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Good Manufacturing Practice Training Manual for Dairy Processors

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Table of Contents

page numbers

1. INTRODUCTION.....	4
1.1. Training objectives	4
1.2. Output of the training	4
1.3. What is good manufacturing practice?.....	5
1.4. Basic GMP and the food business.....	5
2. Rules of GMP.....	6
2.1. Get the facility design right from the start	6
Facility layout	6
Environment.....	6
Equipments	6
2.2. Validate processes	7
2.3. Write procedures and follow them.....	7
2.4. Define competence and who does what	7
2.4.1. Demonstrating job competence	7
2.5. Keep good records	7
2.6. Train and develop staff	8
2.7. Practice good hygiene.....	8
2.8. Maintain facilities and equipment.....	8
2.9. Design quality into the whole product life cycle.....	9
2.10. Perform regular audits.....	9
3. Terms and their definitions.....	9
4. Construction and layout of building	11
4.1. Purpose	11
4.2. Introduction	11
4.3. Requirements.....	11

4.3.1.	Requirements for the site	11
4.3.2.	Requirements for site layout	11
4.3.3.	Roads.....	12
4.3.4.	Layout for building	12
4.3.5.	Isolation of critical areas and standard hygiene areas	13
4.3.6.	Personnel changing facilities.....	14
4.3.7.	Staff amenities	14
5.	Utilities, air, water and energy.....	14
5.1.	Water supply.....	14
5.2.	Air quality and ventilation.....	15
6.	Waste disposal	15
6.1.	Drains and drainage	15
6.2.	Lighting.....	15
7.	Measures for prevention of cross contamination	16
7.1.	Requirements.....	16
8.	Personnel hygiene and employee facilities	16
8.1.	Personnel hygiene facilities and toilets	17
8.2.	Work wear and protective clothing	17
8.3.	Health status.....	18
8.4.	Illness and injures	18
8.5.	Personnel cleanliness.....	18

1. INTRODUCTION

Food forms one of the most essential components vital to human living, and with increasing awareness about issues of health, cleanliness and sanitation, consumers have finally woken up to the issue of food hygiene. The main concern of a consumer lies in food safety, quality and authenticity. Food control procedures have become extremely essential in these days where outbreaks of food borne diseases are common. These procedures should not only emphasize up on maintaining hygienic food in all respects, they ought to be rapid, reliable and cost effective.

People have the right to expect the food they eat to be safe and suitable for consumption. Food borne illness and food borne injury are at best unpleasant; at worst they can be fatal. But there are also other consequences. Outbreaks of food borne illness can damage trade and tourism, and lead to loss of earnings, unemployment and litigation. Food spoilage is wasteful, costly and can adversely affect trade and consumer confidence.

1.1. Training objectives

- To enhance awareness of people engaged in dairy business on good manufacturing practices
- To encourage dairy processing plants to implement GMP to ensure the safety of dairy products to consumers
- To build the capacity of GMP trainers in the dairy sector in order to improve GMP information accessibility to dairy processors

1.2. Output of the training

- ⇒ The skill/ ability to do well /gained through training and experience of trained people
- ⇒ The knowledge of trainers / general awareness or possession of information ,facts, ideas, truths and principles/
- ⇒ The attitude of trainers /personal view / general feeling about the work or a positive attitude to change

1.3. What is good manufacturing practice?

GMP is an operational requirement necessary to enable a food business to produce food safely.

The food business has a legal and moral responsibility to produce and prepare food that will not harm the consumer. There can be a high cost to the food business if it does not implement adequate GMP. Thus why all staff should be trained in the food businesses GMP procedures.

1.4. Basic GMP and the food business

GMP includes many basic operational conditions and procedures that are required to be met by the food business. These includes:-

- ❖ The correct construction and layout of the food premises.
- ❖ The condition of the external environment of the food premises.
- ❖ The adequate maintenance of equipment and utensils used within the food business
- ❖ The use of suitable chemicals within and around the food premises including cleaning chemicals, pest control chemicals and machines lubricants.
- ❖ The identification and storage of waste within and by the food business.
- ❖ The cleanliness of the food premises, equipments, utensils, floors, walls and ceilings.
- ❖ An effective pest control program implemented within the food premises and surrounds.
- ❖ The avoidance of the foreign matter within the finished product. Sources of foreign matter can include wood, glass, metal, plastic, pests, paper, string, tape.

