FRASER RIVER ACTION PLAN

Technical Pollution Prevention Guide for the Dairy Processing Operations in the Lower Fraser Basin

Canada

DOE FRAP 1996-11

Environment Canada Environnement Canada

TECHNICAL POLLUTION PREVENTION GUIDE FOR THE DAIRY PROCESSING OPERATIONS IN THE LOWER FRASER BASIN

DOE FRAP 1996-11

Prepared for:

Environment Canada
Environmental Protection
Fraser Pollution Abatement
North Vancouver, B.C.

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October 1997

DISCLAIMER

This consultant's report was funded by Environment Canada under the Fraser River Action Plan through its Fraser Pollution Abatement Office. Environment Canada is not responsible for the content of this report but has made it available for public distribution.

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Acknowledgments

Funding for this project was provided by Environment Canada. PCA Consultants Ltd. would like to thank Ms. Lisa Walls, Dr. David Poon and Ms. Vivian Au, Environment Canada, for their guidance on project direction and many other technical and management suggestions for this project; Ms. Cristina Jacob and Mr. Jeff Gogol of Greater Vancouver Regional District, Source Control Sewerage & Drainage Department; Mr. Earl Jenstad of BC Ministry of Agriculture; and Mr. Kim Froats, representative of BC Dairy Council, for their inputs and technical assistance in the background information of the operating dairy processing facilities in the Lower Fraser Basin.

Subsequent to the initial circulation of the draft guidance document to the stakeholders for comments and review, Environment Canada sponsored a workshop with the stakeholders to solicit hand-on experience on pollution prevention activities already implemented at the operating facilities in the Lower Fraser River Basin. Valuable inputs from Mr. Bill Warner, Olympic Dairy; Mr. Mario Loscerbo, Mario Gelati Ltd.; and Mr. Orlando Schmidt, Dairy Producers' Conservation Group were collected and incorporated into this final document. Furthermore, Mr. Derek C. Knudsen, BC Ministry of Environment, Lands and Parks, provided the insights of the provincial approaches and directions on industrial pollution prevention. Handouts from the workshop are attached in Appendix F.

This pollution prevention plan development guide is developed based on pollution prevention and related documents from Environment Canada, United States Environmental Protection Agency, Ontario Ministry of Environment and Energy, and Washington Department of Ecology. It contains information compiled from several publications including:

Environment Canada National Office of Pollution Prevention
Pollution Prevention: Towards a Federal Strategy for Action (Draft, October 18, 1994)

Burrard Inlet Environmental Action Program (BIEAP)
Guide for Best Management Practices for British Columbia Dry Bulk Terminals, BIEAP Technical Report No. 04.

Environment Canada
Guide of Storm Water Best Management Practices for Selected Industrial Sectors in the Lower Fraser Basin, (Phase 1 Report, Phase 2 Report).

British Columbia Ministry of Environment, Lands and Parks
New Directions in Environmental Protection, 5 Year Action Plan 1992 - 1997

Ontario Ministry of Environment and Energy
Pollution Prevention Planning Guidance Document and Workbook, May 1993, (ISBN 0-7778-1441-2)

United States Environmental Protection Agency, Office of Research and Development
Facility Pollution Prevention Guide, May 1992, (EPA/600/R-92/088)

United States Congress, Office of Technology Assessment, *Serious Reduction of Hazardous Wastes: For Pollution Prevention and Industrial Efficiency,* September 1986, (OTA-ITE-317)

United States Environmental Protection Agency, Office of Research and Monitoring
Dairy Food Plant Wastes and Waste Treatment Practices, March 1971 (EPA Report 12060).

United States Environmental Protection Agency, Office of Air and Water Programs
Development Document for Effluent Limitations Guidelines and New Source Performance Standards for Dairy Products Processing Point Source Category, May 1974 (EPA-440/1-72-021-a).

United States Environmental Protection Agency, Office of Research and Development
USER'S GUIDE: Strategic WAste Minimization Initiative (SWAMI) Version 2.0, A Software Tool to Aid in Process Analysis for Pollution Prevention, January 1992, (EPA/625/11-91/004).

Washington Department of Ecology*, Pollution Prevention Planning Guidance Manual, for Chapter 173-307 WAC*, September 1993, (#91-2 Revised).

