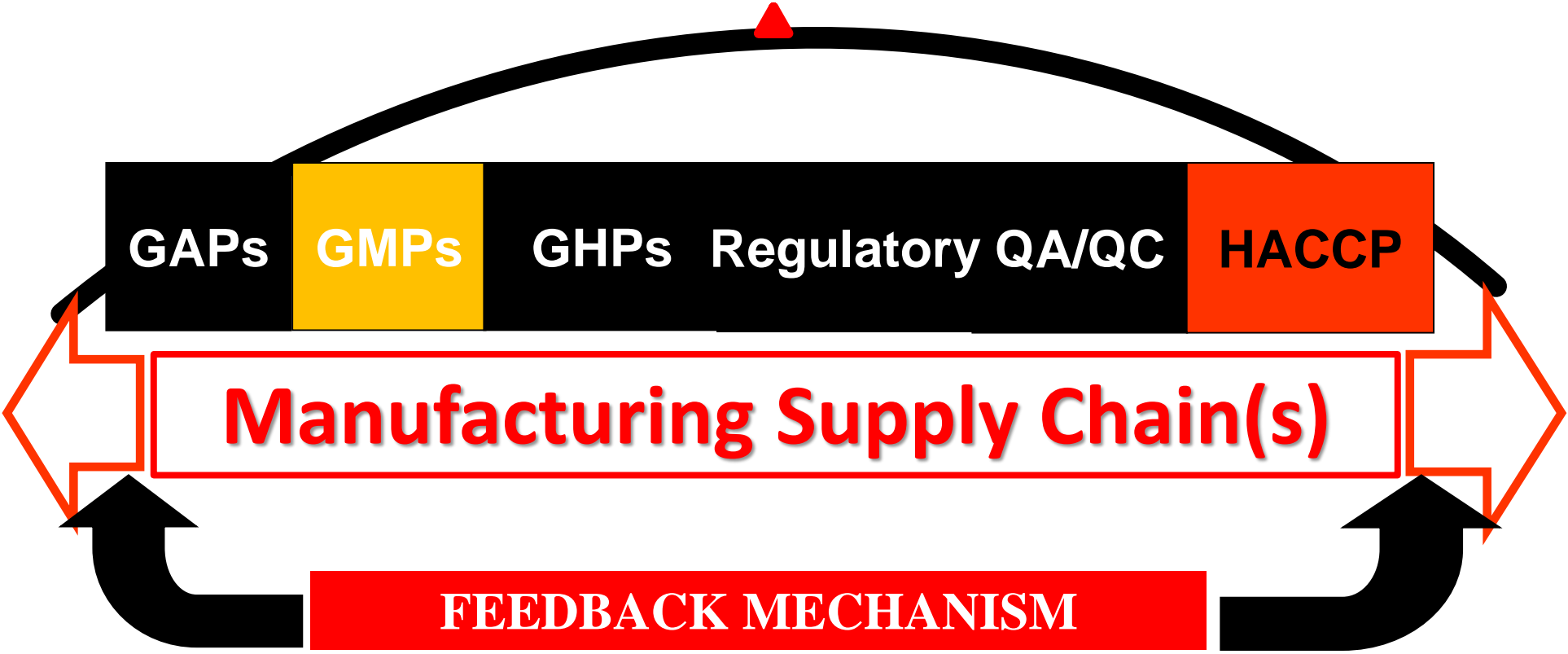


Food Safety Programs = Cost Centers- (Prerequisites, sSOPs)



