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Food safety and quality management system performances in Serbian meat industry*

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A b s t r a c t: In the last ten years a significant number of domestic meat processing facilities implemented and certified (or are in the process of implementation) different safety management systems (HACCP, ISO 22000, IFS). The largest number of food companies and business have determined for the implementation of the concept of Hazard Analysis and Critical Control Points (HACCP). These activities, at least in most cases, followed the adoption of appropriate regulations - Veterinary Law, and particularly Food safety law. Thanks to many years of work related to various aspects of food safety, including consulting and auditing, and other activities that have enabled the authors of this paper to gain insight into the numerous FSMS systems, in this paper we have decided to share our impressions related to the performance analysis of these systems. Among others, we would like to mentioned top management commitment, selection of consultants, defining the process, grouping and product description, hazard analysis, critical control points (CCPs) and critical limits (CLs), monitoring and verification of CCPs, corrections, corrective and preventive measures, as well as other main elements affecting the performance of FSMS.

Key words: *food safety and quality management, system performances, Serbian meat industry.*

Introduction

In the last decade on numerous occasions we have pointed out that insufficient availability and safety of food (in addition to noticeable climate changes and dramatic environmental pollution) are the most important global issues of the modern world. We took advantage of all opportunities: published scientific papers, lectures in domestic and international congresses, particularly personal contacts with governmental officials to draw attention to the more prominent problems regarding food availability and its safety by communicating and analyzing up-to-date information. Also, we were free to propose specific solutions, fully aware of our limited influence on this matter *(Radovanović,* 2008*; Radovanović,* 2009; *Radovanović et al.,* 2010). Therefore, we present you this paper with a similar „mission“, knowing that problems are not solved but instead have multiplied.

Human-kind has an increasing problem regarding hunger and/or insufficient alimentation: production of basic foodstuff (particularly food grains) is not sufficient and with constant increase of population it led to increase of number of people under threat of starvation from 800 million to 1,2 billion, just in the last 3 to 5 years. Every 30 seconds a person dies from hunger (mostly children under 5 years of age). A situation regarding food safety is not much better. Number of epidemics and food borne incidents related to different biological, chemical and physical hazards as well as hospitalized or even fatal cases is increasing. It is often considered that those incidents and their consequences are mainly connected with the characteristics of poorest and developing countries - however this is not true.

In addition to problems that occurred in EU member states (recent cases of dioxin contamination in Germany, Holland and some other countries in the last quarter of 2010), serious problems have emerg-

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ed in USA, Australia and other highly developed countries. Perhaps the best example is the USA, country with the most rigorous food safety legislations and food industry with the best developed system of preventive measures and official control of production, import and trading of agricultural goods.

In spite the fact that in the last twenty years (since 1990) number of food borne illnesses (76 millions), hospitalizations (325.000) and deaths (5.000) have decreased in 2010 to 47,8 millions illnesses, 128.000 hospitalizations and 3.000 deaths (Table 1.), because of uttered rise of the cases with unknown etiology, the cost of food borne diseases in USA has increased from 13,2 (*Mead et al.* 2000*)* to enormous 152 billion US $ - **(***Georgetown University research, cit. Shire,* 2011) in the mentioned period of time. This situation, especially attempt to improve the control of domestic small and medium sized production facilities producing food of animal origin as well as imported food - regarding fulfilment of working conditions, food safety and quality requirements - have generated putting into force new food safety law - so called Food Safety Modernization Act *(FSMA-S.510,* 2011). This act was adopted by the US Congress on December 19th 2010 and was signed by president Obama on January 4th 2011.

Table 1. Estimated annual number of episodes of domestically acquired food borne illness (FBI), hospitalizations and deaths caused by 31 pathogens and unspecified agents - transmitted through contaminated food, US[1] (*Scallion et al., 2011*)

Tabela 1. Procenjeni godišnji broj epizoda lokalno dobijenih bolesti koje se prenose hranom (BPH), broj hospitalizacija i smrtnih slučajeva, koje su prouzrokovali 31 patogen i nepoznati agensi – koje se prenose preko kontaminirane hrane, SAD[1] (*Scallion et al., 2011*)

FBI Cause/ Uzrok BPH	Illnesses Mean (90% Credible Interval) Bolesti/ Srednja vrednost (90% interval pouzdanosti)	%	Hospitalizations Mean (90% Credible Interval)/ Hospitalizacije Srednja vrednost (90% interval pouzdanosti)	%	Deaths Mean (90% Credible Interval)/ Smrtni slučajevi Srednja vrednost (90% interval pouzdanosti)	%
31 Major known pathogens/31 glavnih poznatih patogena[2]	9.4 million *(6.6–12,7)*	20	55.961 *(39.534–75.741)*	44	1.354 *(712–2.268)*	44
Unspecified agents/ Nepoznati agensi[3]	38,4 million *(19.8–61,2)*	80	71.878 *(9.924–157.340)*	56	1.686 *(369–3.338)*	56
Total/Ukupno	47,8 million *(28,7–71,1)*	100	127.839 *(62.529–215.562)*	100	3.037 *(1.412–4.983)*	100

NOTES/NAPOMENA:

[1] *All estimates were based on US population of 300 million in 2006; CrI, credible interval/Sve procene se baziraju na populaciji SAD od 300 miliona u 2006. godini; CrI, interval verovatnoće*