Washington Department of Ecology, Hazardous Waste and Toxics Reduction Program, *Guidance for Reporting Progress in Pollution Prevention*, March 1994, (93-38).

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Executive Summary

The objective of this project was to provide the staff members of the dairy processing operations in the Lower Fraser Basin with a technical step-by-step pollution prevention guidance document on the development, implementation and continual monitoring of facility-specific pollution prevention plans. The document could also be used by the regulatory agencies in assessing the success of various pollution prevention plans implemented by the operating facilities and in evaluating the environmental benefits resulted from those industrial waste minimization activities.

After the initial circulation of the draft document for stakeholders review and comment, Environment Canada sponsored a subsequent workshop with stakeholders to solicit hand-on experience on pollution prevention activities from the operating facilities within the study area. Valuable feedbacks were collected and incorporated in this document. The resulting document includes the followings:

- A brief introduction on pollution prevention concept and benefits.
- Generic profiles of the dairy processing industry and its associated industrial sub-sectors. The profiles present information on the raw material feedstocks and process/handling operations utilized by the various sub-sectors, process waste materials and pollutants of concern, traditional waste management methods in dealing with process wastewater and stormwater, and permitting requirements.
- A step-by-step methodology or procedure for the development of facility-specific pollution prevention plans. The systematic methodology consists of seven (7) steps from establishing a P2 Assessment Program to measuring pollution reduction progress. Anticipated outputs from each of the steps are listed.
- Some examples on the development and implementation of facility-specific pollution prevention plans in Canada and United States.
- Selected bibliography.
- Appendices include worksheets on Pollution Prevention Environmental Review, Pollution Prevention Potential Assessment, and Pollution Prevention Plan; Lower Fraser Basin dairy processing plant profiles; and Reproductions of handouts from the workshop and excerpts from the technical reports on industrial pollution prevention.

Guide de mesures préventives contre la pollution à l'intention des laiteries du bassin du bas Fraser

RÉSUMÉ

L'objectif visé par ce projet était de fournir aux employés des laiteries du bassin du bas Fraser un document technique sur la prévention de la pollution décrivant point par point la préparation, l'application et la surveillance continue des plans de prévention de la pollution propres à chaque établissement. Ce guide pourrait également être utilisé par les organismes de réglementation pour analyser les résultats des divers plans de prévention de la pollution mis en oeuvre par chacun des établissements et pour évaluer les impacts positifs que ces mesures de réduction des déchets industriels auraient sur l'environnement.

Environnement Canada a d'abord soumis une ébauche du document aux intervenants pour fins d'étude et de commentaires. Ensuite, un atelier a été mis sur pied afin de réunir les intervenants de la région visée par l'étude et de recueillir l'expérience pratique de chacun quant aux activités de prévention de la pollution dans leur établissement. Outre les commentaires très pertinents des intervenants, le document final contient les points suivants :

Un brève introduction sur le concept et les avantages de la prévention de la pollution.

Des profils génériques de l'industrie de la transformation des produits laitiers et de ses sous-secteurs connexes. Les profils renseignent sur les matières premières et sur les opérations de traitement ou les procédés utilisés par les divers sous-secteurs, le traitement des déchets et des polluants industriels, les méthodes traditionnelles de gestion des déchets en matière de traitement des eaux de procédé usées ou des eaux pluviales, ainsi que sur les exigences de délivrance de permis.

Une approche étape par étape ou des procédures détaillées pour élaborer des plans de prévention de la pollution propres à chaque établissement. La méthode systématique comprend sept (7) étapes allant du Programme d'évaluation de niveau 2 jusqu'à l'évaluation des progrès réalisés en matière de lutte contre la pollution. Les résultats escomptés sont décrits à la fin de chaque étape.

Des exemples concrets sur la manière dont des plans de prévention de la pollution ont été élaborés et mis en application dans des établissements au Canada et aux États-Unis.

Bibliographie.

Les Annexes comprennent les documents de travail qui ont servi à l'Étude environnementale sur la prévention de la pollution, l'Évaluation potentielle de la

prévention de la pollution et le Plan de la prévention de la pollution; les profiles des laiteries du bassin du bas Fraser, ainsi que des copies des documents qui ont été distribués lors de l’atelier et des extraits de rapports techniques sur la prévention de la pollution industrielle.

