

## **QUALITY ASSURANCE SYSTEMS IN FOOD INDUSTRY AND HEALTH SECURITY OF FOOD**

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**Abstract.** In order to ensure the appropriate food safety and health of consumers, suitable legal requirements and new quality standards are constantly being elaborated. The free trade exchange within the European Union made it necessary to unify food legislation and quality standards within the entire area of the EU. This publication outlines appropriate systems and standards functioning in the food industry as well as the legal basis for their application. Apart from systems which are compulsory in enterprises of the food industry, the article also discusses systems which individual enterprises implement voluntarily as well as informatics systems used to organize and manage the production and product traceability.

**Key words:** GHP, GMP, HACCP, traceability, food safety

### **SAFE FOOD – LEGAL BASIS**

In order to guarantee health security of food and, in particular, consumers' health safety, fresh legal regulations as well as new quality norms and standards are constantly elaborated. The above is associated with an adjustment to the constantly changing consumers' expectations and new emerging diseases. Free trade exchange within the European Union calls for the unification and harmonisation of food laws and quality standards on the entire area of the European community.

The Regulation No. 178/2002 of the European Parliament and the Council of Europe published in 2002 laying down the general principles and requirements of food law also established the European Food Safety Authority as well as laying down procedures in matters of food safety. In addition, it also made the manufacturers of food articles and feeds responsible for the monitoring of the origin of their products and tracing them back also after the stage of distribution.

As to the production of food products of non-animal origin, information concerning traceability of such products was published by the Chief Sanitary Inspectorate and this

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information is relatively liberal on condition that products which do not comply with the appropriate requirements can be withdrawn from the market efficiently [Czarnecki 2005].

In the case of food articles of animal origin, the monitoring system is far more formalised as there is a requirement, which makes it compulsory for producers operating on the meat market to use trade identification documents. This requirement was introduced in 2004 by the Parliamentary Act concerning veterinary requirements for products of animal origin (Law Gazette no. 33, pos. 288) as well as appropriate directives issued in the same year (LG no. 132, pos. 1419, no. 156, pos. 1636, no. 158, pos. 1655, no. 160, pos. 1673). The trade identification document (TID) contains all basic data concerning the producer (name, address, veterinary number) and the product itself (kind of product, origin, date of production/slaughter, date of dispatch, destination and means of transport). The document is always issued in two copies, one for the producer and one for the recipient.

In accordance with the Regulation No. 1760/2000 (EU), each cattle breeder is obliged to:

- conduct a complete registry of animals,
- mark all animals by ear-tags allowing placing appropriate bar codes in order to identify each animal,
- equip each animal with a passport.

The same directive makes it compulsory for all processing plants to mark beef at all stages of its distribution on the market. The applied marking must include the following information:

- number of the identification code of the animal or group of animals,
- identification number of the slaughter-house,
- identification number of the enterprise in which the cutting carcasses into half-carcasses and/or elements was carried out,
- name of the country in which the animal was born,
- name of the country in which the animal was bred,
- name of the country in which the animal was slaughtered.

The Parliamentary Act of April, 2nd 2004 about the system of animal identification and registration, alongside requirements concerning cattle, also refers to the remaining farm animals. It requires farmers to keep registers of other farm animals, for example, pigs. The inventory must include information concerning the owner of animals, the animals themselves as well as the place where they are raised. Moreover, each animal must be marked by an identification number of the herd or flock. The marking is achieved either by tattooing the identification number on ears or back or placing an ear-tag with the herd identification number.

At the slaughter stage of pigs, each animal is designated with a consecutive slaughter number to which the herd number of the slaughtered animal is assigned as well as data concerning its trade value such as weight, meatiness and class.

The directive No. 156, pos. 1636 from the year 2004 specifies veterinary requirements in the production of poultry meat as well as all the documentation that the breeder is expected to keep/carry out and which he/she is obliged to present appropriate veterinary services during the pre-slaughter inspection. Depending on the type of reared poultry, the following data must be provided:

- date of the introduction of poultry into the farm,

- name and address of the hatchery from which the poultry comes,
- number of poultry on the farm,
- mean daily body weight gain for the flock,
- flock mortality,
- type and duration of application of feed additives,
- quantity of feeds used to feed birds and water to water them, the vaccination card of the flock prepared by the supervising veterinary doctor,
- feed conversion rate,
- results of previous official poultry inspections carried out in the flock,
- quantity of poultry intended for slaughter,
- planned slaughter date.

