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Implementation of ISO Standards in Food Industry. Statistical Analysis of Foodborne Illness in Cluj

Sorin APOSTU, Daniela LAZĂR, Ancuta ROTAR

University of Agricultural Sciences and Veterinary Medicine, 3-5 Manastur Street, 400370, Cluj-Napoca, Romania, e-mail: soriapostu@yahoo.com

Abstract: A management system or integrated management system implemented in a food processing unit is a useful tool that provides important information upon technological and managerial processes. This paper drowns information related to ISO 9001, ISO 22000 and ISO 17025 applicability in a food processing unit. Law 150/2004 is the first legal regulation that obliges the food processor to develop a preventive system in order to assure safety of food. A statistical analyze has been made in Cluj to mark the influence of the legislation and international standards upon the quality and safety of the food products. The period taken in consideration is from 2005 – 2008 and follows two directions: strategic program of the territorial authority for food safety and self-control program of the food processor. The study scores the most relevant etiological agents that could cause foodborne illnesses, and their appearance in food products. A relationship has been associated between legal regulations, the years taken in consideration and the preponderant health risk (microbiological, chemical and physical risks).

Keywords: ISO standards, foodborne illnesses, etiological agent, microbiological risk, chemical risk, physical risk, statistical study

INTRODUCTION

Adopting a management system in an organization is a useful tool for ensuring compliance with the requirements specified in the legislation, rules, regulation and the requirements from customer.

Any organization can be regarded as identifiable processes that interact between them. Management processes and the interactions between them can be considered a process approach.

ISO 22000:2005 was developed by ISO TC 34 (Technical Committee 34), responsible for food products. One can think of ISO 22000 as a standard that takes the approach of ISO 9001 as a management system, incorporates the hygiene measures of Prerequisite programs, and adds HACCP principles and criteria.

The *food chain* consists of the entire sequence of stages and operations involved in the creation and consumption of food products, every step from initial production to final consumption – 'from farm to fork' These include organizations that produce feed for animals. It also includes organizations that produce materials that will eventually come into contact with food or food ingredients.

In order to develop a management system, an implementation plan is needed and it covers: education on the contents of the standard, a gap analysis in conformity with the requirements of ISO 22000, a timeline of the implementation steps based on the gap analysis, records collection, and improvement methods.

The system must be evaluated and updated to stay current.

ISO 22000:2005 system procedures are: documents control; registrations control; internal audit; control noncomform product; corrective actions; preventive action; preparedness and response in case of emergency; hazards assessment-evaluation and selection of control measure (related to HACCP); HACCP plan; establishment of critical limits for critical control points.

ISO 9001:2008 has process based principals to add value to food products obtained in a food processing unit.

A "Process" can be defined as a "set of interrelated or interacting activities, which transforms inputs into outputs": INPUT (Requirements Specified) – OUTPUT (Requirements Satisfied).

These activities require allocation of resources such as people and materials. A process-based approach contains: identification and systematic management of the processes used within an organization and in particular the interactions between such processes.

ISO 9001:2008 system procedures are: documents control; registration control; internal audit; control of nonconform product; corrective actions; preventive action.

ISO 17025 is used by laboratories as a standard to develop and establish a quality system in the laboratory. According to the International Organization for Standardization, the standard was designed to confirm and determine the competence of laboratories recognized by customers, regulatory authorities and accreditation bodies. Also this standard is used as a criterion for laboratory accreditation. ISO 17025 standard is divided into two main sections: Management Requirements and Technical Requirements.

Steps in implementing a management system include the following: establishing the structure of processes, interaction between processes, processes responsible; establishing and developing the structure of documentation of an integrated management system; staff training activity, systematic training of staff - and ensuring the maintenance of the Integrated Management System; audits: internal and external audits. Below one can see the *Flowchart of establishing a IMS*

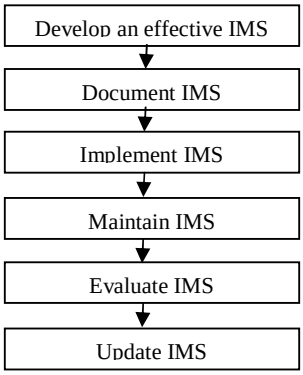

Fig. 1 Flowchart of establishing an IMS

The plan-do-check-act (PDCA) methodology is a dynamic methodology and can be a useful tool to define, implement and control corrective actions and improvements. Maintaining and improving process performance can be achieved by applying the PDCA concept at all levels within an organization. This applies equally to all processes, from high-level strategic processes to simple operational activities.