1O Introduction

In recent years, governments, companies, and individuals have come to accept that minimizing or avoiding the creation of pollutants and wastes can be more effective in protecting the environment than treating them after they have been created. This source control waste management approach is called pollution prevention (P2).

Pollution prevention is not a new idea. Many manufacturers in North America have already implemented programs to minimize the creation of pollutants at the source. In the early 1970's, 3M (Minnesota Mining and Manufacturing) initiated the 3P (Pollution Prevention Pays) Program to provide cash incentive to employees for feasible pollution prevention measures.

The shift in emphasis towards adopting pollution prevention measures by the private sector has been prompted by the continuing increase of waste treatment/disposal costs, the promulgation of laws and regulations limiting waste disposal options, and civil/criminal liability. Many companies have found that an effective waste management program is a sound business practice in today's manufacturing and operating environment. Companies with improved and effective waste management practices are more likely to be low cost producers by:

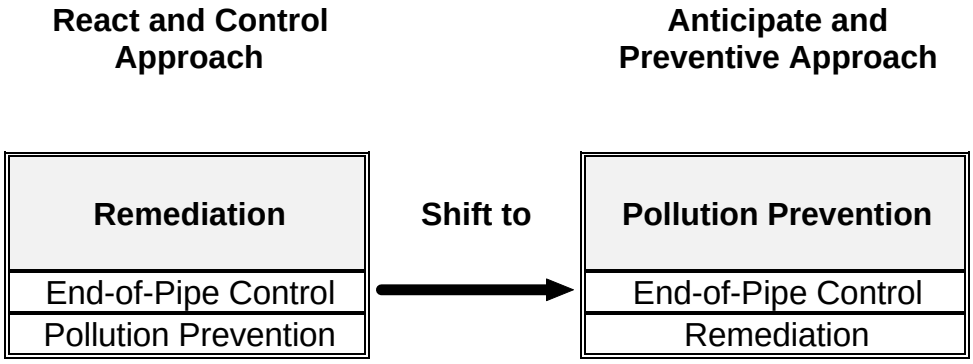
- Minimizing waste treatment costs;
- Avoiding expensive disposal costs; and
- Lowering raw material and/or manufacturing costs.

Many governments have also recognized the positive merits of implementing pollution prevention to minimize the creation of pollutants and lessen the potential threats to human health or the environment. In the United States, environmental regulatory agencies have enacted legislation requiring companies to implement pollution prevention or waste minimization.

Environmental policy in Canada has also begun to shift emphasis from a "control the release of pollutant" policy to pollution prevention. At the federal and provincial levels, strategies are being developed to promote the implementation of pollution prevention practices.

Figure 1.1 presents the environmental protection strategies for the traditional "react and control" approach and the emerging "anticipate and preventive" approach proposed by Environment Canada National Office of Pollution Prevention.

Figure 1.1 Shifting Emphasis for Environmental Protection



As illustrated by Figure 1.1, the environmental protection framework consists of three types of control strategies. These three control strategies are:

- Remediation
- End-of-Pipe Control
- Pollution Prevention

The traditional "React and Control" approach emphasizes the role of remediation in the protection of the environment followed by end-of-pipe control and pollution prevention.

Historically, the react and control approach to environmental protection has been evolved to address the end-of-pipe performance-based environmental regulations imposed by governmental agencies. With the react and control approach, regulated pollutants from point source discharges have been reduced substantially. However, large quantities of non-regulated pollutants are still being discharged to the environment posing substantial future environmental liability. Furthermore, the react and control approach failed to control pollutants from non-point pollution sources.

The emerging "anticipate and preventive" approach emphasizes pollution prevention as the predominant strategy for protecting the environment. By avoiding or minimizing the generation of pollutants in the first place, the remaining two strategies, control and remediation can therefore be de-emphasized.

Even though pollution prevention is the preferred strategy, control and remediation of pollution remain integral components within the environmental protection framework proposed by Environment Canada.

In November 1993, the Canadian Council of Ministers of the Environment (CCME) confirmed in *A National Commitment to Pollution Prevention* that:

"minimizing or avoiding the creation of pollutants and wastes can be more effective in protecting the environment than treating them, or cleaning them up after they have been created. This approach, called pollution prevention, is needed to secure a safe and healthy environment and a sound and prosperous economy. It is a key component of environmental protection and sustainable development."