GMP and HACCP are both systems intended to ensure the safety of products. GMP is the first step to food safety as a series of principles to be fulfilled to ensure that products meet prerequisites for safety and quality. It can be one of components of HACCP which is a systematic approach to production that is designed to prevent hazards from occurring.

2. Rules of GMP

2.1. Get the facility design right from the start

It is much easier to be GMP compliant if the design and construction of the facilities and equipments are right from the start. **“Sometimes you need to step back and reconsider the whole production area”**.

Facility layout

The aim is to reduce the chances of cross contamination and to avoid mix-ups and errors. Example, don't have final product passing through or near areas that contain intermediate products or raw materials.

A logical and well planned layout will improve productivity.

Environment

It's important to control the air, water, lighting, ventilation, temperature, and humidity within a plant so that it does not impact product quality. Make sure that:-

- ✚ Lighting, temperature, humidity and ventilation are appropriate
- ✚ Interior surfaces (walls, floors and ceilings) are smooth, free from cracks and do not shed particulate matter.
- ✚ Interior surfaces are easy to clean
- ✚ Pipe work, light fittings, and ventilation points are easy to clean

Equipments

Design, locate, and maintain equipment to suit its intended use. Make sure that:-

- ⇒ Easy to repair and maintain
- ⇒ Designed and installed in an area where it can be easily cleaned
- ⇒ Suitable for its intended use
- ⇒ Calibrated at defined intervals (if necessary)

2.2. Validate processes

Validation is ‘ establishing documented evidence that provides a high degree of assurance that a specific process will consistently produce a product meeting its pre- determined specifications and quality attributes

2.3. Write procedures and follow them

In the food industry it’s critical that procedures are in place to ensure a controlled and consistent performance and it’s an essential part of GMP. **Procedures should be clear, concise, and logical.**

2.4. Define competence and who does what

All employees should clearly understand what they have to do each day. It avoids misunderstanding and minimizes the risk to product safety and quality. You should create a job description for each role to define job title, job objective, duties, and responsibilities, and skill requirements.

2.4.1. Demonstrating job competence

Employees must demonstrate their job competence every day by producing quality products in a safe and efficient manner. Companies need people who know how to do the job right the first time, every time. Annual performance reviews are also a great way to formally discuss an employee’s development and performance. It’s a great way to review what the employee has achieved and to identify any gaps or areas for further development.

2.5. Keep good records

Good records make it possible to track activities performed during manufacturing from the receipt of the raw milk to the final release of product; they provide the history of the batch and its distribution. It is an essential part of GMP to keep accurate records.

‘If it is not written down then it didn’t happen’

2.6. Train and develop staff

To meet GMP requirements it's essential to have the right people to do the right job.

Training: - should be provided for all employees. This includes basic training on the theory and practice relative to their role.

2.7. Practice good hygiene

It's critical to reduce the risk of product contamination to a minimum by putting in place a situation program. Develop a program to meet the standards of cleanliness necessary for the product. The fight against contamination is a constant battle and is one that requires the attention of every single employee, every day.

To convince staff of the importance of washing their hands after toileting, ask the microbiology department to take finger print samples from each operator after they have washed their hands. They can then see how much bacteria are present on their '**clean hands**'.

Keep these practices in your mind: -

- ✓ Always practice good personal hygiene by washing your hands and wearing the required protective garments.
- ✓ Inform your supervisor if you are ill; you may not allowed to enter the manufacturing area until you are well again
- ✓ Minimize contact with product or product contact surfaces and equipments.
- ✓ **Never** eat, drink, smoke chew in manufacturing areas.
- ✓ **Always** follow cleaning and sanitation procedures
- ✓ Report any condition that may cause product contamination
- ✓ Remove trash and waste materials and store appropriately.

2.8. Maintain facilities and equipment

It is important to have a maintenance schedule for facility and equipment. Regular equipment maintenance prevents:-

- ❖ Equipment breakdowns, which can be costly
- ❖ Product contamination

You should have written procedures for all scheduled and emergency maintenance.

Walk around your plant and check all the calibration stickers you can see. If they are out of date then your maintenance process is not being controlled properly.

2.9. Design quality into the whole product life cycle

By working in the food industry you know that the health and safety of the customer depends on the safety and quality of the product. Every step in the product life cycle requires effective controls to assure product quality.

2.10. Perform regular audits

You should conduct in – house audits, or self – inspection, to ensure whether you are following the GMP rules. It’s a good practice to undertake a self-audit at planned intervals every year and to target different manufacturing, storage and handling areas every time.

