

Food Quality and Safety Regulation Systems at a glance: An Overview

Punam S. Thakur

Department of Zoology

Shankarlal Agrawal Science College Salekasa, Gondia, Maharashtra-441916, India

ABSTRACT

The quality and safety of all food products are the very essential parameter for both ends manufactures and end consumers, this parameter of the food products we cannot overlook or liberalize in any situation, the more than two third of the disease are spread through the contaminated or spoiled food source. The looking at the importance of quality and safety management issue the various governments made the series of rule and regulations for the assessment of the food products. This chapter mainly explains the role of the various assessment agencies and their rights and workflow in brief.

Key words: Codex Alimentarius, Food quality & safety, Code of Practice, Codex organization, ISO 22000, HACCP system, GHPs and GMPs, and Codex General Principles.

Received 29.04.2019

Revised 10.06.2019

Accepted 11.07.2019

CITATION OF THIS ARTICLE

Punam S. Thakur. Food Quality and Safety Regulation Systems at a glance: An Overview. Int. Arch. App. Sci. Technol; Vol 11 [1] March 2020 : 152-162

INTRODUCTION

With the correct ventures and assets, agribusiness can give satisfactory, moderate, protected and nutritious nourishment to everybody, all over the place, each day. However, notwithstanding critical advance, the world keeps on bearing a triple weight of lack of healthy sustenance. As indicated by 2016 information, around 800 million individuals around the world one of every four individuals in Sub-Saharan Africa and one out of six individuals in South Asia - still did not expend their base dietary vitality needs. Less advance has been accomplished in handling different types of ailing health. More than 2 billion individuals do not have the micronutrients required for development, improvement and malady anticipation. More than 2 billion individuals experience the ill effects of the antagonistic wellbeing impacts of being overweight or fat. Tainted sustenance is likewise a broad issue, affecting the wellbeing of 1 out of 10 individuals internationally every year and contrarily influencing the livelihoods of agriculturists, nourishment organizations and exchange. Hunger and sustenance had borne ailments force huge present and future human, financial, social and monetary expenses on nations. Lessening these expenses requires multi-sectoral approaches: There is extraordinary potential for powerful mediations through horticulture and the sustenance framework generally speaking.

Regardless of the enormous endeavours paid by the nourishment security experts, masters and industry, sustenance wellbeing still stays basic and frequently is coming into spotlights pulling in media's consideration with flare-ups that can bring a pile of different negative outcomes. Such real occasions like BSE in 2000, dioxin or PCB emergency in 1999 and others doubted the viability of the sustenance quality confirmation frameworks and nourishment security administration connected and exhibited that new device is expected to supplement the genuine frameworks set up. While assessing the negative outcomes one need to consider the restorative expenses brought about, the practical misfortunes that can gravely shake nearby little enterprises, and minimum yet not last consumers` trust. The

security worldview is that in spite of the fact that nourishment is more secure, consumers' demeanour is commanded by elevated amounts of vulnerability. In this changing atmosphere, we are that as it may, require perceiving the exertion EU experts make to re-establish consumers' trust and authorize new directions and better impart nourishment wellbeing related issues. An imperative highlight of sustenance industry is that makers, to adapt to showcase needs and lawful prerequisites, need to fulfil both wellbeing and quality criteria for their items. Having various choices as various quality as well as administration frameworks, nourishment makers ought to choose the most proper one for its particular movement and should build up, archive and execute powerful frameworks for overseeing quality also, security [1].

Among the accessible Quality Assurance (QA) frameworks there are within reach today frameworks, for example, GMPs (Good Manufacturing Practices), GHPs (Good Cleanliness Practices), GAPs (Good Agricultural Practices) or other essential frameworks and HACCP (Hazard Analysis. Basic Control Points) [1, 8]. This chapter also covers the following point mainly:

(i) Recommended international code of practice - general principles of food hygiene. (ii) Good Manufacturing Practices (GMPs) (iii) Good Hygiene Practices GHPs (iv) The hazard analysis and critical control point (HACCP) System and (v) International Organization for Standardization

RECOMMENDED INTERNATIONAL CODE OF PRACTICE - GENERAL PRINCIPLES OF FOOD HYGIENE (CODES OF PRACTICE)

