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SUSTAIN

WORKSHOP:
HACCP

NOVEMBER 30 - DECEMBER 1, 1994

GUATEMALA

S haring
U nited
S tates
T echnology to
A id in the
I mprovement of
N utrition

A U.S. Private Food Industry initiative
in collaboration with the U.S. Agency for International Development
through a Cooperative Agreement with the National Cooperative Business Association

Upgrading the Food Processing Industries in Developing Countries.

A

Why SUSTAIN?

SUSTAIN represents a successful collaborative effort between the U.S. food industry and the Agency for International Development (A.I.D.) to upgrade food processing in developing countries. It provides an excellent model for similar private-public sector joint ventures in health, agriculture and other areas of concern to developing countries.

Food processing is a major contributor to development. It serves multiple roles. Food processing can increase the available food supply by extending the life of perishable food products. It can improve the nutritional quality of the diet by making nutritious foods available the year round. It can lead to the growth of related enterprises in transportation, storage, distribution and marketing. And, it can produce much needed foreign exchange by creating value added products both for export and for internal substitution of imported processed foods.

The U.S. food industry has embraced the concept that freely sharing its expertise and knowledge is of mutual benefit to recipient and donor - to the recipient by improving current operations - to the donor by contributing to a healthier global future.

How SUSTAIN Works

A.I.D. missions and trade associations in developing countries publicize SUSTAIN's goals and activities. Executives of U.S. food companies with technical expertise and overall knowledge of the food industry serve as the SUSTAIN Steering Committee, providing guidance and overseeing activities.

Food related companies in developing countries submit their requests to SUSTAIN through the A.I.D. mission or a designated organization in their country. SUSTAIN screens all incoming requests and if necessary asks for additional information. Appropriate U.S. companies are then invited to respond.

Some problems can be readily resolved by providing information. Others require that consultants be sent. When a consultant is sent, the usual assignment is for one to three weeks. Upon completion of the assignment, the consultant prepares a report describing findings and making recommendations. Depending on need, some consultants may return for follow-up visits to ensure that recommendations have been appropriately implemented.

SUSTAIN Helps

Requests are diverse. Help may be needed to solve processing problems, to identify equipment needs and sources of new and used equipment, to train personnel in the use of new equipment and new technologies, to find new uses for indigenous commodities, to establish or improve quality assurance procedures, to control insects and rodents in food processing plants and to improve plant layouts and materials handling.

In the past, U.S. food companies, large and small, have provided technical assistance in the form of information, consultants and training to food processors in Africa, Asia, Latin American and the Caribbean.

SUSTAIN

WORKSHOP: Hazard Analysis Critical Control Point

Guatemala

November 28 - December 2, 1994

by

SUSTAIN Volunteers

Dr. Russell Flowers, President
Silliker Laboratories Group, Inc.

Dr. Damien Gabis, CEO
Silliker Laboratories Group, Inc.

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NCBA/SUSTAIN Project 111.052

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I. INTRODUCTION

A. SUSTAIN

Sharing U.S. Technology to Aid in the Improvement of Nutrition (SUSTAIN) provides access to U.S. expertise in food processing to help improve the nutritional quality, safety, and availability of food in developing countries. Technical assistance is provided by volunteer professionals from U.S. food companies, universities, and other organizations who donate their time and expertise. In 1991, the Office of Nutrition of U.S. Agency for International Development awarded the National Cooperative Business Association a $2 million, five-year cooperative agreement to work with SUSTAIN's volunteer leadership to improve, expand, and manage the program.

The assistance SUSTAIN volunteers provide contributes to improved health and nutrition through improved food quality, safety, and availability. In many countries, sufficient food is produced but populations are underserved because much of it goes to waste due to inefficient processing and storage. Improper food handling presents a hazard to human health, and improper waste disposal can contribute to environmental degradation. Providing technical assistance to strengthen food safety and quality helps prevent health and nutrition problems and helps small businesses compete in local, national, and regional markets.

B. Hazard Analysis Critical Control Point Workshop

The Hazard Analysis Critical Control Point (HACCP) Workshop was delivered by SUSTAIN Volunteers Dr. Russell Flowers, President, Silliker Laboratories Group, Inc. and Dr. Damien Gabis, CEO, Silliker Laboratories Group, Inc. in Guatemala on November 30 - December 1, 1994 at the Institute of Nutrition of Central America and Panama (INCAP). HACCP is a preventative means of assuring food safety.

The workshop was requested by INCAP and the Guatemalan Association of Food Technologists (AGTA) as follow-up to a presentation on HACCP that Dr. Gabis delivered in Guatemala at the Second National Congress of the Food Industry and Industrial Exposition sponsored by AGTA in April, 1994.

The workshop was hands-on and covered the importance, principles, and implementation of HACCP. Dr. Flowers and Dr. Gabis prepared a workshop manual specifically for this workshop (Appendix IV) and was distributed to the participants. In addition, a video on HACCP was also shown during the workshop.

Thirty-two food professionals from Central America participated in the workshop (Appendix VI). Participants of the workshop were subdivided into groups and developed HACCP plans for food products related to their companies products. Each group then gave a presentation of their HACCP plan to the rest of the participants (Appendix V). At the end of the workshop, participants evaluated the workshop using the forms attached in Appendix VII. The results were complied by Luis Alfredo Garcia, President, AGTA and a final evaluation was submitted (Appendix VII). Participants felt the workshop was very useful to them and that they use the knowledge gained to develop specific HACCP plans for their companies.

In addition to workshop training, Dr. Gabis visited local food companies to provide one-on-one technical assistance. When Dr. Gabis returned to U.S., he continued to provide technical information and advice to address the problems cited by companies during site visits and workshop.

HACCP is a system by which food processors identify food safety hazards in all stages of food production and develop a means to control or prevent these hazards. HACCP is becoming an increasingly important component U.S. food regulatory policies. The U.S. Food and Drug Administration (FDA) published a proposed HACCP regulation for the seafood industry. It is expected to become final by February 1995 and will become effective one year later. Both importers and processors will be required to have HACCP plans. The FDA is also planning HACCP regulations for other foods. The Food Safety and Inspection Service and the U.S. Department of Agriculture is looking into developing a mandatory HACCP program for the meat and poultry industries.

The globalization of trade has emphasized the need to address food safety, public health, and nutrition issues through direct assistance to small businesses. Regional and international trade agreements have opened Central American markets to unprecedented levels of competition. Many local food businesses are realizing that they must improve food quality and safety in order to stay in business. This workshop was an excellent opportunity for Central American food processors to learn about and develop HACCP plans.

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II. REPORT

SILLIKER LABORATORIES GROUP, INC.

900 Maple Road
Homewood, IL • 60430
(708) 957-7878 • FAX (708) 957-8449

FOOD SAFETY • QUALITY • NUTRITION

January 5, 1995

Ms. Liz Turner
Executive Director
SUSTAIN Program
National Cooperative Business Center
1401 New York Avenue N.W. Suite 1100
Washington, D.C. 20005-2160

Dear Liz:

This is my mission report for my food plant site visits and the HACCP course that Russ Flowers and I presented in Guatemala on November 30 - December 1, 1994. This report will encompass the report for both my visit and Dr. Flowers visit. Ms. Vishaili Patel of the SUSTAIN office in Washington, D.C. attended this mission. The hosts from INCAP (Dr. Elias) and AGTA (Luis Garcia and Maynor Ordonnez of Kerns, Javier Fernandez of OSMOSIS, and Clark McDonald of FRUTESA) were very hospitable and gracious to me, Russ and Vaishali. All in all, I think the mission went very well.

1. **Itinerary of SUSTAIN mission:** The airline schedules for Drs. Flowers and myself are attached. I arrived in Guatemala City on November 27, 1994 and departed on December 3, 1994. Russ Flowers arrived on November 29, 1994 and departed on December 2, 1994. Russ Flowers and I presented the HACCP short course. I visited local food plants on Monday, November 28 and Tuesday, November 29. On Tuesday evening, November 29, Vishaili Patel, Russ Flowers and I attended the GREMIAL Agricultural Exposition at the Dorado Hotel with Mr. Clark McDonald, former president of AGTA. On Wednesday evening, December 1, Vishaili Patel, Russ Flowers and I met with Dr. Elias and Mr.Luis Alfredo Garcia, president of AGTA, to discuss planning and organization for future short courses. On Friday morning, December 2, Vishaili Patel and I met with Dr. Luis Elias and his associates at INCAP to discuss INCAP's role in the devlopment and offering of short courses to the Central American food industry. In the afternoon of Friday, we met with Mr. Grant Pettrie, the US agricultural attache, in order to become acquainted, to understand his role in Guatemala and to begin a discussion on how SUSTAIN and Grant's office might work together in the future.

2. **Brief summary of the purpose of the mission:** One purpose of the mission was to present a short course on the Hazard Analysis Critical Control Point (HACCP) system for food safety to technical managers working in the Central American food industry. The second objective of the mission was to visit several Guatemalan food processing

ILLINOIS • CALIFORNIA • NEW JERSEY • ONTARIO • PENNSYLVANIA

OHIO • GEORGIA • TEXAS • WISCONSIN

companies in order to provide (at no charge) consultation on micirobiological safety and quality of foods. The third objective of the visit was to meet with the host organizations, INCAP and AGTA, to plan for the future of the short course program.

3. **Recommendations for follow-up:** My primary recommendation for follow-up is to continue to offer short courses, in cooperation with INCAP and AGTA, in the areas of food science and technology to the Central American food industry. These short courses should be planned for developed based on the needs identified by the local hosts. Opportunities for interaction between SUSTAIN and the local food industry should be developed and nurtured. Opportunites to obtain funding from other US agencies and organizations should investigated in order to provide continuity and increase the course offerings that could be made.

4. **Site visits:** Visits were made to Foremost Dairies, Sabor (a commissary for a restaurant chain), and a ready-to-eat meat (embutidos) processing plant. I toured the facilities and made observations regarding microbiological safety and quality issues; then discussed them with the quality control managers at each plant. Recommendations for changes in processes, procedures, etc. were made as I felt appropriate at the time. In the case of Foremost, I prepared a confidential written report with specific observations and recommendations. I was to have obtained the names and titles of the people I spoke with from the HACCP course roster, but as of this date I have not received the roster from the local hosts.

5. **HACCP short course materials:** The HACCP short course materials are enclosed. SUSTAIN already has the promotional materials obtained from the host organization, and lastly, a list of the participants should be forothcoming from the local host organizations.

6. **Photos:** Billy Estrada of INCAP took photos of the short course and he has sent copies of them to the SUSTAIN office.

Liz, please feel free to call me if you want to talk about this report.

Sincerely yours,

Damien

Damien A.Gabis

cc: Russ Flowers
Enclosure: Trip expense report
HACCP Course materials

APPENDIX I

SUSTAIN Description

SUSTAIN provides access to U.S. business and scientific expertise to improve the quality, safety, and availability of food in developing countries. Technical assistance and training are provided by senior executives and technical specialists from U.S. food companies, universities, and professional associations who donate their time and expertise.

Many benefits can accrue to developing countries through improvements in food processing and preservation. These technologies can help meet food and nutritional requirements and reduce post-harvest losses. Improved processing can reduce food-borne illness, malnutrition, and micronutrient deficiencies that are devastating to children and other vulnerable populations. Strengthening food businesses helps reduce poverty by providing a means for enhancing job and economic growth in poor urban and rural communities. And the transfer of efficient technologies and management practices in waste handling, utilization, and reduction promotes environmental protection.

Through technical assistance and training, SUSTAIN volunteers help build the capacity of food businesses and local organizations in food manufacturing, management, and problem-solving. Areas of assistance include: food processing, preservation, and storage; food safety and quality assurance; fortification; packaging; marketing; waste handling; and business development and management.

How SUSTAIN Works

SUSTAIN conducts its activities in collaboration with USAID missions and local organizations. It receives support from the Food Technology and Enterprise Project of USAID's Office of Health & Nutrition in the Global Bureau (G/PHN/HN). SUSTAIN also receives support from the U.S. Department of Agriculture and cash and in-kind contributions from corporations and individuals. SUSTAIN receives advice from a Steering Committee made up of private sector representatives and is managed under a cooperative agreement with the National Cooperative Business Association (NCBA, known overseas as CLUSA).

SUSTAIN receives requests for assistance from individual food companies, research institutions, and business organizations in developing countries. Depending upon the nature of the request, SUSTAIN volunteers may be sent to conduct one-on-one technical assistance and workshops or participate in assessment missions. Overseas projects are typically one to three weeks in duration. Through repeat visits of volunteers on particular projects, SUSTAIN is able to provide continuity and on-going problem-solving expertise. SUSTAIN is also able to address many problems through correspondence by providing information that exists either in technical literature or in the "memory" of a company.

SUSTAIN covers international travel costs. Companies or host organizations requesting SUSTAIN assistance are asked to contribute towards in-country expenses. Priority is given to requests that can demonstrate an ability to improve the nutritional quality, safety, and availability of food in the local community. SUSTAIN does not fund product or equipment acquisitions.

SUSTAIN publishes a quarterly newsletter (*SUSTAIN Notes*) on food technology issues. It is provided gratis to over 2000 recipients in more than 50 countries. For more information, contact:

SUSTAIN
1401 New York Avenue, NW; Suite 1100
Washington, DC 20005-2160
Phone: (202) 638-6222, Fax: (202) 628-6726

APPENDIX II

Biographies of SUSTAIN Volunteers

RUSSELL S. FLOWERS, Ph.D. (Food Science-Microbiology, University of Illinois) is President of Silliker Laboratories Group, Inc. and a leading researcher, lecturer, and writer on the development of rapid methods for the detection of foodborne pathogens. Prior to joining Silliker Laboratories in 1979, he served as an Assistant Professor of Microbiology at the University of Arizona. Dr. Flowers has authored or co-authored over 40 scientific refereed research articles, presented over 100 seminars and scientific presentations to professional associations, and participated in a number of collaborative studies. Dr. Flowers is a member of the Association of Official Analytical Chemists' (AOAC) Committee on Microbiology and Extraneous Materials and is an Associate Referee for the same group. In addition, he is a member of the American Public Health Association, the American Society for Microbiology, the Council for Agricultural Science and Technology Task Force, the Institute of Food Technologists, the Society for Industrial Microbiology, and the International Association of Milk, Food and Environmental Sanitarians.

DAMIEN A. GABIS, Ph.D. (Food Science-Microbiology, North Carolina State University, 1970) is the Chief Executive Officer for Silliker Laboratories Group, Inc. His areas of expertise include microbiology, management of laboratories, Hazard Analysis of Critical Control Points (HACCP), and dairy processing. Previously, he was Adjunct Associate Professor of Biology at the Illinois Institute of Technology and a bacteriologist with the Steubenville, Ohio Board of Health. Dr. Gabis has published and lectured widely in the areas of microbiology, food safety, and HACCP. He has served as the President of The International Association of Milk, Food, and Environmental Sanitarians and is active with various professional organizations including the Association of Official Analytical Chemists, American Public Health Association, American Society for Microbiology, and the Institute of Food Technologists. He is a member of SUSTAIN's Steering Committee and Training Methodologies Sub-committee. As a SUSTAIN volunteer, he traveled to Nepal in December 1992 to assess the feasibility of starting a private food testing laboratory and delivered a presentation on HACCP at the Second National Congress of the Food Industry and Industrial Exposition held in Guatemala in April 1994.

APPENDIX III

Workshop Promotion

WORKSHOP ON PRACTICAL HAZARD ANALYSIS CRITICAL CONTROL POINTS (HACCP) FOR FOOD PROCESSORS

Schedule

- November 30 and December 1, 1994

Location

- The Institute of Nutrition of Central America and Panama (INCAP), Guatemala City

Who should attend

- Plant managers
- Quality assurance and quality control personnel
- Anyone responsible for developing and implementing a HACCP program

Workshop overview

A two-day, interactive workshop designed for individuals responsible for developing and implementing a HACCP plan in a food company. This workshop includes an elementary overview of microorganisms of concern to food processors, but focuses on defining microbial hazards and identifying Critical Control Points. Important processing operations and their microbiological implications on finished product will be discussed. In addition, through moderated group "break out" sessions, participants will develop HACCP plans for their specific product types.

The workshop is hosted by SUSTAIN (*Sharing U.S. Technology to Aid in the Improvement of Nutrition*), the Guatemalan Association of Food Technologists (AGTA), and INCAP.

Workshop instructors

The workshop will be taught by two experts on HACCP and food safety -- Dr. Damien Gabis, CEO, Silliker Laboratories Group, Inc. and Dr. Russell Flowers, President, Silliker Laboratories Group, Inc. Dr. Gabis and Dr. Flowers serve as SUSTAIN volunteers.

For registration information contact:

- SUSTAIN, Tel: 202-638-6222, Fax: 202-628-6726
- OSMOSIS, Tel: 502-2-335335; Fax: 502-2-335336

AGTA

La Asociación Guatemalteca de Tecnólogos en Alimentos
AGTA

Guatemala, 13 de Octubre de 1994

Futuro Participante:

La introducción de una amplia cantidad de ingredientes, de nuevas técnicas de procesamiento y de nuevos materiales de empaque en los ultimos 20 años, ha conformado un reto para la seguridad del producto alimenticio. Para lo cual un excelente sistema para disminuir al mínimo los posibles riesgos de contaminación del mismo, es el de **Análisis de Riesgos y Puntos Críticos de Control (HACCP).**

Debido a la importancia de este tema, la Asociación Guatemalteca de Tecnólogos en Alimentos (**AGTA**) y el Instituto de Nutrición de Centro América y Panamá (INCAP), con el apoyo del Proyecto SUSTAIN han invitado a nuestro ciclo de conferencias al **Dr.Damien Gabis** (CEO, Siliker Labs, USA).

Los temas a exponer durante dos días serán los siguientes: Importancia de los microorganismos en los procesos alimenticios (factores que influyen en su sobrevivencia y como controlarlos), los siete elementos críticos de los sistemas de **HACCP**, definición de los peligros microbianos e identificación de los puntos criticos de control en las diferentes operaciones de procesamiento.

Debe mencionarse que se realizará el último día un taller donde los participantes desarrollarán sus planes de **HACCP**, según el proceso de su interés. Además el conferencista realizará visitas a empresas escogidas entre las inscritas los días 28 y 29 de noviembre previa reservación.

LUGAR: Auditorium INCAP (Calz. Roosevelt, z. 11)

FECHAS: 30 de noviembre y 1 de diciembre de 1994

HORARIO: de 8:00 a.m a 5:00 p.m

INVERSION:
Q. 550.00 Socios a AGTA
Q. 600.00 Empresas Asociadas a AGTA
Q. 650.00 No Socios
Q. 500.00 Estudiantes
$. 125.00 Extranjeros
(Incluye Almuerzos, Coffee Breaks, Material y Diploma)

Para mayor información e incripción comunicarse a: OSMOSIS: 19 calle 12-52 z. 10. tels: 335335 y 681493, fax: 335336. **CUPO LIMITADO**

Sin otro particular y esperando contar con ustedes, me despido

Muy atentamente,

Lic. Luis Alfredo García Vela
Presidente AGTA

SUSTAIN
El Proyecto SUSTAIN

BEST AVAILABLE COPY

ASOCIACION GUATEMALTECA DE TECNOLOGOS EN ALIMENTOS

GUATEMALAN ASSOCIATION OF FOOD TECHNOLOGISTS

AGTA

SEMINARIO "ANALISIS DE RIESGOS Y PUNTOS CRITICOS DE CONTROL (HACCP)"
(30 NOVIEMBRE Y 1 DE DICIEMBRE DE 1994)

BOLETA DE INSCRIPCION

Nombre(s) Participante(s): _____

Nombre de empresa: _____

Puesto que desempeña: _____

Naturaleza de la empresa: _____

Dirección: _____

Teléfono(s): _____ Fax: _____

Facturar a nombre de: _____

Nit.: _____ Dirección: _____
Nombre que desea que aparezca en su Diploma; _____

Categoría: (Marque una x)		Cantidad a cancelar
_____	Socio Profesional AGTA	Q. 550.00
_____	Socio Estudiante	Q. 500.00
_____	Empresa Asociada	Q. 600.00
_____	No Socio	Q. 650.00
_____	Extranjeros	$ 125.00

TOTAL A CANCELAR Q. _____
(Incluye almuerzos, coffee breaks, material y diploma)

_____
Firma del participante

Favor de emitir cheques a nombre de: AGTA.
Enviar a OSMOSIS: 19 Calle 12-52 zona 10 Tels.: 33-5335, 68-1493 Fax: 33-5336

PARA USO EXCLUSIVO DE AGTA Categoría: _____ Costo: _____

Forma de pago: Efectivo: _____ Cheque: _____

No. de Cheque: _____ Nombre del Banco: _____

M

_____
Vo.Bo. Firma Agta

BEST AVAILABLE COPY

APPENDIX IV

Workshop Manual

PRACTICAL HACCP FOR FOOD PROCESSORS

November 30 - December 1, 1994

GUATEMALA CITY

Developed and Presented By:

SILLIKER LABORATORIES

FOOD SAFETY • QUALITY • NUTRITION

In Collaboration With:

- **Project SUSTAIN**
- **The Guatemalan Association of Food Technologists**
- **Institute of Nutrition of Central America and Panama**

N

COURSE INSTRUCTORS

DAMIEN A. GABIS, Ph.D.

Silliker Laboratories Group, Inc.

Dr. Gabis is Chief Executive Officer of Silliker Laboratories Group, Inc. and a highly respected consultant to the food and its allied industries. Dr. Gabis has written and lectured extensively on the microbiological safety of food and is highly regarded within the industry for his work on *Salmonella* methodology and microbiological environmental sampling procedures.

Dr. Gabis received his Ph.D. in food science from North Carolina State University and has authored or co-authored over 30 scientific refereed research articles. He has participated in the preparation of all three editions of the Compendium of Methods for Microbiological Examination of Foods as an author and chapter chairperson. Currently, he serves on its editorial board.

Dr. Gabis is a two-term member of the National Advisory Committee for Microbiological Criteria for Foods, and is a past-president of the International Association of Milk, Food and Environmental Sanitarians (IAMFES). He is a member of the American Academy of Microbiology, the American Society for Microbiology, the Institute of Food Technologists, and the American Management Association. He has been a SUSTAIN volunteer since 1992.

COURSE INSTRUCTORS

RUSSELL S. FLOWERS, Ph.D.

Silliker Laboratories Group, Inc.

Dr. Russell S. Flowers is president of Silliker Laboratories Group, Inc. and a leading researcher, lecturer, and writer on the development of rapid methods for the detection of foodborne pathogens.

Dr. Flowers received his Ph.D. in food science and microbiology from the University of Illinois and joined the Silliker organization in 1979. Prior to joining Silliker Laboratories, he served as an Assistant Professor of Microbiology at the University of Arizona. Dr. Flowers has authored or co-authored over 40 scientific refereed research articles, presented over 100 seminars and scientific presentations to professional associations, and participated in a number of collaborative studies.

Dr. Flowers is a member of the Association of Official Analytical Chemists' (AOAC) Committee on Microbiology and Extraneous Materials and an Associate Referee for the same group. In addition, he is a member of the American Public Health Association, the American Society for Microbiology, the Council for Agricultural Science and Technology Task Force, the Institute of Food Technologists, the Society for Industrial Microbiology, and the International Association of Milk, Food and Environmental Sanitarians.

PRACTICAL HAZARD ANALYSIS CRITICAL CONTROL POINTS (HACCP) FOR FOOD PROCESSORS
November 30-December 1, 1994
Guatemala City

Day One - Wednesday November 30, 1994

8:00 a.m. - 9:00 a.m. **Registration and Continental Breakfast**

- Receive course materials.
- Meet other participants and course instructors.
- Introduction to the course.
- HACCP Logic Sequence.

9:00 a.m. - 10:00 a.m. **Session I: Introduction to Microorganisms of Concern to the Food Industry**

- Discussion of the types of microorganisms affecting quality found in foods and environments.
- Explanation of how these organisms survive and grow in food products.
- Introduction to the physical (temperature, moisture, activity) and chemical (acids, gases, salts, O/R potential) used to control microorganisms in foods.

10:00 a.m. - 10:15 a.m. **Break**

10:15 a.m. - 11:00 a.m. **Session II: Microbial Ecology of Food Plants**

- Sources of microorganisms.
- Control of microorganisms in dry environments.
- Control of microorganisms in high moisture environments.

11:00 a.m. - Noon **Session III: Importance of Cleaning and Sanitizing in Control of Microorganisms**

- Plant and equipment design.
- Principles of cleaning.
- Principles of sanitation.

12:00 p.m. - 1:30 p.m. **Lunch**

1:30 p.m.. - 2:00 p.m. **Session IV: Introduction to HACCP**

- The foundations of HACCP.
- Importance of HACCP to the food industry.
- The seven principles of HACCP.

2:00 p.m. - 3:30 p.m. **Session V: Definition and Identification of Hazards**

- Identification of hazards through analyses of epidemiological evidence and technical information

3:30 p.m. - 3:45 p.m. **Break**

3:45 p.m. - 5:00 p.m. **Session VI: Definition and Identification of Critical Control Points (CCPs)**

- Definition of a Critical Control Point.
- Explanation of principles governing the determination of CCPs.
- Monitoring of CCPs.

5:00 p.m. - 7:00 p.m. **Informal Evening Reception**

- Participants will have the opportunity to interact with other industry representatives and the Silliker professionals that they will be working with the following day in the small break-out sessions. The work groups will be formed and HACCP plan work packets will be distributed.

Day Two - Thursday December 1, 1994

8:00 a.m. - 9:00 a.m. **Session VII: Class Workshop: Construction of a HACCP Plan for One Specific Process**

- Participants will use the knowledge that they have to assist the course instructors with the construction of a HACCP plan identifying all and CCPs for one specific process.

R

9:00 a.m. - 12:00 p.m.	**Session VIII: Participant Break-Out Session: Construction of a HACCP Plan**

- Participants will work together in small teams guided by Silliker professionals to build HACCP Plans for specific food processes.

12:00 p.m. - 1:30 p.m.	**Lunch**
1:30 p.m. - 3:00 p.m.	**Session IX: Presentation of Participant Designed HACCP Plans**

- Course instructors and class participants will present their HACCP plans to the class and each will be examined for accuracy and applicability.

3:00 p.m. - 3:15 p.m.	**Break**
3:15 p.m. - 4:00 p.m.	**Session X: HACCP Team Assembly**

- Selection of the HACCP team.
- Development of the program by the HACCP team.
- Identification of training needs.

4:00 p.m. - 5:00 p.m.	**Session XI: Maintenance of the HACCP Plan**

- Selection of verification systems for the HACCP plan.
- Ongoing HACCP maintenance requirements.

SESSION ONE

Introduction to Microorganisms and Concerns in Food Processing Environments

OBJECTIVES

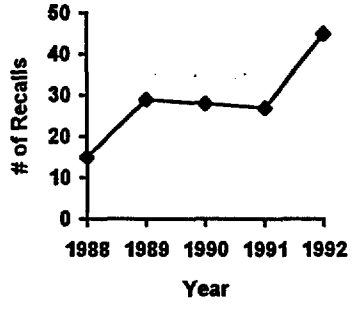
1. Define the primary reasons for cleaning and sanitizing.
2. Review the nature of microorganisms.
3. Identify microbial hazards in food processing.
4. Indicate why control of these hazards through sanitation efforts is important.