To advance pollution prevention, member governments of CCME have agreed to undertake the following actions:

- Make pollution prevention the priority;
- Develop and implement government action plans for pollution prevention, and encourage the development of action plans by other sectors;
- Review legislation, regulations and policy as appropriate, and harmonize approaches to pollution prevention;
- Test and implement economic instruments that will help achieve pollution prevention;
- Educate the public about pollution prevention, and train relevant groups in the technical aspects of pollution prevention;
- Recognize and promote successful pollution prevention initiatives; and
- Develop practical tools, such as guidelines and codes of practice, to enable people to deliver pollution prevention at an operational level.

In support of the CCME pollution prevention initiatives and in compliance with the Canada strategy on pollution prevention (adopted in June 1995), the British Columbia Ministry of Environment, Lands and Parks, and the Fraser Pollution Abatement Office of Environment Canada have taken steps to encourage industries to reduce pollutants discharged to the environment. As a furtherance to promote pollution prevention among governmental agencies and regulated communities, Environment Canada has proposed to develop pollution prevention guides for selected industrial sectors in British Columbia Lower Mainland. These guides are designed to assist plant operators in the development of broad-based pollution prevention programs.

2O Objective

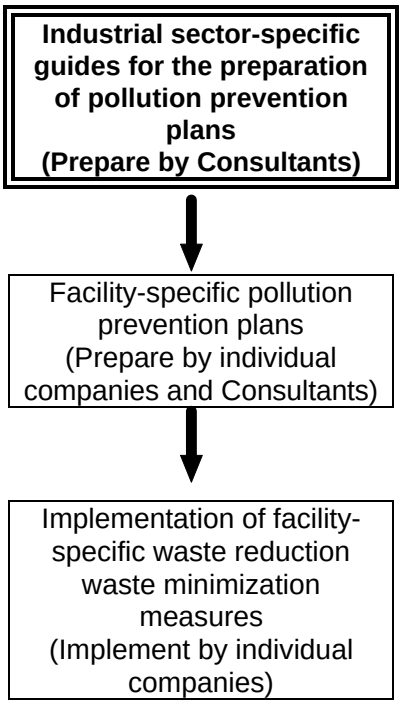
This technical pollution prevention guide is designed to provide staff members of dairy processing operations with guidance to:

- Conduct environmental reviews; and
- Develop appropriate pollution prevention plans.

This dairy products processing industry pollution prevention guide contains detailed process and waste stream information and waste reduction and waste minimization measures. Using the framework and information presented in the technical pollution prevention guide, site-specific pollution prevention plans can be developed for individual dairy processing facilities . The benefits of a pollution prevention program can be realized with the implementation of the site-specific waste reduction/minimization measures in the pollution prevention plan.

The basic components of a pollution prevention program is illustrated in Figure 2.1.

Figure 2.1 Relationship of Pollution Prevention Components



3O Pollution Prevention Concept And Benefits

3.1 Definition Of Pollution Prevention

Pollution prevention is defined by Environment Canada National Office of Pollution Prevention as:

> "The use of processes, practices, materials or energy that avoid or minimize the creation of pollutants and wastes without creating or shifting new risks to communities, workers, consumers or the environment."

As defined, pollution prevention emphasizes source reduction measures for all wastes generated at production areas for the protection the environment. It is a multi-media approach which encompasses reduction in air emissions, wastewater discharges, or solid waste generation. Pollution prevention involves the application of best management practices, product changes, and modifications of manufacturing processes that eliminate or reduce the use of hazardous and non-hazardous materials, energy, water, and/or other resources.

Presented in Table 3.1 are examples of source reduction measures, product changes and process changes, that are classified as pollution prevention measures because they reduce the amount of waste created during facility operations .

Table 3.1 Examples of Pollution Prevention Measures for the Dairy Processing Industry - Source Reduction and Process Changes	
Product Changes	• Product reformulation and redesign for less environmental impact • Increase product life • Use leak-proof containers for finished products
Input Material Changes	• Materials or feed stock substitution • Avoid or minimize the use of toxic materials • Substitution with less toxic materials
Technology Changes	• Redesign equipment layout to minimize losses • Change to Clean In Place from hand cleaning to minimize detergent and sanitizer usage • Increase automation/improved equipment to improve operating efficiencies • Process/technology modification • Install equipment to reduce energy consumption • Provide back-up or standby critical process pumps • Improve instrumentation, such as high/low level alarms and pump shut off
Best Management Practices	• Improve operator training • Improve operation & maintenance procedures • Improve housekeeping practices • Eliminate sources of leaks • Improve inventory control to minimize disposal of outdated materials • Implement segregation of flows to minimize cross-contamination and to facilitate reuse and/or recycling

Traditional end-of-pipe treatment or waste management treats the wastes after they have been generated. It is a single medium approach designed to address performance-based environmental regulations.