After the inspection, the veterinary doctor issues the health certificate of the inspected poultry flock.

### **TRACEABILITY IN PRACTICE**

It is quite clear that the way of marking and identification of products derived from pigs and poultry is not specified so precisely in legal regulations as in the case of beef meat. Nevertheless, producers of pork and poultry meat are obliged to monitor their products appropriately and must elaborate appropriate systems and procedures which will allow them to fulfil all requirements.

The basis of each internal system functioning on a farm/enterprise is documentation following the product. At the stage of distribution/delivery, the meat raw material is accompanied by the following documents: external discharge (ED), VAT invoice and the trade identification document (TID). All these documents are issued in two copies and, therefore, it is possible to identify in the food chain both the supplier of the raw material as well as all receivers. Therefore, if it is necessary to withdraw a defective product from the market, it is possible to find all the receivers to which this product was delivered.

Other documents which accompany a given product in the course of its processing include: documents of inter-warehouse transfers (IWT) or/and internal dispatches and deliveries (IDI and IDE). The above-mentioned documents provide information about the type, quantity and, sometimes, price of the raw material or semi-finished products transferred inside the plant. In order to allow proper identification of the origin of the raw material and the possible recipient, it is necessary to supplement the above information with data about the origin of the specific batch. There is no doubt that on the basis of the above-described internal plant documentation and current legal requirements, irrespective of the organisation, profile and size of production of a given enterprise it is possible to trace the origin of the product. Nevertheless, the question remains what time interval is necessary to trace back the entire chain of events and how costly this operation is going to be. The matter is relatively simple in the case of the slaughter and sale of carcasses. However, an entirely different picture emerges when the carcasses are cut into numerous meat assortments used to produce various articles from different raw materials and functional additives frequently obtained from several different suppliers. It may easily turn out that the amount of incoming and outgoing data is so large that it

will become simply impossible to trace the chain back or that the required information will arrive too late. But in the food industry, it is just time that is essential because it is of paramount importance that, in the case of any discrepancies, the appropriate information about the questionable product must be gathered in the shortest possible time and in order to withdraw the improper or dangerous product from the market before it reaches the final consumer.

In order to meet the growing demand observed in the food industry, special informatics systems are being designed and implemented in enterprises which are capable of processing data fed into the system from traditional documentation or, sometimes, can even replace this documentation. In Poland such systems include software of CSB-System Internationale, BPSC S.A. and other companies. Tracing the origins of products is not the main task of these systems but rather it results from their requirements and technical possibilities.

The appropriate software developed for the running of a company allows the management of the enterprise to control the quality of products and to trace their origin in all departments of the company. Data concerning the quality and origin are registered in the place where a given article is manufactured and can be analysed "on line" in the system [Krzywiński and Schalk 2005 c].

The principal task of the software is to coordinate the flow of external information concerning the supply market as well as internal information obtained from such departments of the enterprise as: the warehouse, production and sales [Krzywiński and Schalk 2005 a]. This makes it possible to carry out effectively:

- the settlement of the livestock purchase,
- the settlement of production,
- the calculation of product prices on the basis of current purchase prices of raw materials,
- planning and control of processes,
- data archiving.

The next step in the process of streamlining data exchange between individual participants in the food chain is the implementation of GSI standards (Global Standards).

The system provides a set of solutions which facilitate trade transactions and electronic economy. It guarantees a standard way of identification and tracing of product movement and origin. The aim of the GSI system is to improve the process of management of the supply chain on through on implementation of clear and simple numbers identifying goods all over the world represented in the form of bar codes allowing their electronic reading. The system was designed in such a way as to overcome the limitations resulting from the application of systems specific for a given enterprise, organisation or sector. The GSI numbers, which identify trade and logistic units, are presented in the form of bar codes GSI-128. These symbols allow the reading of the identification numbers as well as additional data using appropriate devices so that all data can be gathered and processed automatically [Zasady śledzenia... 2005].