[2] *The 31 major known pathogens are astrovirus, Bacillus cereus, Brucella spp., Campylobacter spp., Clostridium botulinum, Clostridium perfringens, Cryptosporidium spp., Cyclospora cayetanensis, enterotoxigenic Escherichia coli (ETEC), Shiga toxin–producing E. coli (STEC) O157, STEC non-O157, diarrheagenic E. coli other than STEC and ETEC, Giardia intestinalis, hepatitis A virus, Listeria monocytogenes, Mycobacterium bovis, norovirus, rotavirus, sapovirus, nontyphoidal Salmonella spp., S. enterica serotype Typhi, Shigella spp., Staphylococcus aureus, Streptococcus spp. group A, Toxoplasma gondii, Trichinella spp., Vibrio cholerae, V. vulnificus, V. parahemolyticus, other Vibrio spp., and Yersinia spp./*
31 glavni poznati patogen: astro virus, Bacillus cereus, Brucella spp., Campylobacter spp., Clostridium botulinum, Clostridium perfringens, Cryptosporidium spp., Cyclospora cayetanensis, enterotoxigenic Escherichia coli (ETEC), Shiga toxin–producing E. coli (STEC) O157, STEC non-O157, diarrheagenic E. coli koji osim STEC i ETEC, Giardia intestinalis, hepatitis A virus, Listeria monocytogenes, Mycobacterium bovis, norovirus, rota virus, sapo virus, nontyphoidal Salmonella spp., S. enterica serotype Typhi, Shigella spp., Staphylococcus aureus, Streptococcus spp. group A, Toxoplasma gondii, Trichinella spp., Vibrio cholerae, V. vulnificus, V. parahemolyticus, ostali Vibrio spp., i Yersinia spp.

[3] *Unspecified agents are defined as agents that cause acute gastroenteritis other than the 31 major known pathogens listed above. They include known agents with insufficient data to estimate agent-specific episodes of illness; known agents not yet recognized as causing food borne illness; microbes, chemicals, and other substances known to be in food but whose pathogenicity is unproven and agents not yet describe/ Nepoznati agensi su definisani kao agensi koji izazivaju akutni gastroenteritis osim 31 poznatog patogena navedenog u prethodnom paragrafu.Uključuju poznate agense sa nedovoljno podataka na osnovu kojih bi mogla da se uradi procena epizoda bolesti izazvanih specifičnim agensom; poznati agensi koji još nisu prepoznati kao agensi koji izazivaju bolesti koje se prenose hranom; mikrobi, hemikalije, i ostale supstance koje se pojavljuju u hrani, ali čija je patogenost još uvek nedokazana i agensi još uvek nisu opisani.*

Having in mind all previous remarks and statements, authors are taking advantage of 56th International Meat Industry Conference invited lecture to shred some light on certain important facts and circumstances regarding food safety management system implementation, certification and performances in Serbian meat sector. Our choice was driven by several, in our opinion, very important facts. There is no food borne diseases surveillance network in Serbia and therefore their causes and consequences that had to do with unsafe meat and meat products remain unknown. More-over, we took into account the fact that unsafe food of animal origin, particularly meat and meat products, are the main cause of food borne diseases (cca 75%) worldwide.

The total annual value of international food trade was about 985 billions of US $ with the major influence of the group that includes trade of livestock and products of animal origin - an average of 672 million US $ or about 70%. We would also like to mention that Serbia was, and we are hoping that in the future will become again, significant exporter of this food group. In order to fulfil these hopes, guaranteed food safety represents the key condition or even imperative. On the basis of the results achieved in academic, scientific and professional activities, especially long term experience gained through the food safety, quality management and integrated system implementation and auditing in Serbian and foreign food production facilities, authors believe that the part of their professional duty is to point out all observed deficiencies, direct or indirect, in food safety management performances in domestic meat production facilities. We are doing this hoping that our experience will be of benefit to those who will be working on the introduction of modern food safety requirements for the meat industry products, especially on the systematic improvement of performances in implemented systems.

Management commitment

It is widely acknowledged that full commitment of top management and active support to the development and implementation of any modern meat and meat products (hereinafter: food or product) safety management system represents one of the key requirements for the successful implementation, maintenance, certification and continual improvement of its effectiveness. In situations where the above condition is met, the appropriate stated vision and mission of the company, and clearly defined policies and objectives in terms of food safety are just a consequence of accepting the fact that product safety is imperative, a key demand of the market (customers, end users/consumers) and the most important condition before anyone could discuss any other aspect of quality. This active approach is the basis for the precise definition and the correct implementation of many other activities within the food safety management system (FSMS), as well as for serious and responsible analysis of system performance.

Although anachronistic, our current experience, unfortunately, has shown that the top management of the domestic meat industry facilities, especially general managers, mostly (thankfully not always!) are not fully committed and dedicated to food safety management systems.

As a result, the implementation (certification is not a legal requirement), including activities that are the foundation of FSMS and form its important support, is primarily generated by binding requirements of adequate regulation. In Serbia, these are first of all, the Veterinary Law *(Official Journal of RS,* 91/2005*)* and Food Safety Law *(Official Journal of RS,* 41/2009), and in the EU General Food Law *(General Food Law,* 2002) and appropriate EC Directives 852, 853 and 854 from 2004., whose application has became mandatory in EU since January 1st 2006. The lack of interest and passive attitude of the top management, unfortunately, is very swiftly recognized and widely accepted by other employees, particularly the operating (HACCP/FSMS) team, and the person in charge and responsible for FSMS (management representative and/or HACCP team leader).

The highest number of concrete actions, along with the slow pace of work and extended deadlines, can be determined until the first, and as a rule always successful (!?), certification. After attaining this „major" objective, acquisition and delivery of certification, the motivation is slowly disappearing, defined activities are less frequently managed and are often overlooked - until the time before the first (or next) audit. Only then activities speed up, again. Specifically, various annual plans (e.g. training, preventive maintenance), simulations of withdrawal and recall of products, internal audits, reviewing and analysis of performance in order to improve the FSMS and other important activities are carried out unsystematically, while the supporting documents, particularly records are, while missing in the real-time, formed afterwards *("post festum")*.

We would like to stress out that these situations usually occur in small plants (up to 20 employees), less frequently in medium-sized, and rarely in large companies. Specifically, within the first group of manufacturers, because of the small number of emplo-

yees, it often happens that the operating HACCP team is made of majority or even all employees who are responsible for the execution of the main processes; it is similar with the HACCP team leader who is, almost as a rule, the production manager. Therefore, all activities defined under FSMS are perceived and performed as an additional, imposed and incidental activity, which is particularly evident in circumstances where there is lack of commitment and support of the owner and/or the top management.