I. Reasons for Cleaning and Sanitizing

A. Moral

B. Economic

1. Product recalls due to *Listeria monocytogenes* contamination 1988-1992.



From Food Industry Report/Vol. 5/No.12/June 28, 1993 (corrected)

2. Estimated annual costs for selected foodborne pathogens, 1992.

Bacterial Pathogen	Approximate # Cases	# Deaths	Annual Medical & Productivity Costs Dollars million
Salmonella	1,920,900	1,920	1,588-1,188
Campylobacter jejuni or coli	2,100,000	360	907 - 1,016
Escherichia coli O157:H7	7,668 - 20,448	389	229 - 610
Listeria monocytogenes	1,526 - 1,581	433	209-233

Adapted from Federal Register / Vol. 58, No. 212 / November 4, 1993

C. Religious

D. Legal

1. Definition of adulteration.

a) 402 (a) (3) "manufactured under such conditions that it is unfit for food"

b) 402 (a) (4) "prepared packed or held under unsanitary conditions where by it may have become contaminated with filth, or whereby it may have been rendered injurious to health

2. Umbrella GMP, sanitation of equipment and utensils (FDA, 1969).

a) All equipment and contact surfaces shall be cleaned *as frequently as necessary*.
b) Where equipment and utensils are used in a continuous production operation, the contact surfaces shall be cleaned and sanitized on a predetermined schedule using *adequate methods* for cleaning and sanitizing.
c) Sanitizing agents shall *be effective and safe* under conditions of use.
d) Any facility, procedure, machine or device may be acceptable for cleaning or sanitizing equipment and utensils if it is established that such facility, procedure, machine or device will routinely *render equipment and utensils clean and provide adequate sanitizing treatment*.

E. Hazard Analysis Critical Control Points (HACCP)

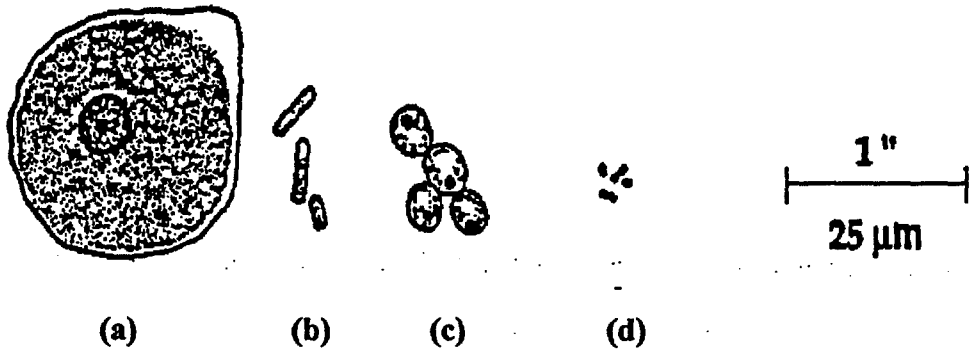
Principles of HACCP

1. Hazard Analysis
2. Identification of Critical Control Points
3. Establishment of Limits at Critical Control Points
4. Monitoring
5. Corrective Action
6. Record Keeping
7. Verification

II. Identification of Microbial Hazards

Size relationships among some microorganisms (magnified 1,000x).

(a) An amoeba; (b) a large bacterium; (c) yeast; (d) a small bacterium.



A. Bacteria: Unicellular organisms which multiply by binary fission, most diversified group of microorganisms of importance in foods.

Microscopic forms of bacteria.

(a) Cocci; (b) Rod; (c) Spirillium

1. **Spoilage agents**

2. **Disease agents**

   a. **Infections: Normally caused by ingesting viable (living) bacteria.**

      1. ***E. coli* O157:H7 Outbreaks 1992-1993.**

Food Type	Location of Outbreak	# Cases/ Deaths
Hamburger	Washington	477/3
No source identified	Idaho	14
No source identified	San Diego, CA	34/1
No source identified	Ellensberg, WA	5
Ground beef products	Vancouver, WA	3
Hamburger	Corvallis, OR	5
Cantaloupe	Corvallis, OR	11
Ground Beef	Mendocino, CA	4
No source identified	Maine	12/1
No source identified	Indiana	unknown/1
No source identified	Chicago	unknown/1
No source identified	Michigan	4/1
Raw milk	Oregon	8
Raw milk	Oregon	5
No source identified	Texas	8/2

   b. **Intoxications:** **The result of ingesting a toxin that is performed in the food sample.**

3. **Food production**

B. Yeasts: **Unicellular organisms which exhibit both sexual and asexual reproduction.**

1. Spoilage agents

a. Approximate pH range of selected foods.

Food	pH Range	Food	pH Range
Egg white	7.6 - 9.5	Cabbage	5.2 - 6.3
Shrimp	6.8 - 8.2	Turnip	5.2 - 5.6
Crab	6.8 - 8.0	Spinach	5.1 - 6.8
Scallops	6.8 - 7.1	Asparagus	5.0 - 6.1
Cod, small	6.7 - 7.1	Cheeses, most	5.0 - 6.1
Cod, large	6.5 - 6.9	Camembert	6.1 - 7.0
Catfish	6.6 - 7.0	Cottage	4.1 - 5.4
Soda crackers	6.3 - 6.8	Gouda	4.7
Maple syrup	6.5 - 7.0	Bread	5.0 - 6.0
Milk	6.3 - 6.8	Carrots	4.9 - 6.3
Brussels sprouts	6.3 - 6.6	Beets	4.9 - 5.8
Whiting	6.2 - 7.1	Bananas	4.5 - 5.2
Haddock	6.2 - 6.5	Dry sausages	4.4 - 5.6
Cantaloupe	6.2 - 6.4	Pimentos	4.3 - 5.2
Dates	6.1 - 6.6	Tomato juice	3.9 - 4.7
Butter	6.0 - 6.8	Mayonnaise	3.8 - 4.0
Honey	6.0 - 6.5	Tomatoes	3.7 - 4.9
Mushrooms	6.0 - 6.7	Jams	3.5 - 4.4
Cauliflower	6.0 - 6.4	Apricots	3.5 - 4.0
Lettuce	6.0 - 6.4	Apple sauce	3.4 - 3.5
Egg yolk	6.0 - 6.3	Pears	3.4 - 4.7
Corn, sweet	5.9 - 6.5	Grapes	3.3 - 4.5
Oysters	5.9 - 6.6	Cherries	3.2 - 4.7
Celery	5.7 - 6.0	Pineapple	3.2 - 4.1
Peas	5.6 - 6.8	Peaches	3.1 - 4.2
Turkey	5.6 - 6.0	Rhubarb	3.1 - 3.2
Chicken	5.5 - 6.4	Strawberries	3.0 - 4.2
Halibut	5.5 - 5.8	Grapefruit	2.9 - 4.0
Beans, lima	5.4 - 6.5	Raspberries	2.9 - 3.7
Potatoes	5.4 - 6.3	Apples	2.9 - 3.5
Walnuts	5.4 - 5.5	Plums	2.8 - 4.6
Pork	5.3 - 6.4	Oranges	2.8 - 4.0
Beef	5.3 - 6.2	Cranberries	2.5 - 2.8
Onions	5.3 - 5.8	Lemons	2.2 - 2.4
Sweet potatoes	5.3 - 5.6	Limes	1.8 - 2.0

b. Water activity.

Water Activity	Foods
1.00 - 0.95	Fresh meat, fruit, vegetables, canned fruit in syrup, canned vegetables in brine, frankfurters, liver sausage, margarine, butter, low-salt bacon
0.95 - 0.90	Processed cheese, bakery goods, high-moisture prunes, raw ham, dry sausage, high-salt bacon, orange juice concentrate
0.90 - 0.80	Aged cheddar cheese, sweetened condensed milk, Hungarian salami, jams, candied peel, margarine
0.80 - 0.70	Molasses, soft dried figs, heavily salted fish
0.70 - 0.60	Parmesan cheese, dried fruit, corn syrup, licorice
0.60 - 0.50	Chocolate, confectionery, honey, noodles
0.40	Dried egg, cocoa
0.30	Dried potato flakes, potato crisps, crackers, cake mixes, pecan halves
0.20	Dried milk, dried vegetables, chopped walnuts

Troller, J.A., Christian, J.H.B., *Water Activity and Food,* Food Science and Technology, Academic Press 1978

c. Product recalls due to yeast contamination, 1992-1993.

Product Type	Number of Units Involved in Recalls
Dressings and condiments	3,736 cases (12-12oz. bottles/case)
Iced tea	21,037 cases (consisting of gallons, 1/2 gallons and pints)
Iced tea (different manufacturer)	61, 766 cases (consisting of 6-, 12- and 24 pack cans, 12 oz. glass bottles and 2L plastic bottles)
Salad dressing	4,135 cases (12 bottles/case)
Fruit punch	1,525 cases (16 oz. bottles)
Apple juice	2,850 cases (8-16oz. bottles/case)
Strawberry drink	921 cases (8-64 oz. bottles/case)
Punch	2,538 cases (27 boxes/case)
Syrup	165,984 cases
Mayonnaise and salad dressing	1,889 cases
Pizza and Spaghetti sauce	1,125 cans
Salad dressing	13,667 cases (6 - 12 bottles/case)
Fruit Juice Blend	40,000 Cases (24 - 8.45 oz. boxes/case)
Fruit punch	1,525 cases
Fruit flavored wine beverage	6,310 cases
Salad dressing	unknown
Grape	1,552 cases
Fruit Punch	78,000 cans
Apple juice	27,95 cases (8.45 fl.oz. tetra packs)

2. Disease agents

3. Food production

C. Molds: **Multicellular organisms which exhibit both sexual and asexual reproduction.**

1. Spoilage agents

a. Product recalls due to mold contamination, 1992-1993.

Product Type	Number of Units Involved in Recall
Blueberry muffins	1,000 cases
Dressings and condiments	3,736 cases
Margarine blend	unknown
Garlic spread	11,176 cases (12 jars/case)
Bottled spring water	2,095 cases (12/1.5L bottles/case)
Salmon jerky	22 containers
Bottled spring water	1,296 cases (24 -16 oz. bottles/case)
Iced tea	21,037 cases
Fruit blend drinks	361,944 - 64 oz. bottles
Fruit juice	24,681 cases
Shredded monterey jack cheese	30 cases
Pizza, spaghetti sauce	1,125 cans
Fudge topping	4,649 cases
Fruit drink	1,250 cases
Grated parmesan cheese	11,232 - 8 oz. containers
Tomato juice	587 cases
Cup cakes	unknown

2. Disease agents

Summary of selected potentially toxic molds from various food commodities

Commodity	Potentially toxic genera/species found		Potential mycotoxins
Wheat, flour, bread, corn meal, popcorn	*Aspergillus* *flavus* *ochraceus* *versicolor* *Fusarium* *species*	*Penicillium* *citrinum* *citreo-viride* *cyclopium* *martensii* *pasitans* *puberulum*	Aflatoxins, ochratoxin A, sterigmatocystin, patulin, penicillic acid, deoxynivalenol, zearalenone
Peanut, in-shell pecans	*Aspergillus* *flavus* *parasiticus* *ochraceus* *versicolor* *Fusarium* *species*	*Penicillium* *cyclopium* *expansum* *citrinum*	Aflatoxins, ochratoxin A, patulin, sterigmatocystin, trichothecenes, cytochalasins, cosporein
Meat pies, cooked meats, cocoa powder, hops, cheese	*Aspergillus* *flavus*	*Penicillium* *viridicatum* *roqueforti* *patulum* *commune*	Aflatoxins ochratoxin A, patulin, penicillic acid
Aged salami and sausage country cured ham, moldy meats, cheese	*Aspergillus* *flavus*	*Penicillium* *viridicatum* *cyclopium*	Aflatoxins ochratoxin A, patulin, penicillic acid
Black and red pepper, macaroni	*Aspergillus* *flavus* *ochraceus*	*Penicillium* *species*	Aflatoxins, ochratoxin A,
Dry beans, soybeans, corn sorghum, barley	*Aspergillus* *flavus* *ochraceus* *versicolor* *Fusarium* *species*	*Penicillium* *cyclopium* *viridicatum* *citrinum* *expansum* *islandicum* *urticae*	Aflatoxins, ochratoxin A, sterigmatocystin, patulin, penicillic acid, citrinin, griseofulvin, alternariol, altenuene
Refrigerated and frozen pastries	*Aspergillus* *flavus* *versicolor*	*Penicillium* *cyclopium* *citrinum* *martensii* *olivino-viride* *palitans* *puberulum* *roqueforti* *urticae* *viridicatum*	Aflatoxins, ochratoxin A, sterigmatocystin, patulin, penicillic acid, citrinin, penitrem,
Moldy supermarket foods	*Aspergillus* species *Fusarium* *oxysporum* *solani*	*Penicillium* *cyclopium*	Penicillic acid, trichothecenes, aflatoxins possibly other *Aspergillus* and *Penicillium* toxins
Foods stored in homes- both refrigerated and nonrefrigerated	Penicillium species	Aspergillus species	Aflatoxins, kojic acid, ochratoxin A, penitrem, patulin penicillic acid
Apples and apple products			Patulin

3. Food production

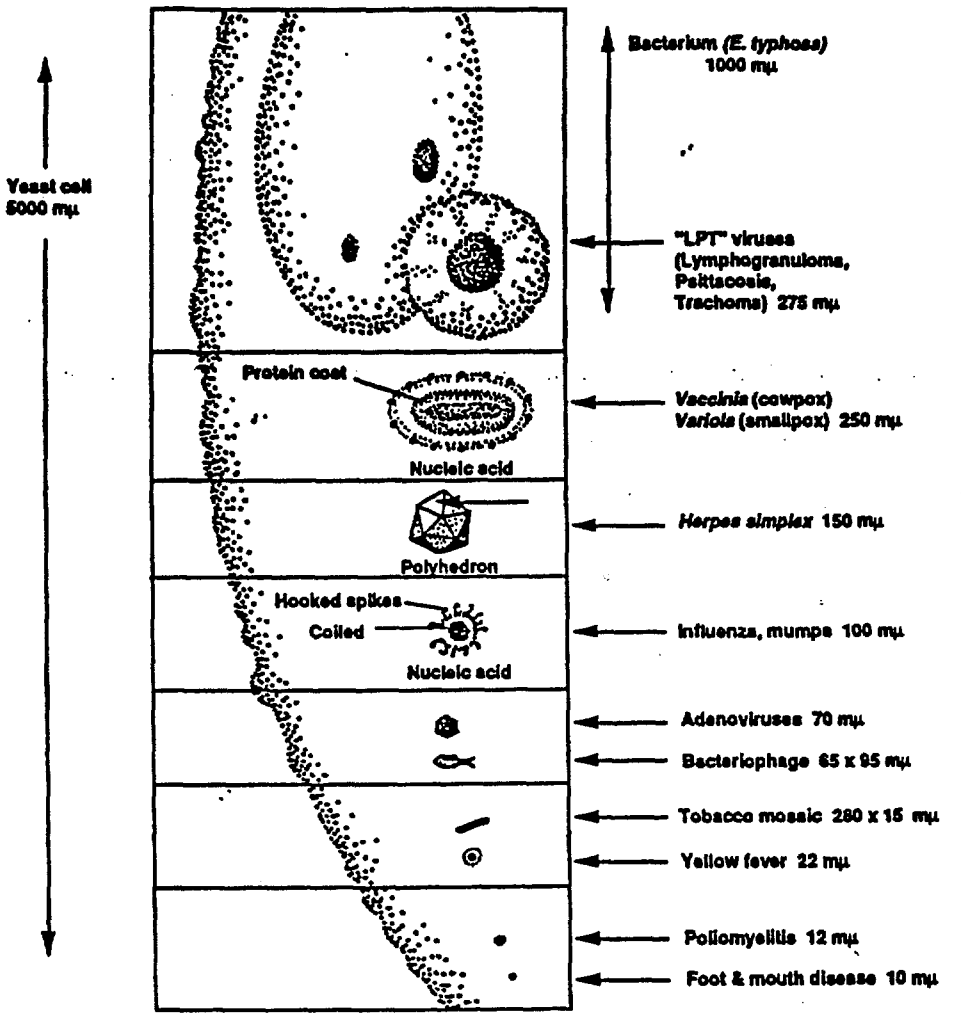
D. Algae: **Any of a large group of mostly aquatic organisms that contain chlorophyll and other pigments and can carry out photosynthesis, but lack true roots, stems, or leaves. May be single cells, or multicellular.**

1. **Responsible for PSP and Aguotoxin disease**

2. **Not spoilage agent**

E. Viruses: **Obligate intracellular parasites which do not multiply, but are produced by a host cell.**

Comparative sizes.



III. Summary of the Importance of Microorganisms in Foods

Though six groups of microorganisms have been designated as significant in food, only bacteria, yeasts, and molds multiply in foods.

When multiplication is extensive, the character of the food is changed, usually in an undesirable way, and this we recognize as spoilage.

With viruses, rickettsia, chlamydia, and parasites, the food serves as a vehicle for disease transmission, but overt changes in the food do not occur. In effect, these organisms simply "ride on the food's back."

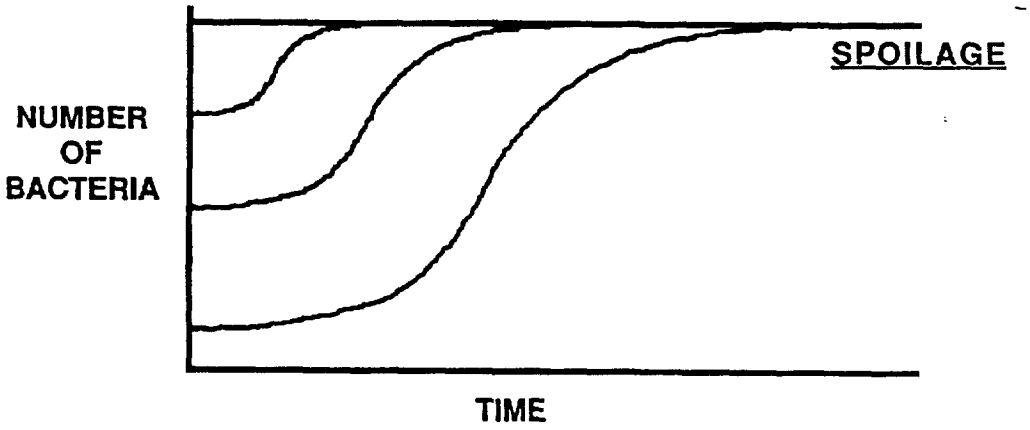
The food microbiologist is primarily concerned with a multitude of food environments in which bacteria, yeasts, and molds are the microorganisms of concern.

IV. Growth of Microorganisms in Foods

A. Requirement for microbial growth

- Microorganisms
- Water
- Nutrients
- Time
- Temperature

Microbial spoilage effect of initial levels and shelf-life



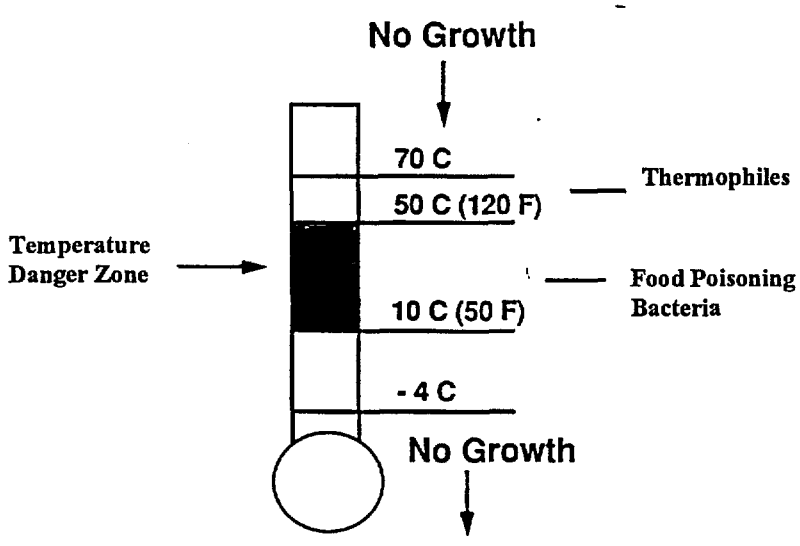
V. Factors Used to Control Microorganisms in Foods

A. Physical and chemical factors affecting microbial growth and survival

- Temperature
- Moisture/water activity
- Atmosphere
  - Aerobic
  - Anaerobic
  - Relative humidity
- Chemicals
  - Acidity/Alkalinity
  - Sanitizers
  - Preservatives (salt)

B. Physical agents to control microorganisms in foods

1. Low temperature

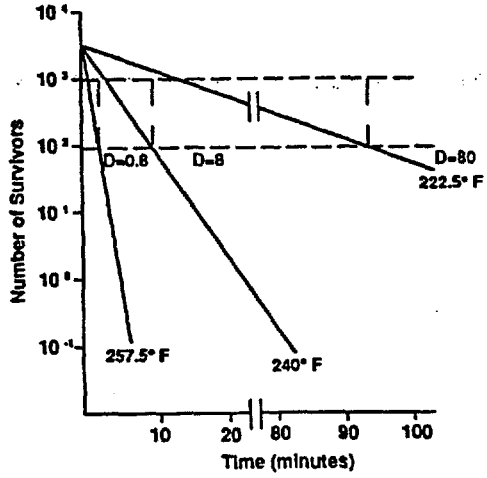


a. **Refrigeration**

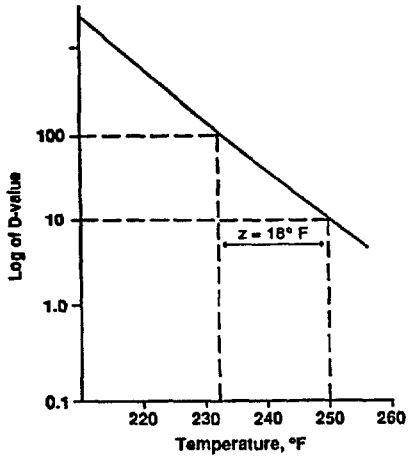
b. **Freezing**

2. **Elevated temperature**

Effect of temperature on D-value with initial population constant



Thermal death time plot



a. Pasteurization

Examples of pasteurization of foods

Food	Pasteurization Schedule	Target Organism
Milk	62.8° C (145° F) for 30 min. 72° C (161.5° F) for 15 sec.	Q - fever rickettsiae
Egg albumin	56.7° C (134.1° F) for 3.5 min.	*Salmonella*
Whole egg	60 ° C (140° F) for 3.5 min.	*Salmonella*
Egg yolk	61.1° C (142° F) for 3.5 min.	*Salmonella*
Vinegar	60° - 66° C (140° - 151° F) for a few seconds	Common spoilage organisms
Frankfurters	68° - 71° C (154.4° - 159.8° F) (achieve)	Common spoilage organisms
Beer in cans or bottles	60° C (140° F) for 15-30 minutes	Yeasts and lactic acid bacteria

b. Canned foods

The 12D concept used in thermal processing of canned foods

$F_0 = 12D$

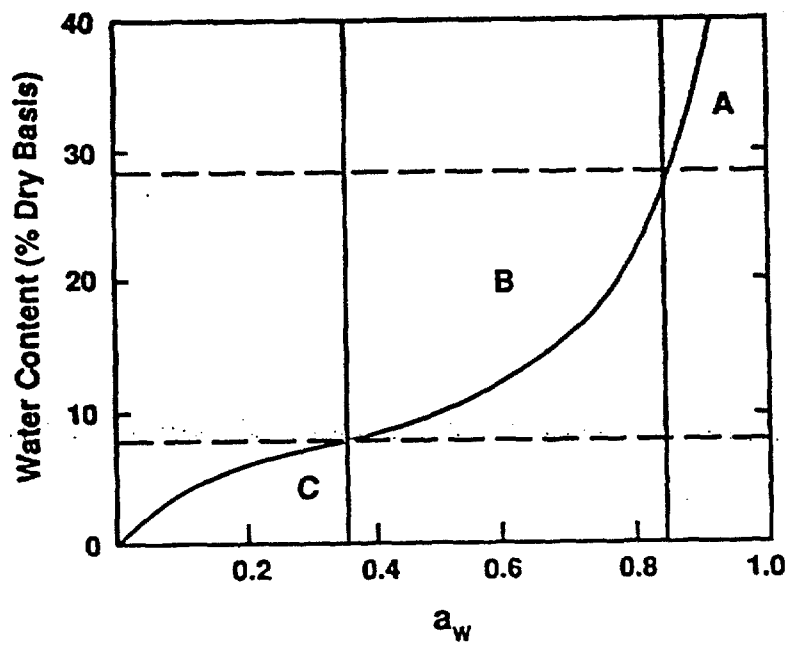
Number of Survivors if Initial Population equals 1 Billion

Number of D values	Total Number of Microorganisms	Number of Surviving Microorganisms
1	1,000,000,000	100,000,000
2	100,000,000	10,000,000
3	10,000,000	1,000,000
4	1,000,000	100,000
5	100,000	10,000
6	10,000	1,000
7	1,000	100
8	100	10
9	10	1
10	1	1/10
11	1/10	1/100
12	1/100	1/1,000

If initial population = 1 million, then with 12D treatment 999,999 cans will be sterile.

