FE 422 FOOD PRODUCTION MANAGEMENT

Food Safety – ISO 22000 Food Safety Management System

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Food safety and quality systems

- Food safety is a scientific discipline handling, preparation, and storage of food in ways that prevent food borne illness. HACCP is a management system in which food safety is addressed through the analysis and control of biological, chemical and physical hazards from raw material to the end product. ISO 22000 concentrates exclusively on food safety and will instruct food producers how they can build up the food safety system itself.
- Food quality is the quality characteristics of food that is acceptable to consumers. The ISO 9000:2000 includes all management, production, distribution, and product design and service activities.

HACCP and ISO 22000-Food safety management system standard

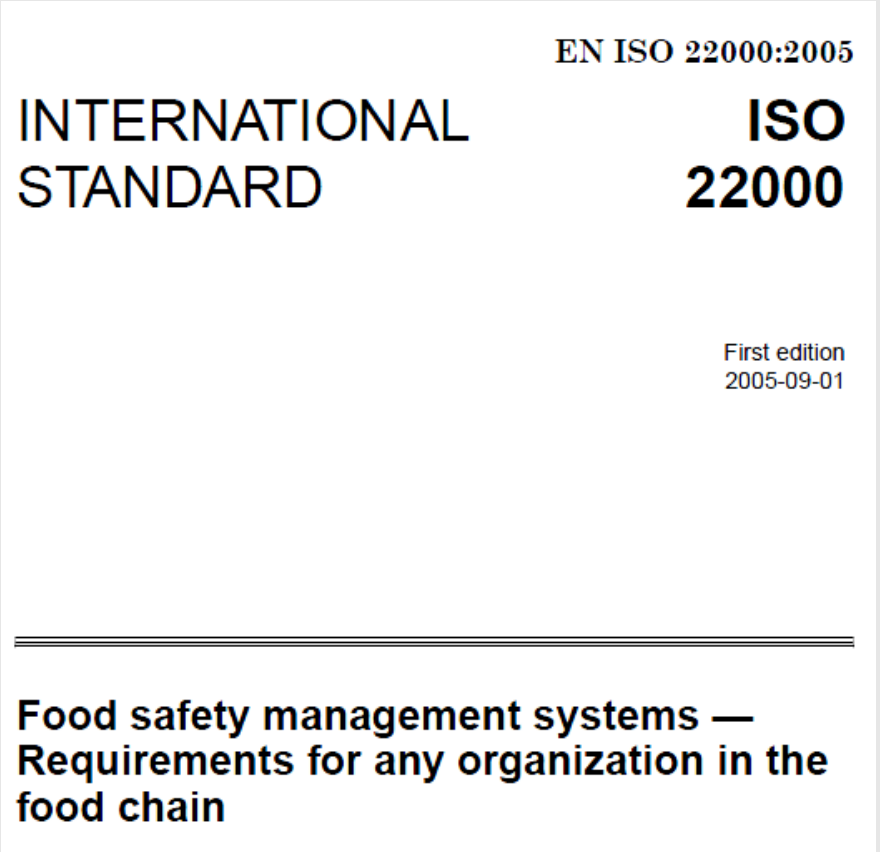
- For the food industry, the HACCP program is currently recognized as the best approach to control food safety. Although concerns such as quality and economic adulteration are not included in the HACCP system, the implementation of an HACCP system means greater control over production process, which results in improvements in both the quality and safety of food. The HACCP system has 7 elements called the HACCP principles and pre-requisite programs that must be in place for the system to operate effectively (FAO, 1998; Codex, 2003).