In working environment of most mid-sized and almost all large manufacturers, the competence of employees is generally at a higher level. Organizational and functional scheme usually defines distinct food safety and quality management department and its head manager is HACCP team leader. Other members of the HACCP team are appointed by the organizational units whose activities have an important influence on the product safety.

This, sometimes regardless of the attitude and level of support of the top management, provides a slightly more serious approach, defined duties and responsibilities are distributed over a number of immediate operators - which are individually less burdened - and the planned activities are sometimes, though not always, accomplished properly and in a timely manner.

Selection of consultants

Regardless of the fact that the facilities of the meat industry do not need to hire consultants for the implementation and development of the food safety management systems and, in principle, all the planned activities to meet the FSMS requirements can be achieved using their own resources, the practice shows that this, nevertheless, happens very rarely. This is typical for small and medium enterprises, which mostly have modest resources - primarily in terms of necessary knowledge, experience and skills on specific (and current) Prerequisite Programs and requirements of the Hazard Analysis and Critical Control Points (HACCP) concept or any other model system for the management of food safety (e.g., ISO 22000, BRC, IFS). Namely, in this phase of implementation, serious mistakes are committed, especially in the working environments where the lack of commitment and support of the owner and/or top management are present, or when the most responsible employees do not dispose necessary and reliable information. Then, often decisions are made routinely while seeking bids where the key criterion is the price rather than the actual competence of consultants which would have to be proven (knowledge, practice/ experience, skills) and confirmed (insight of the previously successfully completed projects for the same or similar processes of food production). Adding to this, claimed specific expertise, often aggressive attitude of interested parties (consultants), unconfirmed recommendations or offers which are characterized by a conflict of interest (consulting services associated with the certification bodies and auditors), it is clear why in a number of FSMS (fortunately not all) serious deficiencies have been noted . This is especially true in terms of the complete absence or deficiency in the performance analysis of the implemented system, where the results (outputs) should serve as a base (inputs) for further and continuous improvement of efficiency and effectiveness of FSMS - which is one of the main general requirements of modern FSMS models. Experience with audits show that similar (and very often the same) nonconformities arise while measurable indicators of the actual improvement of FSMS are very rare, even after re-certification (after three years of application?) and/or consecutive audits.

Without examining the reasons (although we have in mind a number of everyday responsibilities and problems, while not attending conferences, outdated or insufficient monitoring of the regulations, technical literature, etc.), we would like to point out our practical experience by which the owners and/or top management of the Serbian meat industry generally are not aware and not familiar with the content, and therefore do not use standard ISO 10019:2005 which defines guidelines for the selection of quality management system consultants and use of their services.

The issuance of this international standard sends a clear message and is a confirmation of the importance of consultants and their activities as well as their undeniable responsibility for the quality of services provided (design and realization of optimal management solutions for the specific conditions within business organizations); in the same time standard is a reflection of past experiences in terms of the number and severity of the registered and/or possible consequences arising from the improper consulting services, which is in the process of food production, particularly in terms of food safety and the health of consumers, extremely important.

True, this standard is primarily related to the consultants for the current version of ISO 9001:2008. However, in the first part of ISO 10019, in the explanation of application areas (Scope), as well as in Note 2 of the Annex 1, it is emphasized that the Standard, with appropriate modifications, applies to all other management systems therefore including food safety management system(s) (e.g. ISO 22000).

Annex 1: ISO 10019 - 1 SCOPE

”This International Standard provides guidance for the selection of quality management system consultants and the use of their services……..

***NOTE 2 This International Standard addresses the realization of a quality management system but, at the same time, could be used with appropriate adaptation for the realization of any other management systems.”/*Aneks 1: ISO 10019 – 1 OBIM**

”Ovaj Međunarodni standard obezbeđuje smernice za odabir konsultanata za system upravljanja kvalitetom, kao i za korišćenje njihovih usluga ……..

NAPOMENA 2 Ovaj Međunarodni standard se bavi realizacijom sistema upravljanja kvalitetom, ali, istovremeno, uz adaptaciju, mogao bi da pude prihvatljiv i za realizaciju bilo kog drugog sistema upravljanja.”

Without getting into detailed discussion about the provisions of ISO 10019 (this must be the subject of a separate paper), we want to stress that it strongly emanates ”competence” - both in terms of required education, knowledge, experience and skills related to specific management systems (e.g. quality management - QMS, environmental management - EMS, etc), and in terms of the level of competence related to specific knowledge, relevant experience and skills related to business activities of the organization, which is undoubtedly of great importance for all processes in the whole food chain” - FSMS (Figure 1).

nificant non-conformances have been noticed. One of the main reasons for this, at least in our view, is inadequate competence of a number of consultants like mechanical engineers, electrical engineers and even forestry, mining and geology specialists.

In fact, consultants often do not possess even a basic but indispensable knowledge about food production (the corresponding primary education), specific experience (in food processing plants) and skills in the activities, processes, operations and procedures during the production of specific groups and type of food products (e.g. within the meat industry plants). A particular risk is the lack of know-