Basic Elements

Integrated Food Safety System – Supply Chain Focused



Continuous Improvement

PROCESSES , PRODUCT SAFETY , PRODUCTIVITY , PERFORMANCE , PROFITS



Integrated Food Safety System with Performance Indicators

| GAPs | GMPs | GHPs | Regulatory | QA/QC | HACCP |
|---|--|---|---|--|---|
| KPIs | KPIs | KPIs | KPIs | KPIs | KPIs |
| Training Documentation Specifications IPM Harvest Procedures Components Handling Traceability Lot Coding Storage Facilities Buildings and Facilities Welfare Facilities Pesticide Storage Ag Chemicals Chemical Control Soil Amendments Vendor Programs Records Keeping Harvest Index Contracts Auditing | Training Documentation Specifications Process Controls Hygienic Design Manufacturing Procedures Components Handling Traceability Lot Coding Storage Facilities Buildings and Grounds Maintenance Procedures HVAC Welfare Facilities Pest Control Chemical Control Vendor Programs Co-packer Programs Records Keeping Verification Auditing | Training Documented Procedures SOPs Hygienic Design Cleaning Schedules Monitoring HVAC Lighting Actions on Deviations Chemical Control Cleaning Equipment Water Supply Sewers Process Waste Refuse Handling Records Keeping Traceability Verification Auditing | Training Documentation Plant Registration Process Filing Process Authority Inspection Readiness Recall Procedures Traceability Records Keeping Verification Auditing | Training Control of Documents Specifications Testing Methods Traceability Documented Procedures Calibration of Devices Inspection and Testing Process Controls Actions on Deviations Records Keeping Verification Auditing | Training Documentation Product Descriptions Flow Charts Hazard Analysis Critical Control Points Critical Limits Monitoring Actions on Deviations Responsible Personnel Validation Verification Records Keeping Auditing Traceability |