HACCP

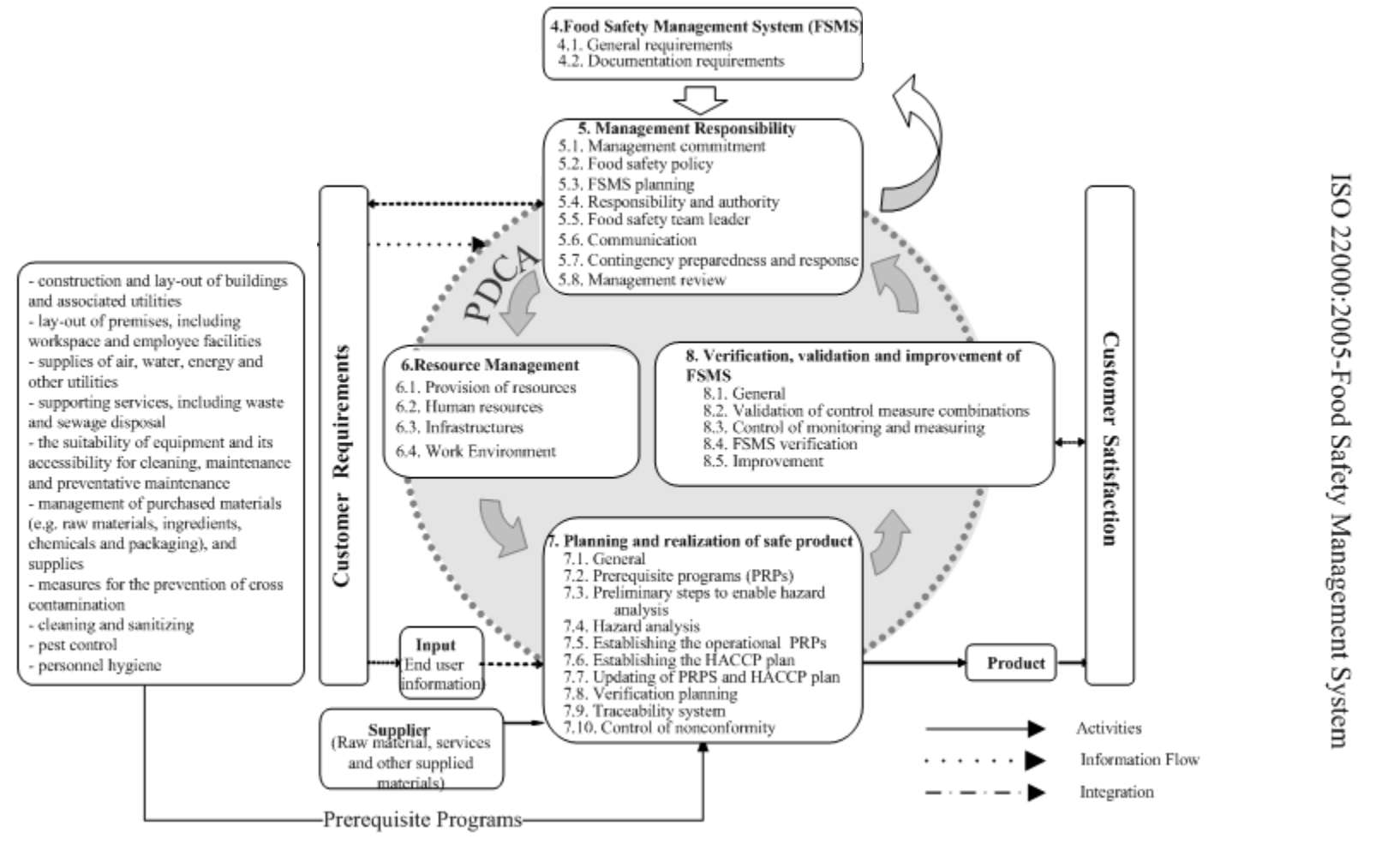
- **Hazard analysis**
- **Critical control points (CCPs)**
- **Critical limits**
- **Monitoring procedures**
- **Corrective actions**
- **Verification procedures**
- **Documentation procedures**

HACCP and ISO 22000-Food safety management system standard

- ISO 22000-2005 FSMS aims to harmonize the requirements for food safety management in food and food related business (ISO, 2005). ISO 22000-2005 FSMS assists the food manufacturers in the use of HACCP principles. Main elements in ISO 22000:2005 FSMS are compatible with ISO 9000:2000 QMS. Both models consist of 5 major elements. For the proposed-integrated models, the principle aim is to provide simplicity and applicability. A common documentation system is provided by the integration