Codes of practice area group of guidelines, or one can be described as process specifications. These guidelines and specifications are generally helpful in providing constructive advice to manufacturers who have the same production facilities and manufacturing similar kind of products. These guidelines involve endorsements for the operational method, the design of construction facility, plant cleaning procedures, personal hygiene, quality and type of equipment, standard packaging procedures, and the handling of various raw materials at each and every stage of production. Codes of practice were prepared by the Codex Alimentarius Commission. For example, the international codes for various fish products were also prepared by the commission, it contains numerous commendations for each product, and starting from its raw material, vessel design and ends up to goods retail practices. It details the codes of practice includes regulations for the processing facility, sanitation procedures, growing areas and harvesting techniques. Some the codes of practice are made compulsory by governments. Such as, the Code of Federal Regulations concerning to human food production in United States of America, which is imposed by the USFDA [2, 3].

Codes of practice and government authorities are in interference with free trade and it is needed some practical attitude to the questions, such as what can be done and how costly it will be. Consumers can only be protected by eliminating the doubtful products from market via strong rules and regulations. There are numbers of products in the market so it was very difficult to command it uniformly. Codes and standards should be proof, fair, widely acceptable, easy to understand, and can be easily managed. It can be effectively applied by the good collaboration between government authorities and industry [2].

Codex Alimentarius

The Codex Alimentarius Commission was formed by the Food and Agriculture Organization (FAO) of UN (United Nations) in November 1961, and in June 1962 it was further joined by WHO (World Health Organization). In October 1963, the first meeting of Codex Alimentarius Commission was held in Rome. The contents are established and maintained by commission [4]. The commission had narrated Codex Alimentarius. It is mainly providing the information regarding the HACCP system and also defines its lacking. FAO/WHO commission had accepted the HACCP system in early 1990, and comprises it into the Codex Alimentarius [10, 11]. It provides the details about the need of hygiene rules in supply chain, regarding to the HACCP, phases of implementation and also discuss the definitions. In general, the Codex Alimentarius is a set of internationally accepted guidelines, standards, codes of practice, and some other recommendations concerning to food safety, foods, and food production [5, 6].

The Codex Alimentarius includes very food products, raw, processed, or semi-processed. It includes specific standards for specific foods as well as some general standards for other. General standards provide details about additives, labeling, hygiene, pesticide residue, and methods for evaluating food quality. The Codex Alimentarius also provides guidelines about the official management, such as import and export examination by government and food certification systems. The Codex Alimentarius is available in the six certified languages of the United Nations (UN): French, Arabic, Russian Chinese, Spanish, and English (CODEX Alimentarius: Understanding Codex". FAO and WHO. [10-13]. Retrieved 6 September 2012). Aim of the commission was shielding the public health by implementing standard practices in manufacturing and international trading of products. The World Trade Organization renowned the Codex Alimentarius as an international reference for resolving clashes related to consumer protection and food safety [14].

The Codex Organizations

In Codex organization the detailed work is alienated within a several committees. Numbers of committees were structured separately for focusing on ‘horizontal’ concerns like, food labelling, whereas some others were focusing on ‘vertical’ concerns like, specific needs for foods for its particular dietary uses. In the developing stage of standard it will be accepted by both kind of committee. In addition these committees, there are other five regional committees including Europe, Africa, Latin America, Asia, Caribbean, South-West Pacific and North America. The Codex Alimentarius commission and their committees can take guidance from WHO and FAO expert Committees. Three other intergovernmental bodies are also there which deals with some particular commodities groups. They are also reporting to the commission. These are united committee of WHO and FAO of Government Experts officials on the Code of Principles regarding to the Milk and related products, a united Codex group of experts/ UNECE (United Nations Economic Commission for Europe) on fruit juices, and a combined UNECE and Codex Group of Experts on quick frozen foods (Ottaway et al., 2003).