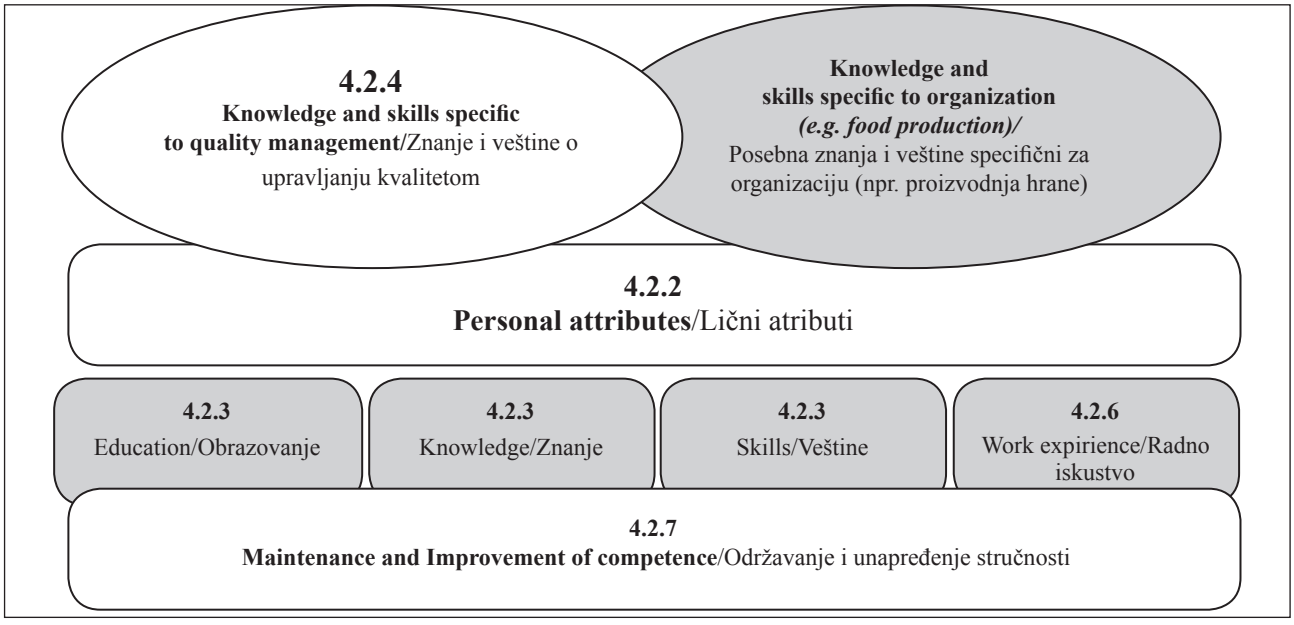

Figure 1. Concept of competence of consultants *(ISO 10019)*
Grafikon 1. Koncept kompetentnosti konsultanata (ISO 10019)

Preliminary remarks have been made mainly due to the fact that, at least according to our experience, in a large number of domestic food processing plants, especially in the meat industry, with implemented concept of HACCP and FSMS according to the requirements of ISO 22000, several sig-

ledge about (re)emerging hazards and their specific characteristics that, in the case of microbiological and some chemical hazards (e.g. mycotoxins), is not constant but is evolving depending on environmental conditions. In this way the risk of unsafe products or production increases or unnecessary time for the

control and funds are spent. In order to provide more comprehensive insight of important requirements of ISO 10019 related to the necessary competence of consultants, they are, because of the precision, given in the original form (Annex 2).

Not knowing the process and/or not understanding the essence of its phases, particularly their mutual relations and interdependence, by the consultants bridged with the universal layman approach is the main cause of nonconformities that arise in terms of not fulfilling Good Manufacturing Practices (GMP) and Good Hygiene Practices (GHP) - requirements as well as specific system requirements for the management of food safety – particularly HACCP requirements.

Annex 2/ Aneks 2

Annex 2: ISO 10019 - Selected requirements *(Scope)/* Aneks 2: ISO 10019/Izabrani zahtevi *(Obim)*

4.2.3 Education, knowledge and skills/ Obrazovanje, znanje i stručnost/veštine

"*Quality management system consultants should have the appropriate education needed to acquire the knowledge and skills relevant for the consulting services to be provided. A typical example is provided in Annex B./Konsultanti za sistem upravljanja kvalitetom moraju imati adekvatno obrazovanje neophodno za sticanje znanja i veština relevantnih za konsultantske usluge koje će se pružati. Tipičan primer je dat u Aneksu B."*

4.2.5 Knowledge and skills specific to the organization/Posebna znanja i veštine specifična za organizaciju

4.2.5.1 Statutory and regulatory requirements/*Statutarni i regulatorni zahtevi*

"Knowledge of statutory and regulatory requirements relevant to the organization's activities and to the consultant's scope of work is essential for quality management system consulting. …/ Poznavanje statutarnih i regulatornih zahteva relevantnih za aktivnosti organizacije i opseg rada konsultanta je od ključne važnosti za konsalting u oblasti sistema upravljanja kvalitetom…."

4.2.5.2 Product, process and organizational requirements/*Zahtevi koji se odnose na proizvod, proces i organizaciju*

"Quality management system consultants should have a reasonable knowledge of the organization's products, processes and customer expectations prior to initiating their consulting services, and should understand the key factors relevant to the product sector in which the organization operates/ Konsultanti u oblasti sistema upravljanja kvalitetom moraju dovoljno poznavati proizvode organizacije, procese i očekivanja potrošača/klijenata pre početka pružanja usluga, i trebalo bi da imaju puno razumevanje ključnih faktora koji su relevantni u proizvodnom sektoru u kom deluje organizacija.

They should be able to apply this knowledge as follows/ Trebalo bi da budu u stanju da primenjuju ovo znanje na sledeći način:

a) to identify the key characteristics of the organization's processes and related products/identifikuju ključne karakteristike procesa organizacije i relevantne proizvode;

b) to understand the sequence and interaction of the organization's processes and their effect on meeting product requirements/razumeju sekvencu/niz i interakciju procesa organizacijei njihov uticaj na ispunjenje zahteva potrošača;

c) to understand the terminology of the sector in which the organization operates/ da razumeju terminologiju sektora u kojem deluje organizacija;

d) to understand the nature of the structure, functions and relationships within the organization/ da razumeju prirodu strukture, funkcija i odnosa u okviru organizacije;

e) to understand the strategic linkage between business objectives & competence resource needs/ da razumeju strateške veze između ciljeva biznisa/delatnosti & potreba sa stanovišta resursa."