3. Terms and their definitions

Contamination: - introduction or occurrence of **contaminant** in food or food environment

Contaminant: - any biological or chemical agent, foreign matter or other substances not intentionally added to food which may compromise food safety or suitability.

Materials: - general term used to indicate raw materials, packaging materials, ingredients, process aids, cleaning materials and lubricants.

Product specification:- detailed documented description or enumeration of parameters, including permissible variations and tolerances, which are required to achieve a defined level of acceptability or quality.

Food grade: - lubricants and heat transfer fluids formulated to be suitable for use in food processes where there may be incidental contact between the lubricant and the food.

Disinfection: - reduction, by means of chemical agents and /or physical methods, of the number of microorganisms in the environment, to a level that does not compromise food safety or suitability.

Cleaning in place: - cleaning of equipment by impingement or circulation of flowing chemical solutions, cleaning liquids and water rinses into, onto and over surfaces in equipment or systems without dismantling and designed for the purpose.

Cleaning out of place: - system where equipment is disassembled and cleaned in a tank or in an automatic washer by circulating a cleaning solution and maintaining a minimum temperature throughout the cleaning cycle.

Sanitizing: - process of cleaning, followed by disinfection.

Sanitation: - all actions dealing with cleaning or maintaining hygienic conditions in an establishment, ranging from cleaning and /sanitizing of specific equipment to periodic cleaning activities throughout the establishment (including building, structural, and grounds cleaning activities).

Zoning: - demarcation of an area within an establishment where specific operating, hygiene or other practices may be applied to minimize the potential for microbiological cross contamination.

Label:- printed matter that is part of the finished product package conveying specific information about the contents of the package, the food ingredients and any storage and preparation requirements.

Product recall: - removal of a non-conforming product from the market, trade and warehouses, distribution centers or customer warehouses because it does not meet specific standards, unsafe, adulterated, contaminated or mislabeled.

First expired first out (FEFO): - stock rotation based on the principle of dispatching earliest expiration dates first.

First in first out (FIFO):- stock rotation based on the principle of dispatching earliest received products first.

Product withdrawal (market withdrawal):- the act of removing a product from distribution when it violates regulatory requirements in a minor or technical way. It does not include products that have been contaminated or adulterated.

4. Construction and layout of building

4.1. Purpose

The purpose of this requirement is to ensure that the design and construction of dairy plant buildings are suitable for processing, handling and storage of milk and milk products and ensuring safety to the consumers.

4.2. Introduction

Buildings should be designed, constructed and maintained in a manner appropriate to the nature of the processing operations to be carried out, the food safety hazards associated with those operations and the potential sources of contamination from the plant environs. Buildings should be of durable construction which presents no hazard to the product. Internal layouts should be designed, constructed, and maintained to facilitate good hygiene and manufacturing practices. The movement patterns of materials, products and people and the layout of equipment should be designed to protect against potential contamination sources.

4.3. Requirements

4.3.1. Requirements for the site

Dairy plants should be located in areas free from objectionable odors, smoke, dust and other contaminants which might be produced from neighboring industries, or the surrounding environment which could affect the safety of dairy products.

4.3.2. Requirements for site layout

The layout of building and facilities on the site should minimize any hazard to the products. Factors which should be taken in to consideration when considering site layout includes:-

- ⇒ Milk transportation tanker access routes and wash areas
- ⇒ Effluent storage, treatment and disposal areas,
- ⇒ Fuel storage and handling facilities
- ⇒ Staff access and amenities
- ⇒ Ventilation and process air intakes and exhausts

4.3.3. Roads

Roads, traffic areas and access ways to the site should be formed, graded, sealed, and sloped so that they drain surface water. They should be kerbed where necessary to control traffic and drainage. Sufficient drainage should be provided to convey water away from the premises and roadways.

4.3.4. Layout for building

4.3.4.1. General

The layout and construction of buildings must support good manufacturing practice. E.g. areas in which dairy product is manufactured should be designed:-

- To provide separation by partition, location or other effective means between operations that may cause cross- contamination;
- Protect input materials and products from risks of contamination;
- To protect deterioration of product by exposure.

4.3.4.2. Hygiene area zoning

Critical hygiene areas: - are those areas in a dairy plant where environmental control is necessary to prevent contamination of heat treated product after the heat treatment step. There should be no raw milk or cream in critical hygiene areas. Processing equipment should be placed in or open into critical hygiene areas where any of the following are **routinely exposed** to the environment:

- ✚ Pasteurized or heat treated milk and milk products which will not receive a further pasteurization heat treatment,
- ✚ Ingredients that are incorporated into the process stream after the designated pasteurizing heat treatment step,

- ✚ Product contact surfaces of packaging materials,
- ✚ Product contact surfaces in equipment that follow the pasteurization heat treatment step in the process flow.