Hazard Analysis



Warning - Requires Specialist Skills and a Team

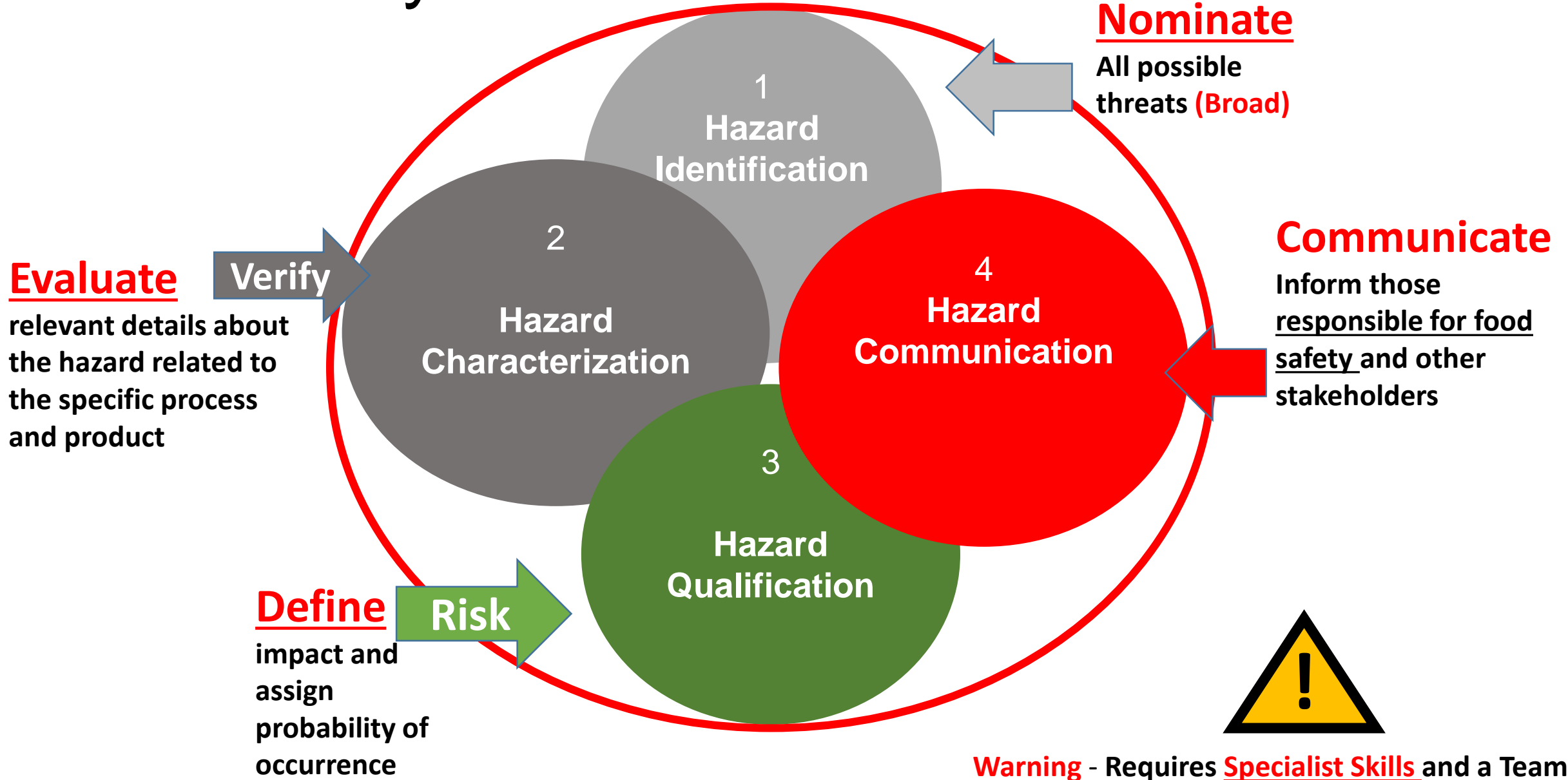
Cross-functional team

**Microbiology, Chemistry, Toxicology, Parasitology, Agronomy, *Engineering*,
Food Science, Maintenance, Sanitation, Product Development, Purchasing,
Consultants**

Key Definitions

- ✓ **Hazard** - A threat that has the potential to cause injury, morbidity or mortality
- ✓ **Food Safety Hazards** – Chemical, Biological, Physical and Allergen
- ✓ **Hazard Event** – realization of the threat
- ✓ **Hazard analysis**- identification of potential hazards in a manufacturing process including; analysis of raw materials, storage conditions, packaging, processing machinery and human factors which may adversely affect product safety