In the future, it will be possible to improve the GSI system by replacing the known and currently used bar codes with RFID – Radio Frequency Identification (ID) labels/identifiers employing radio waves [Krzywiński and Schalk 2005 b]. This system allows data reading and recording without touching products and, hence, eliminating the 'human factor' and possibilities of errors.

## **SYSTEMS OF MANAGEMENT OF FOOD QUALITY AND SAFETY**

In the European Union, apart from systems of monitoring of the origin of food products, companies are also obliged to implement systems which ensure food safety such as HACCP and GHP/GMP. From the moment of Poland's accession to the European Union also the Polish food processing sector is obliged to implement the above-mentioned systems. Although formally Poland joined the EU on May, 1st 2004, the process of adjustment of Polish enterprises had begun earlier (the parliament act on food and nutrition conditions of May, 11th 2001 with later amendments). As of the 1st of January 2006 new, unified legal regulations came into force in all member states of the EU concerning the entire food sector including feed manufacturers (EU) No. 852/2004, (EU) No. 853/2004, (EU) No. 854/2004, (EU) No. 882/2004, (EU) No. 183/2005 which specify precisely the range of application and responsibilities of companies with regard to the implementation of the GHP/GMP and HACCP systems. As a new EU member state, Poland is subject to the same requirements because regulations of the EU legislation come into force in each member state without the need of harmonisation with the national legislation. Nevertheless, the EU requirements find their reflection in the new regulations concerning products of animal origin passed by the Polish Parliament in the form of a new Act about products of animal origin (LG 2006, No. 17, pos. 127 of 16.12.2005).

### **GHP/GMP PRINCIPLES**

Good Hygiene Practice (GHP) refer to procedures that must be undertaken and hygiene conditions that have to be fulfilled and monitored at all stages of production or trade in order to guarantee food safety.

Good Manufacturing Practice (GMP) denotes all the actions that must be undertaken and conditions to be fulfilled in order to ensure that production of food, wrapping materials and other materials expected for contact with food, is executed in proper way to guarantee safe end products and safe food for human consumption.

The Prerequisite Programme in other words GHP/GMP is the first step to implementation of food safety and quality systems along the entire food chain beginning with the initial production, feed production, animal rearing, processing, transport and ending with the retail trade. The area covered by the GHP and GMP requirements [Turlejska 2003] comprises:

- the site, surroundings and infrastructure of the enterprise,
- enterprise facilities and their functional layout,
- machines and equipment,
- washing and disinfecting processes,
- water supplies,
- waste control,
- pest protection and appropriate control in this field,
- personnel training,
- personnel hygiene,
- keeping documentation and records in the area of GHP.

In practice, the process of implementation of the GHP and GMP principles from the moment of their introduction consisted in the modernisation of the existing enterprises and adjustment of their infrastructure, facilities, machines and equipment to legally clearly specified hygiene-sanitary conditions. Unfortunately, in many cases this process was very costly since it was connected with the restructure of the existing facilities or even the construction of completely new ones. Very often the modernisation process involved the exchange of the majority of machines and equipment because the old ones failed to comply with the basic hygiene-sanitary requirements. Successive requirements were fulfilled one after another by writing down definite procedures according to the principle: "Write down how you do it, do as you have written down". The form of the applied procedures is completely free and depends exclusively on the given company, its needs and size, but it must include all the hygiene-sanitary requirements and must comply with the existing law. Correctly written down and implemented principles of good hygiene and manufacturing practices are approved and supervised by the appropriate sanitary services.

### **HACCP SYSTEM – (IM?) PERFECT TOOL**

The Hazard Analysis and Critical Control Point (HACCP) involves all the procedures whose aim is to guarantee food safety by way of the identification and assessment of the scale of threat from the point of view of the health quality of food as well as the risk of hazards which may occur in the course of all the stages of the production process and food circulation. In addition, the system also aims to determine methods of limiting hazards and establishment of remedial actions.

