

GOOD MANUFACTURING PRACTICES (GMPs)

Hygiene standards and procedures usually described as Good Manufacturing Practices (GMP) or Good Hygienic Practices (GHP) and constituted an essential tool in traditional food control for many years. These concepts are still essential in a modern food control system by providing the basic environmental and operating conditions for safe food and the foundation for HACCP in an overall food safety management programme (fig.1) (Huss *et al*, 2013).

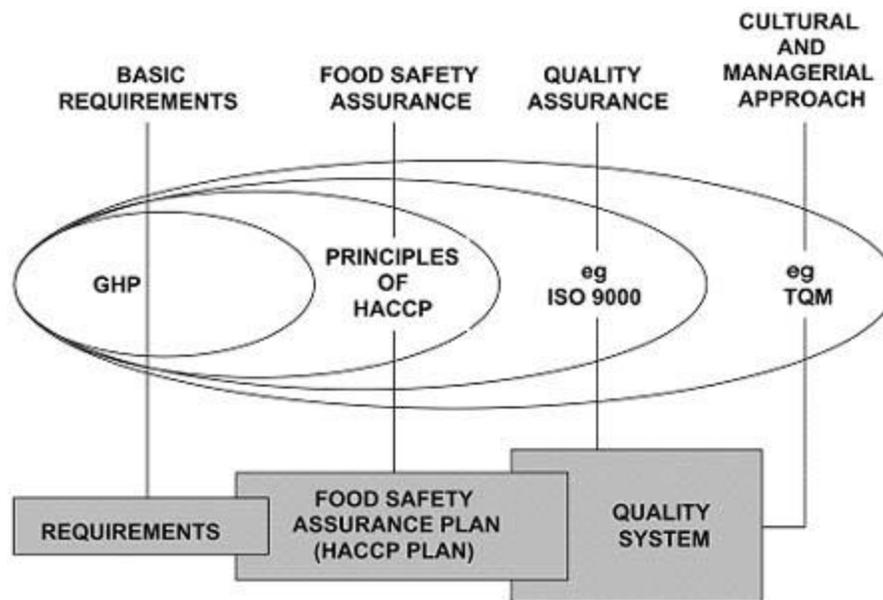


Figure 1. Food Safety and quality, an integrated approach (from Jouve, 1998).

GMPs contain both requirements and guidelines of food products in a sanitary environment. GMP regulations were first introduced in 1969 by the FDA as Part 128 of the Code of Federal Regulations to further implement the Food, Drug and Cosmetic Act. In 1977 this was recoded as Part 110, and it was further revised and updated in 1986, to what is now regarded as GMPs (current GMPs). “GMP regulations are designed to control the risk of contaminating foods with filth, chemicals microbes and other means during their manufacture.” (Safe food guidelines for small meat & Poultry Processors, SSOP & GMP Practices & Programs, PURDUE UNIVERSITY)

As a food industry, employee hygiene is essential because the hygienic condition and habits of workers determine the amount of cross-contamination from worker to food products .Most frequent cause of contamination is the cross-contamination of food by food handlers. Many GMPs focus directly on reducing food handler contamination Examples of personal hygiene include washing hands, removing jewelry, and maintaining personal cleanliness. Also, the food processor should provide training for new employees in personal hygiene based on GMPs, and that training should consists of instruction in proper hand washing, personal cleanliness, and sanitary hygiene.

As employer’s responsibilities, employer should provide training in food handling and personal hygiene, conduct regular inspections of employees’ hygiene and hygienic work habits and provide properly maintained sanitary facilities and supplies. This includes ample quantities of soap, disinfectant, working sinks, hairnets, etc.

According to the Current Good Manufacturing Practices mentioned in the Food and Drug Administration (FDA) regulations, the management shall take all reasonable measures and precautions to ensure,

Personnel

(a) Disease control

Any person who is shown to have or appears to have, an illness, open lesion, including boils, sores, or infected wounds, or any other abnormal source of microbial contamination (by medical examination or supervisory observation) by which there is a reasonable possibility of food, food-contact surfaces, or food-packaging materials becoming contaminated, shall be excluded from any operations until the condition is corrected. Personnel shall be instructed to report such health conditions to their supervisors.

(b) Cleanliness

All persons who are working in direct contact with food, food-contact surfaces, and food-packaging materials shall conform to hygienic practices. The methods for maintaining cleanliness include, but are not limited to:

- (1) Wearing outer garments suitable to the operations that protects against the contamination of food, food-contact surfaces, or food-packaging materials.
- (2) Maintaining adequate personal cleanliness.