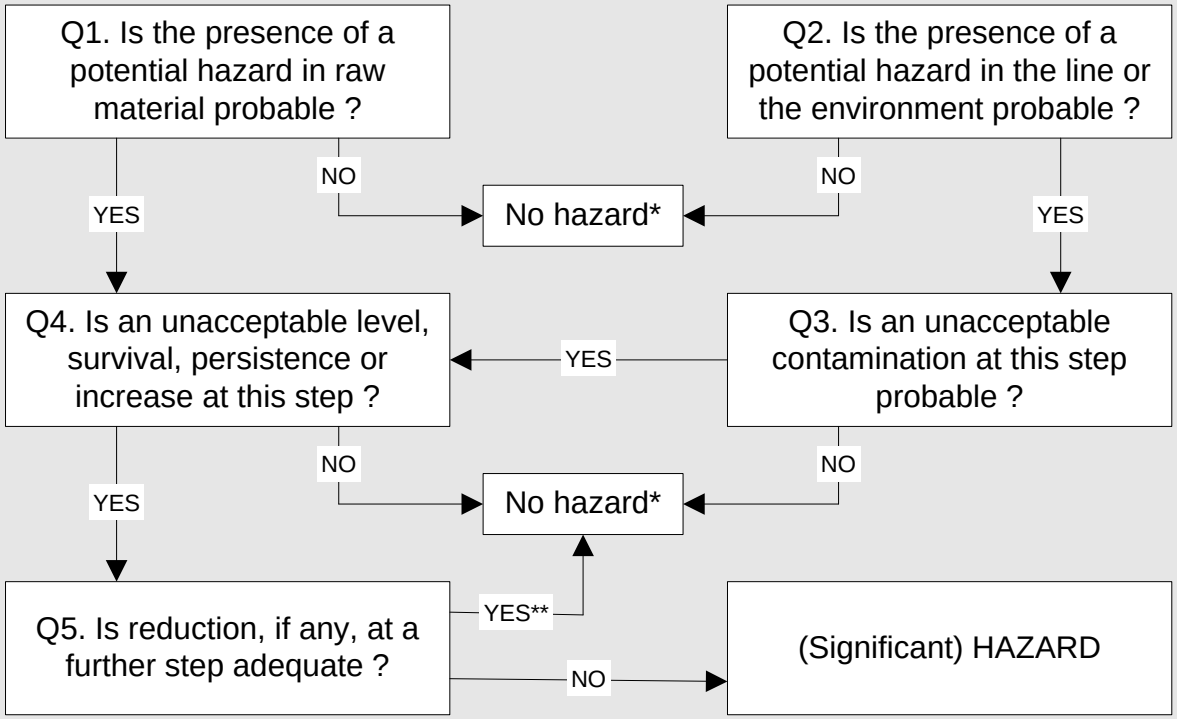
ISO 22000-FSMS Structure



Hazard analysis and cause analysis

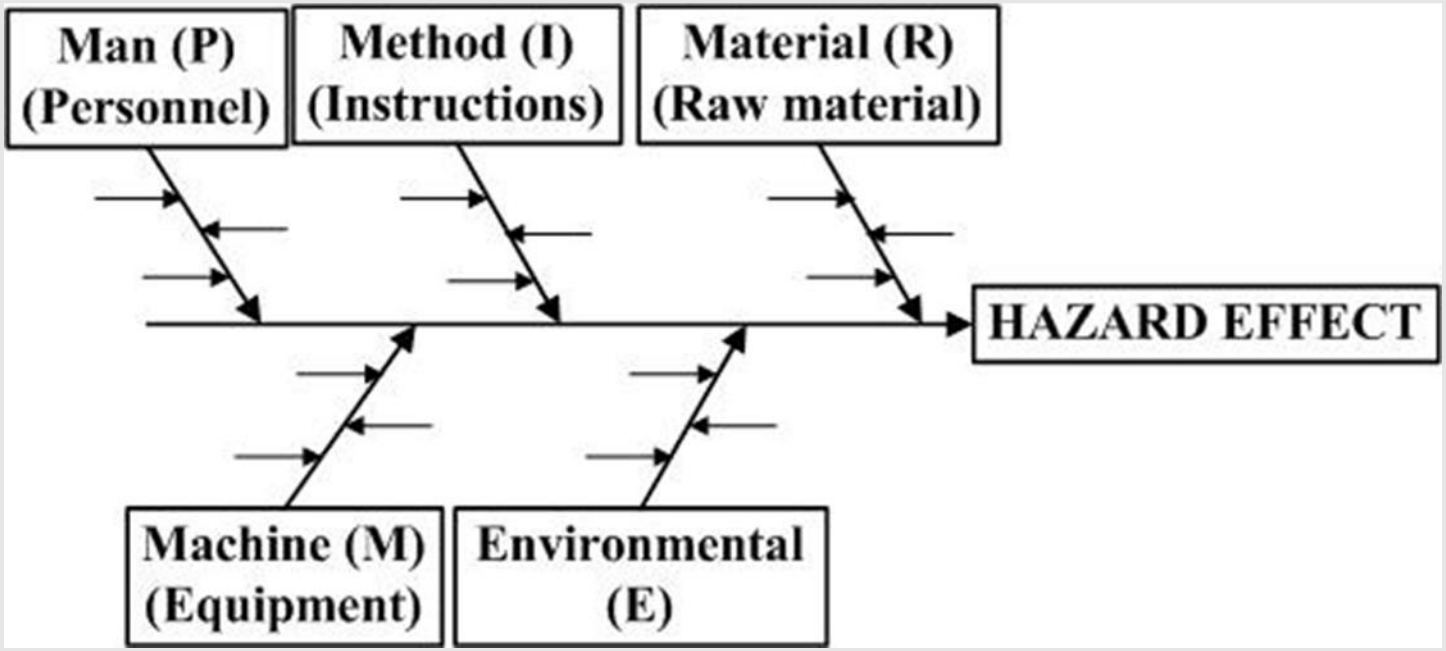
- Hazard analysis begins with identification of the food safety hazards associated with the raw material. First, a complete list of hazards that could potentially be of concern is drawn up.