The HACCP system is based on seven principles which, simultaneously, make up consecutive stages of its implementation [Turlejska 2003]:

- hazard analysis, in other words, identification and assessment of threats and possible hazards of their occurrence and determination of control measures and methods of counteracting these threats,
- determination of critical control points (CCP) in order to eliminate or minimise the occurrence of hazards,
- establish critical limits for the critical control points identified,
- determination and implementation of a system for the monitoring of critical control points,
- establishment of corrective actions, if a critical control point does not fulfil the necessary requirements,
- establishment of verification procedures in order to confirm if the system is effective and acts in accordance with the plan,
- elaboration and maintenance of the documentation of the HACCP system concerning stages of its implementation and determination of the method of data registration and storage as well as archiving of the system documentation.

The basis for the elaboration and implementation of the HACCP system is the Codex Alimentarius. Other standards are also known, among others, the Danish Standard or the new ISO 22000 Standard.

The analysis of hazards provides an excellent tool which helps to involve the company intermediate management in its implementation. They feel obliged to analyse all operations taking place in the enterprise from the point of view of possible hazards which may occur. The HACCP team must, to a smaller or greater extent, collect literature data concerning the threats and risks connected with them as well as data associated with the prevention and elimination of inconsistencies which have already developed. It is a process which helps the manufacturer to become aware of threats that are connected with food production, consequences of such threats as well as the huge responsibility for the consumers' health.

Critical control points (CCPs) are the result of hazard analysis and, in practical conditions, they can be treated as an operation or action that the manufacturer must pay special attention to because these points pose real hazards to the safety of food products in the case of deviations from the established parameters. At the same time CCPs are the point of control for the identified hazard but is not always the point where the hazard occurs i.e. enters the food chain. The control can be applied before the hazard occurs or after i.e. cooking.

Therefore, in spite of frequent complaints that it is simply superfluous red tape, unnecessary requirement of the European Union, the HACCP system is in fact a tool which may be less or more perfect but, eventually, it allows food industry to provide consumers with safe food articles. Therefore, it is treated by the legislators as an important requirement to be fulfilled at all stages of production and distribution of food offered for sale as well as production of feeds for animals. The HACCP system need not be implemented only in the case of basic production, but it can be applied at all stages of the food chain including farms and even fishing boats.

## **STANDARDS FROM THE ISO 9000 FAMILY**

Standards from the ISO 9000 family include standards which implement in various organisations systems of quality management. They were elaborated in such a way as to allow their application in different enterprises irrespective of branches in which they operate. It is, therefore, unimportant if a given organisation manufactures a product or provides services.

The ISO 9000 family comprises the following standards:

- ISO 9000, which embraces the basis of the quality management systems and terminology [ISO 9000:2000],
- ISO 9001, which specifies requirements concerning the quality management system; it is precisely this standard that is implemented in enterprises [ISO 9001:2000],
- ISO 9004, which specifies guidelines for the improvement of the system already implemented in a company [ISO 9004:2000],
- ISO 19011, which contains recommendations concerning auditing [ISO 19011:2002].

The above-mentioned standards are optional but more and more frequently customers, recipients and contractors force their suppliers to work in systems complying with

ISO 9000 standard because they can then be certain that their supplier operates in definite, well-known manner in accordance with the following eight principles:

- customer-oriented,
- leadership (leaders establish the unity of the aim and operation of the organisation),
- involvement of the personnel,
- process approach,
- system approach to management,
- continuous improvement,
- decision taking on the basis of facts,
- mutually beneficial cooperation with suppliers.

In addition, it also simplifies purchase and supplier qualification procedures and, at the same time, reduces costs associated with these operations.

The quality management system based on the ISO 9000 standard covers the following areas: management of the organisation, management of resources, process of product realisation as well as measurements, analyses and improvement.

## **IFS AND BRC STANDARDS**

The International Food Standard (IFS) and the British Retail Consortium (BRC) standard are based, among others, on the GHP/GMP principles, the HACCP system and the ISO 9001 standard [Drabas and Wojciechowski 2006]. However, the above standards include requirements which are not found in any of the earlier discussed norms.