A) **Standard hygiene areas:** - are those areas in a dairy plant in which environmental control is necessary to prevent contamination of milk and milk products prior to a micro biological critical control point such as pasteurization. Processing equipment should be placed in a standard hygiene area only where any of the following are routinely exposed to the environment:

- Milk and milk products prior to a micro biological critical control point such as pasteurization,
- Ingredients which are incorporated into the process stream before the pasteurization heat treatment step,
- Product contact surfaces of equipment before the pasteurizing heat treatment step of the process

Depending on individual circumstances and related food safety risks, the following activities may need to be located in standard hygiene areas:

- Process equipment cleaning,
- Air filter washing, drying and sanitizing
- Laundry of process hygiene overalls and other process protective clothing

4.3.5. Isolation of critical areas and standard hygiene areas

- a) Critical hygiene areas should be isolated from all other parts of the dairy plant including standard hygiene areas. There should be hygiene control measures for entry of personnel, equipment, materials and ingredients. Access by personnel to critical hygiene areas should only be via a personnel changing facility.
- b) The boundary limits of critical hygiene areas and standard hygiene areas signs should be clearly identified for staff and visitors, by signage or other means.

4.3.6. Personnel changing facilities

- i. All personnel access to a critical hygiene area should be via personnel changing facility or suitable alternatives.
- ii. The personnel changing facility should be have provision for:
 - Exchanging or covering foot wear,
 - Exchanging or covering clothing,
 - Covering hair
 - Hand washing and hand sanitizing
- iii. The personnel changing facility should be designed so that, when used correctly, it will minimize the transfer of contamination into a critical hygiene area.
- iv. Ventilation should be provided to prevent stale or offensive odors developing and the air should be floe from that area to an area of lesser hygiene status.

4.3.7. Staff amenities

Staff amenities include cafeterias, locker areas, shower areas and toilets.

- ✓ Staff amenities should not be located in a critical hygiene area.
- ✓ Lockers provided must ensure that protective clothing is adequately protected from dust and other contaminants (including boots, freezer jackets).
- ✓ Hand washing facilities should be provided in each toilet complex. Taps should be electronic, knee- or foot – operated, to minimize the transfer of contaminants

5. Utilities, air, water and energy

5.1. Water supply

The dairy plant should be supply adequate potable water. Appropriate facilities or water storage, treatment, distribution and temperature control should be available to protect the safety and suitability of food products.

- a) Potable water and steam should be supplied at volumes, pressure and temperatures necessary for all sanitation and operational activities including:
 - Production

- Hand washing and
 - Cleaning and sanitation
- b) Steam should be produced, handled and stored in a manner that is protected from contamination
 - c) Water quality test should be performed at planned intervals by recognized laboratories.
 - d) Documentation of the results of water testing should be recorded.
 - e) Water lines installations and equipment should be constructed and maintained to prevent back siphon age and back flow.

5.2. Air quality and ventilation

Building should be constructed in such a way that the rooms are well ventilated to keep them free of excessive heat, humidity, steam, vapors, smoke, particulates and condensation.

6. Waste disposal

Dairy plants should establish and implement a system that ensure that waste materials are identified, collected, removed and disposed in a manner which prevents contamination of products or production areas.

6.1. Drains and drainage

Dairy plants should have adequate drains and drainage system that are maintained to protect the safety and suitability of food and potable water supply system. Liquid waste should be managed in a manner that does not pose any safety hazard to raw materials and products.

6.2. Lighting

All processing areas should be provided with adequate and appropriate natural or artificial lighting to facilitate all activities including processing, product inspection, visual examination of rooms, cleaning and sanitizing, packaging and maintenance to be carried out in a hygiene manner. Light fixtures and light bulbs suspended over food, ingredients, packaging materials and

food contact surfaces should be equipped with coverings to prevent or minimize physical contamination in case of breakage.

7. Measures for prevention of cross contamination

There are many ways that cross contamination of food can occur, such as:-

- Poor equipment hygiene,
- Poor personnel hygiene,
- Inappropriate internal traffic pattern,
- In appropriate storage practices,
- Contaminated packaging materials,
- Poor design and construction of buildings
- Contaminated utilities.