There are three types of hazards: biological, chemical and physical; the most common food safety hazards are biological. More than 95% of all human foodborne illnesses from meat and poultry are caused by bacteria.

Tab. 1

Characteristics of growth for some relevant biological hazards

Name of pathogens	Temperature for growth	pH	Minimum a_w
Bacillus cereus	5- 48 ^{0}C	4,9 - 9,3	0,912
Campylobacter jejuni	30 – 47 ^{0}C	4,9 – 7,5	---
Clostridium botulinum (types A, B,E)	3.2778 – 46 ^{0}C	> 4,6	0,94
Clostridium perfringens	15 - 50 ^{0}C	5,0 - 8,3	0,95
Escherichia Coli O157: H7	10 - 44.5 ^{0}C	4,5 – 9,0	---
Listeria monocytogenes	1- 45 ^{0}C	4,4 – 9,6	0,90
Salmonella	5- 46 ^{0}C	4 -9	0,94
Staphylococcus aureus	6.5– 46 ^{0}C	4,5 – 9,3	0,83
Yersinia enterocolitica	0-45 ^{0}C	4,2 – 9,6	0,94

Tab. 2

Chemical hazards

Location	Hazard
Raw materials	Pesticides, antibiotics, hormones, toxins, fertilizers, fungicides, heavy metals, PCBs
	Color additives, inks, indirect additives, packaging materials
Processing	Direct food additives – preservatives (high levels of nitrites), flavor enhancers, color additives.
	Indirect food additives – boiler water additives, peeling aids, defoaming agents
Building and equipment maintenance	Lubricants, paints, coatings
Sanitation	Pesticides, cleaners, sanitizers
Storage and shipping	All types of chemicals

Tab 3.

Physical hazards

Cause	Source
Glass	Bottles, jars, light fixtures, utensils, gauge covers, thermometers
Metal	Nuts, bolts, screws, steel wool, wire, meat hooks
Stones	Raw material
Plastics	Packing materials, raw materials
Bone	Raw materials, improper plant processing
Bullet / Shot / Needles	Animals shot in field, hypodermic needles used for injections
Jewelry / Other	Rings, watches, pens, pencils, buttons, etc

MATERIALS AND METHODS

Necessary materials: all the necessaries materials used for conducting the analysis in order to determine biological (microbiological), chemical and physical risks.

In order to determine the parameters specific analysis methods are used in conformity with the in force regulations.

The domains activities taken in consideration are: Meat, organelle, semiprep.; Canned food; Fish, fish products; Consumption milk, milk products; Eggs, eggs products; Honey, honey products; Confectionery / Bakery products; Additives, condiments; Water; Packing material, membranes; Sanitation samples; Carcass sanitation samples.

The project has two components: a strategic component that is provided from the legal authorities and a self-control component based on the processors' wish, in conformity with the legislation in force.

RESULTS AND DISCUSIONS

Tab. 4

Strategic component – examined samples evidence in Cluj

Examinated samples name	No. samples examined 2005	Inadequate samples in 2005	No. samples examined 2006	Inadequate samples in 2006	No. samples examined 2007	Inadequate samples in 2007	No. samples examined 2008	Inadequate samples in 2008
Meat, organelle, semiprep.	1181	39	605	29	1975	0	778	5
Canned food	30	0	13	0	21	0	6	1
Fish, fish products	53	2	44	0	36	0	26	5
Consumption milk, milk products	1020	205	297	18	2435	994	3024	1366
Eggs, eggs products	36	2	32	0	58	0	10	0
Honey, honey products	8	0	1	0	3	0	6	0
Confectionery /Bakery products	47	11	16	1	123	0	134	0
Additives, condiments	410	4	128	0	86	0	257	16
Water	375	67	382	28	232	0	165	0
Packing material, membranes	256	0	120	0	161	0	151	0
Sanitation samples	1975	113	459	88	1058	96	1065	95
Carcass sanitation samples	53	0	0	0	35	0	48	0