As we mentioned earlier the Codex committees are differentiated in two parts: specific and general subject committees. There are nine committees currently working on horizontal subjects (Labelling, pesticide residue and food additives). The rest of 15 Codex Commodity Committees are dealing with specific commodity groups (vegetable proteins, oils, and fats). As per the Codex policy, every Codex committee has a host country. The host countries and their governments are responsible for their allotted committee’s meeting arrangement and the administrative infrastructural facilities for meetings should also be provided by those countries. The country is also liable for the financial supports for meeting arrangements, most of the currently hosting countries are in Western Europe and North America. The Meat Hygiene Committee was hosted by New Zealand from 1972 until its suspension 1983 and in 1972, the Methods of Analysis and Sampling Committee was taken by Hungary from Germany, and Mexico hosting the Committee on Tropical Fresh Fruits and Vegetables, which was made in 1988. Codex has prepared a task force on biotechnology, because of the fast growth in biotechnology, specifically genetic engineering. In March 2000 in their first meeting, they are agreed for the development principles regarding the risk assessment of foods prepared from modern biotechnology and also agreed for preparing guidelines for the safety analysis of food products made by those types of processes. The Codex Alimentarius Commission has 186 members of 186 member countries and one additional, the European Union as member organization in 2012. It had 16 United Nations (UN) organizations, 215 codex observers, 150 non-governmental organizations and 49 intergovernmental groups [15-18].

Table-1. General standards and specific standards of the Codex Alimentarius Commission. [10-13, 20, 6]

| General standards | |
|--------------------------|--|
| Food Hygiene | It includes codes and general principle of hygienic practice in particular industries or guidelines for the implementation of the HACCP system, and food handling establishments. These guidelines were represented in broad spectrum. Its primary objective is to ensure that whether the food products are safe for the intended purpose or not. |
| Food Labelling | It includes guidelines regarding labelling claims and some general guidelines and standards on nutrition [26]. |

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|---|--|
| Risk Assessment | Methods for evaluating safety of food which were prepared through biotechnology such as DNA-modified micro-organisms, DNA-modified plants, and allergens [38]. |
| Food Additives | It includes general standard regarding quality specification of food grade chemicals, and its approved utilization [17]. |
| Methods | Process and techniques for sampling and analysis. |
| Food Contaminants | It includes standards and tolerance limits for particular contaminants such as aflatoxins, mycotoxins and radionuclides [35-37]. |
| Specific standards for specific products | |
| Special Dietary Foods | It includes baby formula foods, infant formula and specially manufactured foods for particular purposes [41]. |
| Meat | It provides guidelines about frozen meat, fresh meat, processed meat and also about poultry [16]. |
| Oils and Fats | It includes information about the oil-fats products and their derivatives [17, 18]. |
| Fish and Fishery | It involves fish and fishery products from aquaculture, marine water, and fresh water [22, 23]. |
| Dairy Products | It includes guidelines related to milk processing and other dairy product [24, 25, 26] |
| Miscellaneous Food Products | It includes standards for sugar, mineral water, chocolate, and honey products [27-33]. |

The Codex General Principles of Food Hygiene

1. Primary production
2. Establishment: Design and Facilities
3. Control of operation
4. Establishment: Maintenance and sanitation
5. Transportation
6. Product information and consumer awareness
7. Training

Principle 1: Primary production

The primary food production should be managed in such a way that, it can ensure the food safety and can also confirm its suitability for intended utilization [40]. Primary production involves:

- The plants and animals should be kept in proper atmosphere so that they are free from diseases and contaminants. This ultimately eliminates threats to food safety.
- The use of environmental threat areas is avoided.
- For the hygienic atmosphere and conditions, the standard practices and measures should be considered and this will ensure food safety [41].

Principle 2: Establishment: Design and Facilities

Construction and designing of equipment, premises, and facilities should be done with consideration of associated risks and nature of the operation. The appropriate hygienic construction and design, suitable location, availability of facilities is required for controlling hazards effectively. The design and facilities should be such that:

- Contamination is diminished;
- Layout and designing suitable to easy cleaning, sanitation, disinfections, maintenance, and reduce air-borne contamination [42].
- Materials and surfaces which come in contact with food should be inert, non-toxic, durable, and should be easy to clean and maintain.
- Required facilities should be available for controlled conditions such as humidity, temperature, and other necessary controls.

Principle 3: Control of Operation

The food products consumed by human should be suitable and safe. This can be only achieved by operational control. So the food safety can be achieved by designing appropriate control and monitoring systems for raw materials, raw material composition, processing practices, distribution and handling. Proper designing, implementation, process monitoring and documents reviewing and verification are the effective control systems. The corrective and preventive actions should be taken at every stage of operation; this will be helpful in minimizing the food hazards. The business operators should implement HACCP type of

systems. It should be implemented in whole food chain to control hygiene. The shelf-life of food can be protected by appropriate designing of process and product. Proper monitoring methods and analytical techniques for analysing physical, chemical, and microbial contamination. For prevention of contamination and cross-contamination, the personal entry in the controlled area is monitored by implementing area wise accessing protocols. Portable water should be used food processing. In case of threat to any food product, the product recall channel should be very effective.