4.2.5.3 Management practices/*Praksa u upravljanju*

"Quality management system consultants should have knowledge of relevant management practices to understand how the quality management system integrates and interacts with the overall management system of the organization, including its human resources, and how it will be deployed to secure the goals and objectives of the organization/ Konsultanti u oblasti sistema upravljanja kvalitetom moraju poznavati relevantne upravljačke prakse kako bi mogli da razumeju na koji način se sistem upravljanja kvalitetom integriše i dovodi u interakciju sa ukupnim menadžment sistemom organizacije, uključujući ljudske resurse, i kako će se koristiti u obezbeđivanju ciljeva organizacije .

In some cases, additional competencies can be required to meet the organization's needs, expectations and overall objectives for its quality management system, such as business and strategic planning, risk management, and business improvement tools and techniques (Annex B)/ U nekim slučajevima, dodatna stručnost može biti potrebna kako bi se odgovorilo na potrebe organizacije, očekivanja i sveukupne ciljeve njenog sistema upravljanja kvalitetom, kao što su biznis planovi, strateški planovi, upravljanje rizikom, i tehnike i instrumenti za poboljšanje i unapređenje delatnosti (Aneks B)."

4.2.6 Work experience/Radno iskustvo
”The quality management system consultant should have relevant work experience in managerial, professional and technical aspects of the consultant services to be provided. This work experience can involve the exercise of judgement, problem solving and communication with all interested parties (Annex B)/ Konsultant u oblasti sistema upravljanja kvalitetom mora imati relevantno radno iskustvo u menadžerskim i tehničkim aspektima konsultantskih usluga koje se pružaju. Ovo radno iskustvo može uključivati donošenje sudova, rešavanje problema i komunikaciju sa svim uključenim stranama (Aneks B) .
Verifiable references to past work experience and achievements are important and should be made available to the organization/ Reference o prethodnom radnom iskustvu i dostignućima, koje se mogu proveriti, su važne i moraju biti dostavljene organizaciji.”…

Given the importance and impact of Pre-requisite programs on food safety, in this paper, however, we will not discuss nonconformities in this regard that arise in the domestic meat industry plants. The flaws that the authors of this paper have witnessed are not only numerous but also very versatile, so that, at least in our opinion, they deserve serious investigation and shall be a part of a separate paper. Therefore we will in the following text first of all comment on important and most frequent deficiencies related to the requirements of the HACCP concept, which are largely a result of complete ignorance or of the essence of food safety requirements, especially from the viewpoint of characteristics of particular groups and categories of food/meat products.

Defining the process, grouping and product description

Since the process approach is one of the most important characteristics of modern management systems, proper definition of the process, particularly within the group of main (core) processes, is one of the most important activities in the development of food safety management systems. This is primarily due to the fact that more specific sub-processes can be often defined, within a class of main processes - e.g. ”Meat Products”; of which, for example, we would like to point out only one - e.g. ”Cooked sausage”. Within this sub-process, we can define more specific groups of products - e.g. ”Fine chopped cooked sausages”, ”Rough chopped cooked sausages” and ”Cooked sausages with chunks of meat”.

Although in each of these groups a number of different products exists - e.g. hot dogs, frankfurters, Parisian sausages, extra sausages etc. (the example for,”Fine chopped cooked sausage”) - all of them have the same production and, consequently, there is no difference in their flow charts and since they share the same conditions of heat treatment (pasteurization), hazard analysis defines same critical control points (CCPs) and same values for the so-called critical limits. Generally speaking, a HACCP plan may encompass *(„de facto” and „de jure”)* multiple products, however, provided that the hazards, critical control points, critical limits and procedures / monitoring frequency of CCPs are essentially the same. This means that all the characteristics of the HACCP plan are unique to a group of products that are clearly and visibly marked as such and followed in practice. So, for these groups of products same activities related to monitoring, corrective actions (in case of deviations from critical limits), and verification must be defined. However, all these products differ significantly, since they have distinct composition or ratio of basic raw materials, they have various types of spices, additives, preservatives, diverse types of casings or different diameters, etc.

That is why all of these and other possible differences are defined within product specifications unique for each product. According to the requirements of the HACCP concept (similar to the ISO 22000 requirements 7.3.3 and 7.3.4), this document consists of information about the product composition, important preservation characteristics, intended use, identification of consumer suitability etc. For the same products, according to local regulations, so-called ”manufacturing specifications” must be prepared with the same information mentioned above, but also with the additional requirements/information’ (short description of the process, composition, physicochemical and sensory properties, type of individual or bulk packaging, labelling instructions, special distribution control), and it is only rational to encompass all the above requirements in a single document that will provide a more complete ”picture” of the product.

Unfortunately, practical experience shows that in a number of certified food safety management systems *(HACCP - CAC/RCP 1-1969; Rev.4.2003; ISO 22000)*

- processes are not optimally defined and grouped
- number of HACCP plans is unnecessarily large, as they relate to individual products and not to groups of products,

- documentation is extensive and inefficient, hence the application of the system - is significantly more difficult in practice, and
- requirements related to the product description and its characteristics are presented incomplete and in several documents, etc.

Hazard analysis, critical control points and critical limits

Listed (first, second and third) of the seven principles of HACCP concept are also requiring activities in the process of developing one or more HACCP plans. Understanding of the essence of certain processes/sub processes, responsible approach to the above mentioned principles (requirements of the concept) and the correct implementation of basic and related activities, have strong impact on the performance (efficiency and effectiveness) of the whole system. According to our opinion, hazard analysis is the first and, fundamentally important, principle of HACCP concept, because realization of all other principles / requirements essentially depends on precise and correct analysis of the possible dangers and appropriate records. However, attitude towards this phase of work is casual and superficial both by the HACCP team members and by consultants which is totally unacceptable. During our field of work we have witnessed that:

- a list of possible biological, chemical and physical hazards is very rarely composed (although it is mandatory) and when it exists it is often generic but not specific to each stage and/or procedure within defined and grouped process/sub process;
- almost always, qualitative assessment and quantitative evaluation of the hazards is absent (their probability and frequency), especially assessment of their impact on the consumers health and potential consequences;
- incompetent and irresponsible consideration of the probability and conditions of survival and/or growth of specific microorganisms in different stages of the defined process;
- incompetent and irresponsible consideration of the optimal control measures for specific identified hazards.