- ✓ **Risk** – The Probability and Severity of a consumer being harmed by the identified **hazard**
- ✓ **Risk Ranking** - Assigned hierarchy for the identified **hazards** based on likelihood of occurrence and magnitude of the harm caused
- ✓ **Zero Risk** – *No such thing in food safety*
- ✓ **Critical Limit**- Tolerance established for an identified **hazard** in a specific food (ALOP)
- ✓ **Critical Control Point** – An operation, procedure or device in a process that is capable of eliminating or reducing an identified **hazard** to acceptable levels

Hazard Analysis



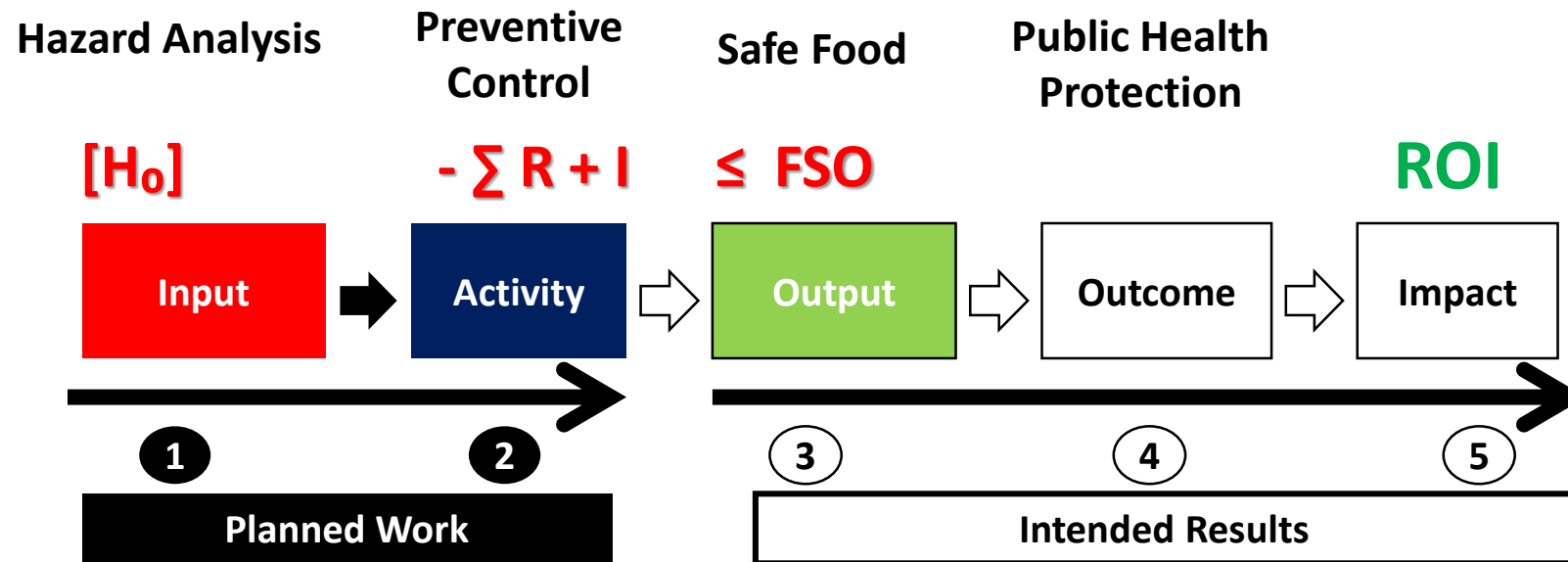
Hazard Identification & Hazard Characterization

