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For Efficient Dairy Plant Operation
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QUALITY MANAGEMENT : HACCP

This bulletin includes technical information, latest developments on products, systems, techniques etc. reported in journals, companies' leaflets, books and based on experience. The technical information would be on different areas of plant operation in different issues. It is hoped that the information contained herein, if employed in the factory, will help in making dairy plant operations more efficient.

Your contributions and suggestions will make the bulletin more useful, and are welcomed.

The theme of information in this issue is ***Quality Management : HACCP****. It may be understood that the information given here is by no means complete.*

In This Issue

1. WHAT IS HACCP?

The concept and the applicability of Total Quality Management and ISO 9002 in dairy industry were detailed in Technews issue 9 (July-August 1997). Hazard Analysis and Critical Control Points (HACCP) is a very important Quality Assurance System and is described in brief in this issue.

The primary quality demands of consumers, and hence quality concerns of dairy processors, are organoleptic attributes, bacteriological control and sanitation, and good nutritional value of the products. Testing the end products of any production process rarely controls the quality. It may indicate if the process is under control, but relatively high levels of sampling and testing may be required.

In the dairy industry microbiological quality assurance of raw materials, part processed components, and finished products is becoming increasingly important. Failure to detect potential spoilage or food poisoning organisms in dairy process can cause considerable operational problems. These can include complex and expensive recalls, the loss of customer confidence, reduced sales and possibly serious public health problems.

Hence, process controls are necessary to produce a dairy product that is safe and acceptable to the consumer. The means by which such controls can be established is a methodology known as Hazard Analysis and Critical Control Points (HACCP). **In the HACCP process "observations and/or testing are made to identify actual or potential hazards in operations and to identify Critical Control Points (CCP) in a process. Control measures are designed and implemented, and the control points are monitored to ensure that control is maintained."**

HACCP was developed in the 1960s in the USA by three organizations : The Pillsbury Company, the US Army Natick Laboratories and the National Aeronautics and Space Administration (NASA).

Although designed primarily for microbiological food safety (prevention of food poisoning), the process is followed for addressing microbiological spoilage and reducing chemical and physical contamination (see item 2) and safeguarding the nutritional quality of dairy products. The effectiveness of this procedure has very widely been accepted by the dairy industry abroad.

HACCP itself is a straightforward and logical system of control based on the prevention of problems — a common sense approach to dairy products' safety management. It

helps to identify the hazard associated with various stages of processes, from the raw milk to the packaged product, assess the relative risks and determine the operation where control procedures will be effective. HACCP has a pivotal role as a management tool for dairy product safety and quality in ISO 9002 quality systems. **It only needs a certain level of expertise to carry out HACCP** but this expertise is a thorough understanding of the products, raw materials and processes alongwith factors which could cause a health risk to the consumer.

2. FOOD HAZARDS

The hazards that concern dairy processor are many. For convenience, most of them can be grouped into three following categories :

A. Microbiological Hazards: Since milk is an excellent medium for the growth of microorganisms, dairy products are most susceptible to microbiological hazards. This makes it necessary to establish requirements covering animal health, sanitation, pasteurization, refrigeration, and microbiological standards.

Modern methods for control of foodborne disease depend on the detection of the causative microorganisms.

B. Chemical Contamination : Residues of animal drugs — sulfa drug, sulfamethazine, and antibiotics like penicillin and tetracycline — found in milk are a continuing health and regulatory concern. Sulfa drugs have been found to cause concern in test animals and antibiotics may cause allergic reactions in people.

Other chemical contaminants are pesticides used on crops that form fodder for dairy cattle, and chemical germicidals. Chemical germicidals such as iodophores, hypochlorites and strong ionic surfactants, are used in formulations for udder hygiene, and to sanitize dairy process equipment. These substances can leave toxic residues in milk.

C. Extraneous Matter: Foreign materials such as wooden splinters, paint chips and metal filings may be introduced into the product through ingredients or during plant operations. Sediment (dirt, soil) is commonly found in milk supplies.

D. Functional Hazards: Functional hazards are very important to the dairy processor. If a package is slack filled, a product has a poor taste, or appearance is unappetizing, dissatisfied customers will surely complain to the manufacturer, and sales will go down. Misbranding errors will invite attention of regulatory authorities.

3. BENEFITS OF HACCP

Implementation of HACCP in dairy factories will provide immediate tangible benefits of reduced customer complaints and compliance to final product specifications, and some promising opportunities to develop Total Quality Management systems for continued and sustained improvement in quality performance. The benefits that can be achieved through HACCP are given in Table 1.