Table 2: Important measures and steps for the control of operation

| | |
|---|---|
| Control of Food Hazards | <ul style="list-style-type: none"> ➤ Identification of critical steps. ➤ Implementation of control procedures. ➤ Monitoring for ensurement of effectiveness. ➤ Reviewing. |
| Incoming Material Requirements | <ul style="list-style-type: none"> ➤ Specifications for the raw materials should be prepared and employed. And incoming material should be properly inspected. |
| Important Aspects of Hygiene Control Systems | <ul style="list-style-type: none"> ➤ Controlling time and temperature. ➤ Specific Process Steps. ➤ Physical and chemical contamination. ➤ Microbiological and other specifications. ➤ Microbiological cross contamination (Van Schothorst et al., 1998). |
| Management and supervision | <ul style="list-style-type: none"> ➤ Supervisors and managers should be highly knowledgeable, effective and able to take proper corrective and preventive actions. |
| Packaging | <ul style="list-style-type: none"> ➤ It should provide satisfactory protection. ➤ Packaging material should be inert and non-toxic. |
| Documentations and Records | <ul style="list-style-type: none"> ➤ Proper record keeping of manufacturing, processing and distribution up to the shelf life of the food product. ➤ It will increase the effectiveness and credibility of food safety control system. |
| Water | <ul style="list-style-type: none"> ➤ In processing and handling of food only portable water should be used. ➤ Water is used as ingredient, steam and in ice from in food processing. |
| Recall | <ul style="list-style-type: none"> ➤ For the prevention of food safety hazard, the recall procedure should be rapid. ➤ The recall products are kept in supervision and then destroyed. |

Principle 4: Establishment: Maintenance and Sanitation

For the development of efficient food processing system, the following steps are the most necessary.

- The periodically pest control in the facility [43].
- Corrective and preventive maintenance after some fixed time intervals.
- Cleaning and cleaning records.
- Waste management systems should be implemented.
- Sanitation and maintenance should be effectively observed and maintained [43].

Table 3: Steps involved in establishment of maintenance and sanitation [44, 41]

| | |
|---------------------------------|---|
| Maintenance and Cleaning | <ul style="list-style-type: none"> ➤ General maintenance. ➤ Cleaning procedures and techniques. |
| Pest Control Systems | <ul style="list-style-type: none"> ➤ General pest control. ➤ Harbourage and infestation. ➤ Preventing access. ➤ Eradication. ➤ Monitoring and detection. |
| Cleaning | <ul style="list-style-type: none"> ➤ Disinfection and cleaning should guarantee that each parts of |

| | |
|---------------------------------|---|
| Programmes | <p>facility are clean.</p> <ul style="list-style-type: none"> ➤ These programmes should be continuously monitored and documented. ➤ The cleaning and sanitation programme should be designed by consulting with relevant experts. |
| Monitoring Effectiveness | <ul style="list-style-type: none"> ➤ Verification for the effectiveness of sanitation systems. ➤ Microbiological assessment of working environment, and contact surfaces should be inspected and reviewed regularly. |
| Waste Management | <ul style="list-style-type: none"> ➤ The waste accumulation in working and storage areas must be prevented. ➤ Some regulatory protocols should be followed for the storage and elimination of waste. |

Principle 5: Establishment: Personal Hygiene

The establishment of personal hygiene is necessary because those who are in direct contact of food may be contaminating the food. By maintaining appropriate personal cleanliness and hygiene, the contamination can be minimized. And also by following the standard operating and working procedures, the chances of contaminations can be reduced. Personal hygiene is helpful in preventing the food contamination due to the personal illness [44].