3. Reduced water activity

Generalized water sorption isotherm of a typical food



Determination of water activity

$$a_w = \text{Available Water} = \frac{\text{Vapor pressure of water in food}}{\text{Vapor pressure of pure water}}$$

a_w for pure water = 1.0
a_w for milk = .97

% water in food is not the same as a_w
ie: Milk = 87% H_2O

Control of water activity in foods

Increase the concentration of solutes in the solution by:

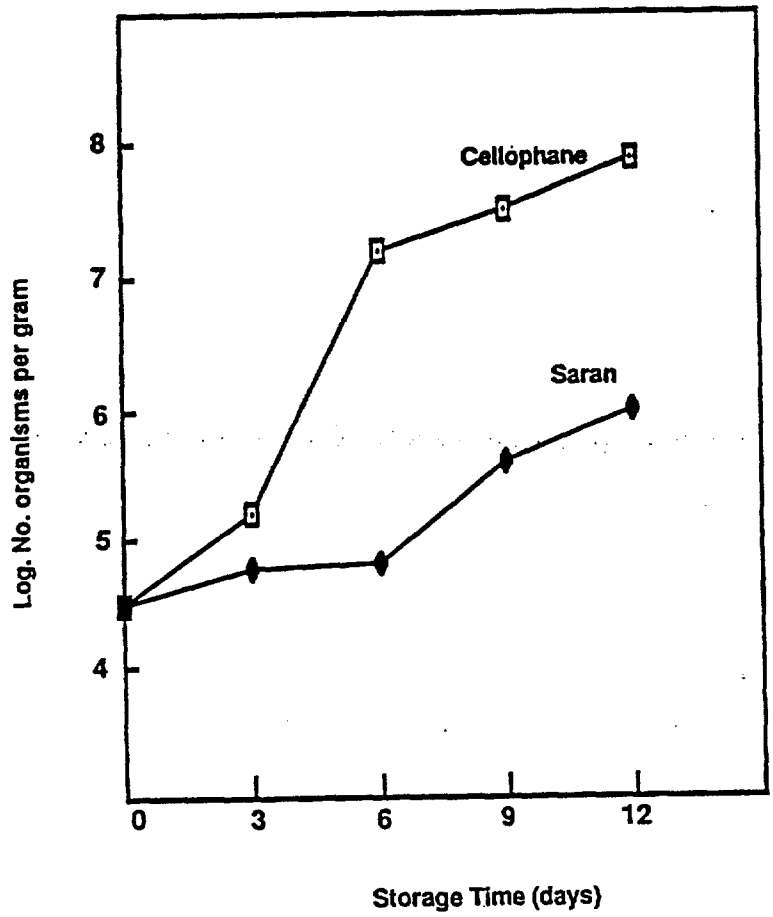
1. Removing moisture:
   a) sun drying
   b) mechanical drying
   c) concentration/evaporation
2. Adding solutes:
   a) sugars
   b) salts

a. Dehydration

b. Addition of solutes

4. Vacuum packaging

Effect of packaging film on total bacterial count in ground beef



a. Aerobes/anaerobes

Bacterial category	Examples
Aerobe - an organism which has the ability to grow in the presence of oxygen. Minimum tolerated oxygen pressure = 10^{-6} atm	*Bacillus subtilis* *Pseudomonas fluorescens*
Anaerobe - an organism which has the ability to grow in the absence of oxygen.	*Clostridium botulinum* *Clostridium perfringens*
Facultative anaerobe - an organism which normally grows aerobically but can grow anaerobically. Minimum tolerated oxygen pressure = 10^{-12} atm	*Staphylococcus aureus* *Escherichia coli* *Salmonella*

C. Chemical agents to control microorganisms in foods

1. Acidity

Categories of foods according to pH

High acid foods	pH below 3.7
Acid foods	pH 3.7 - 4.6
Medium acid foods	pH 4.6 - 5.3
Low or non-acid foods	pH over 5.3

Limits of pH allowing initiation of growth by various microorganisms

	Minimum pH	Maximum pH
Gram-negative bacteria		
Acetobacter acidophilum	2.8	4.3
Alcaligenes faecalis	6.4	9.7
Escherichia coli	4.4	9.0
Klebsiella pneumoniae (aerogenes)	4.4	9.0
Proteus vulgaris	4.4	9.2
Pseudomonas aeruginosa	5.6	8.0
Salmonella paratyphi	4.5	7.8
Salmonella schottmuelleri	4.5	8.0
Salmonella typhi	4.0 - 4.5	8.0 - 9.6
Serratia marcescens	4.0	9.0
Thiobacillus thiooxidans	1.0	9.8
Vibrio parahaemolyticus	4.8	11.0
Gram-positive bacteria		
Bacillus cereus	4.9	-
Bacillus subtilis	4.5	9.3
Bacillus stearothermophilus	5.2	8.5
Clostridium botulinum	4.7	9.2
Clostridium sporogenes	5.0	8.5
Enterococcus spp.	4.8	9.0
Bifidobacterium bifidum (Lactobacillus bifidum)	3.8	10.6
Lactobacillus spp.	3.8 - 4.4	7.2
Micrococcus sp.	5.6	7.2
Staphylococcus aureus	4.0	8.1
Streptococcus faecium	4.4 - 4.7	9.8
Streptococcus lactis	4.3 - 4.8	9.2
Streptococcus pyogenes	6.35	9.2
Yeasts		
Candida pseudotropicalis	2.3	8.8
Hansenula canadensis	2.15	8.6
Saccharomyces cerevisiae	2.35	8.6
Saccharomyces fragilis	2.4	9.05
Saccharomyces pastori	2.1	8.8
Saccharomyces exiguus	1.5	-
Schizosaccharomyces octosporus	5.45	7.05
Candida krusei	1.5	-
Hanseniaspora melligeri	1.5	-
Rhodotorula mucilaginosa	1.5	-
Molds		
Aspergillus cryzae	1.6	9.3
Penicillium italicum	1.9	9.3
Penicillium variabile	1.6	11.1
Fusarium oxysporum	1.8	11.1
Marasmus loetidus	2.0	6.8
Phycomyces	3.0	7.5

a. Organic acids

Concentrations of undissociated acid (in percent) required to inhibit selected microorganisms

Organic acids	Yeasts	Molds	Enterobacteriaceae	Micrococcaceae	Bacillaceae
Acetic acid	0.5	0.1	0.05	0.05	0.1
Benzoic acid	0.05	0.1	0.01	0.01	0.02
Propionic acid	0.2	0.05	0.05	0.1	0.1
Sorbic acid	0.02	0.04	0.01	0.02	0.02

Proportion of total acid undissociated (in percent) as a function of pH

	pH				
Organic acids	3	4	5	6	7
Acetic acid	98.5	84.5	34.9	5.1	0.54
Benzoic acid	93.5	59.3	12.8	1.44	0.144
Citric acid	53.0	18.9	0.41	0.006	< 0.001
Lactic acid	86.6	39.2	6.05	0.64	0.0064
Propionic acid	98.5	87.6	41.7	6.67	0.71
Sorbic acid	97.4	82.0	30.00	4.1	0.48

b. Preservatives

Data on the pH, solubility, and usage of organic acids as food preservatives

		pKa	Solubility (gm/100gm)	ADI * (mg per kg body wt.)	Typical max. use conc. (mg/kg)	Examples of usage
Acetic acid	CH_3COOH	4.75	Very soluble	Not limited	No limit	Packing of meat, fish and vegetable products
Sodium diacetate [a]	$CH_3COONaCH_3COOH_2H_2O$	4.75	Very soluble	Not limited	4000	Bread and bakery products
Sodium benzoate [b]	COONa	4.2	50 (25 C)	5	1 - 3,000	Pickles, acid sauces/ salads, semipreserved fish, fruit juices, soft drinks, jams, margarines
Citric acid	$(COOH)CH_2C\text{-}(OH)(COOH)\text{-}CH_2COOH$	3.1	Very soluble	Not limited	No limit	Soft drinks
lactic acid	$CH_3CH(OH)COOH$	3.1	Very soluble	Not limited	No limit	Salad creams and mayonnaise
Sodium propionate [c]	CH_3CH_2COONa	4.9	Very soluble	10	1 - 3,000	Bread, bakery and cheese products
Sorbic acid (including K salt)	$CH_3CH{=}CHCH{=}CHCOOH$	4.8	0.16 (20 C)	25	1 - 2,000	Fresh and processed cheese, dairy products, bakery products, fruit juices, acid sauces and salads, jams, jellies, soft drinks, margarines, semipreserved fish, and meat products.

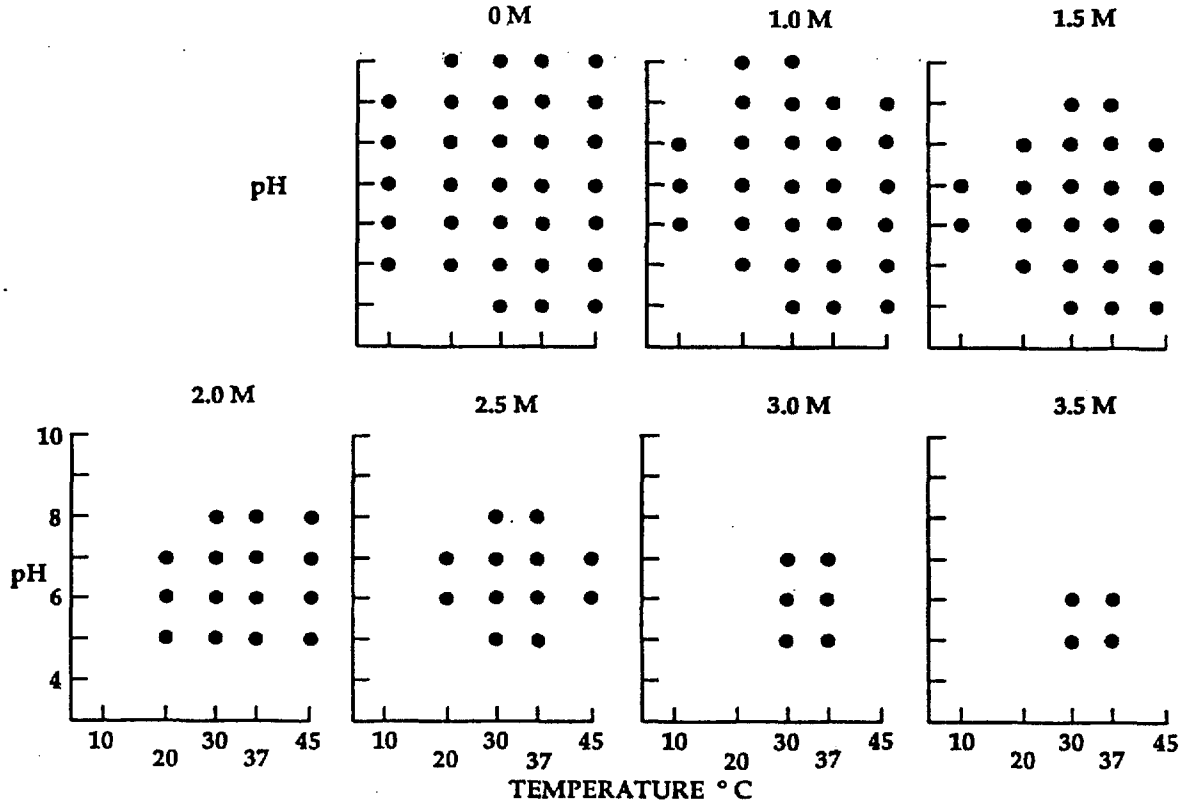
* ADI - Acceptable Daily Intake

[a] Source of acetic acid.

[b] Source of benzoic acid.

[c] Source of propionic acid.

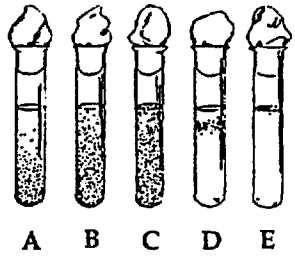
Interactions between pH, temperatures, and water activity on the growth of *Staphylococcus aureus*



2. Oxidation reduction potential

a. Aerobes/anaerobes

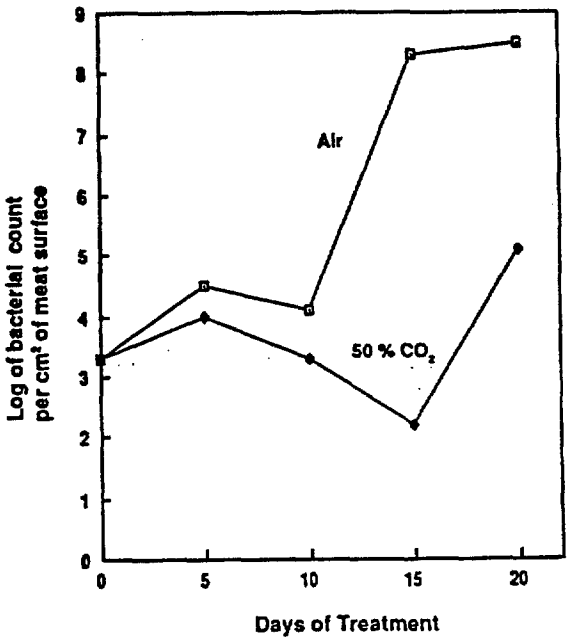
Growth characteristics according to oxygen requirements



A - Fairly strict anaerobe
B - Less strict anaerobe
C - Facultative aerobe - anaerobe
D - Microaerophilic
E - Strict aerobe

b. Modified atmospheres

Effect of storage in CO_2 enriched atmosphere (50% CO_2, 25% O_2, 25% N_2) on microbial growth on pork loins vs. that of storage in air; both at 1°C



SESSION TWO

Microbial Ecology of Food Processing Environments

OBJECTIVES

1. Consider the environment as a control point or critical control point.
2. Consider the source of organisms and requirements for growth.
3. Differentiate between wet and dry processes.
4. Explain the movement of microorganisms about the plant.
5. Review the most common sources of contamination.

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I. Sources of Microorganisms

A. Ubiquitous in nature

Sources of Microorganisms in Nature

- Soil
- Water
- Air
- Vegetation
- Animals
- Sewage

B. Plants

1. Exterior

2. Interior

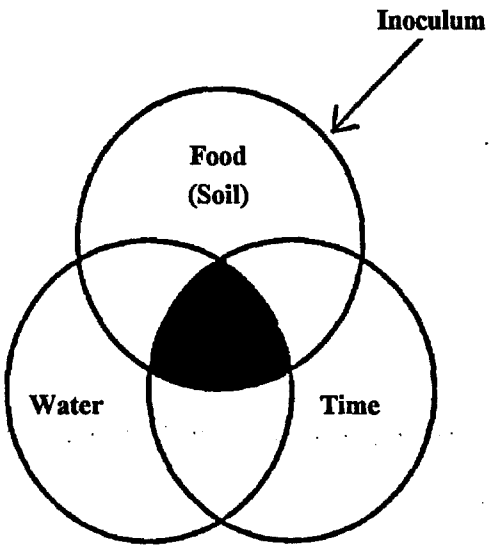
C. Animals

1. Skin/hide

2. Intestinal track

D. Processing environment

Factors leading to microbial growth



II. Role of Cleaning and Sanitizing

A. <u>Cleaning</u>: Removal of food residues (soil).

B. <u>Sanitizing</u>: Killing of microorganisms which are not removed by cleaning.

C. Frequency of cleaning and sanitizing

III. Microbial Ecology and Cleaning; Wet Processing Environments

A. Description of operations

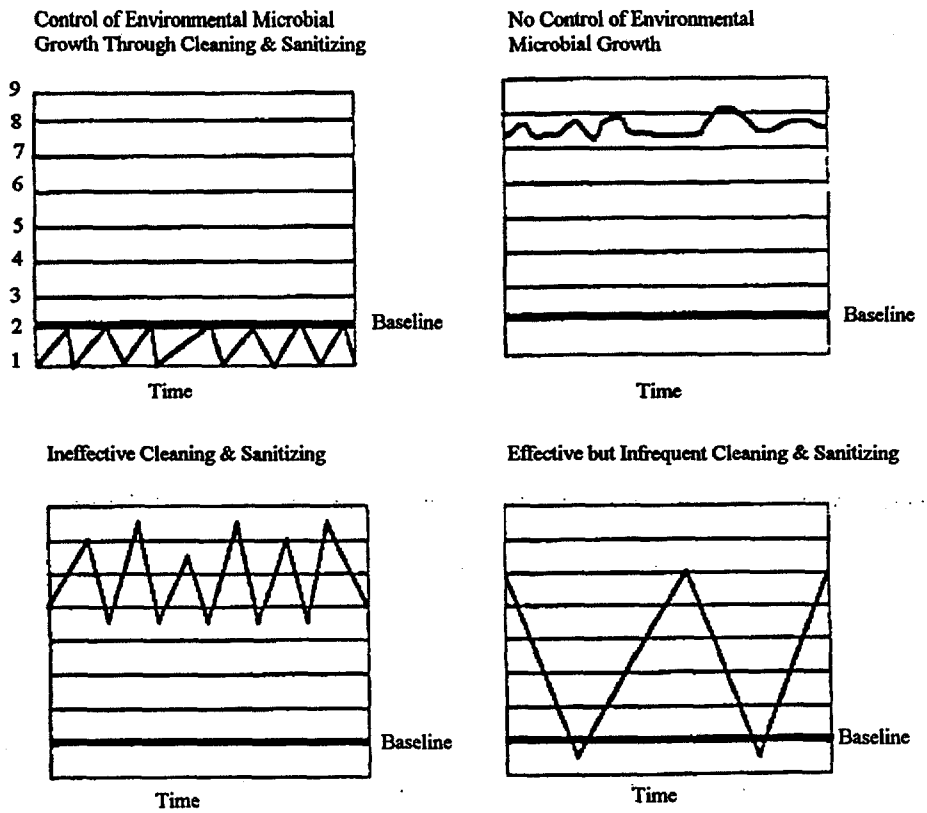
B. Control measures

Microbial status of sliced salami conveyor belt

Time	Total count per square cm.
0	<100
10 min	2,400
1 hour	1,100
2 hours	3,000
3 hours	4,700
4 hours	10,000
5 hours	300,000
6 hours	7,300,000
7 hours	75,000,000

1. Time (frequency)

2. Efficacy of cleaning and sanitizing



IV. Impediments to Microbial Control through Cleaning and Sanitizing

A. Microbial growth niche

1. **Definition: Areas within the food processing plant which cannot be effectively cleaned and sanitized in a reasonable time with normal tools and supplies.**

2. **Formation**

3. **Relationship to equipment design**

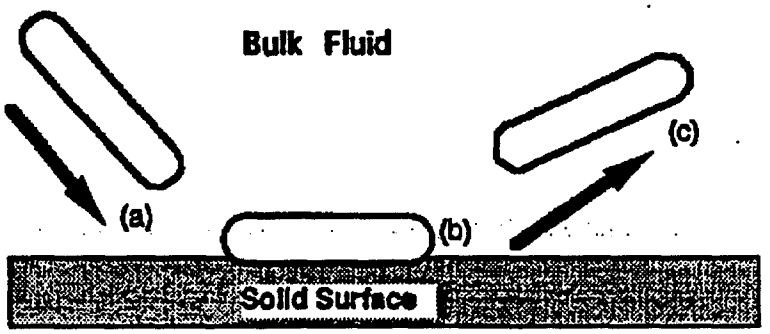
Equipment defects leading to growth niches

- Improperly welded metal surfaces with gaps that trap food residues and water.
- Metal-to-metal surfaces that are bolted together.
- Unsealed hollow-tubed structural components.
- Drilled or improperly installed stainless steel cladding.
- Conveyor parts.
- Improperly chosen and installed caulking gaskets.
- Electrical boxes that are not water tight.
- Metal and plastic plates used as protective shields over product zones.

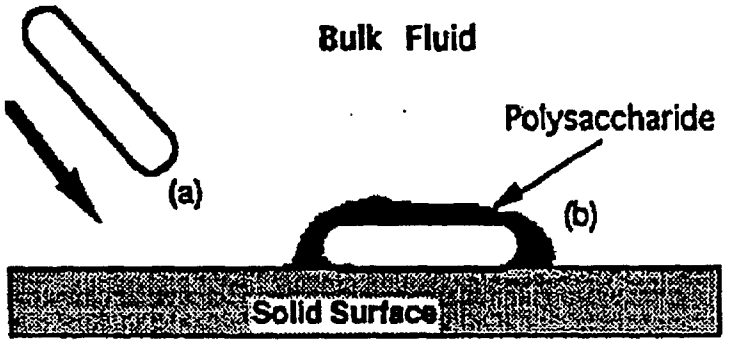
B. Microbial biofilms

1. <u>Definition</u>: **Bacteria which are attached to a surface and grow forming a complex community that also contains extracellular material which traps other bacteria and debris.**

Microbial biofilm adherence



Reversible Adherence. Planktonic cells (a) in the bulk fluid come in contact with the solid surface (b). The cells then desorb from the surface and become planktonic again (c).



Irreversible Adherence. Planktonic cells (a) in the bulk fluid come in contact with the surface. If the forces that hold the cell on the surface are strong enough, the cell is not easily removed and may produce exopolymers that help anchor the cell to the surface (b).

:ood, S.K. and E.A. Zottola. 1994. *Biofilms in Food Processing - A Review.* Food Control (in press).

2. Formation

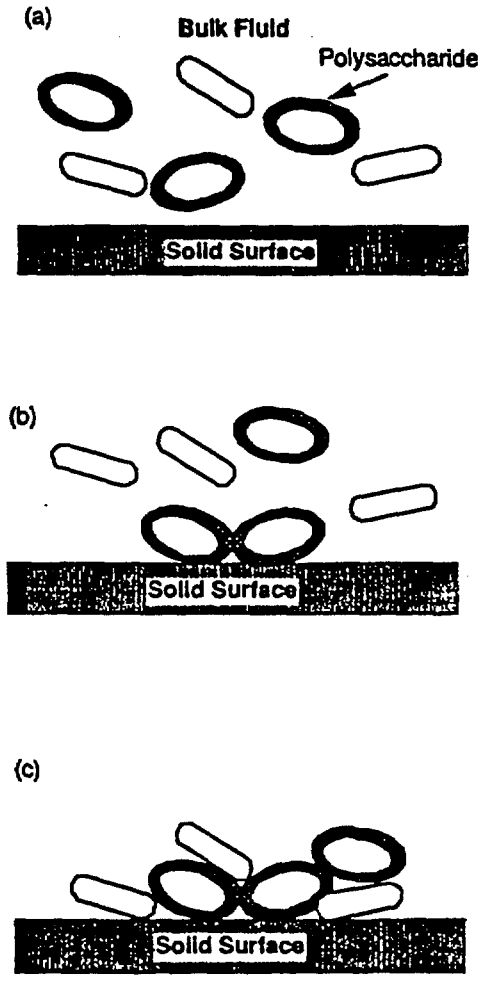
a. Adherence or Attachment

b. Adsorption or Sorption

c. Substratum

d. Growth

e. Colonization



(a) At time zero, a mixed culture of cells isin the bulk fluid above the surface. (b) Over time, primary colonizers adhere to the surface. (c) The primary colonizers provide a favorable environment allowing other microorganisms to adhere to the surface.

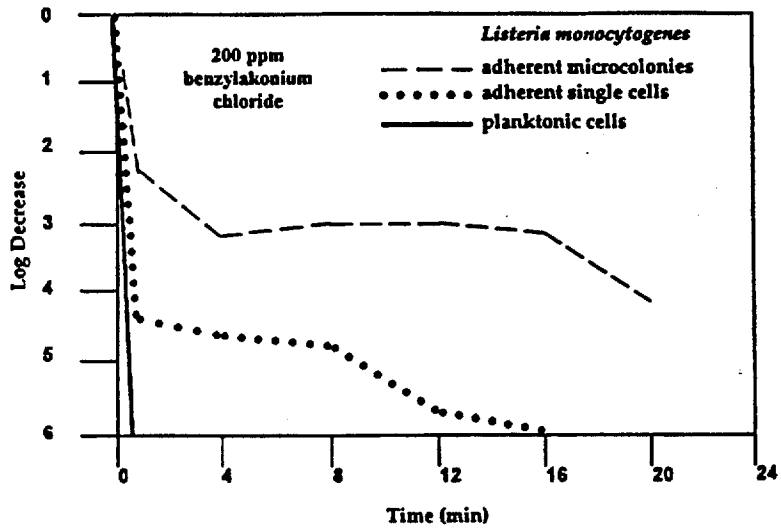
Hood, S.K. and E.A. Zottola. 1994. *Biofilms in Food Processing - A Review.* Food Control (in press).

3. Importance of biofilms

a. Difficulty of removal

b. Resistance to sanitizers

Resistance of biofilms to sanitizers



From Frank, J.F. and R.A. Koffi. 1990. J. Food Prot. 53: 550-554.

V. Dry Cleaning Operations

A. Description of operations

Dry processing operations

Peanuts	Cocoa beans	Sugars/syrups
↓	↓	↓
Roasting	Roasting	Boiling water, 120°C
↓	↓	↓
No Kill Steps Beyond This Point		
↓	↓	↓
Peanut butter	Cocoa liquor Cocoa cake	Fondant

B. Control measures

1. Sources of moisture

- Leaking water and steam lines
- condensation
- leaking roofs
- Improper wet cleaning

2. Maintaining a dry plant environment

a. Reduce and control sources

b. Isolate wet areas from dry areas

c. Wet clean only when necessary

Control procedures in dry processing facilities

- Primary means of control is to eliminate water from the dry processing environment
- When necessary to wet clean:
- Be selective to not spread water to other areas
- Disassemble equipment, allow to dry
- Reassemble dry equipment hygienically

VI. Movement of Microorganisms in the Processing Environment

A. Employees

1. Maintenance workers

2. Typhoid Mary syndrome

3. Hair nets

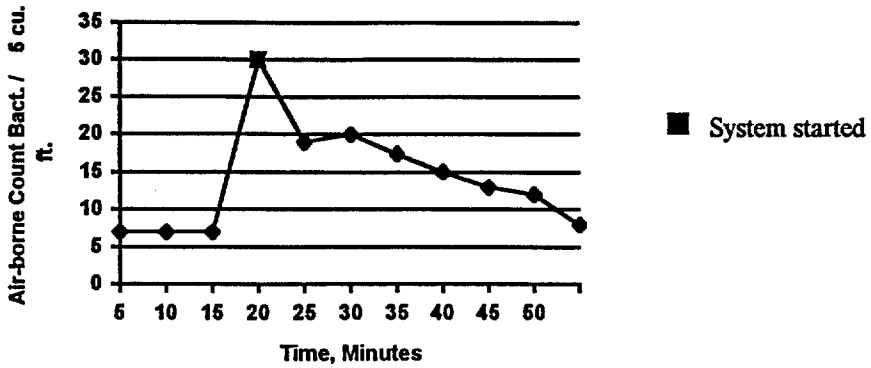
4. Gloves

B. Equipment

C. Water

D. Air

Contribution of ventilation system to air-borne microorganism populations.



From Heldman, D.R., Hedrick, T.I. and Hall, C.W. 1966. *Population sources and control of air-borne microorganisms in dairy plants.* 17th Internationals Dairy congress, Munich

VII. Location of Raw Material and Finished Product

A. Plant design

B. Traffic patterns

1. Employee

2. Equipment

SESSION THREE

Hygienic Considerations in Facility Design

OBJECTIVES

1. Explore the "ideal" plant environment.
2. Discuss physical plant design considerations and most common problem areas.
3. Evaluate equipment design and placement and the impact on plant hygiene and sanitation.

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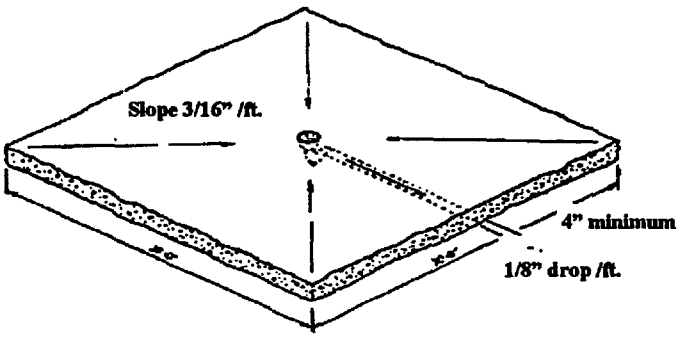
1. **Eliminate growth niches**

   a. **Avoid accumulation - ledges, seams, cracks, nooks, drains, absorbent materials**



From Engineering for Food Safety and Sanitation; A Guide to the Sanitary Design of Food Plants and Food Plant Equipment by Thomas J. Imholte, 1984 Technical Institute of Food Safety.

2. **Efficient and effective cleanability**

   a. **Surfaces - easy to clean, non-porous, non-toxic**

   a. Stainless steel
   b. Ceramic tiles
   c. Acid resistant tiles
   d. Concrete
   e. Fiberglass wall panels
   f. Plastic materials
   g. Rubber and like materials
   h. Epoxy resins

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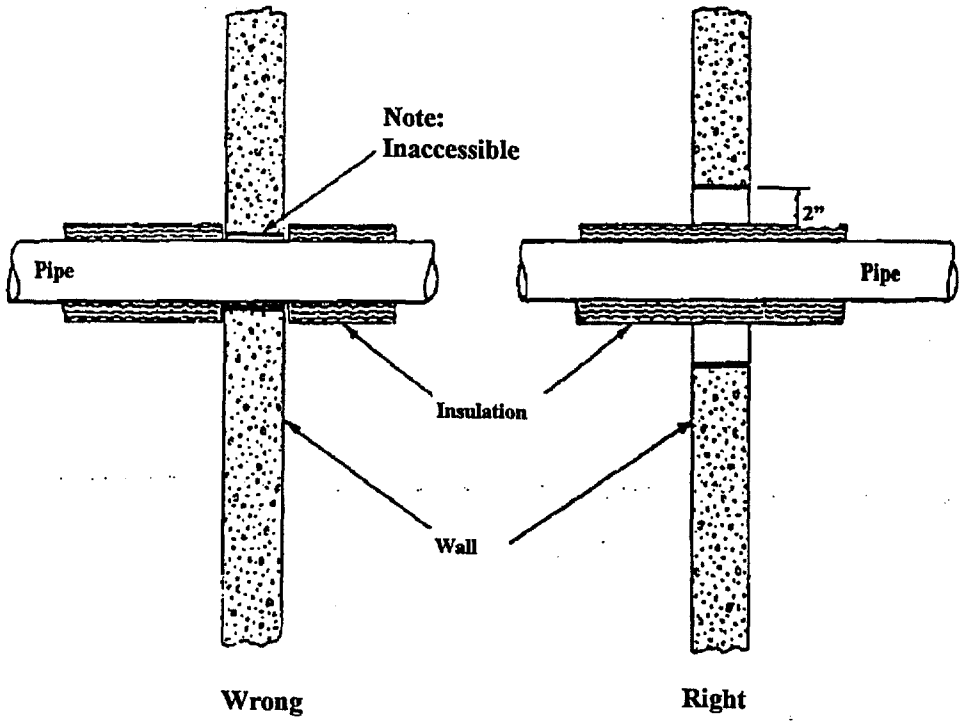
b. Accessible for cleaning



From Engineering for Food Safety and Sanitation; A Guide to the Sanitary Design of Food Plants and Food Plant Equipment by Thomas J. Imholte, 1984 Technical Institute of Food Safety.