Bacteria
Viruses
Parasites
Fungus
Glass shards
Metal fragments
Milk protein
Egg albumin
Tree nuts
Shellfish
Economic poisons
Toxic Chemical
Mycotoxin

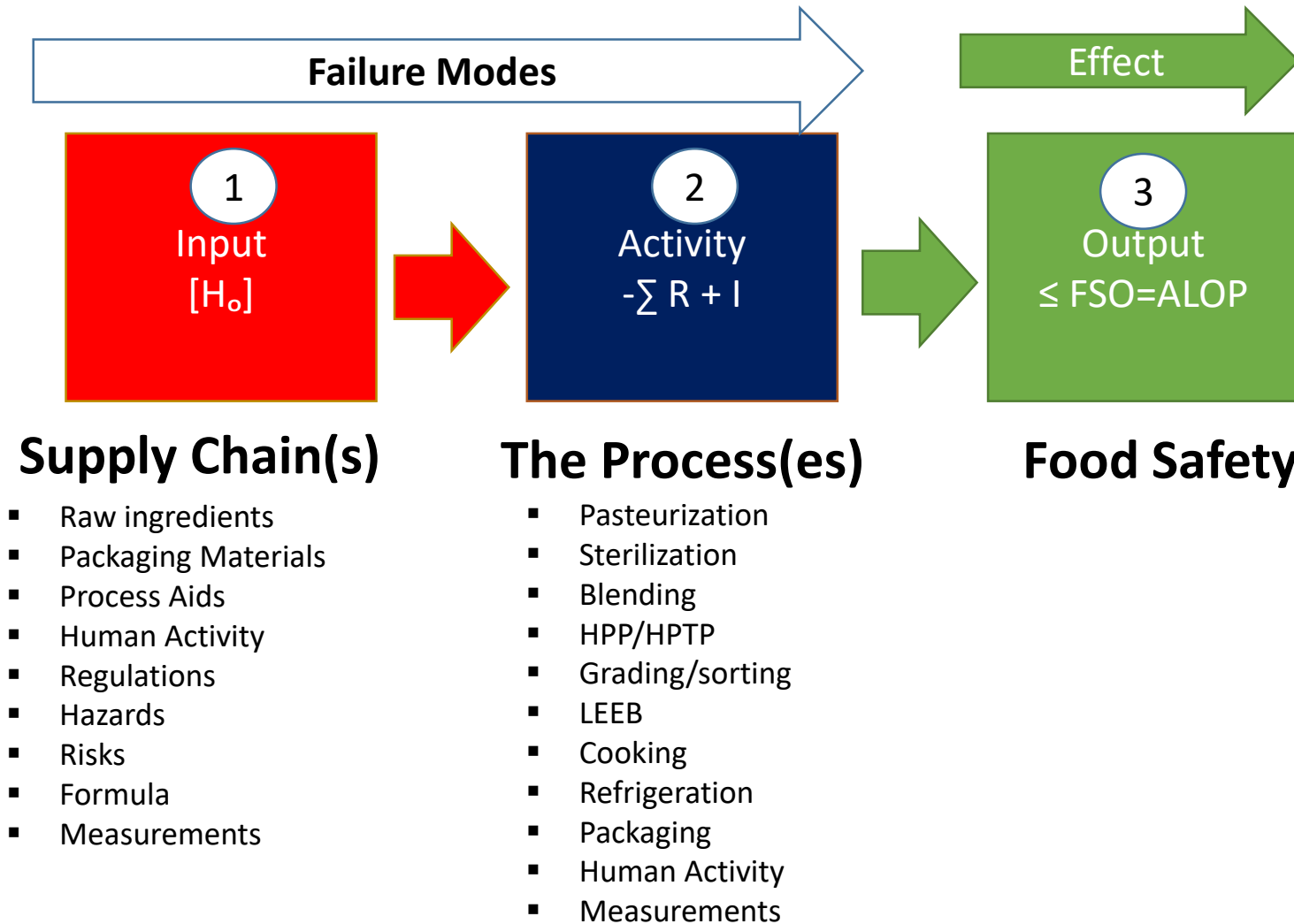
Gram stain reaction
Psychotropic
Mesophilic
Anaerobic
Virulence
Pathogenicity
Thermal resistance
Pressure resistance
D-value, z-value, LSV
Doubling time
Allergenicity
Size of fragments
Magnetic properties
Toxicity (LD-50)
MRL