Table 1
Tangible Benefits of HACCP

1. Producing safe product every time.
2. Providing evidence of safe, production and handling of food products.
3. Management more confident in its products.
4. Satisfying a customer request for HACCP.
5. Improved efficiency in production. Avoids wastage.
6. Increases competitiveness.
7. New customers.
8. Reduced complaints.
9. Quality improvement in raw materials.
10. Export potential.
11. Helps in ISO 9002 accreditation.
12. Conformance to specification and regulatory guidelines.
13. Identification of problems.
14. Review of standards, manuals and facilities.
15. Cost effective use of resources.

4. PRINCIPLES OF HACCP

The HACCP system consists of 7 principles for implementation as given in Table 2. All the actions specified are taken by a HACCP team (see item 6).

Table 2
The Principles of HACCP

Principle/Action necessary

1. **Hazard Analysis:** Construct flow process chart from incoming raw materials to finished products. Identify potential hazards at each stage and describe the preventive measures for their control.
2. **Critical Control Points (CCPs):** Identify CCPs at which hazards can be controlled. Specify control parameters.
3. **Critical Limits:** Establish target values and critical limits for preventive measures of each CCP.
4. **Monitoring:** Establish CCP monitoring requirements for

each parameter. Specify verification frequency and responsibility.

5. **Corrective Action:** Establish corrective actions to be taken when monitoring indicates a deviation from a critical limit. Specify procedures and responsibilities, establish procedures to adjust the process and maintain control.
6. **Documentation:** Establish effective record-keeping procedures and records that document the HACCP system implementation.
7. **Verification:** Establish procedures to verify correct functioning of the HACCP system.

Such formalized procedure will ensure proper attention to the control of a given hazard.

5. PRE-REQUISITES TO HACCP IMPLEMENTATION

For successful implementation of HACCP system certain pre-requisites are required to be met. These are briefed below :

A. Management Commitment: Real commitment and early active involvement and support of senior management from all disciplines is fundamental to the effective implementation of HACCP. There should be complete understanding of what HACCP is, what benefits it can offer, what is really involved and what resources will be required.

B. Employees Involvement: Implementation of the system must be driven from within the organization. Help of external expertise may be taken, whenever needed, but it must largely be planned and implemented by the people within.

C. Good Manufacturing Practices (GMP): GMPs go a long way towards controlling the quality of dairy products. **GMP may be defined as "Those procedures in a dairy-processing plant which consistently yield products of acceptable quality".** A product is likely to get adulterated if it has been prepared, packed, or held under insanitary conditions whereby it may have become contaminated with filth, or whereby it may have been rendered injurious to health. Emphasis, therefore, must be placed on sanitation and employee training. GMPs address such matters as personal hygiene, plant and grounds upkeep, the design and cleaning of equipment, and process controls. The basic GMP requirements for dairy products are listed in Table 3.

Table 3
GMP Considerations for Dairy Products

1. Raw material suppliers and specifications.

2. Raw material checking, storage and rotation.
3. Raw material and finished product testing.
4. Factory planning and construction.
5. Plant selection, layout and maintenance.
6. Cleaning methods and frequency.
7. Segregation of 'clean' and 'dirty' areas.
8. Efficient environmental monitoring-plant and grounds.
9. Effective pest control.
10. Integrated control and monitoring of all processes.
11. Effective hygiene control.
12. Training and supervision of production, QA and hygiene.

Details of GMPs will be presented in another issue of 'Technews'. Codex Alimentarius Commission has prepared food product standards and codified hygienic and technical practices and other requirements. Referring to these would be very useful.

D. Employees Awareness : All staff must be made aware of the importance of quality, safety and their roles in achieving organization goals.

6. PLANNING HACCP IMPLEMENTATION

Just as HACCP is systematic, it is important to be systematic in your approach and plan in a structured manner exactly how to proceed.

The implementation of HACCP can be managed as a project. It will have a definite life cycle, that is a start date and a finish date when HACCP can be said to be fully operational. The project can be managed by a temporary project team. This would involve the appointment of a few key people — two key personnel plus supporting team — and the documentation of the actions and time schedule required.

A possible implementation plan carried out in phases is suggested below. It is useful if HACCP implementation plan alongwith time- table is prepared in a Gantt chart as shown in Fig 1. Figure 2 shows the HACCP implementation flow diagram.