3. Minimize cross contamination

a) Raw and processed
b) Wet and dry
c) Product and non-product
d) Waste removal
e) Temperature variations
f) Traffic

4. **Efficient and effective climate control**

   a. **Temperature**

   b. **Humidity**

   c. **Quality**

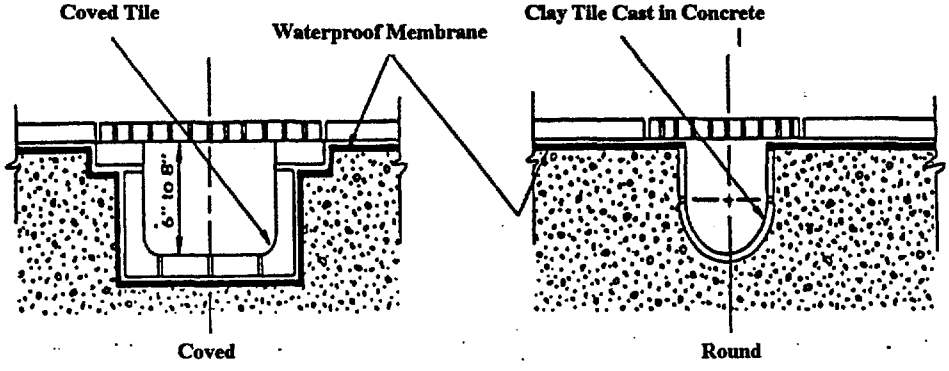
   d. **Flow**

5. **Effective waste removal**

   a. **Solid waste**

   b. **Liquid waste vs. sanitary sewer**

   c. **Floor drains**



From **Engineering for Food Safety and Sanitation; A Guide to the Sanitary Design of Food Plants and Food Plant Equipment** by Thomas J. Imholte, 1984 Technical Institute of Food Safety.

6. Service lines

a. Service lines for equipment

i. Steam and condensate piping

ii. Air and vacuum piping

iii. Conduit and electrical raceways

iv. Dust collection and pneumatic conveying lines

v. HVAC dusts

b. Service line lofts

i. Improves plant appearance

ii. Reduces cleaning costs

iii. Allows unobstructed lighting

iv. Minimizes overhead contamination concerns (leaking pipes, condensate, peeling paint)

v. Improves access for maintenance

B. Equipment Design

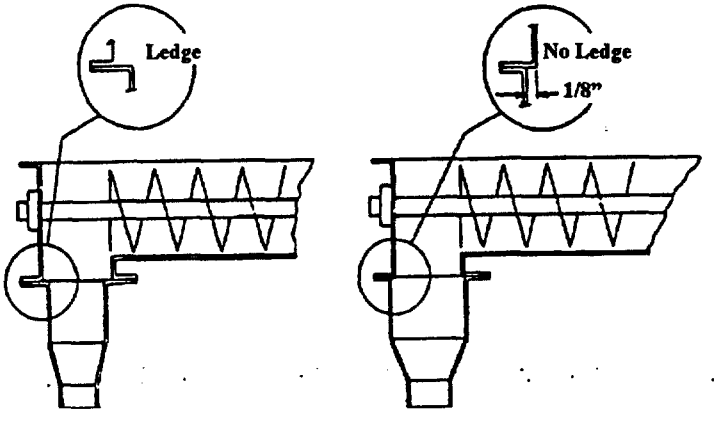
Key Considerations:

1. No points (sites) where microorganisms can lodge and multiply
2. Accessibility and cleanability
3. Protect contact zones from cross-contamination

1. Sites where microorganisms can lodge and multiply

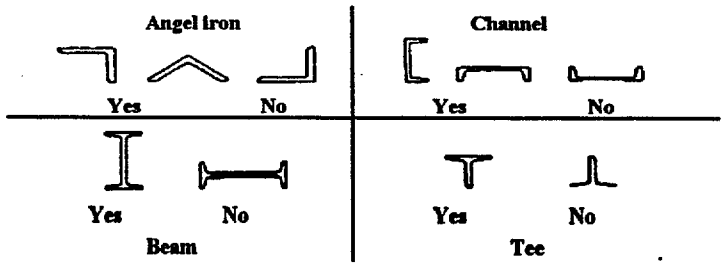
a. Ledges

i. Eliminate product zone ledges on equipment



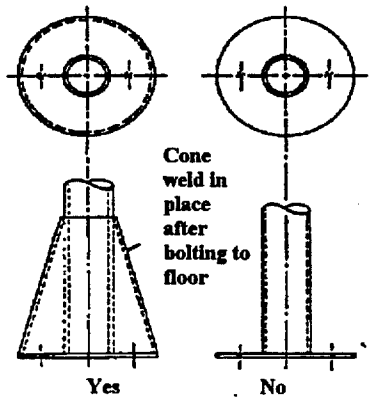
From Engineering for Food Safety and Sanitation; A Guide to the Sanitary Design of Food Plants and Food Plant Equipment by Thomas J. Imholte, 1984 Technical Institute of Food Safety.

ii. Structural shapes that have an impact on sanitation



From Engineering for Food Safety and Sanitation; A Guide to the Sanitary Design of Food Plants and Food Plant Equipment by Thomas J. Imholte, 1984 Technical Institute of Food Safety.

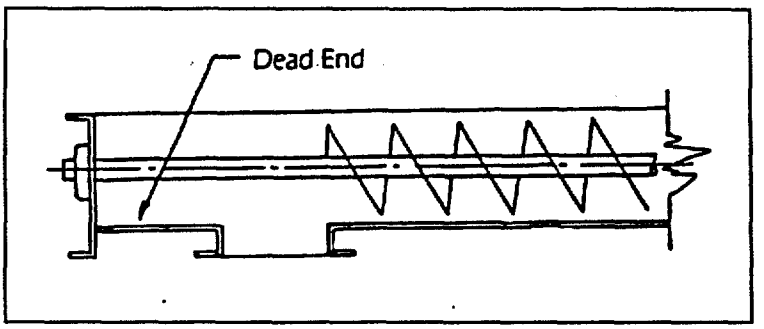
iii. Equipment mounting pads



Mounting pads

From Engineering for Food Safety and Sanitation; A Guide to the Sanitary Design of Food Plants and Food Plant Equipment by Thomas J. Imholte, 1984 Technical Institute of Food Safety.

b. Avoid product accumulation in dead end areas



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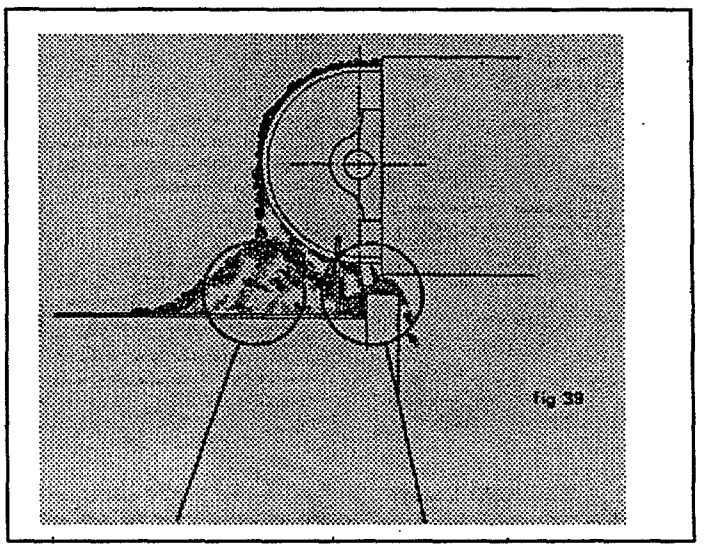
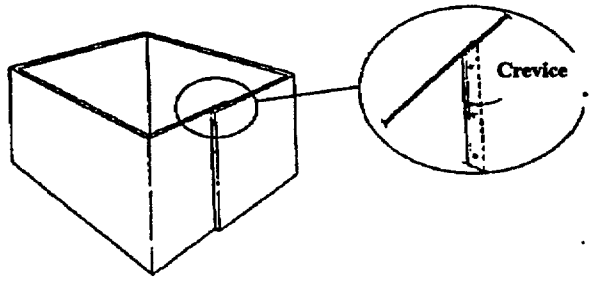


From The Campden Food & Drink Research Association, *Hygienic Design of Food Processing Equipment*, May 1983, Technical Manual No. 7

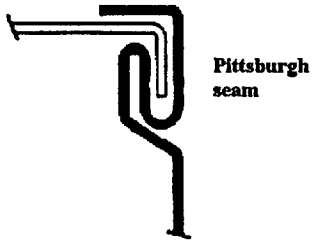
c. Seams

i. Lap seams which are tack or spot welded result in cracks



From **Engineering for Food Safety and Sanitation; A Guide to the Sanitary Design of Food Plants and Food Plant Equipment** by Thomas J. Imholte, 1984 Technical Institute of Food Safety.

ii. Pittsburgh seams



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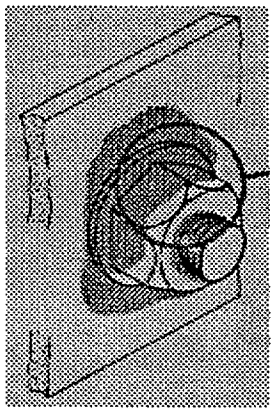


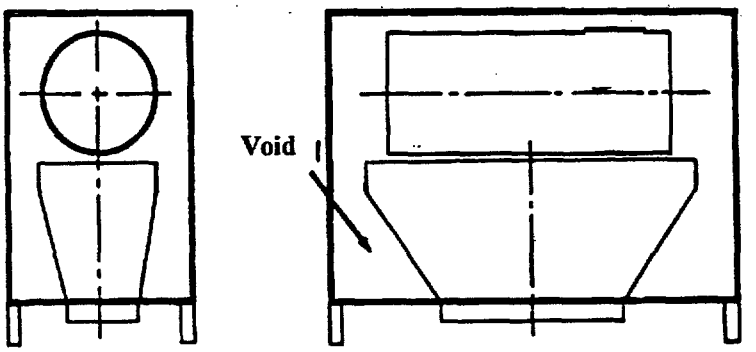
2. **Accessibility and cleanability**

a. **Void areas**

i. **Eliminate**

ii. **Seal**

iii. **Provide access to all areas of equipment**



From Engineering for Food Safety and Sanitation; A Guide to the Sanitary Design of Food Plants and Food Plant Equipment by Thomas J. Imholte, 1984 Technical Institute of Food Safety

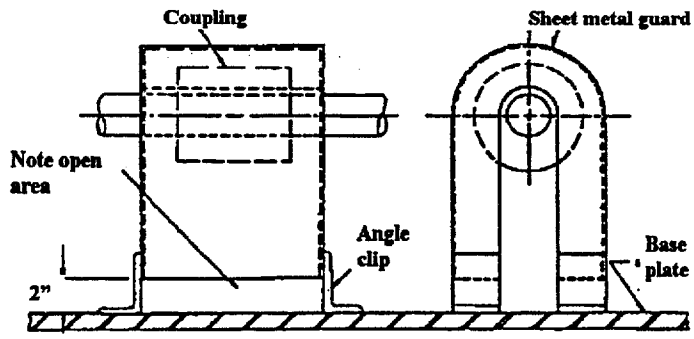
b. **Mounts**

i. **No crevices or ledges**

ii. **No exposed threads**

iii. **Leveling**

iv. **Space for cleaning**



From Engineering for Food Safety and Sanitation; A Guide to the Sanitary Design of Food Plants and Food Plant Equipment by Thomas J. Imholte, 1984 Technical Institute of Food Safety.

c. **Cabinets**

i. **Drainage**

ii. **Prevent accumulation**

d. **Conveyor and pulleys**

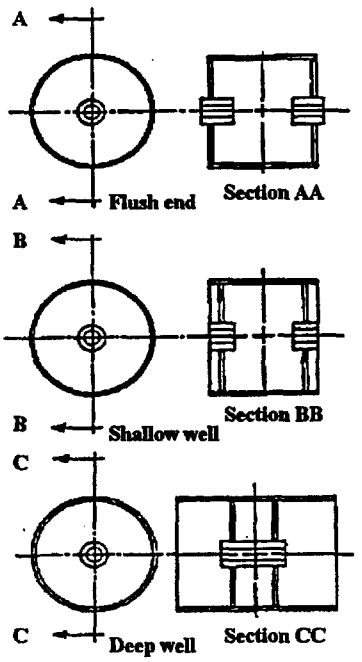
i. **Belt conveyors**

ii. **Screw conveyors**

iii. **Bucket elevators**

iv. **Pneumatic**

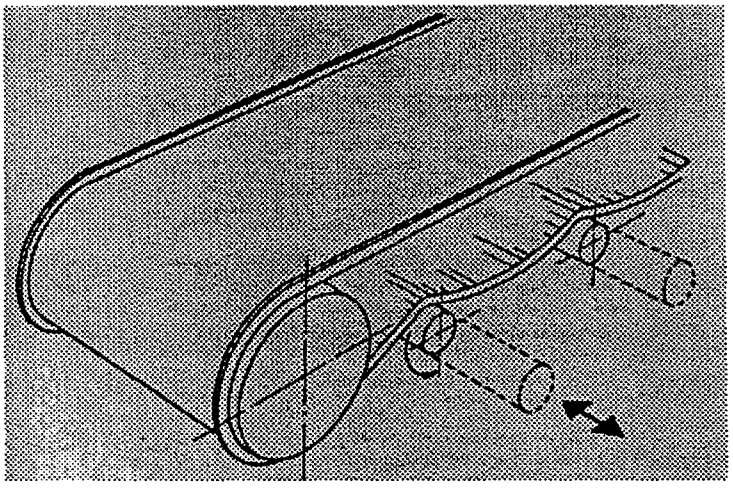
v. Pulleys



From Engineering for Food Safety and Sanitation; A Guide to the Sanitary Design of Food Plants and Food Plant Equipment by Thomas J. Imholte, 1984 Technical Institute of Food Safety.

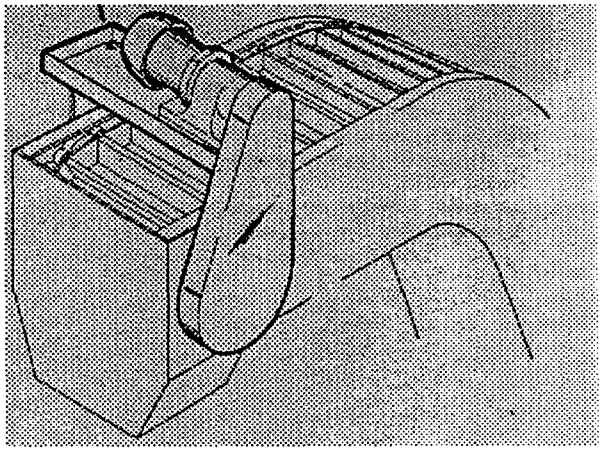
3. Protect from contamination

a. Idler rollers



From The Campden Food & Drink Research Association, *Hygienic Design of Food Processing Equipment*, May 1983, Technical Manual No. 7

b. Motors



From The Campden Food & Drink Research Association, *Hygienic Design of Food Processing Equipment*, May 1983, Technical Manual No. 7

c. Ease of maintenance and service

II. Principles of Cleaning

A. Objectives

1. **Removal of gross soil**

2. **Reduction or control of microbial activity**

3. **Eliminate the food contact or equipment surface as source of:**
   a. **Spoilage organisms**
   b. **Pathogenic organisms**

B. Wet vs. dry environments

C. Soil and soil deposition

Component on Surface	Solubility	Ease of Removal	Effect of Heating
Sugar	Water soluble	Easy	Carmelization, more difficult to clean
Fat	Water insoluble, Alkali soluble	Difficult	Polymerization, more difficult to clean
Protein	Water insoluble, Alkali soluble, Slighty acid soluble	Very difficult	Denaturation, more difficult to clean
Salts			
Monovalent	Water soluble, Acid soluble	Easy to difficult	Generally not significant
Polyvalent	Water insoluble, Acid soluble	Easy to difficult	Interactions with other constituents

D. Detergents

1. **Function** - to make water insoluble soil soluble in water

2. **Fundamentals of cleaning**

a) Bringing the detergent solution into intimate contact with the soil to remove it (soil) by means of good wetting and penetration properties

b) Displacing the soil from the surface to be cleaned by saponifying fat, peptizing proteins, and dissolving minerals

c) Distributing the soil in a solvent by dispersion, deflocculation, or emulsification

d) Preventing the redeposition of soil onto the clean surface

3. **Ingredients**

Class of Compound	Major Function
Basic Alkali	Soil displacement by emulsifying, saponifying, and peptizing
Complex phosphates	Soil displacement by emulsifying and peptizing; dispersion of soil; water softening, prevention of soil depositions
Surfactants	Wetting and pentrating soils; dispersion and prevention of soil redepositions
Chelating compounds	Water softening; mineral deposit control; soil displacement by peptizing; prevention of redepositions
Acids	Mineral deposit control; water softening

a. **Alkaline compounds**

b. **Phosphates**

c. **Wetting agents**

d. **Acids**

i. **Organic**

ii. **Inorganic**

4. **Typical detergent formula**

E. Principles of soil removal

1. Fat removal

2. Protein removal

3. Carbohydrate removal

4. Mineral removal

F. Methods of application

Factors affecting the selection of cleaning systems

Factor	HPLV	LPHV	CIP	Manual	Foam/Gel
Soil Type					
Tenacious	Y	(Y)	Y	Y	N
Water Soluble	Y	Y	Y	Y	Y
Soil Level					
High	Y	(Y)	Y	Y	N
Low	Y	Y	Y	Y	Y
Equipment-Open					
Access - Close	Y	Y	N	Y	Y
Access - Distant	(Y)	N	N	N	Y
Horizontal Surface	Y	(Y)	N	Y	Y
Vertical Surface	Y	N	N	(Y)	Y
Void Spaces	Y	(Y)	N	Y	N
Equipment - Closed					
Absence of void space	Y*	N	Y	N	N
Presence of void space	Y*	N	(Y)	(Y)	N

HPLV = High pressure- Low volume
LPHV = Low pressure - High volume
CIP = Clean-in-place

***Vessel only, not pipeline**
Y = Ideally suited,
(Y) = May be suited, if managed properly
N = Inappropriate

III. Principles of Sanitization

A. Sanitization

1. **Definition of a sanitizer - chemical or physical agent which will effectively inhibit growth of or destroy microorganisms and their spores**

Chemical Sanitizers Must Pass Chambers Test

AOAC 4.020 - 4.029 (1984)

Those chemicals which, at recommended concentration, produce 99.999% kill of 75-125 million *E. coli* (ATCC 1129) and 75-125 million *S. aureus* (ATCC 6538) within 30 seconds at 70-75°F are considered satisfactory and can be called sanitizers.

2. **Sanitizing agents**

   a. **Heat**

   b. **Radiation**

   c. **Chemicals**

Comparison of commonly used disinfectants

Properties	Steam	Chlorine	Iodophors	Quats	Acid anionic surfactants
Effective against					
Gram - positive bacteria (lactics, clostridia, *Bacillus*, *Staphylococcus*)	Best	Good	Good	Good	Good
Gram - negative bacteria (*E. coli*, *Salmonella*, psychrotrophs)	Best	Good	Good	Poor	Good
Spores	Good	Good	Fair	Poor	Fair
Bacteriophage	Best	Good	Good	Poor	Poor
Corrosive	No	Yes	Slightly	No	Slightly
Affected by hard water	No	No	Slightly	Type A-No Type B-yes	Slightly
Irritative to skin	Yes	Yes	Yes, some people	No	Yes
Affected by organic matter	No	Most	Somewhat	Least	Somewhat
Incompatible with:	Material sensitive to high temps.	Phenols, amines, soft metals	Starch, silver	Anionic wetting agents, soaps, wood, cloth, cellulose, nylon	Cationic surfactants and alkaline detergents
Stability of use solution	Not applicable	Dissipates rapidly	Dissipates slowly	Stable	Stable
Stability in hot solution (>66°C)	Not applicable	Unstable; some compounds stable	Highly unstable	Stable	Stable
Leaves active residue	No	No	Yes	Yes	Yes
Tests for active residual chemical	Unnecessary	Simple	Simple	Difficult	Difficult
Maximum level permitted by USDA and FDA w/o rinse	No limit	200 ppm	25 ppm	200 ppm	**
Cost	Expensive	Cheapest	Cheap	Expensive	Expensive
Effective at neutral pH	Yes	Yes	No	Yes	No

** 400 ppm dodecyl benzene sulfonate. 200 ppm sodium salt of olenic acid.

B. Chlorine as a sanitizer

Two types

1. Na and Ca Hypochlorites
2. Organic types

Active ingredient: formation of HOCl (Hypochlorous acid) which kills bacterial cells

REACTION

$$Cl_2 + H_2O \longrightarrow HOCl + H^+ + Cl^-$$
$$HOCl \longleftrightarrow H^+ + OCl^- \text{ (hypochlorite)}$$
$$NaOCl + H_2O \longrightarrow HOCl + Na^+ + OH^-$$

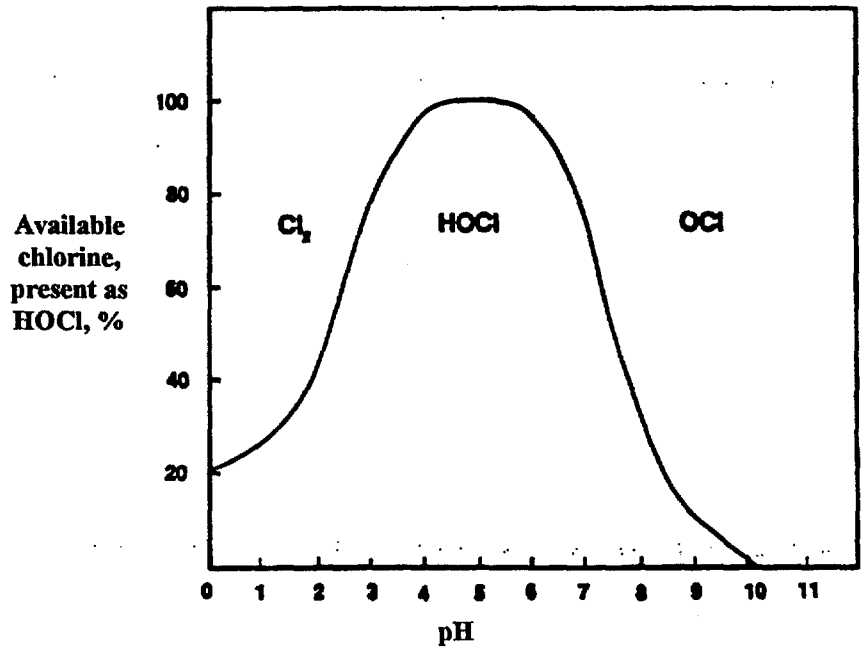
HOCl (Hypochlorous acid) enters the bacterial cell and attacks cell components, destroying it.

1. **Types of chlorine sanitizers**

2. **Dissociation of chlorine in water**

3. **Reaction**

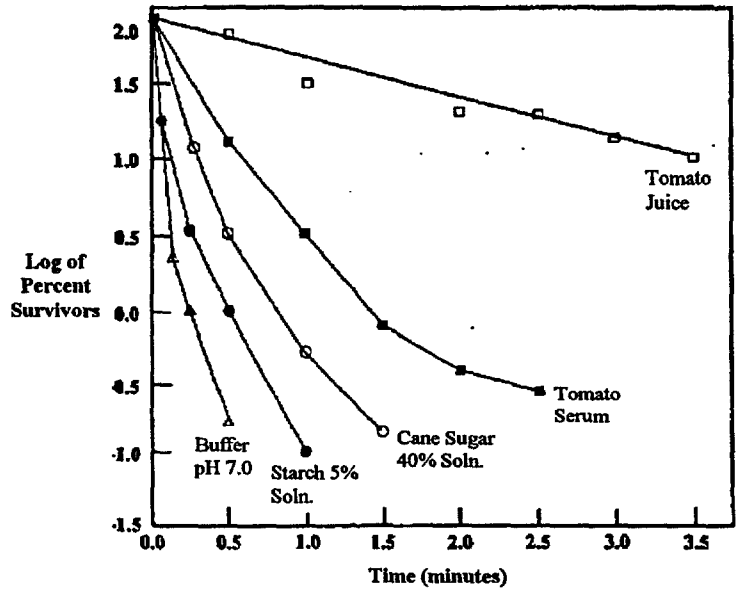
4. Effect on pH on chlorine



5. Hypochlorous acid reactions

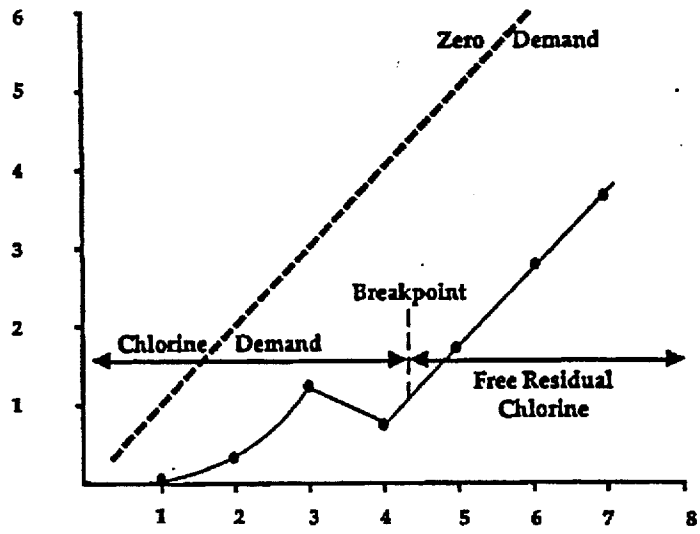
a. Organic matter

The effect of organic matter on the germicidial acitivty of chlorine



b. Ammonia and amines

6. **Breakpoint chlorination**



C. **Iodophors**

D. **Quaternary compounds**

E. **Acids anionic surfactants**

F. **Chlorine dioxide**

G. **Peracetic and peroxyacetic acids**

SESSION FOUR

Introduction to HACCP

OBJECTIVES

1. Review the origin and foundations of HACCP.
2. Demonstrate the importance of HACCP to the food industry.
3. Define the important terms used in HACCP systems.
4. Introduce the seven principles of HACCP.