Table 4: Factors to be considered for the establishment of personal hygiene

| | |
|-----------------------------|---|
| Health Status | <ul style="list-style-type: none"> ➤ If any personal is suffering illness or disease, then he should not be allowed to enter in food processing area. ➤ Any kind of illness or symptoms of personal should be informed to the management. |
| Personal Cleanliness | <ul style="list-style-type: none"> ➤ The food handling personal should maintain personal hygiene and cleanliness by using personal protective equipments such as apron, shoe cover, head cap, and hand gloves. ➤ The workers should always wash their hand before and after food handling activities. |
| Illness and Injuries | <ul style="list-style-type: none"> ➤ If any working personal is suffering from jaundice, fever, vomiting, diarrhoea and sore throat with fever. Then the situations should be informed to management, so that further medical examination can be done. |
| Visitors | <ul style="list-style-type: none"> ➤ The visitors coming to the manufacturing facilities should wear personal protective cloths for avoiding threat to food contamination. |
| Personal Behaviour | <ul style="list-style-type: none"> ➤ During food handling activities spitting, smoking, eating, chewing, sneezing, and coughing will contaminate foods. So that it should be avoided. ➤ Watches, jewellery, pins and other items should avoid to worn during food handling. |

Principle 6: Transportation

Food transportation should be done under control measures. Transportation is comes under food supply chain and distribution. The food should be provided to end user in suitable form without any contamination. During food transportation following measures should be taken:

- The food products should be protected from damaging, so that its not became unsuitable for the end user.
- The food must be protected from its effective source of contamination.
- The transportation environment must be suitable to the quality sustenance of the product. Appropriate environmental conditions will protect the food from micro-organism and pathogenic growth.

The type food containers and packaging form will depends on the nature of foods. The food products should be transported in their suitable conditions. The designing and construction of bulky food containers should be according to following requirements:

- The food containers should not contaminate foods.
- There should be an appropriate separation of foods and food from non-food materials.
- They should be easy to clean and easy to be disinfected.
- The containers have to maintain humidity, temperature, atmosphere and other required conditions to protect food from deterioration and microbial growth.
- The container should design in such a way that the food products are free from fumes and dust.
- The design should be such that the humidity, temperature and other conditions can be easily checked and operated.

Principle 7: Product Information and Consumer Awareness

The food products should contain proper details. The sufficient and manageable should be available to the food chain personal, so that they can be easily stored, handle, prepare and display products correctly and safely. With the help of product information, it can be rapidly identified and recalled. The consumers should be aware of food hygiene, so that they can easily understand the significance of product information. The end user should have appropriate information and awareness so that they can eliminate contamination and microbiological and pathogens growth. The end user information and trade information can be easily distinguishable [45-53].

Principle 8: Training

Personals who are working in food processing or who are in direct or indirect contact of food should be well instructed and trained for food hygiene and safety. They should be trained for following standard codes of practice so that the level of food hygiene can be maintained in the processing facility [50, 51]. The Components of training are mentioned below:

Awareness and Responsibilities: The training is one of the most necessary thing to maintain food hygiene. All the workers should be aware of their working responsibility for personnel should be aware of their role and responsibility in guarding foods from deterioration and contamination.

Instruction and Supervision: There should be routine supervision of instruction and training programmes. Efficiency of training should also monitor. Supervisors should be knowledge about the food hygiene safety principles and practices. And they should be able to identify the risk and take corrective actions.

Training Programmes: Workers should be frequently trained for the procedures to be followed during the handling, packaging, and storing.

Refresher Training: The personal trainings should be frequently observed, modified and updated as per the norms and necessity. [52-54, 11-13].

Good Manufacturing Practice(GMPs)

Good Manufacturing Practices (GMP) is a collection of detailed information and guidelines for the act and standard operating procedures to be followed and their requirements should be fulfilled. GMP is implemented for the ensurement of food safety. GMP covers the basic activity of the facility. The activities should be as per the standard procedures and norms, so that the quality food products can be prepared [55, 5].

Good Hygiene Practice (GHPs)

Good Hygienic Practices (GHP) contains a collection of guidelines focusing on the hygienic conditions which should be at a satisfactory level and monitored at every stage of food chain for the assurance of safety of food. Following the GHP rules and regulations is generally making all the activities in the preparation process and in profit of foods with ensuring appropriate conditions to foods and their proper health quality. In case of Health Conditions of Foods and Nutrition's, the GMP and GHP are explained differently, both are closely connected and both are implemented for hygienic requirements in the facility. Both the GMP and GHP are employed and properly maintained and documented [55-58].