7.1. Requirements

- I. The traffic pattern of personnel and visitors should be controlled.
- II. The process flow, from receiving to shipping, should be linearly arranged
- III. Washing and cleaning materials should be located away from production areas
- IV. Toilet rooms should not open directly into production, packaging and raw materials and finished goods storage areas.
- V. Operations that have the potential to cause cross contamination should be closely monitored at planned intervals.

8. Personnel hygiene and employee facilities

Employees play vital role in producing safe dairy products. Proper employee hygiene and practices can prevent the contamination of milk and milk products, containers, equipment and facilities.

Dairy plants should have a written employee hygiene and training program. This should be outline the excepted standards of hygiene, behavior and habits for employees. Employees

involved in any stage of processing, packaging or distribution should be trained to make sure they produce food that meets customer as well as regulatory requirements for the safety and quality. It is also important to make sure that visitors and contractors know about the plant's employee hygiene standards and should be adhere to them.

8.1. Personnel hygiene facilities and toilets

Requirements for these facilities include:-

- 1) Wash rooms, change rooms and lunch rooms should be designed and maintained in good repair to prevent or minimize contamination of food and others.
- 2) The wash rooms should be equipped with adequate lighting to facilitate sanitary procedures.
- 3) Hand washing signs, written in local language should also be present at all hand wash stations with pictorial and written guidance. Furthermore, signs should be posted at all entry ways into the production facility which stated ‘**clean hands before entering this area**’ in local language.
- 4) Toilet doors have self closing mechanisms and their proper functionality should be monitored regularly.
- 5) Hand washing stations should have hot and cold potable water, soap (with taps, antimicrobial liquid soap), a hygiene drying apparatus and a cleanable waste receptacle and only for hand not for other purpose.
- 6) All hygiene facilities do not open directly into production, packing or storage areas
- 7) Separate changing facilities should be in place for men and women and should be inspected to be clean, orderly and well maintained.

8.2. Work wear and protective clothing

- A) Clothing assigned that for food protection or hygiene purpose should not be used for other purpose.
- B) Work wear should not have buttons and outside pockets above waist level.
- C) Employees should be issued clean work wear and should be required to wash and maintain them in a clean manner.
- D) Gloves should be used as personnel protective for product contacts.

E) Shoes used in processing areas should be fully enclosed and made from non- absorbent materials.

8.3. Health status

1. People known, or suspected, to be suffering from, or to be a carrier of a disease or illness likely to be transmitted through food, should not allowed to enter milk receiving and processing areas,
2. The organization requires the employees to immediately report illness or symptoms of illness to the management.
3. Visitors and pest control contractors should be required to advise management when they are suffering from a communicable disease likely to be transmitted through food,
4. Medical examination of personnel involved in production of milk should be carried out if clinically or epidemiologically indicated; otherwise medical checkup should be done bi annually. Personnel found to be infected with communicable disease should away from designed areas until medication and re examination proves completely cured.

8.4. Illness and injures

Personnel health procedures should require employees with symptoms of illness, injuries or open wounds to be adequately protected; reassigned to non sensitive work or sent to home until get cured. Conditions which should be reported to management so that any need for medical examination and /or possible exclusion from milk and milk products handling can be considered and included:- jaundice, diarrhea, vomiting , fever, sore throat with fever, visibly infected skin lesions (boils, cuts, etc.), discharges from the ear, eye or nose. Any cut, abrasion, burn or broken of the skin should be bandaged. Wounds and sores should be treated and plastered immediately. When hands are plastered, single use gloves must be worn.

8.5. Personnel cleanliness

Personnel working in milk and milk production should a high degree of personnel cleanliness.

- Hair nets should be worn to maintain the integrity of the milk products.
- Maintain short, clean and polish- free finger nails. No artificial nails are permitted in the milk production areas.
- Take off aprons, uniform or any other protective clothing before using the toilet facility

- Personnel protective wears should be cleaned and sanitized effectively at planned intervals.

8.6. Hand washing procedures

- ✚ Wet hands with warm water
- ✚ Apply soap
- ✚ Rub hands and arms vigorously for 20 seconds
- ✚ Rinse completely
- ✚ Dry hands with air drier or with single use paper towel.

8.7. Personal behavior

Dairy plant should requires that people engaged in milk and milk products handling activities should refrain from behavior which could result in contamination of food, such as smoking, splitting, chewing or eating, sneezing or coughing over unprotected milk and milk products and raw materials.