Decision Tree for Hazard Analysis



Cause analysis is based on determining potential hazard sources and classifying the causes.

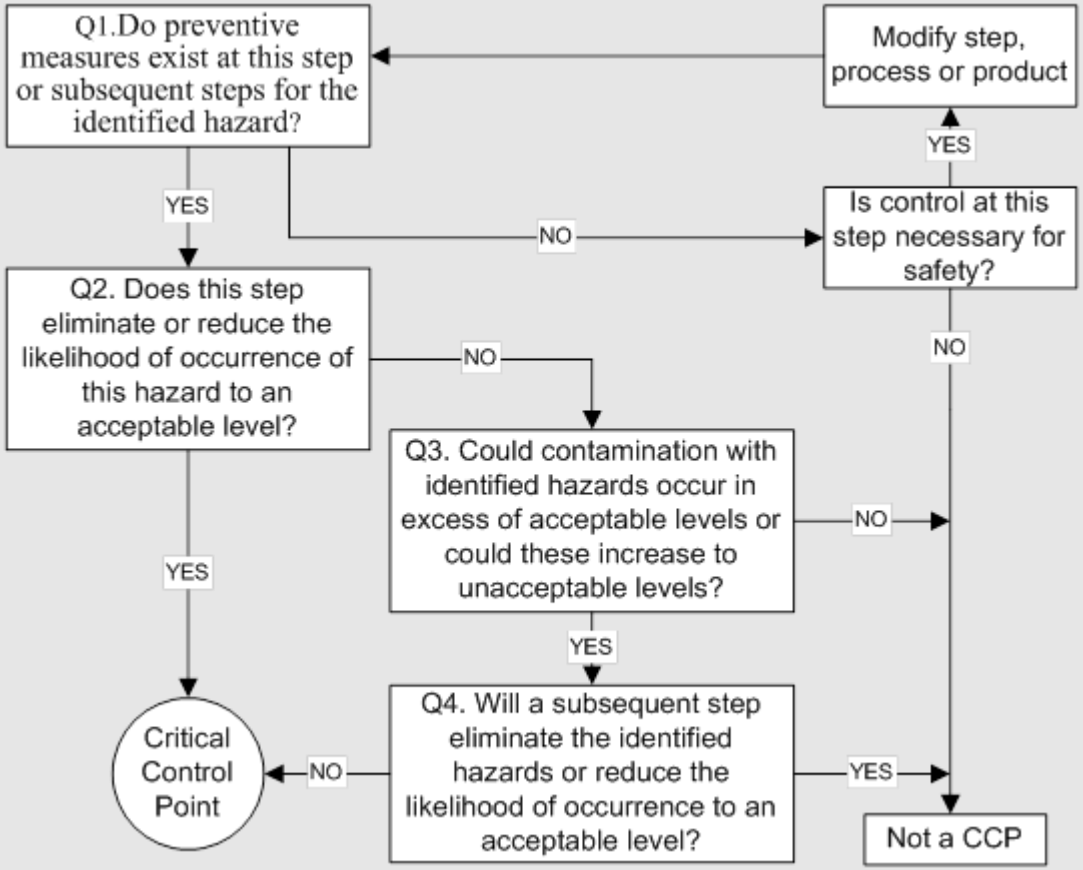
Cause Analysis-Fish bone diagram



Process name/step	Process descriptions	Potential Hazards	Cause analysis [α]		Hazard Analysis (Y/N) [β]						
			Causes (Sources and reasons)	Cause class	Q1	Q2	Q3	Q4	Q5	SH
Raw Material Reception	Dry hulled pistachio reception	B: Mold, insects	Agricultural environment	R	Y	-	-	Y	N	Y
		C: Aflatoxin, Pesticide residue	Aflatoxin produced by mold, pesticides used in the growing of pistachio.	R	Y	-	-	Y	N	Y
		P: Foreign material	Insufficient harvesting	R	Y	-	-	Y	Y	
Raw material storage	Dry hulled pistachio storage at room temperature	B: Mold growth	Inappropriate storage conditions	I	-	Y	Y	Y	N	Y
		C: Aflatoxin		I	-	Y	Y	Y	N	Y
Cleaning	Dry and/or cleaning	B: Mold growth	Insufficient cleaning	I	-	Y	Y	N		
		C: Aflatoxin		I	-	Y	Y	N		
Dehulling	Dry and/or wet dehulling of pistachio	B: Mold growth	Insufficient dehulling process	I	-	Y	Y	N		
		C: Aflatoxin		I	-	Y	Y	N		
Floatation	Separation of empty pistachio	B: Mold growth	Insufficient floating process	I	-	Y	Y	N		
		C: Aflatoxin		I	-	Y	Y	N		
Drying	Mechanical or sun drying	B: Mold growth	The temperature and/or time of drying	I	-	Y	Y	Y	N	Y
		C: Aflatoxin		I	-	Y	Y	Y	N	Y
Grading	Sizing of pistachio	P: Metal contamination	Metals contaminate during grading	I	-	Y	Y	N		
Hard shell breaking and separation	For pistachio kernel processing	P: Kernel damage		I	-	N	-	-	-	N
Split separation		P: Metal contamination	Metals contaminate during splitting	I	-	Y	Y	N		
Splitting	At home or in plant	B: Microbiological contamination	Microbiological contamination from humans	P	-	Y	Y	Y	N	Y
Roasting and salting	Splitted pistachios roasted at 130°C and salted by1 %	P: Metal contamination	Metals contaminate during roasting	I	-	Y	Y	Y	N	Y