I. Presentation of Silliker Laboratories Group's Video

"The Heart of HACCP"

II. The Foundation of HACCP

A. The need to control microorganisms in food

1. Prevention of foodborne illness

2. Prevention and retardation of spoilage

3. Where failures to control microorganisms in foods occur

a) At production
b) At harvest or slaughter
c) At processing
d) In distribution and storage
e) At final use

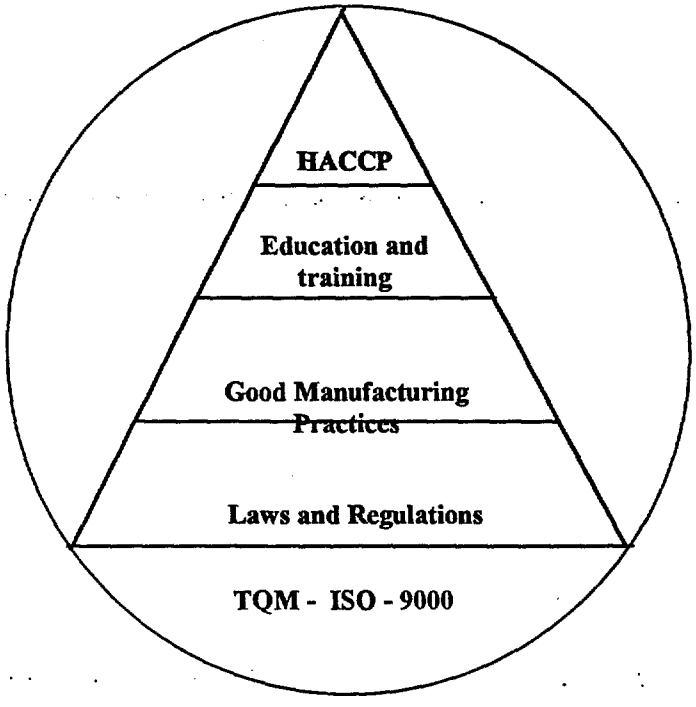
Foodborne disease outbreaks classified by place of mishandling foods, U.S. 1974-1978 and Canada, 1973-1975

	United States		Canada	
PLACE	NO. OF OUTBREAKS	% OF KNOWN PLACES	NO. OF OUTBREAKS	% OF KNOWN PLACES
FOOD SERVICE EST.	1285	77	425	57
HOMES	327	20	245	33
FOOD PROC. PLANTS	52	3	75	10
OTHER / UNKNOWN / UNSPECIFIED	615	–	695	–
TOTAL	2279	100	1440	100

1 U.S. DEPT. OF HEALTH, EDUCATION AND WELFARE, 1975-79.
2 HEALTH AND WELFARE, CANADA, 1976, 1978, 1979.

B. Traditional approaches to food control

1. **A brief history of food control**
2. **Inspection**
3. **Sampling and testing**
4. **Quality control programs**



Systematic Management of Food Safety and Quality

C. The origins of HACCP

1. **National Aeronautic and Space Administration (NASA)**

2. **The Pillsbury Company**

3. **1971 National Conference on Food Protection**

4. **The FDA's low acid canned food regulation**

5. **The International Commission for Microbiological Specification for Foods**

6. **National Advisory Committee for Microbiological Criteria for Foods**

III. The Importance of HACCP to the Food Industry

A. Systematic approach to hazard assessment

B. Comprehensive system for prevention of food safety hazards

C. Focuses on the factors specifically affecting food safety

D. Permits more effective use of resources

E. Integration of HACCP into existing food safety programs

F. Favorable cost/benefit relationships for the food industry, regulators and consumers

G. Avoids many weaknesses of the traditional approaches to food safety

H. Decreases reliance on microbiological testing

I. Rational approach for development of safe new foods

J. Specific HACCP plans and systems are unique to each plant and process

K. Specific HACCP plans are needed for each food product

IV. Definitions for HACCP

HACCP Definitions

Audit: A checklist or other documentation used during the verification process.

CCP decision tree: A sequence of questions to determine whether a control is a CCP.

Continuous monitoring: Uninterrupted recording of data such as a recording of temperature on a strip chart.

Control: (a) to manage the conditions of an operation to maintain compliance with established criteria; (b) the state wherein correct procedures are being followed and criteria are being met.

Control Point (CP): A point, step or procedure at which a chemical, microbial or physical hazard can be controlled.

Corrective action: Procedures to be followed when a deviation occurs.

Criterion: A requirement on which a judgment or decision can be based.

Critical Control Point (CCP): A point, step or procedure at which control can be applied and a food safety hazard can be prevented, eliminated or reduced.

Critical defect: A defect that may result in hazardous of unsafe conditions for individuals using and depending upon the product.

Critical limit: One or more prescribed tolerances that must be met to insure that a critical control point effectively controls a microbiological health hazard.

Deviation: Failure to meet a required critical limit for a critical control point.

Deviation file: A file that contains any documentation referencing a deviation that occurred when a CCP limit was exceeded. It should also include action plans that were implemented to prevent recurrence.

HACCP plan: A written document based upon the seven principles of HACCP that dictates the procedures to follow to assure the control of a specific process or procedure. Please keep in mind that this is part of the total HACCP system. There are additional components that are necessary to develop and educate individuals on an effective food safety system.

HACCP plan revalidation: A HACCP plan should be reviewed and updated due to a formulation change to an existing product, a change in a processing parameter, a modification or installation of new processing equipment, a change in packaging or final product handling, a change in intended use by the customer, any label changes regarding preparation of food by the consumer, or a new hazard awareness.

HACCP plan validation: The initial review by the HACCP team to ensure that all elements of the HACCP plan are accurate.

HACCP system: Results when a HACCP plan has been formally implemented in a processing facility.

HACCP team: The group of people who are responsible for developing a HACCP plan.

Hazard: Any biological, chemical, or physical property that may cause an unacceptable consumer health risk.

Monitoring: A planned sequence of observations or measurements of critical limits designed to produce an accurate record and intended to insure that the critical limit maintains product safety.

Preventive measure: Physical, chemical, or other factors that can be used to control an identified health hazard.

Random checks: Observations or measurements that are performed to supplement the scheduled evaluations required by the HACCP plan.

Risk: An estimate of the likely occurrence of a hazard or danger.

Risk category: One of six categories prioritizing risk based on food hazards.

Sensitive ingredient: Any ingredient historically associated with a known microbiological hazard

Severity: The seriousness of a hazard.

Significant risk: Posing moderate likelihood of causing an unacceptable health risk.

Spot check: Supplemental tests performed on a random basis

Target levels: Criteria which are more stringent than critical limits and which are used by an operator to reduce the risk of a deviation.

Verifiable: This results when the supplier HACCP plan meets all criteria stated in the HACCP Plan Review Checklist. In addition, the supplier can provide actual documentation used in monitoring to determine if their HACCP system is in compliance with the HACCP plan. If the documentation provided by the supplier indicates that a CCP has failed during verification, the supplier must include action plans that have been implemented to prevent a recurrence.

Verification: The process used in monitoring to determine if the HACCP system is in compliance with the HACCP plan.

Verified: A QA representative, an outside consultant or a product council member determined that the supplier HACCP system is in compliance with their HACCP plan.

Verification Results

The auditor should review records, methods or procedures associated with the question on the HACCP Verification Checklist. The auditor must check "yes" for the supplier to have an effective HACCP system. If for any reason the auditor checks "no" to a question, the supplier must immediately implement corrective action for full verification.

V. The Seven Principles of HACCP

1. Conduct a hazard analysis.
2. Determine the CCPs in the process.
3. Establish criteria that indicate whether an operation is under control at a specific CCP.
4. Establish CCP monitoring requirements.
5. Establish corrective actions to be taken when monitoring indicates that there is a deviation from an established critical limit.
6. Establish effective record-keeping procedures that document the HACCP system.
7. Establish procedures for verification that the HACCP system is working correctly.

VI. HACCP Logic Sequence

1. Assemble HACCP team
2. Describe product
3. Identify intended use
4. Construct flow diagram
5. On site verification
6. List all identified hazards associated with each step and consider any preventative measure to control hazards
7. Apply decision tree to each step
8. Establish critical limits for each CCP
9. Establish a monitoring system for each CCP
10. Establish corrective actions
11. Verification
12. Establish record keeping and documentation

VII. HACCP Team Assembly

SESSION FIVE

Identification of Hazards

OBJECTIVES

1. Demonstrate the construction of a process flow diagram.
2. Show how epidemiological data and technical information are used to identify hazards.
3. Identify potential hazards associated with processes using the process flow diagram and the principles of microbial ecology.
4. Evaluate the risks and severity associated with identified hazards in foods.

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I. Identification of Hazards

A. Purpose of the hazard analysis

The Hazard Analysis consists of an evaluation of all procedures concerned with the production, distribution, and use of raw materials and food products to:

1. **Identify potentially hazardous raw materials and foods**
2. **Identify potential sources of contamination**
3. **Determine the potential of microorganisms to survive or multiply during production, distribution, storage or use.**
4. **Assess the risks and severity of the hazards identified**

B. Experts in hazard analysis

A specialist in the hazards of concern has the knowledge and experience to correctly:

1. **Identify potential hazards**
2. **Assign levels of risk and severity**
3. **Recommend controls, criteria, and procedures for monitoring and verification**
4. **Identify research needs for a HACCP plan**
5. **Predict the success of a HACCP plan**

C. Preparation of the process flow diagram

1. **Purpose of the process flow diagram**

- Provide a clear, simple description of the process steps
- Help HACCP team to understand the process
- Help regulators to understand the process for verification procedures
- Helps to identify critical points and to develop CCPs

2. **Scope of process flow diagram**

a. Cover all steps in the process

b. Keep it simple

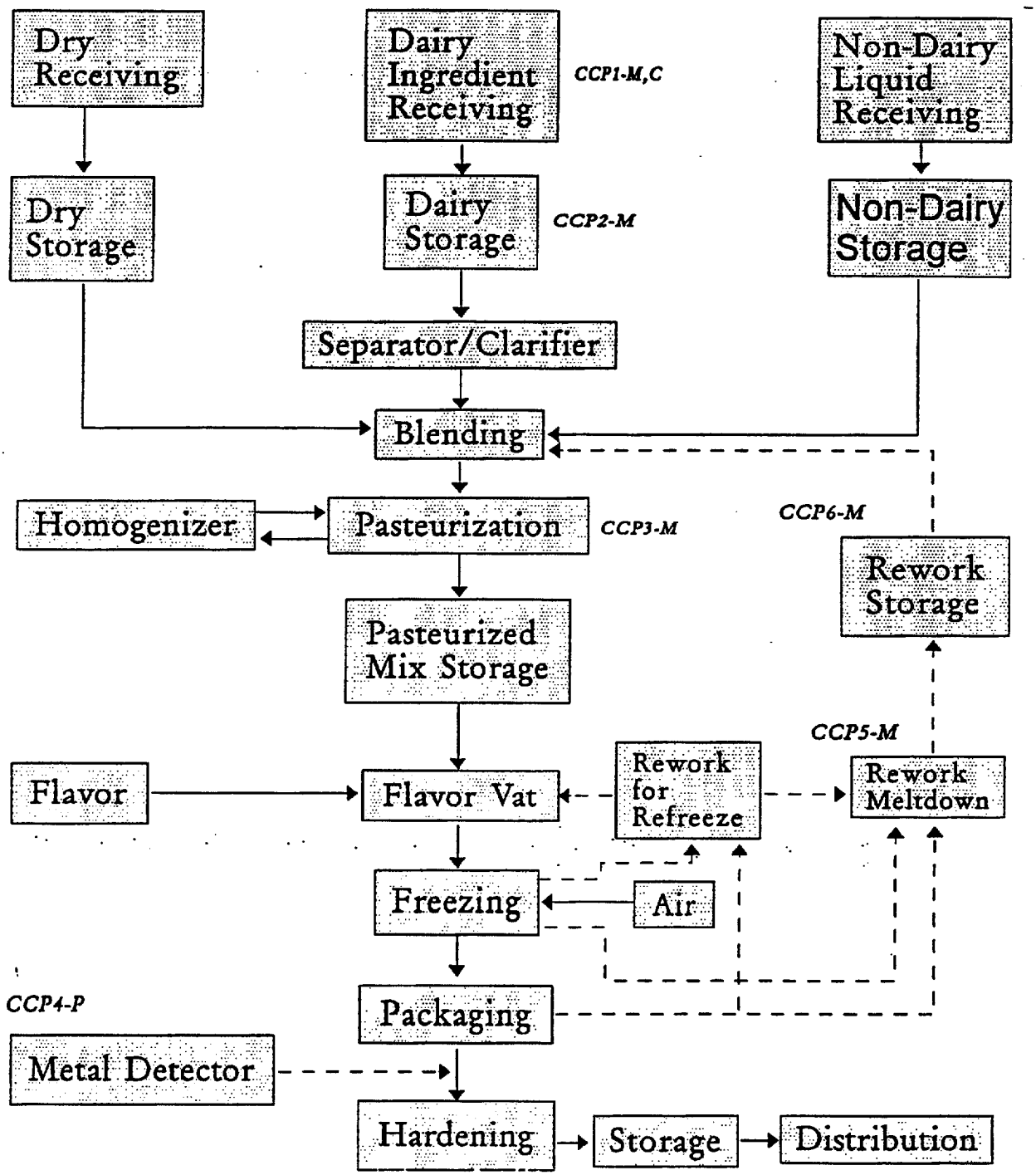
c. Engineering drawings not required

3. **Verification of process flow diagram**

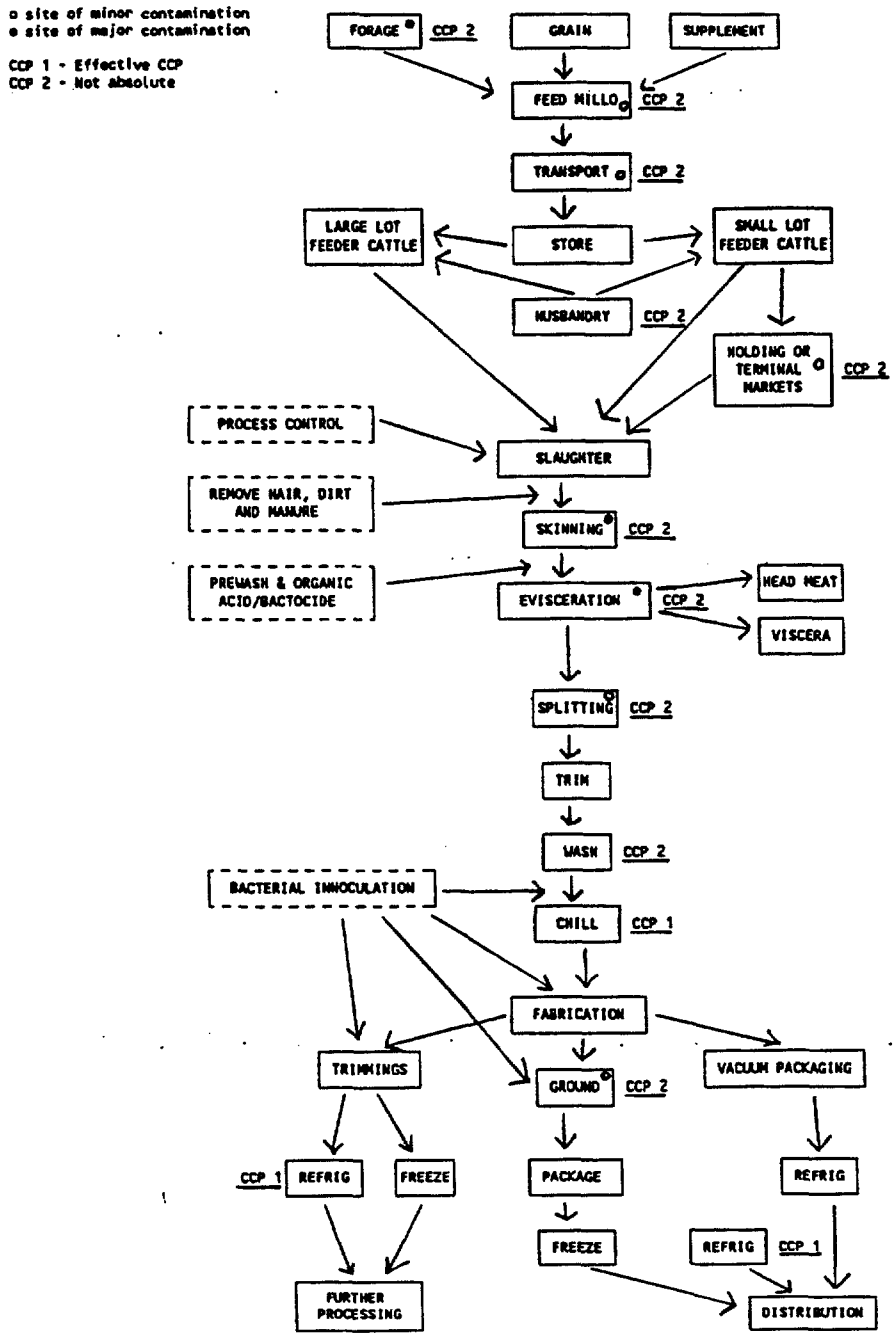
a. Requires on-site inspection of the process by the HACCP team to verify the accuracy and completeness of the diagram

b. If necessary modify the process flow diagram to reflect the actual conditions as observed by the HACCP team

Flow chart for vanilla ice cream



Flow chart for meat products



D. What is a hazard?

A biological, chemical, or physical property that may cause a food to be unsafe for consumption

1. **Biological**
2. **Chemical**
3. **Physical**

E. Identification of microbiological hazards

1. Epidemiological data

Number and percentage of foodborne disease outbreaks and cases by etiologic agent (1973-1987)

Etiologic Agent	Outbreaks No.	Outbreaks %	Cases No.	Cases %
BACTERIAL				
Bacillus cereus	58	2	1,123	1
Brucella	4	<1	43	<1
Campylobacter	53	2	1,547	1
Clostridium botulinum	231	8	494	<1
Clostridium perfringens	190	7	12,234	10
Escherichia coli	10	<1	1,187	1
Salmonella	790	28	55,864	45
Shigella	104	4	14,399	12
Staphylococcus aureus	367	13	17,248	14
Streptococcus, group A	12	<1	1,917	2
Streptococcus, other	7	<1	248	<1
Vibrio cholerae	6	<1	916	1
Vibrio cholerae, non-01	2	<1	11	<1
Vibrio parahaemolyticus	23	1	535	<1
Yersinia enterocolitica	5	<1	767	1
Other bacterial	7	<1	373	<1
Total bacterial	1,869	66	108,906	87
VIRAL				
Hepatitis A	110	4	3,133	3
Norwalk virus	15	1	6,474	5
Other viral	10	<1	1,023	1
Total viral	135	5	10,630	9
PARASITIC				
Giardia	5	<1	131	<1
Trichinella spiralis	128	5	843	1
Other parasitic	7	<1	30	<1
Total parasitic	140	5	1,004	1
CHEMICAL				
Ciguatoxin	234	8	1,052	1
Heavy metals	46	2	753	1
Monosodium glutamate	18	1	58	<1
Mushroom poisoning	61	2	169	<1
Paralytic shellfish poisoning	21	1	160	<1
Histamine fish poisoning	202	7	1,216	1
Other chemical	115	4	1,046	1
Total chemical	697	25	4,454	4
TOTAL	2,841	100	124,994	100

a. What is the incidence of foodborne illness?

b. Are microbiological surveys available of the product?

2. **Ingredients**

a. Does the food contain sensitive ingredients?

b. Are raw materials separated from finished product areas?

3. **Intrinsic factors**

a. Product formulation?

b. Temperature?

c. Water activity?

d. pH?

e. Preservatives?

f. Survival/multiplication of microorganisms?

g. Toxin formation?

h. History of similar products in the marketplace?

i. "Hurdles" concept

j. What intrinsic factors must be controlled?

4. Processing procedures

a. What is the nature of the process?

b. Is there an intended kill step in the process?

c. What is the range of process time/temperature conditions?

d. What is the effectiveness of the kill step?

e. Will the process kill vegetative cells and spores?

f. Is there a chance for cross contamination of the product after processing?

g. What degree of exposure to the processing environment does the product have?

5. Microbial content

a. Is the food commercially sterile?

b. Will the food contain viable microorganisms, or spores?

c. What is the normal microbial flora of the food, pathogens?

d. Does the microbial population change during the time between processing and consumption?

e. What are the microbial growth rates in ingredients and product?

f. Do changes in the microbial population before consumption alter the safety of the food -- pro or con?

6. Facility design and construction

a. Are raw ingredients separated from finished products?

b. Does the facility contain sites that will promote microbial multiplication in the processing environment?

c. Are humidity and water in the environment controlled?

d. Are sewers and floor drains located appropriately?

e. Are air flow patterns controlled?

f. Is the air supply filtered?

g. Are the facilities properly maintained?

h. Are facility refrigeration utilities adequate?

i. Are the facilities designed for wet or dry cleaning?

j. Are the facilities easy to keep clean and sanitary?

7. Equipment design, fabrication, and installation

a. Will the equipment provide the time/temperatures, flow rates, air supply, etc. needed to control microbial hazards?

b. Can the equipment be controlled so that variation in performance will be within the tolerances required to produce safe food?

c. Is the equipment designed, fabricated and installed so that it will not allow development of microbial niches in the equipment, i.e., no product hang up points, no condensation?

d. Is the equipment easily and effectively cleanable?

e. Are current process engineering diagrams accurate?

f. Are pipelines, valves, hoppers, etc. free of static product?

8. Packaging

a. Does the packaging process allow post processing contamination of the product?

b. Does the method of packaging affect the multiplication of microbial pathogens/toxins?

c. Is the package properly labeled, e.g., "Keep Refrigerated"?

d. Does the package include instructions for the safe handling and preparation of the food by the end user?

e. Is the packaging material resistant to damage?

f. Are tamper-evident packaging features used?

g. Is each package and case legibly and accurately coded?

h. Does each package contain the proper label

9. Sanitation

a. Will sanitation affect the microbial safety of the product?

b. Can the facility and equipment be cleaned and disinfected to permit the safe processing and handling of foods?

c. Are sanitary conditions reliably and consistently present to assure safe food production?

d. Are dry cleaning methods used when required to prevent microbial multiplication in the environment?

e. Are the facilities and equipment cleaned at sufficiently close intervals?

f. Are the cleaning and disinfecting agents appropriate to remove the food residues?

g. Are the cleaning procedures standardized?

10. Employee health, hygiene and education

a. Can employee health or personal hygiene habits affect the safety of the food?

b. Do the employees understand the process and the factors they must control to assure the preparation and handling of safe foods?

c. Will the employees inform management of a problem that could affect the safety of the food?

11. Conditions of storage between packaging and the end user

a. What is the likelihood that the food will be stored at the wrong temperature?

b. Would improper storage cause the food to be microbiologically unsafe?

12. Intended use

a. Will the food be heated by the consumer?

b. Will there likely be leftovers?

13. Intended consumer

a. Is the food intended for the general public?

b. Is the food intended for consumption by a population with increased susceptibility to illness?

II. Risk and Severity Assessment for the Hazards Identified

A. Severity

1. Seriousness of the hazard

a. Life threatening

b. Attack rate

c. Disease sequelae

d. Extensive and serious economic loss

2. Trivial

B. Risk

1. Likelihood of occurrence

2. Frequency of occurrence

a. Always present

b. Daily

c. Yearly

d. Seasonal

C. Ranking of hazards

1. Classes of hazards

Hazard A: A special class that applies to nonsterile products designated and intended for consumption by at-risk populations, e.g., infants, the aged, the infirm, or immunocompromised persons.

Hazard B: The product contains "sensitive ingredients" in terms of microbial hazards.

Hazard C: The process does not contain a controlled processing step that effectively destroys harmful organisms.

Hazard D: The product is subject to recontamination after processing and before packaging.

Hazard E: There is substantial potential for abusive handling in distribution or in consumer handling that could render the product harmful when consumed.

Hazard F: There is no terminal heat process after packaging or when cooked in the home.

D. Categories of risk

Category VI: A special category that applies to nonsterile products designated and intended for consumption by at-risk populations, e.g., infants, the aged, the infirm, or immunocompromised persons. All six hazard characteristics must be considered.

Category V: Foods subject to all five general hazard characteristics, e.g., Hazards B-F.

Category IV: Foods subject to four general hazard characteristics.

Category III: Foods subject to three general hazard characteristics.

Category II: Foods subject to two general hazard characteristics.

Category I: Foods subject to one general hazard characteristics.

Category 0: No hazard

SESSION SIX

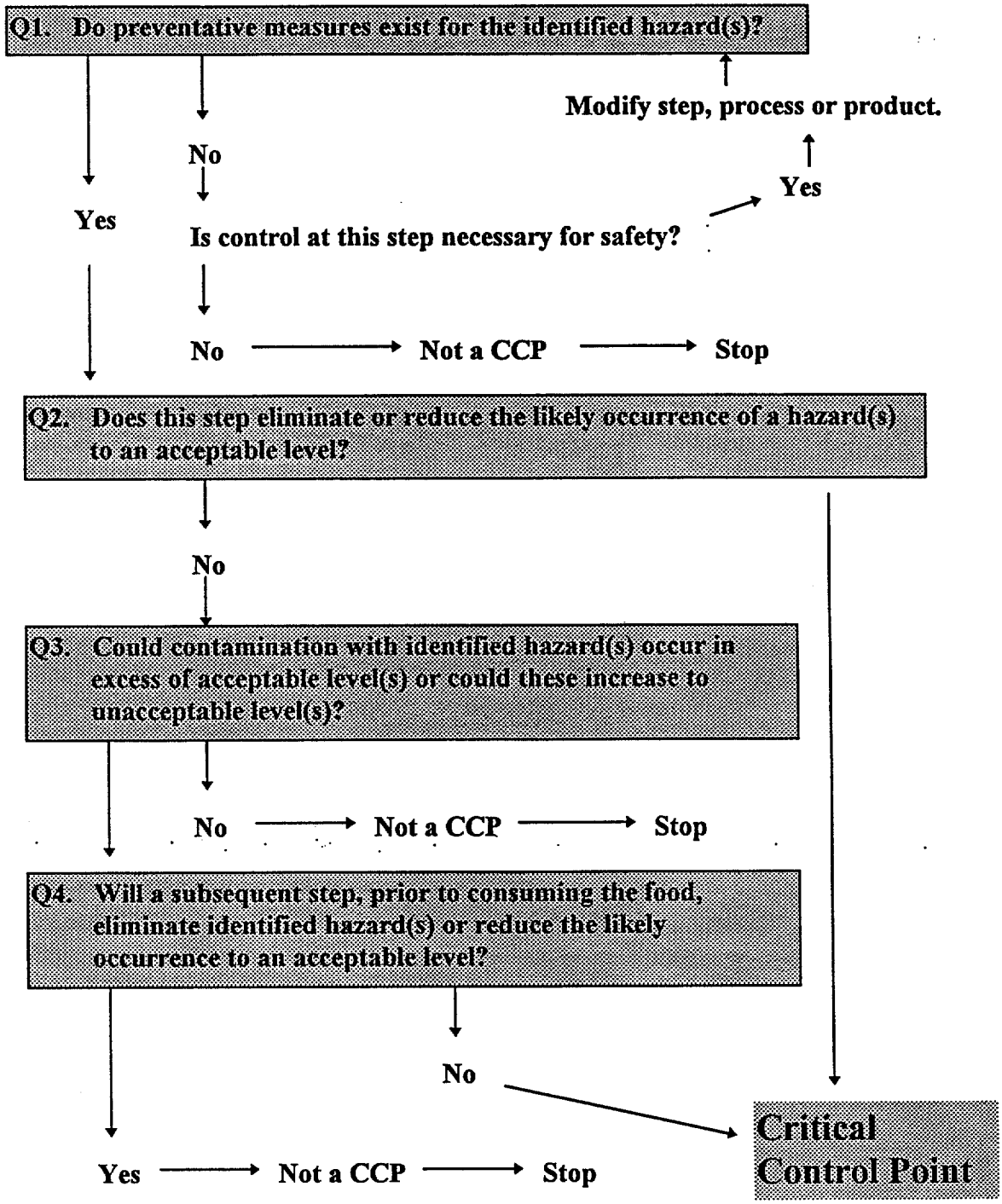
Critical Control Points (CCPs)

OBJECTIVES

1. Demonstrate the use of the Critical Control Point (CCP) decision tree to identify CCPs.
2. To provide examples of types of critical control points.
3. To describe the criteria and control procedures of critical control points.
4. Explain monitoring and record keeping for CCPs in a HACCP plan.