8.8. Employee regulations

1. Refusal to follow this instructions will not be tolerated
2. No employee should smoke, chew tobacco, chew gum, candy or spit in the food processing areas
3. No employee should return product that has come in contact with contaminated surfaces(e.g. floor)
4. At any time containers with or without food materials or products should not be placed directly on the floor. These should always be at least 15 cm above the floor.
5. Hands /gloves that have been in contact with contaminated surfaces (garbage, inedible food totes, floor, etc.) should be disposed.
6. Production line workers handling raw foods should not wear the same gown and gloves in handling final product.
7. Gowns, hair nets and gloves are not to be worn into was rooms, locker rooms, and lunch rooms or outside the building.

8. No employee, while known to be infected with a disease likely to be transmitting through food or while afflicted with infected wounds skin infections and sores or with diarrhea, is permitted to work in any food handling area in capacity in which there is any directly or indirectly contaminating the food with pathogenic organisms.
9. Any employee who has an open cuts or wound will not permitted to handle food or food surfaces until the injury is completely protected by water proof covering which is firmly secured.
10. Fingernails must be trimmed short and you are not permitted to wear nail polish at any time.
11. Jewelry must be removed prior to working in a food handling area
12. Do not cough or sneeze around food or a food preparation area
13. Keep your hands away from your mouths, nose, ears and hair.
14. Lunch room must be kept clean and tidy at all times
15. All garbage should be placed immediately in garbage containers, not thrown on the floor.
16. All employees are responsible for reporting any sightings of rodents in the plant.

8.9. Compliance declaration

I understand and will abide by these regulations. I further understand that should I commit any violation of the regulations, disciplinary and /or appropriate legal action may be taken.

Employee's name& signature

date

9. Cleaning and sanitizing

In the food industry, cleaning and sanitizing process are very important to achieve great levels of food safety and quality.

Table1. Cleaning and sanitation Key Terms

Cleaning	Removal of Visible physical dirt and stains.
Disinfection	Removal of harmful bacteria / microbes.
Sanitation	Process in which most or nearly all micro organisms (whether or not pathogenic) killed through use of chemicals, heat, ultraviolet rays.
Sterilization	Total destruction of all microorganisms (whether or not pathogenic) and their spores, usually through the use of drastic methods.

9.1. The objective of cleaning and sanitizing

- To achieve great levels of food safety and quality.
- Up-gradation to higher quality products
- Reduction in Cost and Improved productivity and organizational profitability.
- To be competitive with current market.
- To enhance the confidence of our consumers
- To improve the shelf life of and quality of the product
- From grass to glass or from farm to fork it prevents transmission of human diseases by foods and etc.

9.2. CIP (clean in place)

A cleaning system designed and a common type of cleaning processes in most dairy plants, applied to clean raw materials and product residues in vessels, pipe lines, and equipment. It Provide reliable, fast, economic and efficient cleaning without dismantling the equipment.

9.3. Cleaning raw milk and pasteurized milk tankers

1. Remove all small parts of the tanks and clean by manual or by soaking in the solution of detergents
 2. Clean outer surfaces of tankers by spraying or manual(COP) with the help of detergents
 3. For the inner part of tankers use the CIP system by either soda ash or caustic soda if it is necessary Nitric Acid.
- If there is no CIP system , use manual system
 - For CIP means cleaning:- soda ash solution for 90 liter of water add 1kg of soda ash and should be boiled at 70- 80 °c.
 - Caustic soda 1-3% of the solution or we can use according to chemical detergent manufacturers instruction, and should be boiled at 70-90°c and strength 2.5%.
 - Circulation time of the solution:-
 - ✓ 15-45 minutes for tankers
 - ✓ 5-20 minutes for raw milk trucks and butter churners
 - For manual cleaning we use the solution of detergent from 0.5 – 1% which boiled or heated at 45-50°c .

9.4. COP (clean out place)

Cleaning and sanitizing smaller items such as valve and pump parts, gaskets and “o” rings retainer rings springs.