(3) Washing hands thoroughly (and sanitizing if necessary to protect against contamination with undesirable microorganisms) before starting work, after each absence from the work station, and at any other time when the hands may have become contaminated.

(4) Removing all unsecured jewelry and other objects that might fall into food and removing hand jewelry that cannot be adequately sanitized during periods where food is manipulated by hand. If such hand jewelry cannot be removed, it may be covered by material which can be maintained in an intact, clean, and sanitary condition and which effectively protects against the contamination by these objects of the food, food contact surfaces, or food-packaging materials.

(5) Maintaining gloves, if they are used in food handling, clean, and sanitary condition. The gloves should be of an impermeable material.

(6) Wearing in an effective manner, hair nets, caps.

(7) Storing clothing or other personal belongings in areas other than where food is exposed or where equipment or utensils are washed.

(8) Confining the eating food, chewing gum, drinking beverages, or using tobacco to areas other than where food may be exposed or where equipment or utensils are washed.

(9) Taking any other necessary precautions to protect against contamination of food, food-contact surfaces, or food-packaging materials with microorganisms or foreign substances including, but not limited to, perspiration, hair, cosmetics, tobacco, chemicals, and medicines applied to the skin.

(c) Education and training

Personnel responsible for identifying sanitation failures or food contamination should have a background of education or experience, or a combination thereof, to provide a level of competency necessary for production of clean and safe food. Food handlers and supervisors receive appropriate training in proper food handling techniques and food protection principles and should be informed of the danger of poor personal hygiene and insanitary practices.

(d) Supervision

Responsibility for assuring compliance by all personnel with all requirements of this part is clearly assigned to competent supervisory personnel.

Plant and Grounds

(a) Grounds

The grounds about a food plant protect against the contamination of food. The methods for adequate maintenance of grounds include, but are not limited to:

(1) Properly storing equipment, removing litter and waste, and cutting weeds or grass within the immediate vicinity of the plant buildings that may constitute an attractant, breeding place, or harborage for pests.

(2) Maintaining roads, yards, and parking lots so that they do not constitute a source of contamination in areas where food is exposed.

(3) Adequately draining areas that may contribute contamination to food by seepage, foot-borne filth, or providing a breeding place for pests.

(4) Operating systems for waste treatment and disposal in an adequate manner so that they do not constitute a source of contamination in areas where food is exposed.

(b) Plant construction and design

Plant buildings and structures shall be suitable in size, construction, and design to facilitate maintenance and sanitary operations for food-manufacturing purposes. The plant and facilities:

(1) Provide sufficient space for such placement of equipment and storage of materials to the maintenance of sanitary operations and the production of safe food.

(2) Permit the taking of proper precautions to reduce the potential for contamination of food, food-contact surfaces, or food-packaging materials with microorganisms, chemicals, filth, or other extraneous material. The potential for contamination may be reduced by adequate food safety controls and operating practices.

(3) Floors, walls, and ceilings may be adequately cleaned and kept clean and kept in good repair; that drip or condensate from fixtures, ducts and pipes does not contaminate food, food-contact surfaces, or food-packaging materials; and that working spaces are provided between equipment and walls and are adequately unobstructed and of adequate width to permit employees to perform their duties and to protect against contaminating food or food-contact surfaces with clothing or personal contact.

(4) Provide adequate lighting in hand-washing areas, dressing and locker rooms, and toilet rooms and in all areas where food is examined, processed, or stored and where equipment or utensils are cleaned; and provide safety-type light bulbs, or other glass suspended over exposed food in any step of preparation or otherwise protect against food contamination in case of glass breakage.

(5) Provide adequate ventilation or control equipment to minimize odors and vapors in areas where they may contaminate food; and locate and operate fans and other air-blowing equipment in a manner that minimizes the potential for contaminating food, food-packaging materials, and food-contact surfaces.

(6) Provide, where necessary other protection against pests.

Sanitary Operations

(a) General maintenance

Buildings, fixtures, and other physical facilities of the plant are maintained in a sanitary condition and kept in repair sufficient to prevent food from becoming adulterated. Cleaning and sanitizing of utensils and equipment are conducted in a manner that protects against contamination of food, food-contact surfaces, or food-packaging materials.

(b) Substances used in cleaning and sanitizing; storage of toxic materials.

Cleaning compounds and sanitizing agents used and sanitizing procedures are free from undesirable microorganisms and safe and adequate under the conditions of use. Compliance with this requirement may be verified by any effective means including purchase of these substances under a supplier's guarantee or certification, or examination of these substances for contamination.