I. Principles Governing the Determination of CCPs

A. CCP decision tree



B. CCPs and hazards are directly related

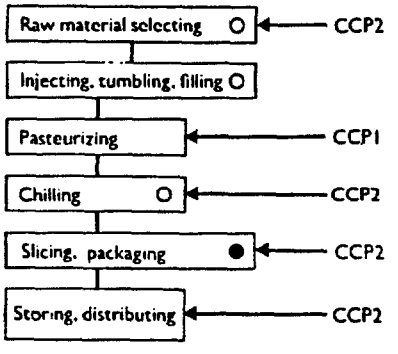
II. Examples of Critical Control Points

A. Thermal processes

1. Retorting

2. Pasteurization

Flow diagram for production of packaged sliced ham from pasteurized canned ham



O indicates a site of minor contamination
● indicates a site of major contamination
CCP1 effective CCP, CCP2 not absolute

ICMSF. *Microorganisms in Foods*, Application of the hazard analysis critical control point (HACCP) system to ensure microbiological safety and quality, Blackwell Scientific Publications, Oxford, 1988.

B. Reduced temperatures

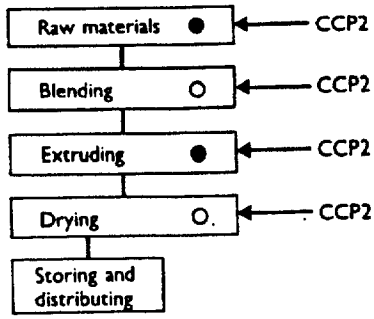
1. Refrigeration

2. Freezing

C. Reduction in water activity

1. Dehydration

Flow diagram for production of dried-egg pasta



O indicates a site of minor contamination
● indicates a site of major contamination
CCP2 not absolute

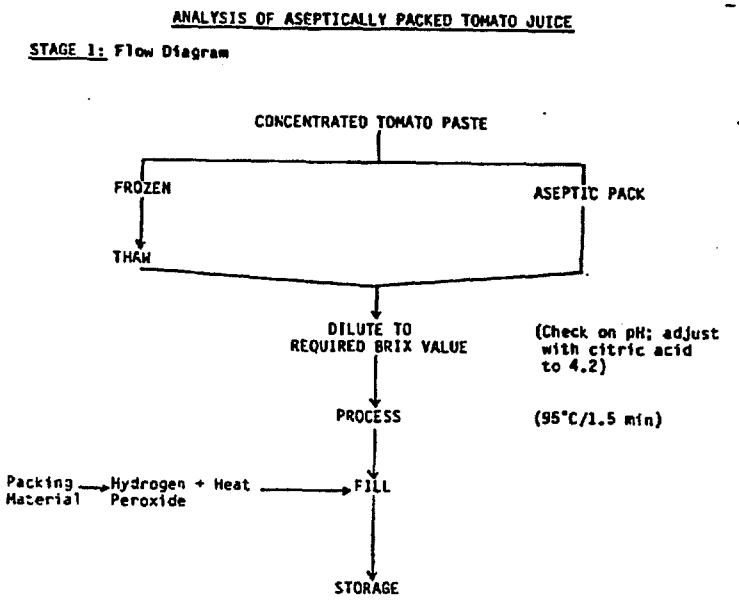
ICMSF. *Microorganisms in Foods*, Application of the hazard analysis critical control point (HACCP) system to ensure microbiological safety and quality, Blackwell Scientific Publications, Oxford, 1988.

2. Addition of solutes

D. Acidification

1. Fermentation

2. Acidulation



From The Campden Food & Drink Research Association, *Guidelines for the Establishment of Hazard Analysis Critical Control Point (HACCP)*, Reprinted February 1991, Technical Manual No. 19

III. Criteria for Control of CCPs / Setting Critical Limits

A. Criteria for CCPs should be:

1. **Designed to indicate whether a CCP is in or out of control**
2. **Simple, specific and clear**
3. **Based on scientifically determined parameters**
   - a. **Published data**
   - b. **Expert advice**
   - c. **Experimental data**
   - d. **Mathematical modeling**
4. **Quantifiable**

B. Examples of specific criteria for control

1. Temperature

Minimum pasteurization times and temperatures for milk and milk products are:		
Milk	**145°F**	**30 minutes**
	161°F	**15 seconds**
	191°F	**1 second**
	194°F	**0.5 second**
	201°F	**0.1 second**
	204°F	**0.05 second**
	212°F	**0.01 second**
Milk Products of 10% fat or more with added sweeteners, i.e. chocolate milk, cream, etc.	**150°F**	**30 minutes**
	166°F	**15 seconds**
	191°F	**1 second**
	194°F	**0.5 second**
	201°F	**0.1 second**
	204°F	**0.05 second**
	212°F	**0.01 second**

Minimum times and temperatures for frozen dessert mixes are:	
Temperature	**Time**
155°F	**30 minutes**
175°F	**25 seconds**
180°F	**15 seconds**
191°F	**1.0 second**
194°F	**0.5 second**
201°F	**0.1 second**
204°F	**0.05 second**
212°F	**0.01 second**

Source: Frozen Dessert Processing Guidelines; Milk Safety Branch, U.S. Food and Drug Administration, 1989.

2. Water activity

Approximate minimum water activity (A_w) of selected microorganisms

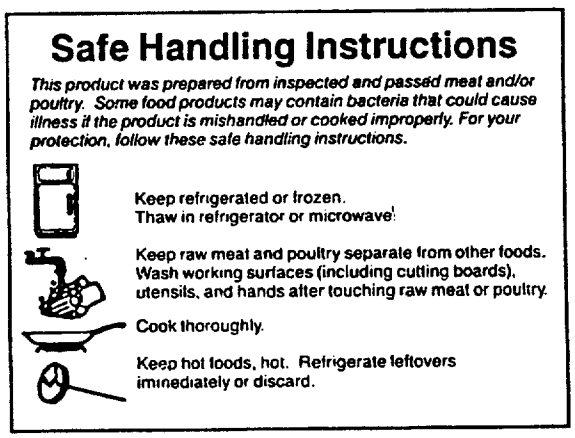
Most spoilage bacteria	0.90
Most spoilage yeasts	0.88
Most spoilage molds	0.80
Halophilic bacteria	0.75
Xerophilic molds	0.65
Osmophilic molds	0.60
Salmonella	0.95
Staphylococcus aureus	0.86
Clostridium botulinum	0.94
Clostridium perfringens	0.95
Bacillus cereus	0.95

3. Acidity

4. Storage conditions

- Temperature
- Humidity
- Modified atmosphere

5. Label instructions



IV. Establishment of Specific Control Procedures for CCPs

A. Based on technical knowledge about hazards

B. Process development

C. Process design and engineering

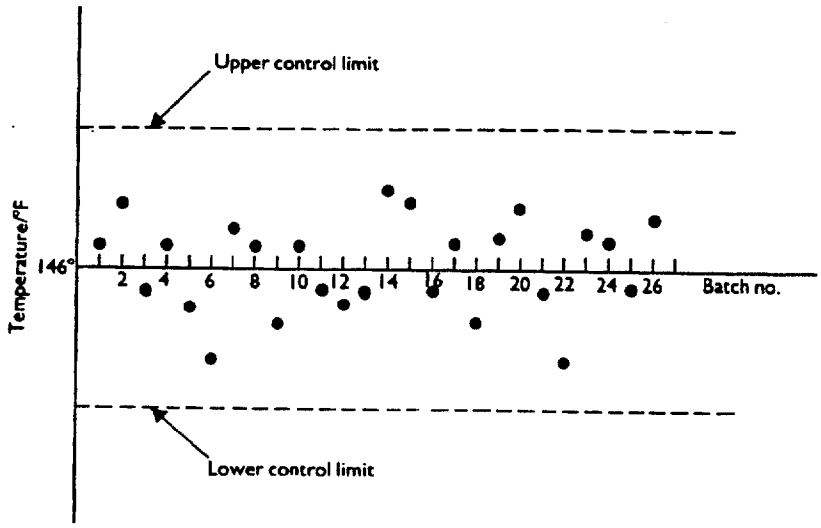
D. Procedure development and validation

V. Monitoring of CCPs

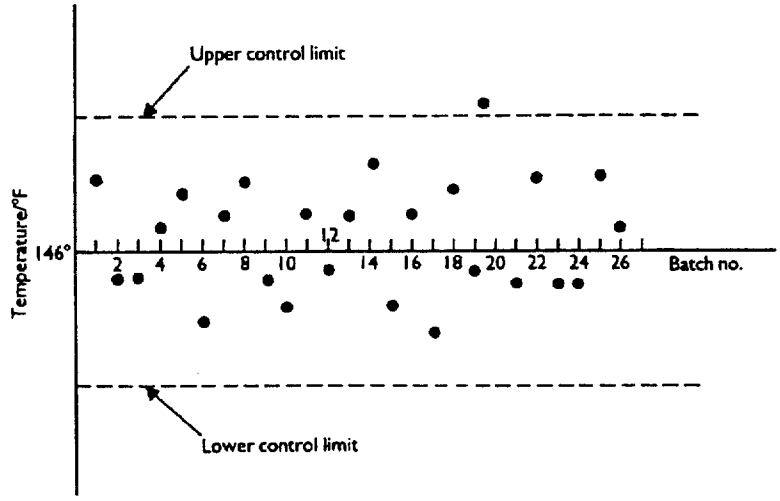
Purpose of monitoring:

1. **To indicate if there is a trend for a loss of control of a CCP**
2. **To determine when there is a loss of control of a CCP**
3. **Provides documentation for use in verification of the HACCP plan**

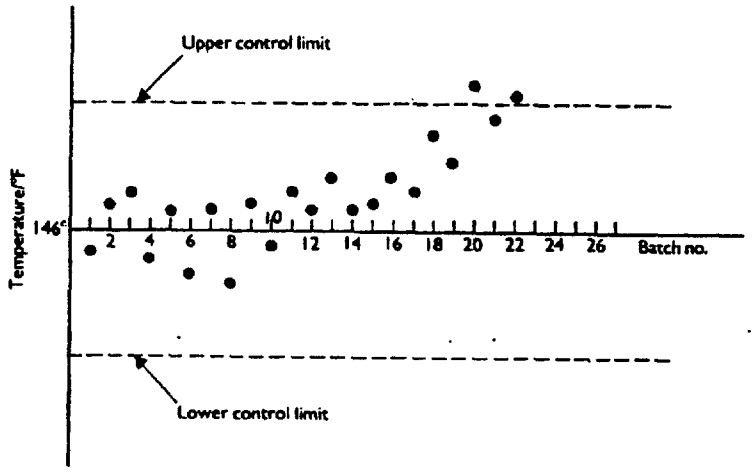
Control Chart A: Process in Control



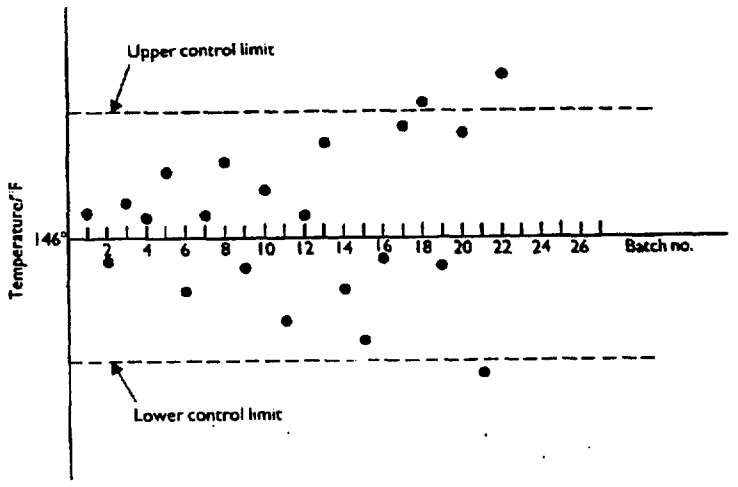
Control Chart B: Process in Control



Control Chart C: Process Control Lost Due to Upward Trend of Mean



Control Chart D: Process Control Lost Due to Excessive Batch Variability



All from ICMSF. 1988. Microorganisms in Foods 4: Application of the Hazard Analysis Critical Control Point System to Ensure Microbiological Safety and Quality.

A. Classes of monitoring

1. Visual observation

a) Real time
b) Equipment
c) Facilities
d) Employee hygiene

2. Sensory evaluation

a) Real time
b) Odor
c) Color
d) Texture

3. Physical measurement

a) Real time
b) Continuous recording of critical factors
c) Temperature
d) Pressure
e) Vacuum
f) Flow rate/ holding times
g) Viscosity

4. Chemical testing

a) Real time
b) Rapid measurements
c) pH
d) Moisture/ water activity
e) Salt
f) Nitrite
g) Preservatives
h) Cleaning agent concentration
i) Sanitizer concentration

5. **Microbiological testing**

a) Not real time
b) Not a good monitoring tool
c) Delay in test results prevents immediate corrective action
d) May use with raw materials that can be held for test results
e) Use for testing for verification of HACCP

B. **Monitoring records**

1. **Accurate**

2. **Complete**

3. **Retention**

VI. Corrective Actions Based on Monitoring

A. Have a written plan in place before the deviation occurs

B. Assignment of responsibility for taking corrective action

C. Take immediate corrective action

D. Deal with the material that was produced under the deviation

1. **Place suspect product on hold**
2. **Seek advice from the HACCP team, management, and other relevant experts**
3. **Conduct further tests to assess safety**

E. Possibilities for disposition of CCP-deviant product

1. **Destroy product**
2. **Rework into new products**
3. **Use in less sensitive products, e.g. animal feed**
4. **Release product after sampling and testing**
5. **Release product**

SESSION SEVEN

HACCP Workshop

OBJECTIVES

1. Participants and instructors will construct a HACCP plan using the principles and techiques from sessions I-VI.

Logic Sequence for Application of HACCP

Assemble the HACCP Team
↓
Describe Product
↓
Identify Intended Use
↓
Construct Flow Diagram
↓
On-Site Verification of Flow Diagram
↓

List All Identified Hazards Associated With Each Step
and
Consider Preventive Measures to Control Hazards

Step	
Identified Hazard	**Preventative Measures (PM)**
Biological	
Chemical	
Physical	

↓

CCP Decision Tree

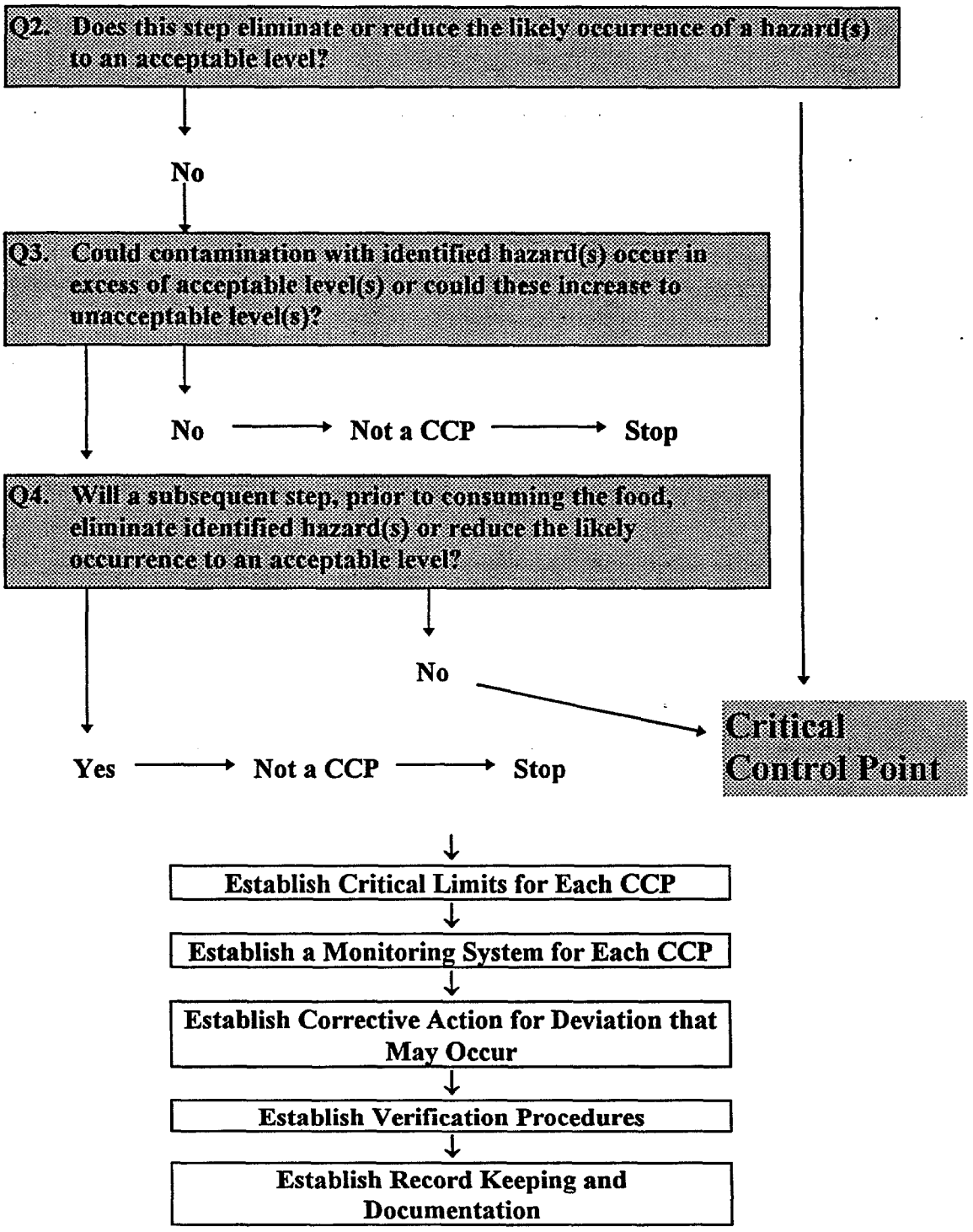
Q1. Do preventative measures exist for the identified hazard(s)?

Yes → **Q2. Does this step eliminate or reduce the likely occurrence of a hazard(s) to an acceptable level?**

No → **Is control at this step necessary for safety?**

Yes → **Modify step, process or product.** → **Q1. Do preventative measures exist for the identified hazard(s)?**

No → **Not a CCP** → **Stop**


Q2. Does this step eliminate or reduce the likely occurrence of a hazard(s) to an acceptable level?
No
Q3. Could contamination with identified hazard(s) occur in excess of acceptable level(s) or could these increase to unacceptable level(s)?
No
Not a CCP
Stop
Q4. Will a subsequent step, prior to consuming the food, eliminate identified hazard(s) or reduce the likely occurrence to an acceptable level?
No
Critical Control Point
Yes
Not a CCP
Stop
Establish Critical Limits for Each CCP
Establish a Monitoring System for Each CCP
Establish Corrective Action for Deviation that May Occur
Establish Verification Procedures
Establish Record Keeping and Documentation

HACCP Description Chart

Product: **Vanilla Ice Cream**

Plant: **IDFA**

CCP / Process Step	Hazard / Concern	Control Point	Critical Limit	Monitoring / Frequency	Records / Location	Responsibility	Corrective Action	Verification
CCP 1 Dairy Ingredient Receiving	Microbiological Chemical-Drug Residues (raw milk)	Temperature β - lactam screening	≤ 45° F No positives	Every tanker Every Tanker	QA/QC office QA/QC office	Intake operator Intake operator	Reject Reject	Indicating thermometer Calibrate test kit
CCP 2 Dairy Ingredient Storage	Microbiological	Temperature Time	≤ 45° F ≤ 72 hours	Four times dairy[1]	QA/QC office	QA Technician	Investigate cause and adjust	Recording vs. indicating thermometer
CCP 3 Pasturization	Microbiological	Temperature Time	≥ 175° F ≥ 25 sec.	Continous	Production office	Pasteurizer operator	Flow divert, recirculate, and heat	Seal checks, timing pump, indicating therm. calibration
CCP 4 Metal Detector	Metal Fragments	Metal Detector	Zero (limit of detection)	Continous	QA/QC office	Packaging operator	Reject, locate source	Detector calibration
CCP 5 Meltdown	Microbiological	Temperature Time	If > 45° F and < 140° F, ≤ 4 hours	Four times dairy[1]	QA/QC office	QA Technician	Investigate cause and adjust	Recording vs. indicating thermometer
CCP 6 Rework Storage	Microbiological	Temperature Time	≤ 45° F ≤ 72 hours	Four times dairy[1]	QA/QC office	QA Technician	Investigate cause and adjust	Recording vs. indicating thermometer
[1]Continous recording thermometer								

HACCP Description Chart

Product: _____

Plant: _____

CCP / Process Step	Hazard / Concern	Control Point	Critical Limit	Monitoring / Frequency	Records / Location	Responsibility	Corrective Action	Verification

SESSION EIGHT

HACCP Workshop

OBJECTIVES

1. **Participants will work together in small teams, coached by the instructors, to construct HACCP plans for specific food processes.**

SESSION NINE

HACCP Workshop

OBJECTIVES

1. Class teams will present their HACCP plans to the class to review for accuracy and applicability

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SESSION TEN

HACCP Team Assembly

OBJECTIVES

1. Identify some of the desired prerequisites for developing a HACCP plan.
2. Identify steps used to develop and implement a HACCP plan.
3. Review the procedures for selecting and training a HACCP team.
4. Review types of data needed in developing a HACCP plan.
5. Identify some of the causes for HACCP plan failing.

I. Prerequisites to HACCP

A. Management commitment

B. Established QA/QC program

C. Effective clean-up & sanitizing program with pre-op monitoring

D. GMPs and sanitation program written and enforced

E. Written procedures for:

1. **Training**
2. **Insect and rodent control**
3. **Raw material/ingredient control**
4. **Microbiological testing**
5. **Preventative maintenance**
6. **Ingredient and product coding/tracking**

These prerequisites are necessary for the operation of an effective HACCP program. They can be developed at the same time as the HACCP plan and program, but it is difficult to do everything at once and make "quantum leaps." It is easier, more effective, and preferred to take a step-by-step approach and develop these prerequisites before establishing a HACCP program.

II. Steps in Implementing a HACCP Program

A. **Management makes a proactive commitment.**

B. **Responsibilities are assigned**

HACCP team leader

C. **A HACCP team is established**

Get "buy-in" from other departments

D. **Enlist outside expertise**

1. **Facilitator**
2. **Consultant**

E. **Train team in HACCP principles and system**

G. **Description and intended uses of**

1. **Products**
2. **Ingredients**

H. **Develop detailed flow charts**

I. **Verify flow charts on-site in plant**

J. **List all hazards associated with each step in processes**

K. **Develop HACCP plan**

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L. Phase-in plan

M. Verify program once implemented

Outside audit

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III. Selecting the Team

A. Team leader

1. **Supervisory skills**
2. **Organizational skills**
3. **Technical knowledge**

B. Members - knowledgeable representatives of various departments

1. **Manufacturing/operations**
2. **QC**
3. **Research and development**
4. **Engineering**
5. **Maintenance**
6. **Sanitation/clean-up**
7. **Distribution**
8. **Employees**

C. Members gain knowledge and experience in HACCP system

D. Members serve as communication link with rest of plant

E. Develop "ownership" in HACCP plan

F. Team assists in the implementation of HACCP plan

G. Team assists in the training of employees in various departments

H. Develop in-house expertise in HACCP to deal with customers/regulators

IV. Train HACCP Team

A. Send members to outside HACCP course

B. Have a company provide an in-house custom HACCP course

C. Train a trainer to train members of the team

D. Other people that should be trained:

1. **Senior plant management**
2. **Persons responsible for HACCP studies**
3. **Persons responsible for implementing HACCP evaluations**

V. Types of Technical Data Required

VI. Doctrine of Reasonableness

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A. **FDA in its proposed seafood HACCP plan states that:**

"Hazards that involve low risk and that are not likely to occur need not be considered for the purposes of HACCP." (IV A. 1.)

"Processors and importers should identify in their written plans only those safety hazards that are reasonably likely to occur, rather than every conceivable hazard no matter how theoretical or remote. ...processors and importers should not be required to establish controls and regularly monitor for hazards that are highly unlikely to occur in the absence of those controls." (VII C. 5.)

VII. Microbiological Testing in the Plan

A. **To confirm the effectiveness of the plan**

B. **For environmental testing**

C. **Testing of raw materials and critical ingredients**

D. **Verify CCPs**

E. **Verify safety of finished products**

F. **Testing during verification audits of the plan**

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VIII. Causes for Failure of HACCP Plans

A. Lack of true commitment

B. Lack of the necessary organization to support plan

C. HACCP not truly understood

D. Poor communications

E. Lack of training

F. Lack of ownership in plan/no buy in

G. Failure to identify hazards and CCPs

H. Plan too complex

I. Responsibilities not clearly defined

J. Failure to verify that the plan is working properly

K. Failure to change plan as needed

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SESSION ELEVEN

Maintenance of the HACCP Plan

OBJECTIVES

1. Identify the HACCP plan as a dynamic document that needs periodic updating.
2. Define monitoring and verification.
3. Review types of verification activities and schedules.
4. Present some verification questionnaires and checklists.

I. HACCP -- A Dynamic Document

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A. Update plan where there is a change in:

1. **Raw materials, ingredients, or formula/recipe**
2. **Equipment, process, facility, or flow chart**
3. **Cls, CCPs, monitoring, or corrective actions**
4. **Packaging, storage, or distribution**
5. **Intended use**
6. **Regulations**

B. Update plan when there is an identification of a problem or issue of safety concern, such as an increase in microbial counts, presence of pathogens, consumer complaints, spoilage or shortened shelf-life.

C. Update plan when verification or audit shows the need; e.g., the plan is no longer effective or is too complex and not being followed.

D. Update plan when employees and organization show the capability to operate under an improved or more sophisticated plan based on current performances.