Phase 1: Establish the HACCP Team: This phase includes several steps. **The very first is the organization's board's approval** for HACCP implementation, its firm commitment, support and setting clear objective. At this stage the Project Sponsor could be appointed, who could be the Managing Director, Operations General Manager or Technical General Manager. He should be the one who is likely to sit on the senior

HACCP Implementation — Gantt Chart

Name	Duration	Jan	Feb	...
Phase 1 : Establish HACCP Team				
Identify project sponsor and manager.				
Awareness training				
Form HACCP team				
Train HACCP team				
Set up external support links				
Phase 2 : Determine the System Scope.				
Write HACCP or food safety policy.				
Publish scope & timescale for implementation.				
Phase 3 : Supplier Quality Assurance (SQA)				
Write raw material specification				
Identify & train SQA personnel				
Set up SQA audit schedule & carry it out				
Phase 4 : Prepare HACCP Plan				
Prepare process flow diagram				
Conduct hazard analysis				
Establish CCP				
Establish control procedures (HACCP charts)				
Write procedures for CCP monitors				
Train CCP monitors				
Implement the HACCP plan				
Verification of the HACCP plan				
Phase 5 : Project Sign-off				
Agree HACCP is fully implemented				

Fig 1 HACCP Implementation - Gantt Chart

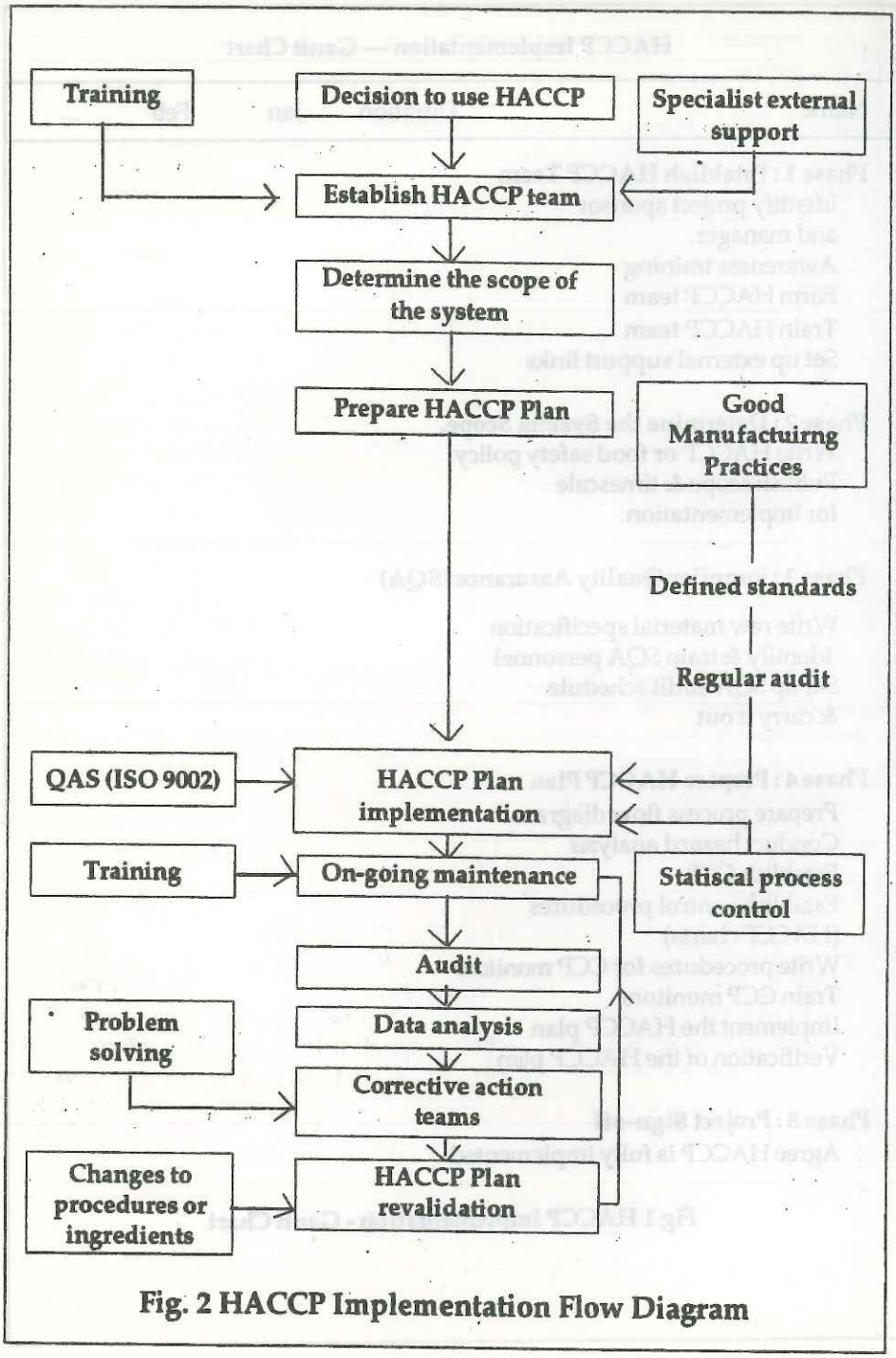

Fig. 2 HACCP Implementation Flow Diagram

management team and have budgetary control. His responsibilities are to : provide funds and resources, approve and drive HACCP policy, approve the business issues, appoint Project Manager and team, establish a progress reporting procedure, and approve any changes to the original project.