Hazard Analysis

Demands an exquisite understanding of your manufacturing processes and its supply chains relative to the *character* and *concentration* of the inbound *hazards*



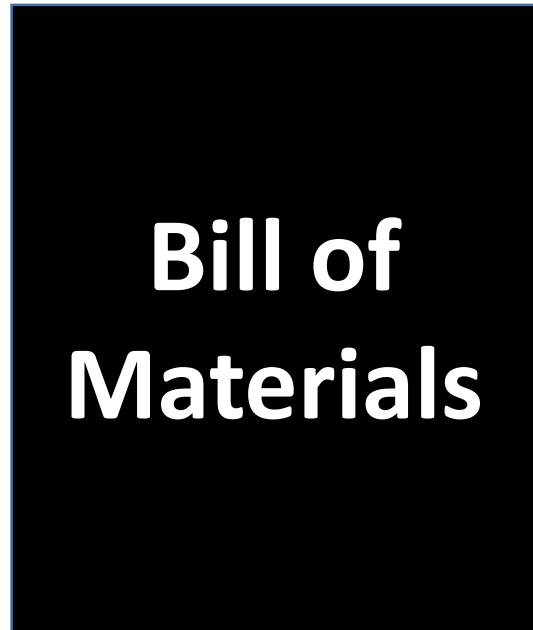
Generalized Food Manufacturing Process



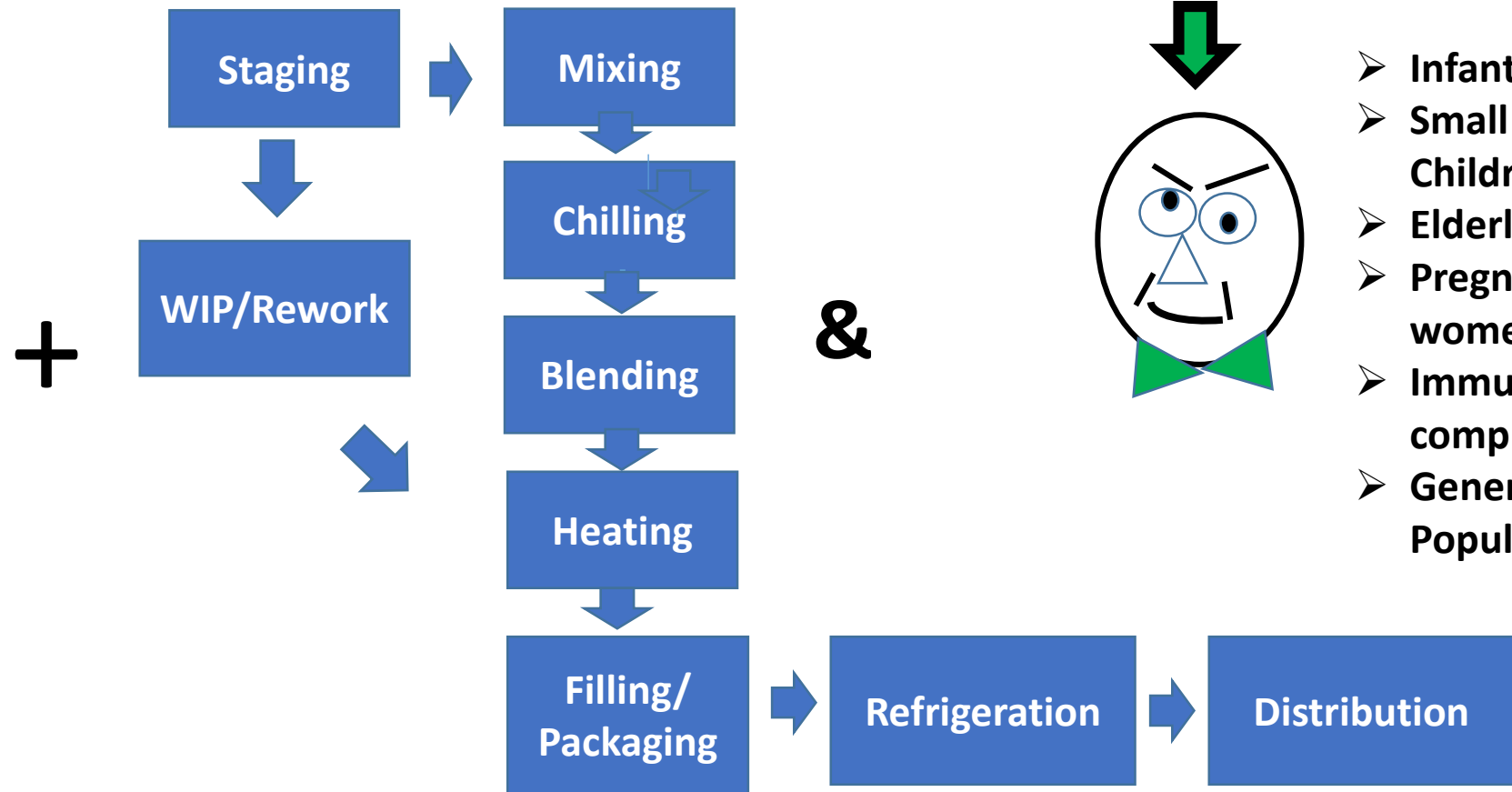
Important Considerations for Hazard Analysis

What's the Food?

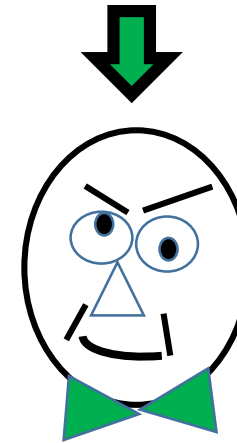
You need more than a 100% formula



What's the Process?