(c) Pest control

Pests are not allowed in any area of a food plant. Effective measures are taken to exclude pests from the processing areas and to protect against the contamination of food on the premises by pests. The use of insecticides or rodenticides is permitted only under precautions and restrictions that will protect against the contamination of food, food-contact surfaces, and food-packaging materials.

(d) Sanitation of food-contact surfaces

All food-contact surfaces, including utensils and food-contact surfaces of equipment, are cleaned as frequently to protect against contamination of food.

(1) Food-contact surfaces used for manufacturing shall be in a sanitary condition at the time of use.

(2) In wet processing, when cleaning is necessary to protect against the introduction of microorganisms into food, all food-contact surfaces shall be cleaned and sanitized before use and after any interruption during which the food-contact surfaces may have become contaminated. Where equipment and utensils are used in a continuous production operation, the utensils and food contact surfaces of the equipment shall be cleaned and sanitized as necessary.

(3) Non-food-contact surfaces of equipment used in the operation of food plants should be cleaned as frequently as necessary to protect against contamination of food.

(4) Sanitizing agents shall be adequate and safe under conditions of use. Any facility, procedure, or machine is acceptable for cleaning and sanitizing equipment and utensils if it is established that the facility, procedure, or machine will routinely render equipment and utensils clean and provide adequate cleaning and sanitizing treatment.

(e) Storage and handling of cleaned portable equipment and utensils.

Cleaned and sanitized portable equipment with food-contact surfaces and utensils should be stored in a location and manner that protects food-contact surfaces from contamination.

Sanitary Facilities and Controls

Factory is equipped with adequate sanitary facilities and accommodations including, but not limited to:

(a) Water supply

The water supply shall be sufficient for the operations intended and shall be derived from an adequate source. Any water that contacts food or food contact surfaces shall be safe and of adequate sanitary quality. Running water at a suitable temperature, and under pressure as needed, shall be provided in

all areas where required for the processing of food, for the cleaning of equipment, utensils, and food-packaging materials, or for employee sanitary facilities.

(b) Plumbing. Plumbing shall be of adequate size and design and adequately installed and maintained to:

(1) Carry sufficient quantities of water to required locations throughout the plant.

(2) Properly convey sewage and liquid disposable waste from the plant.

(3) Avoid constituting a source of contamination to food, water supplies, equipment, or utensils or creating an unsanitary condition.

(4) Provide adequate floor drainage in all areas where floors are subject to flooding-type cleaning or where normal operations release or discharge water or other liquid waste on the floor.

(5) Provide that there is not backflow from, or cross connection between, piping systems that discharge waste water or sewage and piping systems that carry water for food or food manufacturing.

(c) Sewage disposal.

Sewage disposal shall be made into an adequate sewerage system or disposed of through other adequate means.

(d) Toilet facilities.

Each plant shall provide its employees with adequate, readily accessible toilet facilities. Compliance with this requirement may be accomplished by:

- (1) Maintaining the facilities in a sanitary condition.
- (2) Keeping the facilities in good repair at all times.
- (3) Providing doors that do not open into areas where food is exposed to airborne contamination.

(e) Hand-washing facilities.

Hand-washing facilities shall be adequate and convenient and be furnished with running water by providing:

- (1) Hand-washing and, where appropriate, hand-sanitizing facilities at each location in the plant where good sanitary practices require employees to wash and/or sanitize their hands.
- (2) Effective hand-cleaning and sanitizing preparations.
- (3) Sanitary towel service or suitable drying devices.

(4) Devices or fixtures, such as water control valves, so designed and constructed to protect against recontamination of clean, sanitized hands.

(5) directing employees handling unprotected food, unprotected food-packaging materials, of food-contact surfaces to wash and, where appropriate, sanitize their hands before they start work, after each absence from post of duty, and when their hands may have become soiled or contaminated.

(f) Rubbish and offal disposal.

Rubbish and any offal shall be so conveyed, stored, and disposed of as to minimize the development of odor, minimize the potential for the waste becoming an attractant and harborage or breeding place for pests, and protect against contamination of food, food-contact surfaces, water supplies, and ground surfaces.

Equipment and Utensils

(a) All equipment and utensils shall be so designed to be adequately cleanable, and shall be properly maintained. The design, construction, and use of equipment and utensils shall preclude the adulteration of food with lubricants, fuel, metal fragments, contaminated water, or any other contaminants. All equipment should be so installed and maintained as to facilitate the cleaning of the equipment and of all adjacent spaces.