Sieving		P: Metal contamination	Metals contaminate during sieving	I	-	Y	Y	Y	N	Y
Aflatoxin detection		C: Aflatoxin residue	Improper aflatoxin test	I	-	Y	Y	Y	N	Y
Metal detection		P: Metal residue	Improper metal detector	I	-	Y	Y	Y	N	Y
Packaging		P: Dirt and foreign matters	Recontamination by packaging material	R	-	Y	Y	Y	N	Y
Product storage	Roasted pistachios are stored at room temperature and 65% RH within 1 years	B: Mold growth	Inappropriate storage conditions	I	-	Y	Y	Y	N	Y
		C: Aflatoxin		I	-	Y	Y	Y	N	Y

Critical control points

Critical control points include location, operation, procedure, or process that can be checked and if found, the food safety hazard can be removed or brought to an acceptable level. Critical control points of pistachio processing were determined.



Five-class hazard scoring matrix –Hazard Assesment

Severity			Risk Classes				
Catastrophic	Death or lasting damage	E	3	4	4	4	4
Critical	Many concerned people and lasting or continuous damages	D	3	3	4	4	4
Serious	Many concerned people, no lasting damages	C	2	3	3	4	4
Low	Single case, no lasting damages or minimal concentration	B	2	2	3	3	4
Ignorable	Hazard to be discovered prior to consumption or minimal indisposition	A	1	2	2	3	3
			I	II	III	IV	V
			Unlikely (< per 1 years)	Rare (per year)	Occasional (per semester)	Frequent (per month)	Very frequent (per week)
			Probability				

Control measures	Risk classes
1. No measure necessary.	
2. Periodic measures are measures which often cover a one-time activity.	
3. General control measures, such as proper hygiene facilities, procedures for cleaning and disinfection personal hygiene instructions and maintenance, vermin control, maintenance and calibration, purchasing procedures and raw material specifications, complaint handling and recall procedures, etc. (of course, many of them are prerequisite programs)	
4. Specific control measures are specifically developed and used to control the risk.	