In the identification (positioning) of critical control points (CCPs) for specific process steps, professional and analytical approach is not used, but almost exclusively so-called „Decision tree". Answering routinely to four questions from „the tree" which should guide us to the final decision (wheatear it is or is not CCP) is not sufficient, since it lacks serious analysis of the relationships / interconnections between the phases of the whole process; this often generates insufficient definition of control measures, or a decision that one control measure can cover more hazards, or that one hazard needs multiple control measures.

Casual approach in certain situations can lead to a situation where control point (CP) - because of "fear of errors" and/or attempts to obtain a higher level of security, is wrongly identified as a critical (CCP). The additional effect is unnecessary monitoring and verification. All this, within serious performance analysis, suggests that a significant number of the implemented food safety management systems in the domestic meat industry facilities are not sufficiently effective and efficient.

Critical limits (CL) for the identified critical control points, according to our experience, are usually defined correctly. This is from at least three reasons. Most commonly used values are already defined in the regulations (e.g. +7 ^{0}C as the upper limit for the cold storage of meat), or have been taken from validated literature sources (e.g. water pressure in the shower for the final washing of carcasses of min. 2 bars, which significantly reduces the total number of microorganisms from its surface - so--called "antimicrobial washing"). Finally, because of certitude and/or other reasons and based on their years of experience, manufacturers often determine the regimes that are at a higher or lower level compared to ones defined by relevant regulations. This is, for example, often the case with the cooling process and exactly in such situations may be a particular problem. Specifically, in defining the conditions of cooling often, because of ignorance or the need for some comfort in the work, risky "corrections" are made in terms of reducing the temperature by only 2–3 °C. For example in the case of slicing area of cooked meat products can create conditions in which the most important pathogenic microorganisms (in this case *Listeria monocytogenes*), independently of type of packaging (vacuum or modified atmosphere), can multiply much faster than anticipated by the declared shelf life of the products.

Monitoring and verification of CCPs

If hazard analysis, identification of critical control points and critical limits are a foundation for the development of a HACCP plan, then definition of monitoring activities and verification of CCPs are the core operational activities, through application of HACCP plan and should enable highly controlled production and the full safety of the final products.

Because of this, precise definition, later consistent application of monitoring and verification are very important and responsible activities. During the development of one or more HACCP plans, key attention should be paid not only to the needs (WHAT is the subject of the action?), but also to the conditions that should ensure that the defined activities of monitoring/verification are filled during application. Before all, available measurement equipment (HOW?), which must be recorded, reliable and under constant control (e.g. calibration plan, calibration certificate issued by competent institutions, measuring equipment records, etc.), which in reality is not often the case. Dynamics (frequency) of monitoring and verification (WHEN?) is often not synchronized with the dynamics of the process, or cannot be achieved in real time during the actual events at the appropriate stages of the process that has been identified as a CCP. The consequence of this situation is that both activities are not implemented in the defined time; monitoring is executed less frequently than expected, and even there are cases that all relevant records are ”filled” at the end of the process or end of shifts. In addition, the verification activities usually do not ask for adequate measurements but instead checking of the documents that arise during the application of a HACCP plan. So here, the question of responsible person in charge of these activities, not depending on a defined (WHO?) - is very problematic. These situations are generally the characteristics of the small-sized facilities that, as a rule, have modest resources (people, technology and measuring equipment). In plants which have modern technology and measuring equipment (usually medium-sized and large facilities), these situations are rare, certainly the situation where the HACCP plans monitoring and verification are correctly defined. Certain deficiencies in the monitoring and verification activities are the consequences of incidents, when the process stops and the problems are resolved by applying pre-defined corrective measures, eliminating errors. Moreover, in these facilities, technological apparatus is increasingly equipped with adequate measuring devices that allow critical process stages to product safety to be followed on monitors and/or diagrams (e.g. cooling, freezing, pasteurization, sterilization). In addition, it is important to point out that some (though not all) stages of the process that are subject to monitoring and verification in the appropriate HACCP plans, are also the subject of inspections / official controls of competent inspection services (e.g. veterinary inspections at meat production plants). However, it should be noted that official control is usually achieved by routine inspection of carcasses and products (sensory, by touching or cutting), during which it is not possible to determine all of the possible hazards to product safety. For example, the inspection of carcasses and organs can identify a disease of animals that occurred ”ante mortem” and determine the conditional use of such meat/organs during further processing (e.g. obligatory pasteurization / sterilization, or confiscation). It is similar with the routine examination of the presence of *Trichinella spiralis* in swine carcasses. However, during routine inspection it is simply not possible to determine the level of microbiological contamination of carcass surfaces, eventual residues of heavy metals in the organs and so on. As a consequence, the appropriate professional services within the EU started seriously to think about the changes to the veterinary inspection procedures. Finally, we wish to point out that during the monitoring and verification activities within the related documents (notes, charts/diagrams, etc.) a number of important data and information are noted and registered. Most of them are important indicators, key input elements, and therefore the basis for performance analysis and continuous improvement of the meat / meat products safety management systems. Unfortunately, in terms of the domestic meat industry, as far as we can tell, a large number of measured values (indicators) remain where they are registered, occasionally are archived, but almost never become parts of serious performance analysis of the food safety system and are not used as a tool for continual improvement.