9.4.1. Large items and equipments (non C.I.P.)

- a) Remove ,all foods, debris , and packaging and processing supplies from the work area
- b) Dismantling or breakdown all equipment for cleaning
- c) Clean all food contact items as follows:
 - ✚ Remove excessive, visible soil
 - ✚ Soap and scrub
 - ✚ Rinse

- ✚ Soap and scrub
 - ✚ Rinse
- d) Sanitize by spraying or pouring sanitizer solution over all surfaces. Dip small , removable parts in sanitizer solution. Do not rinse after sanitizing.
 - e) Position all items so they will drain and dry completely such as air dry.
 - f) Reassemble at beginning for next shift
 - g) Sanitize as necessary after reassembly

9.4.2. Machinery surfaces and frame work

- 1) Clean thoroughly with hot, soapy water.
- 2) Rinse with warm, clean water
- 3) Apply sanitizer solution
- 4) Air dry

9.4.3. Small milk containers cleaning

Cans and other milk containers are should be cleaned as soon we use the milk from it as following:-

- a) Rinse with the water until the milk removed
- b) By soda ash or the soap prepared for this solution wash manually with help of brush the inner part and outer part of the material very well
- c) Then, clean by pure water until the smell of solution disappeared from the material.
- d) If we have steam source, we can sanitize with it
- e) f)Then, if we have no steam , dry the can by bending at clean place
- f) After the can dried we can put in store or we can use it.

9.5. Four types of food soils

- **Those that dissolve in water:-**
 1. simple carbohydrates like sugars
 2. some simple mineral salts (NaCl)
 3. Some starches
- **Those that dissolve in alkali:-**

- I. proteins
- II. Starches associated with proteins or fats
- III. bacterial films(bio films)
- **Those that dissolve in Acids**
 - a. Hard water hardness salts (Ca and Mg salts)
 - b. Complex mineral films ((Fe Mng deposits)
- **Those that dissolve with surfactants**
 - a. Fats ,oils and greases
 - b. Many food residues
 - c. Inert soils such as sand, clay or fine metals
 - d. Some bio films

9.6. Cleaning agents

Most of time cleaning agents we use in dairy industry.

- ❑ Basic alkalis :- e.g. (caustic soda) sodium hydroxide

Soda ash :- (sodium carbonate)

- ❑ Acid :-

- good at mineral deposit control and soften the water
- Used for rust stains and tarnish on copper and brass.

Example Nitric acid

9.7. Factors those influence cleaning efficiency

- ❖ **Choosing the right cleaner for the task**
- ❖ **Time** –increased time improves efficiency
- ❖ **Temperature** –increasing the T⁰c of the cleaning solution decreases the strength of the bond between the soil and surface and Decreases the viscosity and increases the solubility of the materials and the chemical reaction rate

- ❖ **Velocity (turbulence)** - increased velocity provides mechanical action to remove soil and filth.
- ❖ **Concentration:-** increased cleaner concentration can improve efficiency, but this is the least effective variable to change in cleaning. Example: - either increasing temperature by decreasing concentration or decreasing temp and increase the concentration with contact time.

9.8. Cleaning procedure

- prewash
- Washing
- Rinsing
- Disinfection(sanitizing)

9.8.1. Prewash:

The removal of gross food particles before applying the cleaning solution. This may be accomplished flushing the equipment surface with cold or warm water under moderate pressure.

9.8.2. Washing :

The application of cleaning compound.

➤ **Washing methods:-**

- ❖ **Soaking:** - immersion in the cleaning solution. the cleaning solution should be hot around 50 °c and the equipment permitted to soak for 15-30 minutes before manually or mechanically scrubbed
- ❖ **Spray method:** - Spraying cleaning solution on the surface. This method uses a fixed or portable spraying unit with either hot water or steam.
- ❖ **Foaming:** - utilizes a concentrated blend of surfactant developed to be added to highly concentrated solution of either alkaline or acid cleaners. Produces stable, copious foam when applied with a foam generator. The foam clings to the surface to be cleaned, which increases :-

- ✚ contact time of the liquid with the soil,
- ✚ Prevents the rapid drying and runoff of the liquid cleaner,
- ✚ Thereby improving cleaning



9.8.3. Rinsing

Removes all traces of cleaning solution with clean potable water.

9.8.4. Disinfection (sanitization)

A process either by using heat or a chemical concentration that will reduce the bacterial count including pathogens, to a safe level on utensils and equipment after cleaning .

9.9. Necessary tools

- ✓ Protective cloth
- ✓ boots
- ✓ hand Glove and head hat /cape
- ✓ nose and mouth protective cloth



9.10. Results of Improper Cleaning

- Poor Quality Food and Food-Unsafe for Human Consumption
- Increased Utility Consumption viz. Steam, Water, Refrigeration etc.
- Wastages & Reduced Safety
- Increased level of chemical usage
- Risk of Brand Damage
- Continuous deposition of soil on surfaces, which may become difficult to remove even manually
- Affects economy of production adversely

9.11. Cleaning and sanitation schedules

Cleaning and sanitation program and its schedule should be based on the importance of the processes, its impact on food safety, the intensity and priority needed.