Critical control points in the pistachio processing

Process name/step	Significant Hazard	Hazard assessment*			Preventive actions/control measures	CCP analysis (Y/N)**				
		Severity	Probability	Risk class		Q1.	Q2.	Q3.	Q4.	CCP no:
Raw Material Reception	B: Mold, C: Aflatoxin	E	V	4	Certified suppliers with HACCP program, Aflatoxin analysis	Y	N	Y	N	CCP1
Raw material storage	B: Mold, C: Aflatoxin	E	IV	4	Aflatoxin analysis	Y	N	Y	N	CCP2
Drying	B: Survival of mold C: Aflatoxin	E	III	4	Time-temperature profile.	Y	N	Y	N	CCP3
Splitting	B: Microbiological contamination	B	V	4	Control of the cleaning schedule is correctly applied at the equipment	Y	N	Y	N	CPP4
Roasting, salting, and sieving	P: Metal contamination	A	V	3	Metal detection	Y	N	Y	Y	
Aflatoxin detection	C: Aflatoxin residue	E	II	4	Calibration	Y	Y			CCP5
Metal Detection	P: Metal residue	A	III	3	Calibration	Y	Y			CCP6
Packaging	P: Dirt and foreign matters with packaging material	A	III	2	Good manufacturing practices	Y	N	Y	N	CCP7
Storage	B: Microbial growth	B	II	2	Good storage practices	Y	N	N		GSP

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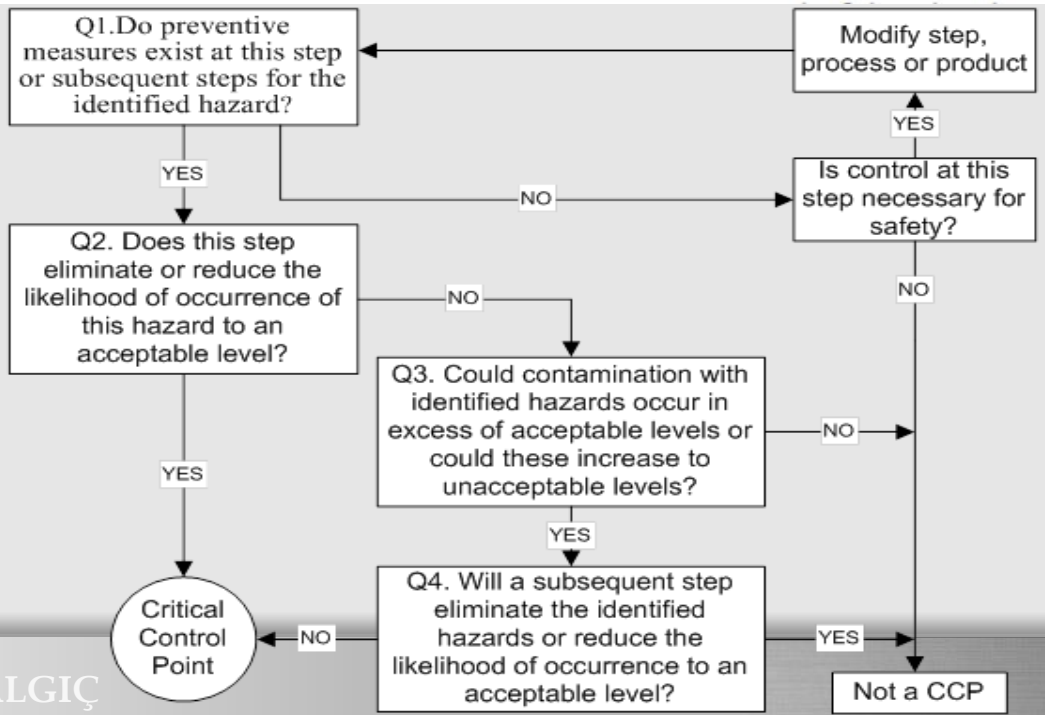
Drying	B: Survival of mold C: Aflatoxin	E	III	4	Time-temperature profile.	Y	N	Y	N	CCP3