Food-contact surfaces shall be corrosion-resistant. They shall be made of nontoxic materials and designed to withstand the environment of their intended use and the action of food, and, if applicable, cleaning compounds and sanitizing agents. Food-contact surfaces shall be maintained to protect food from being contaminated by any source, including food additives.

(b) Seams on food-contact surfaces shall be smoothly bonded or maintained so as to minimize accumulation of food particles, dirt thus minimize the opportunity for growth of microorganisms.

(c) Equipment that is in the manufacturing or food-handling area and that does not come into contact with food shall be so constructed that it can be kept in a clean condition.

(d) Holding, conveying, and manufacturing systems (eg. Seamer) enable them to be maintained in an appropriate sanitary condition.

(e) Each freezer and cold storage compartment used to store and hold food capable of supporting growth of microorganisms shall be fitted with an indicating thermometer, temperature-measuring device, or temperature recording device to show the temperature accurately within the compartment.

(f) Instruments and controls used for measuring, regulating, or recording temperatures or other conditions that control or prevent the growth of undesirable microorganisms in food shall be accurate and adequately maintained.

Processes and Controls

All operations from receiving to end product and storing of food shall be conducted in accordance with adequate sanitation principles. Appropriate quality control operations shall be taken to ensure that food is suitable for human consumption and that food-packaging materials are safe and suitable.

Overall sanitation of the plant shall be under the supervision of individual assigned responsibility for this function. All reasonable precautions shall be taken to ensure that production procedures do not contribute contamination from any source.

Chemical, microbial, or extraneous-material testing procedures shall be used where necessary to identify sanitation failures or possible food contamination. All food that has become contaminated shall be rejected, or if permissible, treated or processed to eliminate the contamination.

(a) Raw materials and other ingredients.

(1) Raw materials and other ingredients shall be inspected (colour, odor, temperature) that they are clean and suitable for processing into food and shall be stored under conditions that will protect against contamination and minimize deterioration.

Water used for washing, rinsing, or conveying food shall be safe and of adequate sanitary quality. Containers and carriers of raw materials should be

inspected on receipt to ensure that their condition has not contributed to the contamination or deterioration of food.

(2) Raw materials and other ingredients shall either not contain levels of microorganisms that may produce food poisoning or other disease in humans. They shall be pasteurized during manufacturing operations so that they no longer contain poisonous microorganisms.

(3) Raw materials, other ingredients, and rework shall be held in bulk, or in containers designed and constructed so as to protect against contamination and shall be held at appropriate temperature to prevent the food from becoming adulterated.

(b) Manufacturing operations.

(1) Equipment and utensils and finished food containers shall be maintained in an appropriate cleaning and sanitizing conditions.

(2) All food manufacturing, including packaging and storage, shall be conducted under such conditions and controls as are necessary to minimize the potential for the growth of microorganisms, or for the contamination of food. One way to comply with this requirement is careful monitoring of physical factors such as time, temperature, heat processing, to ensure that mechanical breakdowns, time delays, temperature fluctuations, and other factors do not contribute to the decomposition or contamination of food.

(3) Food that can support the rapid growth of undesirable microorganisms, particularly those of public health significance, shall be held in appropriate temperatures. Heat treating foods are held in hermetically sealed containers.

(4) Measures such as pasteurizing are taken to destroy or prevent the growth of undesirable microorganisms.

(5) Work-in-process shall be handled in a manner that protects against contamination.

(6) Equipment, containers, and utensils used to convey, hold, or store raw materials, work-in-process, rework, or food shall be constructed, handled, and maintained during manufacturing or storage in a manner that protects against contamination.

(7) Blending, filling, packaging, and other operations shall be performed in such a way that the food is protected against contamination including,

(i) Use of a quality control operation in which the critical control points are identified and controlled during manufacturing.

(ii) Adequate cleaning and sanitizing of all food-contact surfaces and food containers.

(iii) Using materials for food containers and food packaging materials that are safe and suitable.

(iv) Providing physical protection from contamination, particularly airborne contamination.

(v) Using sanitary handling procedures.

(8) When ice is used in contact with food, it shall be made from water that is safe and of adequate sanitary quality, and shall be used only if it has been manufactured in accordance with current good manufacturing

Warehousing and Distribution

Storage and transportation of finished food shall be under conditions that will protect food against physical, chemical, and microbial contamination as well as against deterioration of the food and the container.