Corrective and preventive measures v / s corrections

Since it is a principle (requirement) of the HACCP concept, corrective actions are pre-defined as an integral part of HACCP plan and they follow monitoring activities. In fact, all non-conformities that are found during monitoring of CCPs, especially deviations from the defined critical limits, ask for **urgent** action(s) that are designed to prevent, eliminate or reduce risks to an acceptable level (so-called **correction**), but also measures to eliminate detected nonconformities and its cause and other undesirable situations affecting the safety of food (so-called **corrective action**). We emphasize that in the process of food safety management in the domestic meat industry plants often a misunderstanding of the essential difference between the terms ”correction” and ”corrective action” exists and therefore improper definitions of appropriate actions/activities that are implicit. The ”corrective actions” in the HACCP plan are usually defined as simple ”corrections” or

measures for immediate resolution of the problem, while a serious analysis of the causes for a deviation (the reason, impact(s) and their relationship, the particular circumstances/ conditions, appropriate tests or simulations, measurements, etc.) - are usually absent. So, there is a lack of the proper definition (in the HACCP plans) and the correct implementation of appropriate corrective actions (through application of HACCP plans in practice). Therefore, analysis of implemented corrective actions is also missing (efficiency, resource availability, responsiveness, the reasons for possible delays, etc.), especially analysis of actual effects. All this leads to the absence of important inputs for performance analysis and systematic improvement of FSMS.

Other elements affecting the performance of FSMS

HACCP concept does not explicitly require documented procedures for the management of documents and records (as opposed to the standard ISO 22000 – 4.2.2 and 4.2.3), but in its seventh principle and requirement 5.7 (CAC / RCP 1-1969, Rev.4-2003) only provides for the obligation to establish appropriate documentation and its archiving. We have witnessed only few HACCP systems that introduced and consistently applied management of documentation and records (?!). This practice has resulted in many gaps in the documentation: documentation levels are not defined, they are wrongly used (for example, interference between the guides / instructions and records), there are differences in the appearance of the documentation within the same level; not defined encryption and other important elements (e.g. version / edition, copy, date of adoption and/or application, the manner, place and time of filing, etc.). Important disadvantage is a lack of record distribution procedure, process changes and withdrawal of documents, the manner, place and time of filing invalid documentation etc.

One of the most important and most responsible actions in the processes of production of meat and meat products, especially from the standpoint of security, is purchasing. This is primarily because the subject of purchasing are the product ingredients (e.g. primary and secondary raw materials, spices, additives, etc.), but also materials that are in direct contact with products (e.g. packaging materials, packaging). To our knowledge, **purchasing control** is infrequently introduced as a part of the HACCP system, although appropriate requirements exists - both within the HACCP concept (Incoming material requirements - CAC / RCP 5.3), and within the requirements of ISO 22000 (Product characteristics - 7.3.3). Thus, within the certified HACCP systems in the Serbian meat industry, existence of documented procedures relating to purchasing requirements, defined within the relevant specifications (the input specifications), is rare, do not exist or are incomplete, criteria for evaluating, ranking and selection of suppliers is not determined, etc. How is it possible to execute full performance analysis of FSMS, if numerous and important data and information relating to purchasing are not available. This is even more important, if other important purchasing outputs important to food safety (like equipment, tools, supplies, hygiene items, etc.) are taken into consideration.

A significant part of the system for managing food safety is, beyond doubt, the management of nonconforming products. Without going into details of this requirement (in the HACCP concept and ISO 22000 - 7.10), in this part we just want to draw attention to the terms of „recall" and „withdrawal" of the products. These requirements are indeed, although not in the same manner, specified in the HACCP concept as well as in ISO 22000 standard. Specifically, the document CAC / RCP 1-1969, Rev.4-2003. (Section 5.8) states the term "recall", while the standard ISO 22000 (Section 7.10.4) states the term „withdrawal"; (though the article 7.3.1 of this standard, within the note, defines that term recall includes withdrawal of the product). Regardless of the note, we wish to emphasize that in most of the HACCP systems to which the authors of this paper had access, withdrawal and recall are more or less correctly defined in the relevant documents (procedures). However, they do not perform mock recalls, since this required activity, as a rule, is not simulated as planned in the real conditions/situations, but only „filling in" of the appropriate forms/ records exists.

HACCP concept does not explicitly requires documented procedures for internal audits (as opposed to the standard ISO 22000 - 8.4.1), although the importance of these activities needs not to be proved. Routine relationship with the introduction of HACCP concept generates situation, at least in systems in which the authors had access, where internal audits are not designed so they have not been implemented. In our opinion, it is the result of the internal audit that provides an effective opportunity to create a realistic insight into the performance of the system (FSMS). Data and information that are acquired during the internal audits represent inputs to analyze the performance, efficiency and effectiveness of food safety management systems, as well as powerful support in the efforts for con-

tinuous improvement. While the HACCP concept also does not explicitly require management reviews (as opposed to the standard ISO 22000 - 5.8), the importance of this activity is undeniable. Unfortunately, to our knowledge, most domestic plants in the meat industry in which HACCP have been introduced, this activity have not been defined and enforced. A disadvantage of this approach, primarily by the consultant and members of the HACCP team, is the fact that the organization has been denied for a number of very useful information (review outputs) that are not only the basis for further analysis and in making judgments about the performance of systems based on the facts (one of management principles), but are the basis for the continuous improvement of FSMS.

Instead of conclusion

In the last ten years a significant number of domestic meat processing facilities (as well as other food producers), implemented and certified (or are in the process of implementation) different safety management systems (HACCP, ISO 22000, BRC, IFS). The largest number of food companies and business have determined for the implementation of the concept of Hazard Analysis and Critical Control Points (HACCP). These activities, at least in most cases, followed the adoption of appropriate regulations - Veterinary Law (*Official Journal of RS,* 91/2005), and particularly Food Safety Law (*Official Journal of RS,* 41/2009). Thanks to many years of work related to various aspects of food safety, including consulting and auditing, and other activities that have enabled the authors of this paper to gain insight into the numerous FSMS systems, in this paper we have decided to share our impressions related to the performance analysis of these systems.