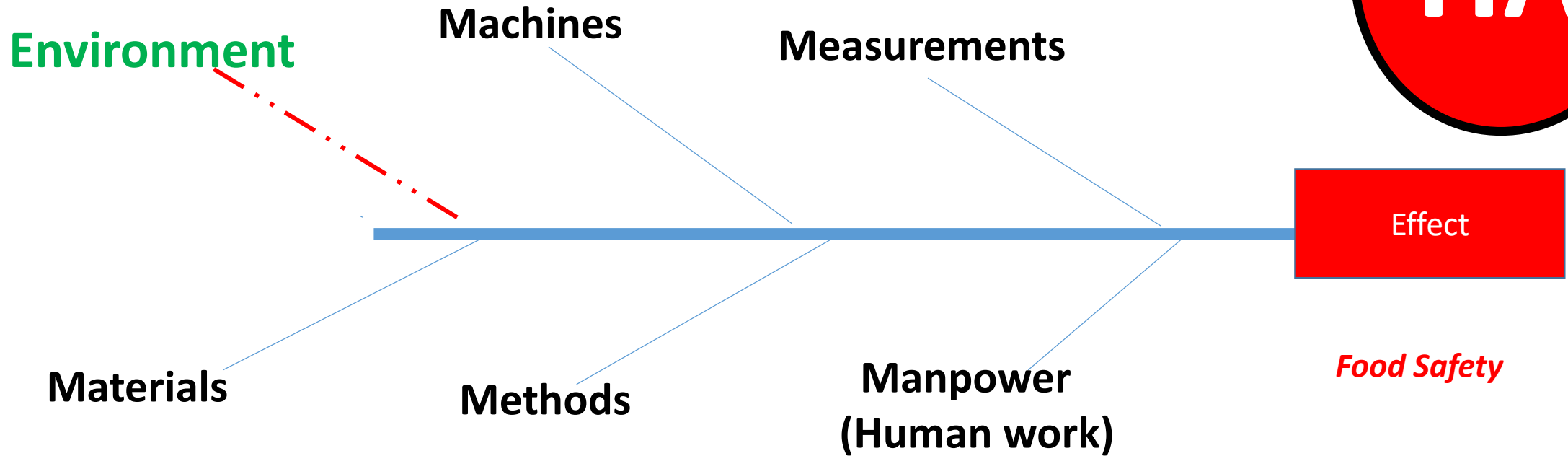
Who's at Risk?



- Infants
- Small Children
- Elderly >65yrs
- Pregnant women
- Immune compromised
- General Population

Food Safety Assurance is product and process specific

Failure Modes and Effects Analysis (FMEA)



✓ **FMEA- Prospective** identification of potential hazards in a manufacturing process including analysis of raw materials, storage conditions, packaging, processing machinery and relevant human factors which may *adversely affect product safety*



Root Cause Analysis

FMEA = Strategy
Ishikawa Chart = Tool

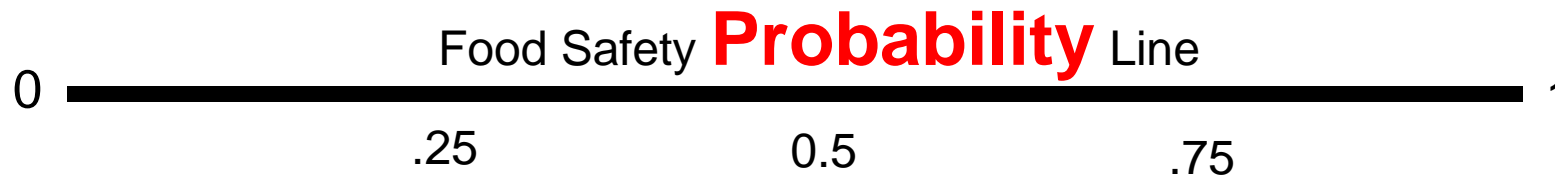


Hazard Qualification and Risk Assessment

Impact

Likelihood

| | Negligible | Minor | Moderate | Significant | Severe |
|---------------|------------|-------|----------|-------------|--------|
| Very Likely | | | | | |
| Likely | | | | | |
| Possible | | | | | |
| Unlikely | | | | | |
| Very Unlikely | | | | | |



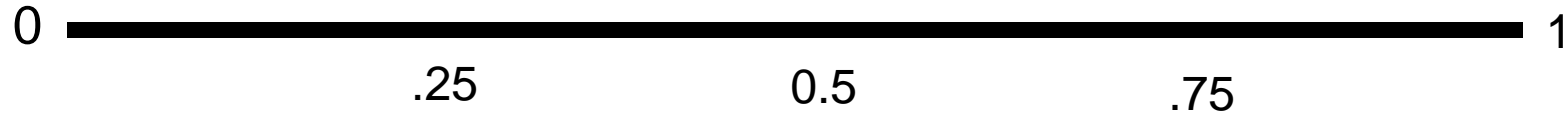
“Risk Assessment: What Is It, and What Does It Have to do with My Food?” (U.S. FDA March 2024)