Hazard Analysis and Critical Control Point (HACCP)

The HACCP was constructed for the assurance of food health and safety. It is composed of two main stakes: Health hazard analysis and critical control points which were settled after the completion of hazard analysis. Improper following of guidelines and conditions leads to the health hazards. The health hazards cannot be controlled by the conventional tools.

In accordance with the HACCP system each deviations and potential hazards in the manufacturing method will be identified at a time of production or before that. The main

objective of the HACCP is to eliminate any hazards before its establishment. In early time of system establishment, primarily it was just designed to prevent every microbiological hazard. Secondly it was employed to physical, chemical and biological hazards.

Basic steps of implementation of HACCP system: the 1st is hazard analysis for identifying the possible danger related with food processing at each stage up to the consumption. In the next step, monitoring methods should be developed and observations should be mentioned in registers.

The proper employment of HACCP system needs:

- Appropriate designing of the documentation process.
- Carrying out detailed hazard analysis.
- Designing of control points and critical control points.
- Structuring of monitoring methods.

International Organization for Standardization

On 23 February 1947, the International Organization for Standardization (ISO) is an international standard-setting body was created that's representatives from various national standards organizations. The ISO 22000 addresses the food safety standard management issue, the significances of unhygienic and unsafe food can be harmful to the health, The ISO's food safety management standards service organizations categorise and regulator the food safety standard and hazards [59].

Nowadays many food products frequently cross national boundaries, so the international standards are required to certify the safety of the worldwide food supply chain. The ISO 22000:2018 fixed the necessities for a food safety management system and can be certified the food products. It recognizes which organization needs to do validate its ability to regulate food safety and standards and hazards to certify that food is safe or not. More than two hundred diseases are speeds only because of contaminated or spoiled food stuff so that it is very clear the hygienic, safe, sustainable food production is one of our extreme challenges. The food trade globalization is further complicates because of maintains the food safety standards. The food safety is about the elimination, avoidance, and regulates the food products from the foodborne hazards factors, from the production site to utilization site.

Meanwhile, food safety standards and hazards may be introduced at any stage of the food processing. Each food supply chain company must implement adequate hazard controls. Food safety can be secured only by the united efforts of all parties: producers, governments, retailers and end customers.

The new edition of ISO 22000 improved the clarity of understanding for the many of companies globally that already used this standard. Its latest following improvements comprise:

- Implementation of the High-Level Structure common to all ISO management system standards, creating it easier for organizations to combine ISO 22000 with other management systems (such as ISO 14001 or ISO 9001) at any given time
- A different approach to risk as an important concept in the food product business – which differentiates between risk at the working level and the corporate level of the management system
- Strong links to the Codex Alimentarius, a United Nations food group that develops food safety guidelines for government authorities.

The new ISO 22000 standard offers a forceful control of food safety hazards coalescing the following generally recognized key elements: systems management, interactive communication, Prerequisite Programmes (PRPs), and Critical Control Points (HACCP), and the principles of Hazard Analysis [59, 60].

CONCLUSION

The quality and safety assessment of the all food products are the very essential step for the entire food chain from the manufacturer to end consumers. Because of the causes of the maximum disease are reported from the contaminated or unhygienic food source so that the food safety and quality standard assessment is very crucial before selling or consuming the food products. This chapter summarises in brief the analysis of the specific and integrated/advanced food quality and safety management system, along with the identification and analysis of the factors that can influence the employment process. The

various investigating and assessment agencies and their role in the whole process of quality and safety assessment for the food products. The efficiency of the ISO systems is based on the association between external and internal organizational factors. In addition to that these factors act in to the food industry have to balance the food quality and safety assurance management systems, select the appropriate ones permitting to its resources and requirements and implement tolerable outfits for continuously evaluating and measuring the quality safety and performance of the individual or advanced/integrated management systems.

ACKNOWLEDGEMENT

Dr P S Thakur thanks to Department of Zoology S. A. Sci. College, RTM University Nagpur, for providing research facility, and Dixit V. Bhalani thanks DST for providing DST-INSPIRE Fellowship. And Arvind K. Singh Chandelthank CSIR, India for providing a research fellowship (CSIR-JRF). DV and AK also thanks to CSIR-CSMCRI for providing research facility

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