Tab. 5

Self-control component – examined samples evidence in Cluj

Examinated samples name	No. samples examined 2005	Inadequate samples in 2005	No. samples examined 2006	Inadequate samples in 2006	No. samples examined 2007	Inadequate samples in 2007	No. samples examined 2008	Inadequate samples in 2008
Meat, organelle, semiprep.	1455	12	1672	53	1968	7	2562	32
Canned food	2	0	4	0	32	1	79	0
Fish, fish products	9	0	7	0	32	0	32	0
Consumption milk, milk products	504	38	519	1	884	133	754	89
Eggs, eggs products	51	4	48	6	124	0	134	24
Honey, honey products	15	4	21	0	11	0	22	0
Confectionery/Bakery products	49	1	62	6	263	1	772	9
Additives, condiments	41	0	40	0	84	3	52	1
Water	73	16	61	4	42	0	125	22
Packing material, membranes	38	0	46	0	43	0	40	0
Sanitation samples	32	0	1568	17	1243	21	1384	18
Carcass sanitation samples	50	0	133	0	196	0	179	2

Tab. 6

Relevant etiological agents appearance in food – from the examined samples in Cluj State

		Inadecquate samples no.								No. analyzed samples E. Coli O157:H7	No. analyzed samples Listeria monocytogenes
		Staf. coag. pozit.	NTG	Bact. Colif.	E. Coli	Salm.	Yeasts and moulds	Cl. sulf. red.	B. cereus		
2005	Strategic	8	576	211	35	0	18	11	6	7	2
	Self-control	4	29	37	20	2	18	38	1	3	121
2006	Strategic	34	117	129	11	0	4	0	0	2	763
	Self-control	19	30	63	24	4	5	33	2	20	94
2007	Strategic	10	1044	81	20	0	0	0	0	23	2466
	Self-control	8	85	4	24	0	3	3	1	30	535
2008	Strategic	8	1154	55	80	0	0	0	0	43	1080
	Self-control	4	95	16	24	3	5	1	1	60	1109

Foodborne illnesses are scattered around the globe and appear in the form of collective epidemic outbreaks or family and rarely, sporadically, after consumption of contaminated food.

Incriminated food and contaminants:

- Meat (poultry, pigs, cattle, sheep) and meat products (minced meat, sausage, meat pies): *Salmonella, Staphylococcus, Cl. perfringens,*
- Milk and derivatives: *Staphylococcus, Salmonella, Streptococci;*
- Fish, fishery products, crustaceans: *Staphylococcus, Salmonella, V. parahaemolyticus*;
- Confectionery Products: *Staphylococcus, Salmonella*
- Preparations of vegetable (rice, beans, potatoes): *B. cereus, Salmonella, Cl. Botulinum*.

Food contamination may occur throughout the circuit, from the source to consumption.

Route of transmission: oral by ingestion of contaminated food, infected with the toxin or perform receptivity.

CONCLUSIONS

Taking in consideration the results listed above one can observe the following:

- an increase of the NTG values not only for the self-control component but also for the strategically component. The decreased values of self-control component in comparison to the strategic one may be due to a special attention, during the samples prelevation.
- for the Salmonella contamination of the samples examined 2 kind of examinations were conducted in order to obtain the results: the surface contamination (for ex. determination of Salmonella from carcass sanitation samples – for a meat processing unit); the deep contamination (for ex: meat, muscles);
- samples of the : B. cereus, Staf. coag. pos., Cl sulf. red, Bact. colif, are decreasing on the 2005-2008 period, because there has been made a lot of modifications for the legislation in force. As a recommendation a proper homogenization of the food safety legislation.
- because of the implementation of the Regulation 1441/2007, one can understand the increasing values for the Listeria monocytogenes number of samples taken;

Foodborne illnesses can appear through 2 mechanisms of action of bacteria:

1. direct action of pathogens (by the large number of them cause of ulcerative lesions in intestinal area);

2. action of toxins.

Etiological any germ that contaminated food can cause a foodborne ilnesses when it is in a quantity large enough or when secrete a certain amount of toxin.

The most frequent found etiology: Salmonella spp, Staphylococcus coag. pos., Cl.sulf. red., B. cereus, B. colif.

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