II. Monitoring vs. Verification

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A. **Monitoring: the "real time" observations or measurements of an operating process whereby adjustment can be made on the process before the product leaves the production line. That is, the product is still under the control of the process. Microbiological testing can be monitoring if the product is on hold and under control of operations/QC.**

B. **Verification: a process of confirming that some process or action has happened, such as verifying that proper monitoring of CCPs has or is taking place. Verification involves the review of HACCP documentation to insure that the HACCP plan is being followed as written. Microbiological testing is used to verify the quality of raw materials, effectiveness of the clean-up/sanitizing operation and CCPs, safety of the finished products, and overall effectiveness of the HACCP plan.**

III. Verification

A. **The success of a HACCP program is in fulfilling all seven principles well, but verification is the step that insures all other steps are being performed on a consistent and reliable basis and that the product is safe. Verification is the "soul" of HACCP. One of the many strengths of HACCP programs is the built-in verification requirement (principle #7). HACCP programs are to be audited periodically to ensure that all principles have been fully covered in the plan and that the program is operating according to the plan. The audit includes a thorough review of all documentation as well as an audit of actual operations.**

B. **Verification should not be thought of as something that is done semi-annually or annually. Verification is a dynamic process just like a HACCP plan is. There are many types of verification, such as:**

1. **Regular, daily, or operational verification would be the verification provided by department or line supervisors on virtually a daily basis to ensure that those aspects of the plan under their responsibility, such as monitoring, are being performed according to the plan and that equipment is properly calibrated. This regular verification would also include periodic, random microbiological testing of the environment, raw materials and CCPs to ensure the effectiveness of the appropriate CCPs.**

2. **The person responsible for the HACCP plan, QC supervisor and department managers, should also conduct periodic verification reviews to ensure themselves that the plan is functioning properly and that there is not any reason for adjusting the plan.**

3. **Periodically, there should be formal audits of the complete plan, which would also include appropriate microbiological testing. A schedule for such audits should be included in the HACCP plan. A new HACCP plan should be audited, preferably by an outside expert, within six months after it has been implemented to ensure its validity and effectiveness. Thereafter, the plan should be audited at least every six months to ensure that it is properly operated, the process is in control and to determine if any adjustments are necessary. The six month audit should be done by an internal auditor, which is rotated among several managers so that more people become familiar with the plan and the audit benefits from different points of view. Annually, the audit should be done by an outside HACCP consultant to again benefit from their broader expertise.**

4. **The HACCP plan should include how each CCP will be verified so that much of the procedure is already set out.**

IV. Verification Activities and Checklists

A. The following "Examples of Verification Activities" is from the National Advisory Committee on Microbiological Criteria for Foods as published in the *International Journal of Food Microbiology*.

A. Verification procedures may include

1. Establishment of appropriate verification inspection schedules,
2. Review of the HACCP plan
3. Review of CCP records.
4. Review of deviations and dispositions.
5. Visual inspections of operations to observe if CCPs are under control.
6. Random sample collection and analysis.
7. Review of critical limits to verify that they are adequate to control hazards.
8. Review of written record of verification inspections which certifies compliance with the HACCP plan or deviations from the plan and the corrective actions taken.
9. Validation of HACCP plan, including on-site review and verification of flow diagrams and CCPs.
10. Review of modifications of the HACCP plan.

B. Verification inspections should be conducted:

1. Routinely, or on an unannounced basis, to assure selected CCPs are under control.
2. When it is determined that intensive coverage of a specific commodity is needed because of new information concerning food safety.
3. When foods produced have been implicated as a vehicle of foodborne disease.
4. When requested on a consultative basis or established criteria have not been met.
5. To verify that changes have been implemented correctly after a HACCP plan has been modified.

C. Verification reports should include information about:

1. Existence of a HACCP plan and the person(s) responsible for administering and updating the HACCP plan.
2. The status of records associated with CCP monitoring.
3. Direct monitoring of the CCP while in operation.
4. Certification that monitoring equipment is properly calibrated and in working order.
5. Deviations and corrective actions.
6. Any samples analyzed to verify that CCPs are under control. Analyses may involve physical, chemical, microbiological, or organoleptic methods.
7. Modifications to the HACCP plan.
8. Training and knowledge of individuals responsible for monitoring CCPs

B. This "General questionnaire for use in HACCP verification" is a useful standardized checklist for conducting audits, preparing for audits, or use by the HACCP team in developing the HACCP plan. This questionnaire was published by R. B. Tompkin in Food Control 1994, Volume 5, Number 4.

Name of Plant:
Date of Review:

- Who is on the HACCP team?
- Who is the HACCP team leader?
- Is there a HACCP plan for each process?
- Is there a simple plant layout available?
- Review the layout. Does the flow of product and people minimize the possibility of cross-contamination?
- Who was responsible for identifying hazards and critical control points (CCPs)?
- Does that person qualify as an expert in hazard analysis for the type of foods and food processes in the facility?
- Have critical limits been established for each CCP in each HACCP plan?
- Who established the limits?
- What rationale was used for the critical limits?
- Who approves the change in a CCP? Is the change documented?
- Select a HACCP plan and review the current process flow. Does it agree with the HACCP plan?
- Who monitors the CCPs?
- Do they understand their role in the HACCP plan?
- Is the monitoring done according to the plan?
- Are the results recorded?
- Who verifies that the CCPs are being monitored correctly?
- Do the operators know the critical limits and when a deviation occurs?
- Do the operators know how to adjust the process to prevent a deviation or does this occur automatically?
- What happens when a deviation occurs?
- Is a plan in place to address deviations at each CCP?
- How is management notified of a deviation?
- Are corrective actions for deviations recorded?
- Is a deviation log book or similar central record being maintained?
- Who is responsible for making decisions on corrective actions?
- Where are the HACCP plan records maintained?
- Are the records available for verification (can they be seen and reviewed)?
- Are all records pertaining to CCPs available?
- Where and how long are they kept?
- Who is responsible for maintaining the records?
- Is the effectiveness of the HACCP plan verified by any physical, chemical or microbiological testing?
- Who collects and interprets the data from tests which are performed for verification?
- Who receives the test results?
- Do the plant manager and his/her staff understand the HACCP concept and support the plant's HACCP system?
- Are those who are directly involved with CCPs adequately trained?
- Who is responsible for training?
- Does the plant have someone on staff who has attended a course in HACCP?
- On the basis of your review, is the HACCP plan complete, accurate and being correctly followed?
- Do you have any recommendations for correction or improvement?

C. Companies develop their own HACCP Verification Checklists for auditing their supplier' HACCP plans. This is an example of what one large company developed and used for this purpose.

HACCP Verification Checklist

SUPPLIER: _____
DATE: _____
PRODUCT: _____
AUDITOR: _____

AREA	RECORDS TO BE AUDITED	YES	NO
HACCP PLAN	Is a completed NACMCF HACCP plan available? Date:		
	Does the plan identify the supplier's product?		
	Does the plan include a product description and intended use?		
	Does the plan include a raw material list or ingredient list?		
	Does the plan include a flow diagram of process with CCP's?		
	Does the plan include a product hazard assessment?		
	Does the plan include CCP's and limit descriptions?		
	Does the plan include monitoring method and frequency for each CCP?		
	Does the plan include corrective action for each CCP?		
	Does the plan include record keeping requirements and responsibility for each CCP?		
	Does the plan include a verification plan, frequency and responsibility?		
	Is the HACCP plan revalidated when the product or process changes?		
	Has an individual or team been assigned to head up the HACCP program?		
MONITORING	Are historical records available and complete for each CCP?		
	Are historical internal verification records available and complete?		
	Are historical microbiological records available and complete?		
	Are all these records initialed and dated by the person responsible?		
	Period examined:		
AREA	PROCEDURES TO BE AUDITED DURING PLANT TOUR	YES	NO
CORRECTIVE ACTION	Are deviation records available?		
	Are these records kept in a deviation file?		
	Were action plans developed and implemented to prevent a recurrence?		
CCP	Is a procedure written and implemented for each CCP?		
	Is the person responsible for monitoring each CCP aware of the critical limits		
	and corrective actions?		
	Are real time measurements being recorded for each CCP?		
MICRO-BIOLOGICAL TESTING	Is a protocol written and implemented for microbiological testing		
	on finished product? ,		
	Is a protocol written and implemented for environmental testing?		
	Are guidelines being met?		
	(Outside laboratory test methods and results should be kept on file at the supplier.)		

COMMENTS: _____

Please refer to the reverse side of this document for definitions and verification results.

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SELECTED READING

HACCP

Campden Food & Drink Research Association: Hygienic Design of Food Processing Equipment; Technical Manual No. 7. 1993. Chipping Campden, Gloucestershire, GL55 6LD, U.K.

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APPENDIX V

HACCP Plans

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1. ANALISIS DE RIESGOS

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a. Descripción del Producto: Queso cheddar

Queso semiduro, madurado y su presentación es en trozos empacados en plástico al vacío.

Ingredientes: Leche completa pasteurizada
Cultivo láctico: Streptococcus láctis
Sal 2%
Colorante vegetal

b. Quienes lo consumen:

Para la mayoría de la población incluyendo niños, ancianos y enfermos que se les permita en su dieta.

c. Diagrama de Flujo

d. Riesgo identificado:

- Antibióticos
- S. aureus
- Salmonella
- E. coli
- L. monocytogenes
- Campylobacter jejuni
- TB
- Brucella

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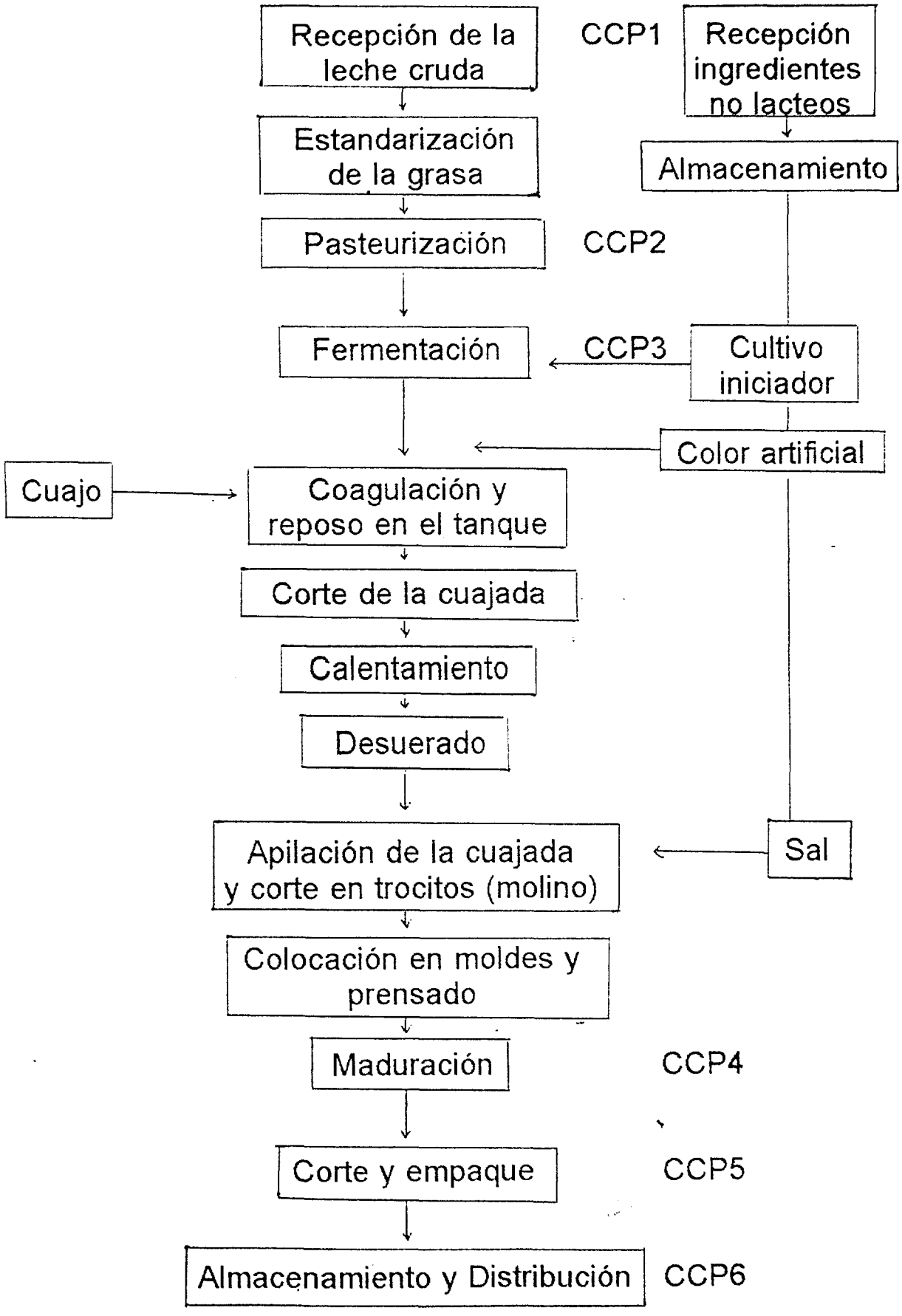
DIAGRAMA DE FLUJO PARA QUESO CHEDDAR



HACCP Description Chart

60°C 30'

Product: Cheddar Cheese

Plant: _____

CCP / Process Step	Hazard / Concern	Control Point	Critical Limit	Monitoring / Frequency	Records / Location	Responsibility	Corrective Action	Verification
CCP1 Recepción de leche cruda	Microbiológico Químicos, - agua - antimicrobianos	Temperatura Acidez Sustancias inhibidoras	4°C No positivos	Cada tanque Cada tanque	Lab/oficina QC o producción	Operador Operador	Rechazo Rechazo	Calibración Termómetro Kit
CCP2 Pasteurización	Microbiológico	Temperatura tiempo	65°C 15 seg	Continuo	Oficina QC o Producción	Operador Pasteurizador	Reprocesar y utilizar para otro producto	Fosfatasa chequeo del equipo
CCP3 Fermentación	Microbiológico	Temperatura Acidez o pH	32 °C? .22? 4.5?	Continuo	Laboratorio Oficina QC o producción	Operador y Tec. lab.	Agrega más cultivo o rechazo	Chequeo del cultivo y antimicrobianos Calibración potenciometro
CCP4 Maduración	Microbiológico	Temperatura Humedad Tiempo	4°C HR=? 6-10 meses	Continuo	Oficina QC o Producción	Operador y supervisor	Cambiar de bodega	Calibración instrumentos de medición
CCP5 Empaque	Microbiológico	Vacío	?	Cada lote	Oficina QC o Producción	Operador	Reempacar	Calibración del vacío chequeo material empaque
CCP6 Almacenamiento	Cambios Fisicoquímicos	Temperatura	4°C	Continuo	Oficina QC o producción	Operador	Cambiar de bodega	Calibración temperatura

? Se necesitan chequear estos límites en una referencia sobre manufactura de queso cheddar

HACCP Description Chart

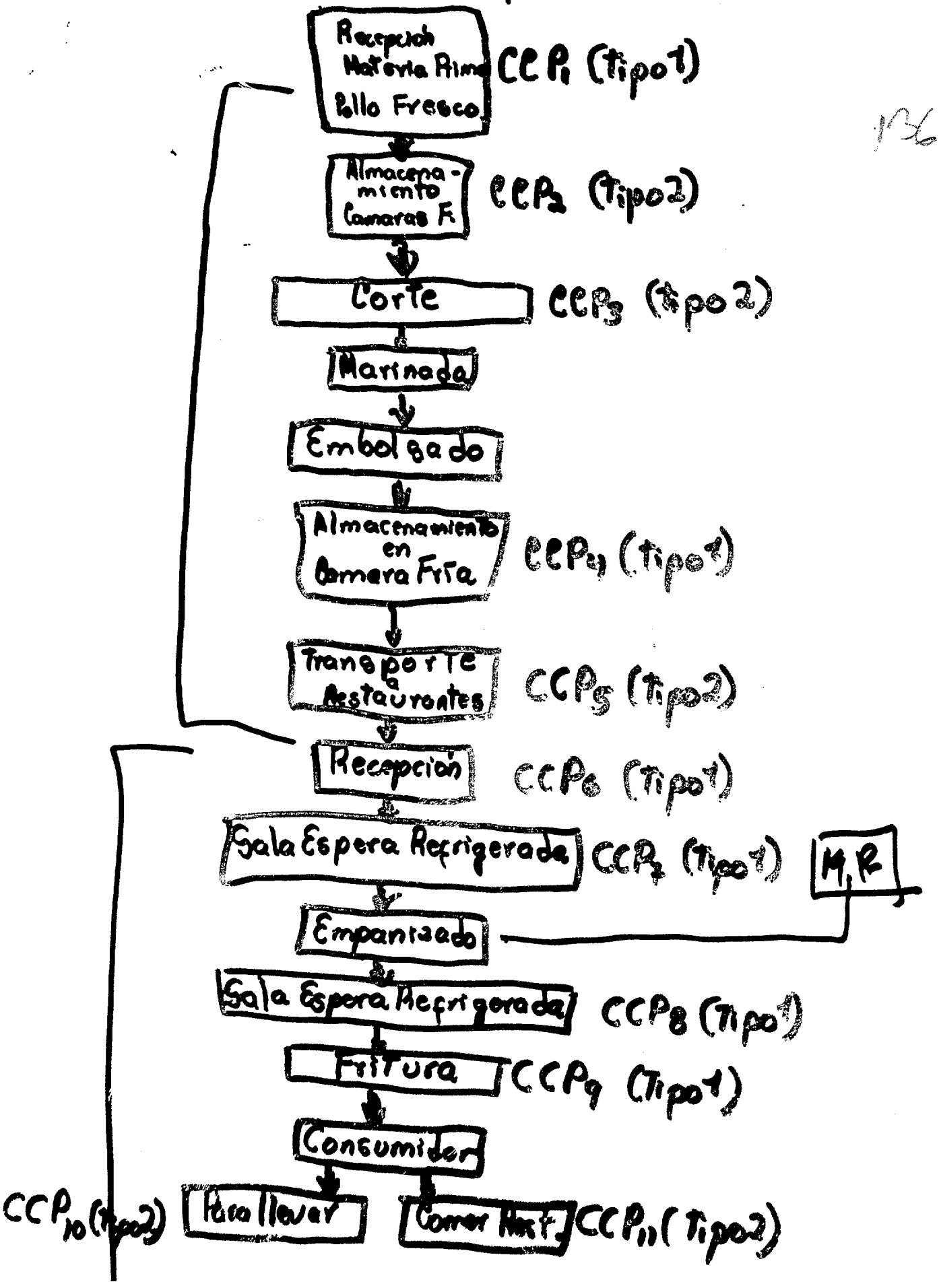
Product: Cheddar cheese SANITIZACION

Plant:

CCP / Process Step	Hazard / Concern	Control Point	Critical Limit	Monitoring / Frequency	Records / Location	Responsibility	Corrective Action	Verification
CCP1 Pasteurizador	Microbiológico	Conc. Limpiadores y desinfectante Temperatura ~~Tiempo~~	Cloro 200pm TA ~~Gráficos~~	Previo a usar y al final (eliminación)	Lab/oficina de producción o QC	Operador y Laboratorio	Volver a limpiar	Swab test del equipo
CCP2 Tanques	Microbiológico	Conc. limpiadores y desinfectantes	Visual Medir Concentración Desinfectante	Previo a usar y al final	Oficina Producción o QC	Operador y Laboratorio	Volver a limpiar	Swab test
CCP3 Instrumentos	Microbiológico	Conc. limpiadores y desinfectantes	Visual Medir (Desinfectante)	Previo a usar y al final	Oficina Producción o QC	Operador y Laboratorio	Volver a limpiar	Swab test
CCP4 Higiene Personal	Microbiológico	Supervisión	Suciedad Manos Ropa, etc.	Continuo	Oficina Producción o QC	Supervisor y Laboratorio	Capacitación Disciplina	Inspección y muestras de manos

QC = oficina de control de calidad

Pollo Frito Empanizado



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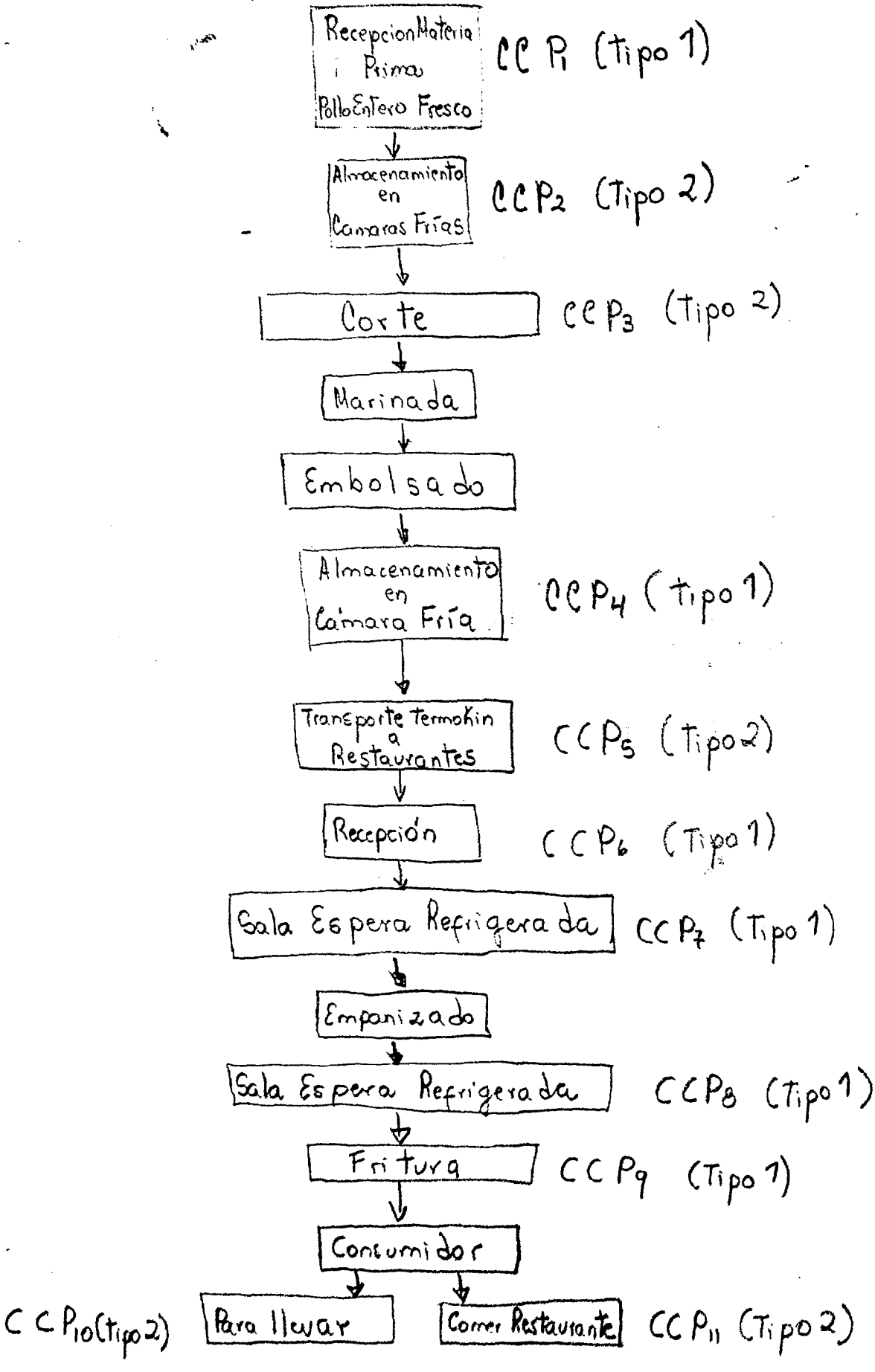
HACCP Description Chart

Product: _____

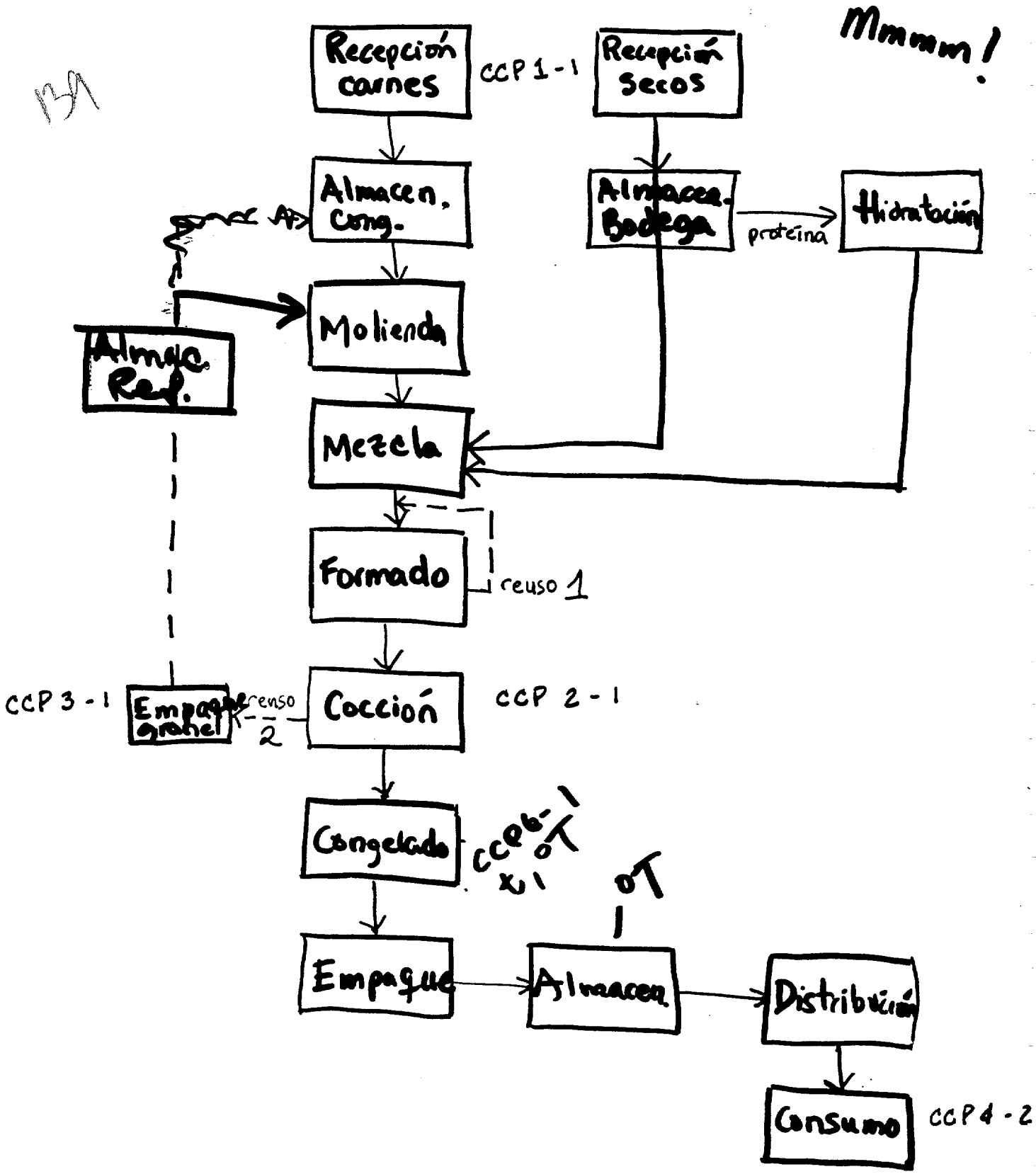
Plant: _____

CCP / Process Step	Hazard / Concern	Control Point	Critical Limit	Monitoring / Frequency	Records / Location	Responsibility	Corrective Action	Verification
CCP7 Sala de Espera en Cámara fría	- Temp.	MOS	≤ 4°C	Continuamente	QC	Supervisor de Área	Rechazo o Decomiso	Termómetro Análisis físicos Microbiol.
CCP8 Regreso Sala de Espera	Temp.	"	≤ 4°C	Continuamente	QC	"	"	"
CCP9 Frituras	- Temp. - tiempo - Desinfecc. - calidad Aceite	"	10 - 12'	Continuamente	QC	"	"	"
CCP10 Consumidor	- tipo envoque - filtros desinfección - tiempo despacho	"	10'	Continuamente	QC	"	"	"

Pollo Frito Empanizado



IORTAS DE CARNE RES-CERDO



CCP 5 : Sanitización y T° de Cuartos

TORTAS DE CARNE RES-CERDO

CCP	Peligro	Punto Control	Límite	Monitoreo. Frecuencia	Records Localiz.	Responsab.	Acción Correctiva	Verific.
CCP1 - 1 Recepción carne	Microbiol. Parasitario (cisticerco)	°T transporte Visual Procedencia	≤ 4°C Color, olor, ausencia de quistes Registro certificado	Cada recepción	CC	Supervisor CC Bodega	Rechazo	Calibrar termómetro Auditoría rastro
CCP2 - 1 Cocción	Microbiol.	°T t	70°C final interno producto → diario 75°C horno → c/ batch Tailor chart 20 min.	Sup CC Producción	Supervisor CC Operador	Aumentar tiempo y/o °T	Calibrar termómetro Verificar ΔT horno/producto	
CCP3 - 1 Reuso 2	Microbiol.	°T t almacén	4°C ≤ 2 días	diario	CC	Supervisor CC	Rechazo	Calibrar termómetro Recuentos vs. descomp.
CCP4 - 2 Consumo	Microbiol.	Instrucciones etiqueta						
CCP5 Sanitización °T cuartos	Microbiol.	Conteo micro.	Según proceso	Semanal	CC	Gerente CC	Cambiar proc. sanit.	Químicos Uso y [ ] Controles micro

CHOCOLATE BAR

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MANUFACTURER : CHAPITICAS S.A.