- What is to be cleaned
- Who is to clean it
- When it is to be cleaned
- How it is to be cleaned

- The time necessary to clean it
- The chemicals used
- Materials and equipment to be used
- The cleaning standard required
- The precaution to be taken
- The protective clothing to be worn
- Who is responsible for checking and recording that it has been cleaned?

Table2. Schedule of cleaning

<i>Area /equipment/</i>	<i>Who</i>	<i>When (am/pm)</i>	<i>How</i>	<i>Cleaning/ disinfecting material</i>	<i>Safety precautions</i>	<i>Checked by</i>

10. Verification of cleaning and sanitation methods

Commonly used methods include:-

10.1.1. Test strips

Strips are simply are soaked directly in the solution to be tested,

- a change in color indicates the presence of the sanitizers, the shade or intensity of which relating to the concentration of the chemical.
- These are very rapid, low cost, do not require any laboratory equipments or chemicals,
- Can be performed on site, and require very little training. E.g. Chlorine indicator test strips.

10.1.2. Contact plate:-

- ⇒ Is containing agar which has a convex surface.
- ⇒ These plates are pressed against the surface of equipment then incubated.
- ⇒ Examination of the plate will give an organism count and individual colonies can be lifted from the plate and identified.
- ⇒ The surface of the equipment touched by the contact plate must be cleaned of any agar residue.
- ⇒ This method is used for verifying periodic effectiveness of cleaning and sanitizing plant surfaces.
- ⇒ The test procedure is very simple and requires no additional special equipment and little training. Most contact plates are simply touched to the surfaces to be tested then covered with a protective cap.

10.1.3. Swabbing:-

- ❖ A sterile cotton or calcium alginate swab is wetted/in sterile buffer, saline solution, or broth and rubbed over a measured portion of the surface of the sanitized equipment.

- ❖ The swab is then either streaked across an agar plate or placed into a sterile broth tube.
- ❖ The plate or tube is incubated for the appropriate length of time.
- ❖ Examination of the plate will give an organism count and the individual colonies can be lifted from the plate and identified.
- ❖ Tubes are examined for turbidity. This is a pass / fail test.
- ❖ Swabbing is very useful for irregular surfaces or curved equipment

Swabbing count: -

In 1 cc TBC on 100cm² = $N \cdot 100 / A$

N= microorganisms per ml

A= surface area swabbed (cm²)

<500 = good; 500-3000 = Moderate and >3000 = bad.

10.1.4. Final Rinse Test: -

- ✓ Water of known microbiological quality and volume is rinsed through the equipment.
- ✓ The water is recovered and filtered via membrane filtration technique.
- ✓ The membrane is placed onto a plate and incubated.
- ✓ Examination of the plate will give an organism count and individual organisms can be identified.
- ✓ Note that rinse water analysis may not detect the presence of bio film on equipment surfaces.

Final Rinse Test count:- TBC should be

✚ <2500/ml Good

✚ 2500-10,000.....moderate

✚ >50,000.....bad

✚ But in 1cc coli form bacteria should not be found.

11. Emergency and measures

11.1. Skin exposure:-

- If caustic soda comes into contact with clothing ,immediately remove the clothing and wash the skin with a large quantity of flowing water for a long time
- The best way to clean the skin is to wash it under a water shower.
- Since shock may be experienced in cases of severe injury, or chemical injury to a large area of the skin , lay the patient down quietly and warm him/her moderately, and immediately call an ambulance
- Do not apply oils or other ointments except under the direction of a physician.

11.2. Eye Exposure:-

- ❖ If caustic soda gets into the eyes, immediately rinse it out with a large quantity of flowing water for at list 15minutes.
- ❖ In this case, hold the eye lids open wide with the fingers so that water can reach every part of the eyeballs and eyelids.
- ❖ Call an ambulance or ophthalmologist.

11.3. Swallowing:-

- If swallowed, even a diluted solution affects the mucous membranes of the mouth, throat, esophagus and stomach.
- Never force the patient to vomit, since the stomach wall that is penetrated and thinned by caustic soda may be punctured.
- If the patient becomes unconscious, do not give food or drink orally.
- If the patient is clearly conscious, wash the mouth out with a large quantity of water,
- if possible, give him/her vinegar, or fruit juice to promptly neutralize the caustic soda.

- If the measures described above cannot be taken immediately, have the patient drink as much water as possible.
- Inform a physician of the details of the accident.