Implementation of HACCP System-HACCP Plan

CCP No:	Process name/step	Significant hazard	Critical limits	Monitoring			Corrective action
				Method	Frequency	Responsible	
CCP1	Raw Material Reception	B: Mold, C: Aflatoxin	No tolerance	Test kit	Each party	Lab. technician	Rejection of doubtful lot
CCP2	Raw material storage	B: Mold, C: Aflatoxin	No tolerance	Time/Temp., Moisture Content	Each run	Operator	Check/repair the storage control units
CCP3	Drying	B: Survival of mold C: Aflatoxin	No tolerance	Time/Temp., Moisture Content	Each run	Operator	Check/repair the machine, reprocess if necessary
CCP4	Splitting	B: Microbiological contamination	No tolerance				
CCP5	Aflatoxin detection	C: Aflatoxin residue	No tolerance	Aflatoxin detection	Per month	Operator	Calibration
CCP6	Metal Detection	P: Metal residue	No tolerance	Metal detection	Per month	Operator	Calibration
CCP7	Packaging	P: Dirt and foreign matters with packaging material	No tolerance	Visual control	Each party	Operator	Rejection of doubtful lot

Continuous Improvement

Deming Wheel (PDCA Cycle)	Quality and safety improvement steps	ISO 9000-QMS	ISO 22000-FSMS
Plan (P): The plan phase of the cycle is an improvement area and a specific problem with it to be identified. In this phase, objectives and strategies are developed and necessary sources are determined.	1. Theme Selection	5.3. Quality Policy	5.2. Food Safety Policy
	2. Current situation review and analysis	5.4. Quality planning	5.3. FSMS planning
	3. Preventive action planning	5.4. Quality planning	5.3. FSMS planning
Do (D): The do phase of the cycle deals with implementing the changes according to the plan.	4. Action	7. Product/Service Realization 7.5. Production and Service Provision	7. Realization of safe product 7.9. Operation of FSMS
Check (C): The check phase deals with evaluating data collected during implementation.	5. Analysis	8. Measurement, Analysis, and Improvement	8.2. Monitoring and measuring
Act (A): During the act phase, the improvement is codified as the new standard procedure; necessary revisions are applied and replicated in similar processes throughout the organization.	6. Standardization of the countermeasures	7.5. Production and Service Provision	8.4. Validation of control measure combinations
	7. Identification of remaining problems	8.3. Control of Nonconforming product	8.3. FSMS verification
	8. Evaluation of whole plans and procedures	8.5. Improvement	8.5. Improvement

Pre-requisite programs

	Strategic	Operational	Support
ISO 9000:2000-QMS	QP.1 Market Research and Customer Relation QP.2 Internal Communications QP.3 Document and record Control QP.4 Planning QP.5 Resources Management	QP.6 Product Design QP.7 Food Manufacturing	QP.8 Purchasing QP.9 Internal Audit QP.10 Data Analysis QP.11 Maintenance of measurement's and process equipments QP.12 Calibration of measurement's equipment
ISO 22000:2005-FSMS	PR.1 Construction and lay-out of buildings and associated utilities PR.2 Lay-out of premises, including workspace and employee facilities PR.3 The suitability of equipment and its accessibility for cleaning, maintenance and preventative maintenance	PR.4 Supplies of air, water, energy and other utilities PR.5 Supporting services, including waste and sewage disposal PR.6 Cleaning and sanitizing PR.7 Pest control PR.8 Personnel hygiene PR.9 Measures for the prevention of cross contamination	PR.10 Management of purchased materials (e.g. raw materials, ingredients, chemicals and packaging), and supplies

QP: Quality Process, PR: Pre-requisite

FE 422 Food Production Management

Excellence always endures…
It remains long after cost is forgotten

Grading Policy

Assessment Tool	Quantity	Percentage
Midterm Exam	2	60
Final Exam	1	40

Reference Books

J.M. Juran, A.Blanton Godfrey	Juran's Quality Handbook	McGraw-Hill	2000	978-0071165396
David Smith, Tracey Jackson-Smith, Rob Politowski	ISO 22000 Food Safety: Guidance and Workbook for the Manufacturing Industry	BSI Standards	2007	978-0580499890
David Hoyle	ISO 9000 Quality Systems Development Handbook: A Systems Engineering Approach	Butterworth-Heinemann	1998	978-0750625623
Richard B. Chase Nicholas J. Aquilano F. Robert Jacobs	Production and Operations Management: Manufacturing and Services	Richard D Irwin; 8th Inst M edition	1998	978-0256269215