The largest part of the comments relates to the identified deficiencies, can be classified into several groups:

- In most meat industry plants there is no genuine preference, full commitment and active support of the top management for food safety management systems;
- Members and leaders of the operational teams (HACCP teams), in particular lower levels of employees, access binding activity as the imposed additional duties and responsibilities - which are not additionally evaluated and rewarded (lack of motivation);
- Consultants are often incompetent people without proper, specific training and experience, while the available experience and skills are usually acquired in the implementation of other management systems;
- Requirements of the appropriate standards (HACCP concept, ISO 22000, etc.) are not well understood and are superficially implemented and routinely executed.

We wish to point out that serious and responsible analysis of the performance of the implemented FSM system generally do not exists, especially not as a tool for systematic improvement of efficiency and effectiveness of the system and enhancement of product safety. Certified systems with defined key performance indicators of the process (KPI) that should be systematically monitored, precisely measured and seriously analyzed, are almost impossible to find. In this paper we have primarily analyzed and pointed out the major deficiencies of FSMS in domestic meat industry facilities and emphasized the necessity of, in time ahead of us, changes to the existing ”practices”. Selection, application and analysis of the most important performance indicators for the processes of meat production are not given, since it was a topic of our paper that we have already presented at the International Quality Day 2010 (*Đekić et al.,* 2010**).**

References

CAC/RCP 1-1969. Rev., 4–2003.

CDC - Centres for Disease Control and Prevention, 2011. Vol. 17, 1, January 2011, (www.cdc.gov/eid).

Đekić I., Radovanović R., Tomić N., Tomašević I., Rajković A., 2010. Indikatori efektivnosti procesnog pristupa upravljanja kvalitetom u prehrambenoj industriji - primeri iz prakse. Kvalitet, XX, 9–10, 41–44.

Scallan E., Hoekstra R. M., Angulo H. R., Tauxe J. H., Widdowson V. R., Marc-Alain, Roy M. A., Jones L. S., L.J., Griffin L. J. P., 2011. Food borne Illness Acquired in the US - Major Pathogens. Emerging Infectious Diseases (DOI: 10.3201/eid1701.P11101).

ISO 22000:2005.

ISO 10019:2005.

Mead P. S., Slutsker L., Dietz V., McCraig L. F., Bresse J. S., Shapiro C., Griffin P. M., Tauxe R. V., 2000. Food-Related Illness and Death in The United States. Centres for Disease Control and Prevention (Population Reference Bureau). Emerging Infectious Diseases, Vol.5, 5, pp.607-625.

Radovanović R., 2008. Bezbednost hrane: Globalni problem kao osnova za buduće inicijative i aktivnosti. Biotechnology in animal husbandary, 24, 21–54.

Radovanović R., Baćović I., Simić V., 2008. Izbor konsultanata i proverivača - teme i zamke. Predavanje održano na XVII Manifestaciji poscećenoj Svetskom danu kvaliteta i Evropskoj nedelji kvaliteta. Kvalitet, XVIII, 9–10, 23–26.

Radovanović R., 2009. Bezbednost hrane: Stanje i problemi u uslovima ekonomske krize. Kvalitet, XIX, 9–10, 36–42."I u ekonomskoj krizi m kvalitet i rešenje i izazov".

Radovanović R., Đekić I., Tomašević I., Šmigić N., 2010. Raspoloživost ili bezbednost hrane: Šta je veći problem ? Kvalitet XX, 1–2, 41–48.

Regulation (EC) No 178/2002 of the EU Parliament and of the Council of 28 January 2002, laying down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety.

Regulation (EC) No 852/2004 of the EU Parliament and of the Council of 29 April 2004, on the hygiene of foodstuffs.

Regulation (EC) No 853/2004 of the EU Parliament and of the Council of 29 April 2004, laying down specific hygiene rules for food of animal origin.

Regulation (EC) No 854/2004 of the EU Parliament and of the Council of 29 April 2004, laying down specific rules for the organisation of official controls on products of animal origin intended for human consumption.

Shire B., 2011. FSMA - Faces immediate and future challenges. Meat & Poultry, Jan.,19.www. MeatPoultry.com

USDA, 2011. Food Safety Modernization Act - S.510, Washington.

Zakon o veterinarstvu - Sl. glasnik RS, 91/2005.

Zakon o bezbednosti hrane - Sl. glasnik RS, 41/2009.

Performanse sistema za upravljanje bezbednošću i kvalitetom u pogonima industrije mesa Srbije

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R e z i m e: Poslednjih desetak godina značajan broj domaćih pogona inudtrije mesa uveo je i certifikovao neki od aktuelnih sistema za upravljanje bezbednošću proizvoda (HACCP, ISO 22000, IFS). Osnova svih tih sistema je koncept analize rizika i kritičnih kontrolnih tačaka (HACCP), a navedene aktivnosti je generisala aktuelna domaća regučativa - Zakon o veterinarstvu (Sl. glasnik RS, 91/2005) i Zakon o bezbednosti hrane (Sl. glasnik RS, 41/2009). Zahvaljujući višegodišnjem iskustvu stečenom tokom rada u oblasti bezbednosti hrane, uključujući istraživanja, konsalting i zvanična ocenjivanja za više domaćih i međunarodnih sertifikacionih tela, autori rada su se opredelili da daju prikaz važnijih performansi sistema za upravljanje bezbednošću i kvalitetom u pogonima industrije mesa Srbije. Posebna pažnja ukazuje se na posvećenost vrhovnog rukovodstva, izbor konultanata, definisanje glavnih procesa, grupisanje i opis proizvoda, postupak analize rizika, definisanje kritičnih kontrolnih tačaka (KKT) i kritičnih granica (KG), definisanje i sprovođenje postupka monitoringa, korekcija/ korektivnih i preventivnih mera i verifikacije kritičnih kontrolnih tačaka. Komentarišu se i drugi važni elementi od uticaja na performanse sistema upravljanja bezbednošću i kvalitetom u procesima proizvodnje i prerade mesa.

Ključne reči: *sistem za upravljanje bezbednošću i kvalitetom, performanse sistema, industrija mesa u Srbiji.*

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