Presented in Table 3.2 are examples of traditional approach to environmental protection that are not pollution prevention measures.

Table 3.2 Examples of Traditional Pollution Control Measures - Not Pollution Prevention Measures	
Recycling Outside of the Waste Generating Process	• Off-site reuse and recycling • Waste exchanges • Off-site reclamation
Waste Treatment	• Physical, chemical, and biological treatment • Evaporation • Incineration • Solidification/stabilization
Disposal	• Discharge to the receiving environment • Discharge through sewers • Landfill • Waste processing facility

3.2 Benefits Of Pollution Prevention

With the continuing increases of performance-based environmental regulations, the traditional end-of-pipe single medium approach generally resulted in increasingly more complex treatment technologies that inevitably increased environmental compliance costs. Furthermore, this approach often simply transfer pollutants from one medium to another, and/or moves the pollutants to another location. In contrast, pollution prevention can more effectively and efficiently address cross media impacts (air, water and solid waste) from facilities or processes via source reduction measures. Furthermore, pollution prevention encourages creative pollution control efforts thereby minimizing non-production related capital and operational costs.

By minimizing the amounts of waste generated at the source, a pollution prevention approach allows for the reduction of labour and equipment required for waste treatment. In addition to reduction in waste treatment costs, pollution prevention offers other benefits, both tangible and intangible. These benefits include:

- reduced waste treatment and disposal costs;
- improved business efficiency and profitability;
- improved corporate image;
- reduced regulatory compliance costs;
- reduced future cleanup costs;
- reduced future risk of environmental liability;
- reduced risk to workers and to the community; and
- improved workplace morale.

3.3 Environmental Management Hierarchy

Notwithstanding the many benefits inherent in pollution prevention measures, these measures alone will not eliminate all pollution in the environment. Other traditional waste management methods are still needed and should not be excluded from a comprehensive environmental protection program.

As such, Environment Canada National Office of Pollution Prevention in the "anticipate and prevent" strategy recognizes pollution prevention is the first step in a hierarchical approach for the protection of the environment. Other waste treatment techniques including recycling, treatment, and disposal are lower in priority.

Table 3.3, presented below, illustrates the priority of pollution prevention within the environmental management hierarchy.

Table 3.3 Hierarchical Structure of Environmental Management

Waste Management Approach	Implementation Priority	Management Method	Example Applications
Pollution Prevention Measures	1 (Highest)	• Source Reduction	• Modify product to eliminate solvent use
	2	• On-site Reuse Recycling	• Capture and return evaporator condensate to process
Traditional End-of-pipe Treatment Methods	3	• Off-site Reuse Recycling	• Whey processing/ disposal off-site facility
	4	• Material and/or Energy Recovery	• Boiler for energy recovery
	5	• Residual Waste Management	• Land disposal

As illustrated in Table 3.3, the highest priorities are assigned to preventing pollution through source reduction and reuse, or closed-loop recycling. Other non-pollution prevention measures such as traditional end-of-pipe treatment methods are ranked lower in the implementation priority.

4^O Industry Profile

4.1 Industry Description

The basic function of the Dairy Products Industries is the manufacture of foods based on milk or milk products. Dairy products manufacturing facilities in British Columbia produced goods valued at over 560 million dollars in 1993[1]. This monetary value is approximately two percent of the total value of goods (26,900 million dollars) produced from all manufacturing industries in British Columbia in 1993.

Based on the Standard Industrial Classification (SIC) system[2], the dairy products processing operations are further sub-categorized as Fluid Milk Industry - (SIC) codes 1041, and Other Dairy Products - (SIC) codes 1049.

Fluid Milk Industry - SIC 1041

Facilities in this category are primarily engaged in processing (pasteurizing, homogenizing, vitaminizing, bottling) and distributing fluid milk and cream and related products.