These requirements comprise, among others [Drabas and Wojciechowski 2006]:

- the obligation to include in the threat analysis of the hazards associated with allergies,
- monitoring of work effectiveness,
- the need to cover facial hair with appropriate hygiene masks,
- checking of the hands' hygiene of workers,
- the requirement to carry out application tests of products,
- documented system of management of stocks of raw materials and products, complying with the FIFO principle,
- elaboration of a system which allows the company to obtain information about GMO,
- elaboration of procedures in case of unusual situations,
- the requirement to apply metal detectors,
- elaboration of the list of places in the production-storage area where glass and other hazardous material occur,
- development of a procedure for the qualification, approval and verification of suppliers,
- total ban of smoking on the entire area of the company.

Both the IFS and BRC standard do not allow any freedom and each, even the smallest requirement, is described precisely. The advantage of this approach is that there are no problems with the interpretation of requirements and later on with the over-interpretation of auditors.

The above-mentioned standards enforce many requirements to be fulfilled by manufacturers. They are optional and are implemented by manufacturers who deliver their goods to large super-market networks such as: Ahold Poland, Auchan Poland, Carrefour Poland, Geant Poland, Jeronimo Martis (Biedronka), etc.

### **ISO 22000**

The ISO 22000:2005 standard is a completely new standard published in September 2005 with the aim to unify principles of the quality systems used in the food industry [Fabisz-Kijowska and Kijowski 2006]. It is an optional standard because it goes beyond the framework of the GHP/GMP and HACCP requirements. Its range encompasses [ISO 22000:2005]:

- The Prerequisite Programme (PRP), i.e. the above-mentioned GHP/GMP principles and GAP (Good Agricultural Practice), GVP (Good Veterinarian Practice), GPP (Good Production Practice), GDP (Good Distribution Practice), GTP (Good Trading Practice),
- the HACCP system,
- the identification system (traceability system),
- the quality management system ISO 9001:2000.

ISO 22000:2005 integrates both the quality management system (ISO 9001:2000) and HACCP system. There are also cross references between ISO 22000, ISO 9004 and terms and definitions from ISO 9000 [Fabisz-Kijowska and Kijowski 2006].

The most effective system of food quality and safety was designed, which implemented into existing structure of management can give profits both organisation and other interested party. Furthermore, it may be implemented independently of other management systems existing into enterprise [Fabisz-Kijowska and Kijowski 2006].

### **AQAP – ALLIED QUALITY ASSURANCE PUBLICATION**

The system which complies with the AQAP standards is required among suppliers to the NATO forces.

AQAP documents, which complement and extend the ISO 9000 standard, require [Wierzbicki 2003]:

- cooperation between the orderer, user and supplier in the area of quality assurance of the product,
- cooperation in the area of quality systems described in the ISO 9000 series and their inclusion in the contract requirements,
- adjustment of the quality requirements to the risk level associated with the realised undertaking,
- supervision by the representative of the orderer (QAR – Quality Assurance Representative) of the quality assurance system of the deliverer (and not the product) but only in the areas where risks have been identified,

- analysis and assessment of the occurring risk associated with the product and deliverer in order to guarantee that the requirements specified in the contract will be fulfilled.

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### SYSTEMY ZARZĄDZANIA JAKOŚCIĄ W PRZEMYSLE SPOŻYWCZYM A BEZPIECZEŃSTWO ZDROWOTNE ŻYWNOCI

**Streszczenie.** W trosce o bezpieczeństwo zdrowotne żywności, a przede wszystkim konsumenta opracowywane są wymagania prawne oraz coraz to nowsze normy i standardy jakościowe. Swobodna wymiana handlowa wewnątrz Wspólnoty Europejskiej wymogła

ujednocienie prawa żywnościowego oraz standardów jakości w obszarze całej Unii Europejskiej. W publikacji w przekrojowy sposób omówiono systemy i normy funkcjonujące w przemyśle spożywczym oraz podstawy prawne do ich stosowania. Oprócz systemów wprowadzanych obowiązkowo w przedsiębiorstwach sektora spożywczego, przedstawiono również te stosowane na zasadzie dobrowolności. Uwzględniono także systemy informatyczne związane z organizacją produkcji w zastosowaniu do identyfikowalności wyrobów.

**Słowa kluczowe:** GHP, GMP, HACCP, identyfikowalność, bezpieczeństwo żywności

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