The Project Manager is likely to be the Production or Technical Manager who may also become the HACCP Team Leader or Chairman. His responsibility centres on ensuring that the project plan is drawn up and objectives achieved within the agreed time scale.

Formation of HACCP Team. A critical action in the process of HACCP implementation is the formation of a HACCP team. The team may consist of four to six members (Table 4). Very large organization may have more than one HACCP team.

Training: For HACCP to be effective, the people responsible for it need to be competent. Hence, **training becomes the single most important element** in setting up a HACCP system. Training should provide the technical skills to implement HACCP, and help in changing attitude of people.

HACCP Team needs skills in hazard and risk assessment, drawing process flow diagram and

Table 4
HACCP Team Members and their Roles

Title	Role
Chairman	Convenes and chairs all meetings. Ensures the correct application of technique.
Technical Specialist	Provides the expertise in hazards associated with the product, and measures to prevent them.
Production Specialist	Constructs flow process chart. Screens recommended control measures.
Process Engineer	Provides a working knowledge of process equipment.
Additional Specialists	Internal: provides expertise in raw material purchases, packaging, distribution, warehousing and sales; and external.
Secretary	Provides an accurate written record of progress.

collating data onto control charts, knowledge of GMPs, skills to identify CCPs, problem solving techniques, to monitor implementation etc.

Senior management and other personnel need HACCP awareness training. It should include what HACCP is, why it is required, who will be involved, changes required, what CCPs are and are *not* negotiable, etc.

Phase 2: Determining HACCP System Scope: Once the HACCP team has been suitably trained, the scope of the HACCP system should be determined. This includes writing HACCP or food safety policy, and publishing scope and timescale for implementation.

Phase 3: Supplier Quality Assurance (SQA): This phase includes the following :

* Write and agree raw material specifications with suppliers.
* Identify and train SQA personnel.
* Set up SQA audit schedule and carry out agreed assessments.

Phase 4 : Prepare HACCP Plan: In this phase all the steps as described in the HACCP principles (item 4) are taken. HACCP analysis should always be specific to a product as manufactured in discrete production units. HACCP procedures can be presented in the form of HACCP charts (Table 5). When the system has been detailed out, has been put to function with the final step of verification procedures of the HACCP system working in operation, the system is at the stage of full implementation.

Phase 5 : Project Sign-off : Once the HACCP is in full operation, the project is completed. The system continues to be implemented. If properly and sincerely planned and executed, it would take about 5-6 months to implement Phase 1 to 4 successfully.

7. HACCP SYSTEM AND ISO 9002

HACCP is a Quality Assurance System (QAS) concerned with food safety management and ISO 9002 with quality management. Both have much in common. HACCP can be built into the ISO 9002 system. This will in fact help getting ISO 9002 accreditation faster.

GLOSSARY

Critical Control Point (CCP). A point, step or procedure where control can be applied and a food safety hazard can be prevented, eliminated, or reduced to acceptable levels.

Critical Limit. An absolute tolerance value which must be met for each control measure at a CCP. Values outside the Critical Limits indicate a deviation and potentially unsafe product.

Table 5
A Sample HACCP Control Chart

Process Step	CCP No.	Potential Hazard	Critical Control Point	Critical Limits	Monitoring Procedure	Monitoring Frequency	Corrective Action	Responsibility	Record
Pasteurization		Survival of pathogenic organisms	Pasteurization time and temperature	≥72°C ≥15	Check temp. setting and chart recorder	At the start and end of each batch	Attend to pasteurizer as required to fix any faults and reprocess milk as necessary Manager to decide on further action as necessary	Pasteurizer operator	Chart recorder
			Diversion Valve	Diversion at ≥72°C	Check that diversion valve is working	Before start of batch	- do -	Pasteurizer operator	Chart recorder
			Temperature calibration	Temp. device to be within ±0.5°C	Check temperature calibration	Every six months	Thermometer to be repaired or replaced and recalibrated before use.	Maintenance operator	Calibration record
		Microbiological contamination	Cleaning and sanitation	Refer to cleaning & sanitation procedures	Ensure that the pasteurizer and associated lines have been cleaned & sanitized	Before use	Reclean and sanitize as necessary	Pasteurizer operator	Cleaning and sanitation record

HACCP Plan. The document which defines the procedures to be followed to assure the control of product safety for a specific process.

Monitoring. A planned sequence of observations or measurements to assess whether a CCP is under control. Records of monitoring are kept for future use in verification.

Preventive Measure. A factor which can be used to control an identified hazard. Preventive measures will eliminate or reduce the hazard to an acceptable level.

Verification. The procedures (other than those used in monitoring) which ensure that the HACCP study has been carried out correctly and that the HACCP Plan continues to be effective.

SOME USEFUL REFERENCES

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