- ✓ *In risk assessments, we figure out where the **risks of contamination** are, in the many steps it takes to get different kinds of foods from the farm to the table. Then we use scientific evidence and calculations to predict what the best ways are of preventing contamination by specific substances in specific foods. (**Hazard Identification**)*
- ✓ Our scientists begin by gathering information about a contaminant – a bacterium or virus, for example – and about what conditions it needs to survive or grow in a given food. The scientists collect information about how that food is grown, transported, received, processed, stored, shipped, and sold, and about **where in the process it’s likely to become contaminated**. They also gather information about different ways of preventing the contamination. (**Hazard Characterization**)
- ✓ The scientists enter the information they’ve gathered into mathematical models they’ve created, which “crunch the numbers.” The results are estimates of **how much contamination or illness** from a given substance **could be prevented** if specific actions were taken at various points in the **supply chain** for a given food (**characteristics and concentration** ($[H_0] - \sum R + \sum I \leq FSO$)) (**Hazard Quantification**)

Impact

| | | Impact | | | | |
|--|---------------|------------|-------|----------|-------------|--------|
| Likelihood | | Negligible | Minor | Moderate | Significant | Severe |
| Botulinum toxin Low acid canned food → | Very Likely | | | | | |
| | Likely | | | | | |
| Botulinum toxin in canned tomatoes → | Possible | | | | | |
| | Unlikely | | | | | |
| | Very Unlikely | | | | | |

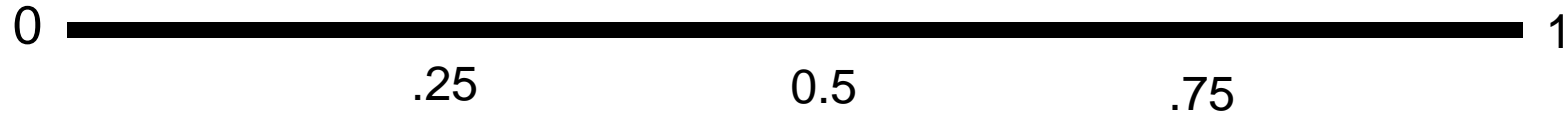
Food Safety Probability Line



Impact

| | Likelihood | Negligible | Minor | Moderate | Significant | Severe |
|--|---------------|------------|-------|----------|-------------|--------|
| PFAS Chemicals In Potable Water Supply → | Very Likely | | | | | |
| | Likely | | | | | |
| [NAOH] in fluid milk ? → | Possible | | | | | |
| | Unlikely | | | | | |
| <i>Cyclospora</i> in ground lamb → | Very Unlikely | | | | | |

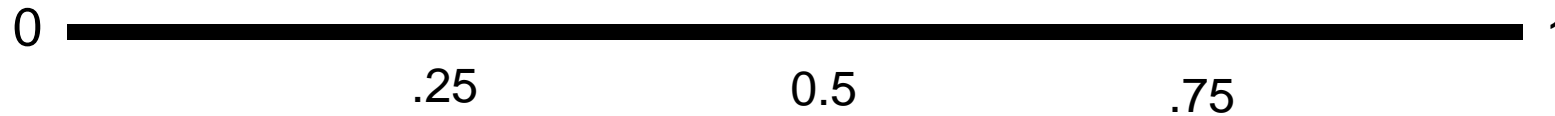
Food Safety Probability Line



Impact

| | Likelihood | Negligible | Minor | Moderate | Significant | Severe |
|---|---------------|------------|-------|----------|-------------|--------|
| <i>Campylobacter</i> spp., on raw chicken? | Very Likely | | | | | |
| <i>E. Coli</i> 0157:H7 in ground beef | Likely | | | | | |
| | Possible | | | | | |
| <i>Salmonella</i> in pasteurized Egg whites | Unlikely | | | | | |
| | Very Unlikely | | | | | |

Food Safety Probability Line





Hazard Analysis



Summary

- **HA** is the hard work of food safety assurance.
- Failed **HA** is a primary cause of food safety failures.
- When a threat goes unrecognized it can't be prevented.
- Preventive control is predicated on accurate **HA**.

HA & CCP

Warning - Requires Specialist Skills and a cross-functional team- **Get Help!**