INGREDIENTS

Cocoa liquor
Powdered Cocoa
Milk, dry powdered
Lecithin
Hardener
Cocoa Butter
Glass Sugarr
Vainilla
Salt

Aracelly Luján

Ana Cristina Astia

Ileana Espela

Indra de Reyes

HACCP Description Chart

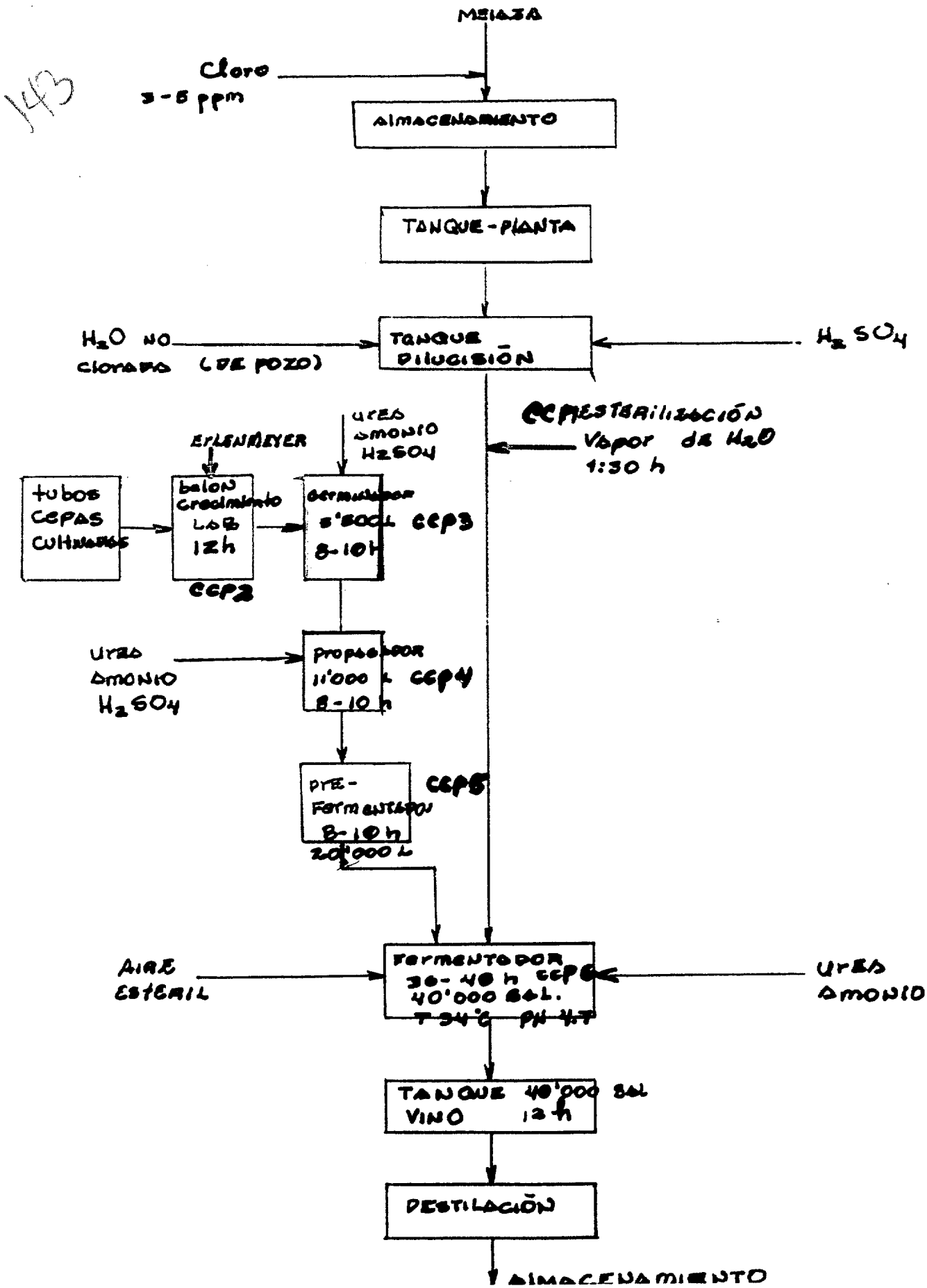
Product: Chocolate Bar

Plant: "CHAPITICAS"

	CCP / Process Step	Hazard / Concern	Control Point	Critical Limit	Monitoring / Frequency	Records / Location	Responsibility	Corrective Action	Verification
CCP1	Raw Ingrediehts Inspection	Milk - Salmonella Listeria Liquor and Cocoa - Salmonella	Suppliers Selecction	Neg Neg Neg	Each lot Each lot	QC / QA Office	QC Technician	Reject	Method validation
CCP2	Grinding ↓ Packing	Microbiological Contamination	· Cleanning & Sanitizing Procedures. · Swab Test A	Check list 10/dm² molds Neg pathogens	Daily Weekly	QC / QA Office	QC Technician	Investigate cause and corrected	Method validation (Swab test) Procedures Revision
CCP3	CONCHING 72 hrs	Microbiological (recontaminatio) Foreing Mat.	6 HP Hicrophysical Analysis	Internal Audit Historical minimum	Permanently Every batch	QC Office	Production Supervisor and QC Inspector	Investigate cause and corrected	Refresment Personal Training
CCP4	FINISHED PRODUCT	Microbiological Hicrophysical	Salmonella Holds Listeria Hicrophysical Test	Neg 0/g Neg H. H. I.	Statistical Sample Lot Composite.	QC / QA Office	QC Manager	Reject	Method Validation. (Check Samples).

A Enviromental Control

DIAGRAMA FLUJO: FERMENTACIÓN alcoholica



HACCP Description Chart

Product: Etanol

Plant: D. A. R. S. A.

fecha: 1 – 12 – 1994.

	CCP / Process Step	Hazard / Concern	Control Point	Critical Limit	Monitoring / Frequency	Records / Location	Responsibility	Corrective Action	Verification
P1	Esterilización de la melaza	Microbiológico Químico. Físico.	Temp. pH Tiempo °Brix	90 °C 4.7 1.5 hr 20 – 25°	Cada Batch	Admón Laboratorio Proceso	Operadores	Reproceso	Hidrómetros Termómetros. Calibrar c/15 días
P2	Inóculo Laboratorio	Microbiológico Químico	Temp. Conta pH Tiempo °Brix	34 °C 4.7 12 hrs. 15 – 20°	Cada Batch	Admón Laboratorio Proceso	Técnico de Laboratorio	Descartar	Hidrómetros Termómetros. Calibrar c/15 días
P3	Germinador	Microbiológico Químico	Temp. Cal pH Tiempo °Brix	34 °C 4.7 8-10 hrs 15-20°	Cada Batch	Admón Laboratorio Proceso	Técnico de Laboratorio	Ajuste	Hidrómetros Termómetros Calibrar c/15 días
P4	Propagador (Incremento de masa celular)	Microbiológico Químico	Temp. pH Tiempo °Brix	34 °C 4.7 8-10 hrs. 15 – 20°	Cada Batch	Admón Laboratorio Proceso	Técnico de Laboratorio	Ajuste	Hidrómetros Termómetros. Calibrar c/15 días
P5	Pre-fermentador	Microbiológico Químico	Temp pH Tiempo °Brix	34 °C 4.7 8-10 hrs. 15 – 20°	Cada Batch	Admón Laboratorio Proceso	Técnico de Laboratorio	Ajuste	Hidrómetros Termómetros Calibrar c/15 días
P6	Fermentación.	Microbiológico Químico.	Temp. pH Tiempo °Brix	34 °C. 4.7 36 – 40 hrs 20-25°	Cada Batch	Admón Laboratorio Proceso	Supervisión Automática	Ajuste	Hidrómetros Termómetros Calibrar c/15 días.

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GRUPO 6

PRODUCTO:

BROCCOLI CONGELADO

1) DESCRIPCION DEL PRODUCTO:

BROCCOLI CONGELADO GRADO A EN PRESENTACIONES A GRANEL Y AL DETALLE

2) USUARIO:

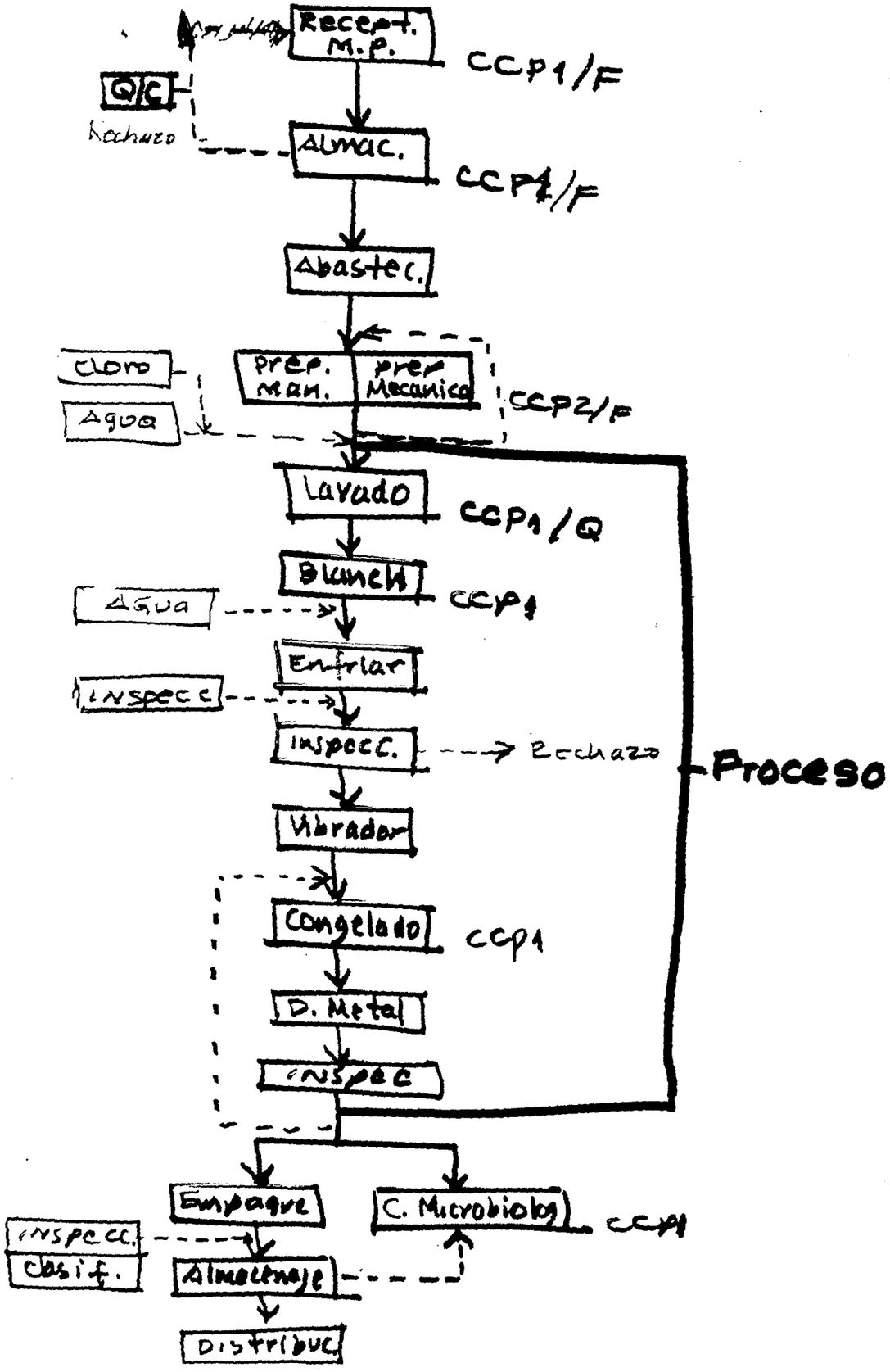
MERCADO AMERICANO

PARTICIPANTES

TIERRA FRIA S.A.
DEL TROPIC FOODS.
ALCOSA
INCAP

PRODUCTO: BROCCOLI CONGELADO.
USUARIO: U.S.A. INDUSTRIAL / DETOLLE.

DIAGRAMA DE FLUJO



HACCP Description Chart

Product: Brocoli

Plant: Congeladora

	CCP / Classification	Hazard / Concern	Control Measure	Critical Limits	Monitoring / Frequency	Records / Location	Responsibility	Corrective Action	Verification
CCP_2	FINAL	FISICO	SABOR OLOR TAMAÑO PCA	REQUISITOS USDA	CONSTANTE	C. de C.	C. de C.	RECLASI-FICACION	REGISTRO
CCP_1	CALIDAD MICROBIOLOGICA	MICROBIO-LOGICO	LEVADURAS HONGOS COLIFORMES	MENOR DE REQUERIDO POR CLIENTE	C/ 2 HRS.	C. de C.	C. de C.	EMBARGO	REGISTROS.

HACCP DESCRIPTION CHART

HACCP Description Chart

PRODUCT: BROCCOLI CONGELADO

Product:

PLANT: Congeladora

Plant:

CCP /	Hazard / Concern	Control Point	Critical Limit	Monitoring / Frequency	Records / Location	Responsibility	Corrective Action	Verification
CCP1	MAT. PRIMA	FISICO QUIMICO	ASPECTOS COLOR LIMPIO VERDE	CADA LOTE 5%	CONTROL DE CALIDAD	INSPECTOR MAT. PRIMA	RECHAZO	REG. TEMP. patron color inspeccion visual
CCP2	ALMACENAJE	ALMACENAJE MAT. PRIMA	TEMP. TIEMPO LD. LOTE 40-50 %	C/HORA	MANTENIMIENTO C. de C.	MANTENIMIENTO	CORRECCION INMEDIATA TRASLADO a otro c/frio	REGISTROS DE C. de C Y MANT.
CCP2	INSPECCION VISUAL Preparacion.	FISICO	TAMAÑO CORTE	C/½ HR.	C. de C.	C. de C.	INSTRUCC. PRODUCCION RECLASIFICACION	REGISTROS
CCP1	LAVADO	QUIMICO	CONTROL DE CONCENTRACION 10-30 PPM	5-30 MIN.	Q.A	C. de C.	CORRECCION INMEDIATA x MANTENI.	REGISTROS
CCP1	BLANCHADO	FISICO QUIMICO	TEMP. TIEMPO PEROXIDASA CATALASA 190-200 °F 1-4 MIN. NEGATIVO	C/5-10 MIN. c/30 min.	C. de C.	PRODUCCION Q.C.	CORRECCION INMEDIATA Rechazo	REGISTROS
CCP1	CONGELADO	FISICO	TEMP. TIEMPO -20 -30 °F 7-12 MIN.	CONSTANTE	MANTENIMIENTO PRODUCCION	PRODUCCION	CORRECCION INMEDIATA RECONGELAR	REGISTROS

APPENDIX VI

List of Participants

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NOMBRE	NOMBRE DE LA EMPRESA Y DIRECCION	NO. TEL.	NO. FAX
Amy Kuen Dong	EL TAMAL, 10a. Av. 25-63, zona 13, Int. 11, Guatemala	310555	332704
Carlos Arturo Montalvan	AGROVAL, S.A. 10a. Av. Sur 825, San Salvador, El Salvador	2702991	2706061
Ana Teresa Artiga de Salmerón	DEL TROPIC FOODS, S.A DE C.V. Km. 27 Carretera a Sonsonate, Colón, El Salvador	384100	384149
María Teresa Portillo	DEL TROPIC FOODS, S.A DE C.V. Km. 27 Carretera a Sonsonate, Colón, El Salvador	384100	384149
Patricia Bernal	POLLO CAMPERO DE EL SALVADOR, Plaza Jardín, Antiqua Calle a Sta. Tecla, San Salvador, El Salvador	2985166	2980053
Liz Murillo Gómez	CIA. NUMAR, Barrio Cuba, San José, Costa Rica	2579666	2552892
Ana Cristina Astúa S.	PRODUCTOS GERBER, C.A. S.A.(P.O. Box 2070-1000, San José C.R.	2258411	2248034
Ileana Espeleta	PRODUCTOS GERBER, C.A (Idem)	"	"
Nancy Quan	TNCAP, Calzada Roosevelt, Z. 11, Guatemala, Gua.	723762-7	736529
Hector Cruz V.	TIERRA FRIA, S.A., 10a. Calle 1-40, zona 9, Guatemala, Guate.	317879	344974
Anabella Escobar	DESTILADORA DE ALCOHOLES Y RONES, Sta. Lucía, Cotz, Escuintla, Guatemala	0845314	0845464
Sandro Carrieri	FRUTALIA, 27 Av. 33-58, zona 12, Guatemala	760348	764122
Carlos Fuentes P.	ALPAK, S.A. Km 8. Carr. Sta. Catarina Pinula, Guatemala	370922	370922
José Carlos Prem	ALIMENTOS KERN'S Km. 6.5 Carretera al Atlántico, Guatemala	562222	

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NOMBRE	NOMBRE DE LA EMPRESA Y DIRECCION	NO. TEL.	NO. FAX
Maynor Ordóñez	KERN'S, Carretera al Atlántico Km. 6.5 zona 18,Guatemala	562222	
Briceyda Pérez	Destiladora de Alcoholes y Rones, S.A., Camino Estación FEGUA, Sta. Lucía Cotz., Escuintla, Guatemala	0845314	0845464
Rosa Ma. Chew	COLTEC, S.A., 12 Calle 14-01, zona 1	28442-43	
Ma. Eugenia Batsche de Ortíz	COLTEC, S.A. " "	"	
Aracely Luján T.	SALVAVIDAS, S.A., 3a. Av. final norte, fca. el Zapote, zona 2, Guatemala, Guatemala	27072	
Carlos Roel Marroquín Aldana	DIGESEPE, 6a. calle 1-36, zona 10 Guatemala	320482-3	320790
Evelyn Zimeri	EMPACADORA TOLEDO, Calz. Aguilar Batres 50-52, z. 11 Guatemala	773515	773592
Adolfo Sanz G.	PROMECA, 5a. Calle 8-78, z. 13, Guatemala	713843	710664
Victor Manuel Orellana E.	PROMECA, " "	"	"
Luz Marie Ortega	SABORA, 3a. Calle 13-80, zona 1, Villa Nueva, Guatemala	0311519	0311519
Indra Mara Flores de Reyes	Fabrica VENUS, 13 Av. 4-90, zona 1, Guatemala, Guatemala	516171	
Julio Roberto Catú B.	EMPACADORA TOLEDO, Calz. Aguilar Batres 50-52, zona 11, Guatemala, Ciudad	773515	
Gladys Angélica Rodríguez	MERCK CENTROAMERICANA, Km. 13 Carretera Roosevelt, Guatemala	922111	942954
Pedro Pablo Ng Ho	INVERSIONES DE GUATEMALA, S.A., Km. 16.5 Carretera Roosevelt, Guatemala	934235	

NOMBRE	NOMBRE DE LA EMPRESA Y DIRECCION	NO. TEL.	NO. FAX
Omar Dary	INCAP, Calzada Roosevelt, Zona 11, Guatemala, Guatemala	723762-7	736529
Floridalma Cano	INCAP " "	"	"
Julio Ricardo Morales Ruano	ALCOSA, Km. 18.5 Carret. a Sn. José Pinula	0341759	0341662
Mario René García Marroquín	TIERRA FRIA, 10a. Calle 1-40, zona 9, Guatemala, Guatemala	317879	344974

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APPENDIX VII

Workshop Evaluation

ASOCIACION GUATEMALTECA DE TECNOLOGOS EN ALIMENTOS

AGTA

GUATEMALAN ASSOCIATION OF FOOD TECHNOLOGISTS

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EVALUACION DEL SEMINARIO-TALLER

"ANALISIS DE RIESGOS Y PUNTOS CRITICOS DE CONTROL (HACCP)"
30 NOVIEMBRE Y 01 DICIEMBRE DE 1994
INCAP, GUATEMALA.

1. Se enteró del Seminario por?

   a) Carta - Inscripción ( )
   b) Otra persona ( )
   c) Otro medio ( )

2. Cubrió el Seminario sus expectativas?

   a) Sí ( )
   b) A medias ( )
   c) No ( )

3. El contenido de la documentación técnica fue?

   _____

   _____

4. La calidad del material y equipo audiovisual fue?

   a) Excelente ( )
   b) Muy Bueno ( )
   c) Bueno ( )
   d) Regular ( )

5. Cómo calificaría el desarrollo global del Seminario?

   a) Excelente ( )
   b) Muy Bueno ( )
   c) Bueno ( )
   d) Regular ( )

6. Evalúe cada uno de los siguientes puntos, colocando una X en el lugar que le corresponde.

	Excelente	Muy Bueno	Bueno	Regular
a) Programa/Contenido del Seminario	_____	_____	_____	_____
b) Atención y Servicio de la sede	_____	_____	_____	_____
c) Comodidad del salón (temperatura, sonido, iluminación)	_____	_____	_____	_____

5a. Avenida 15-45, Zona 10, Torre I, Oficina 304, Centro Empresarial. Tel. y Fax: (502-2) 337024
Ciudad de Guatemala, Guatemala. Apartado Postal 8F, 01910, Guatemala.
U.S. Postal Address: AGTA M-333, P.O. Box 02-5345, Miami, Fl. 33102-5345

(Cont.)

7. Es usted?

Asociado AGTA _____ No asociado _____ Estudiante _____

8. Si no es asociado, le gustaría recibir aplicación?

Sí _____ No _____

9. Si desea recibir una aplicación favor de indicar sus datos:

Nombre: _____
Dirección: _____
_____
Tel: _____

10. Qué le pareció el costo del Seminario?

_____
_____

11. Tiene ideas sobre otros temas de interés para futuros seminarios o actividades similares, en el tema de control de calidad o en otros temas relacionados con la industria de alimentos?

a)_____
b)_____
c)_____

11. Qué días de la semana son mejores para atender Seminarios?

_____

12. Qué horario es mejor para un Seminario?

_____ Dos días completos
_____ Sólo en la tarde
_____ Después de las 5:00 pm

13. Cómo evaluaría usted a los expositores?

	Excelente	Muy Bueno	Bueno	Regular
Damien Gabis/Silliker Labs.	_____	_____	_____	_____
Russell Flowers/Silliker Labs.	_____	_____	_____	_____

14. Otros Comentarios:

_____
_____
_____
_____

INSTITUTO DE NUTRICION DE CENTRO AMERICA Y PANAMA (INCAP)
COORDINACION DE FORMACION Y DESARROLLO DE RECURSOS HUMANOS

EVALUACION DE ACTIVIDADES DESARROLLADAS EN GRUPOS DE TRABAJO, TALLERES Y/O REUNIONES DE EXPERTOS

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I. GENERALIDADES

Actividad:_____

Lugar:_____Fecha_____

II. INSTRUCCIONES

A continuación encontrará una serie de ítems que corresponden a aspectos relacionados con la actividad desarrollada. Lea cuidadosamente cada ítem y anote una "X" en la categoría que corresponda a su opinión.

III. ITEMS

		Excelente (5)	Buena(o) (4)	Regular (3)	Mala(o) (2)	Pésima(o) (1)	No Aplica	Puntaje:
A.	Objetivos:							
1.	Formulación de objetivos	----	----	----	----	----	----	----
2.	Adecuación de los objetivos a la actividad	----	----	----	----	----	----	----
3.	Grado de cumplimiento de los objetivos y metas fijadas	----	----	----	----	----	----	----
B.	Metodología:							
4.	Orientación previa sobre la metodología utilizada	----	----	----	----	----	----	----
5.	Pertinencia de la información previa suministrada	----	----	----	----	----	----	----
6.	Adecuación de la metodología para el logro de los objetivos propuestos	----	----	----	----	----	----	----
7.	Calidad de la programación inicial	----	----	----	----	----	----	----
8.	Cumplimiento de la programación	----	----	----	----	----	----	----
C.	Aspectos administrativos:							
9.	Calidad del apoyo administrativo recibido en el desarrollo de la actividad	----	----	----	----	----	----	----
10.	Calidad del apoyo administrativo recibido en sus trámites personales	----	----	----	----	----	----	----
	TOTAL:							----
	PROMEDIO:							----

IV. OBSERVACIONES:

Anote sus observaciones sobre otros aspectos relacionados con el desarrollo del Curso. Anote sus sugerencias al respecto.

_____

_____

_____

_____

Workshop Evaluation

Please complete this workshop evaluation to assist us in assessing the quality of this workshop and to help us make improvements.

Name of Workshop Hazard Analysis and Critical Control Points Date Nov 30, Dec 1st 1994
Instructor(s) Dr. Damien Gabis ; Dr. Russ Flowers
Your Name (optional) Luis A. Garcia-Vela Company AGTA

Please rate the following aspects of the workshop by circling the appropriate number:

	Poor		Average		Excellent
1. How well did the content of the workshop meet your needs?	1	2	3	4	(5)
2. How well did the workshop give you information that you can use on the job?	1	2	3	(4)	5
3. How well was the workshop presented?	1	2	3	4	(5)

- What were the most significant strengths of this workshop?

A. Subject (5)

The subject is of great importance to the Food Industry.

B. Workshop Material

Very well presented. Complete

C. Practical/Laboratory Exercises

Very useful to have a workshop

D. Instructor(s) (If more than one instructor, write each instructor's last name and follow with your comments)

Both Gabis and Flowers are excellent instructors and have a lot of experience on the subject

- What information that you learned will be especially useful in your job? How will you use this information?

Most of the participants will try to make a HACCP plan for their individual companies

- Would you add or emphasize any subject matter in future sessions of this workshop?
  ✓ Yes ____ No (If yes, please list these topics and give reasons)

  Clearly stating the objectives of HACCP: microbiological concern vs Quality concern

- Would you delete or deemphasize any subjects?
  ____ Yes ____ No (If yes, please list these and give your reasons)

- If there were any weakness in this workshop, list those you think were most significant and explain why you think so.

  A. Subject (5)

  B. Workshop Material

  Should have been translated into Spanish

  C. Practical Exercises

  D. Instructor(s) (If more than one instructor, write each instructor's last name and follow with your comments)

  ____

- Do you have any other comments?

  The above is a summary of the evaluation forms that were filled by all the participants.

Thank you!

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NCBA

National Cooperative Business Association

The National Cooperative Business Association
1401 New York Avenue, N.W., Suite 1100
Washington, D.C. 20005-2160
Telephone: (202) 638-6222; Fax: (202) 628-6726