Presented in the following table (Table 4.1) is a listing of products from the Fluid Milk Industry sub-category.

Table 4.1 Fluid Milk Industry

Type of Product	Type of Product
• Buttermilk	• Milk bottling or packaging
• Chocolate drink (milk base)	• Pasteurizing milk
• Cream, fluid, processed, fresh	• Skim milk, fluid, processed, fresh
• Cream, fluid, processed, sour	• Whole milk, fluid, processed, fresh
• Egg nog	• Yogurt
• Homogenizing milk	

[1] *British Columbia Manufacturer Directory, 1994.*
[2] *Standard Industrial Classification 1980* , Statistic Canada.

Other Dairy Products Industries - SIC 1049

Processing facilities within this industry group primarily engaged in manufacturing dairy products not classified elsewhere.

Presented in the following table (Table 4.2) is a listing of products from the Other Dairy Products Industries sub-category.

Table 4.2 Other Dairy Products Industries

Type of Product	Type of Product
• Butter	• Cream dried, powdered
• Butter oil	• Curds
• Cheese	• Dairy powder blends
• Cheese Spreads	• Dairy powders with fat additives (feed)
• Chip dip (milk base)	• Evaporated milk
• Condensed milk	• Ice cream
• Cottage cheese	• Ice cream mix
• Ice milk products	• Powdered milk
• Lactose	• Processed cheese
• Malted milk mix	• Sherbets
• Milk shake mix	• Specialty cheese
• Paste cheese	• Whey products

There are 21 dairy products processing operations in the Lower Fraser Basin, of which 8 have fluid milk operations. Among these 8 operations, there are only 2 plants that are solely for fluid milk processing activities.

Table 4.3 provides a listing of the dairy processing operations in the Lower Fraser Basin.

Table 4.3 Dairy Processing Operations in Lower Fraser Basin

Plant Name	Location	Products
Agrifoods International Cooperative Ltd.	Annacis Island	Juices/UHT products
Agrifoods International Cooperative Ltd.	Burnaby	Fluid milk, Cultured products
Agrifoods International Cooperative Ltd.	Burnaby	Ice cream, Frozen deserts
Alamar Farms	Delta	Yogurt, Devonshire cream, Non-fat sour cream
Avalon Dairy	Vancouver	Fluid milk
Bari Cheese	Vancouver	Cheese
Bendick Ice Cream Factory Ltd.	Vancouver	Ice Cream
Birchwood Dairy's Inc.	Abbotsford	Fluid milk, Cultured products, Cheese
Efcon Incorporated	Vancouver	Ice cream
Flamingo Foods Ltd.	Burnaby	Cheese
Fraser Meadow Farm	Abbotsford	Yogurt
Foremost Foods	Burnaby	Fluid milk, Ice cream
International Ice Cream	Vancouver	Ice cream
Landmark Dairy	Surrey	Fluid milk
Lucerne Foods	Burnaby	Fluid milk, Cultured products, Cheese
Lucerne Foods	Burnaby	Ice cream, Frozen desert
Mario's Gelati Ltd.	Vancouver	Ice cream, Frozen desert
Meadow Fresh Dairy	Burnaby	Yogurt, Sour cream, Creamer cups
Milk Maid Dairy	Chilliwack	Fluid milk, Cultured products, Ice cream, Frozen desert
Olympic Dairy Products	Richmond	Yogurt
The Daily Scoop Ice Cream	Langley	Ice cream, Frozen desert

Geographic and environmental regulatory breakdowns of the 21 dairy processing facilities in the Lower Fraser Basin are as follows:

- 12 - within the Greater Vancouver Regional District;
- 6 - outside the Greater Vancouver Regional District but within the City of Vancouver; and
- 3 - outside both of the Greater Vancouver Regional District and the City of Vancouver.

Information of these operating facilities were obtained and compiled from the records and files maintained by the regulatory agencies, and they are summarized and presented in Appendix D.

4.2 Raw Materials

Raw materials for the Dairy Products Processing Industry typically consist of the following categories of items or ingredients:

- Dairy products - milk and milk products including cream, condensed or dried milk and whey, etc.; and
- Non-dairy ingredients - sugar, corn syrup, fruits, flavors, nuts, preserves, and fruit juices that are utilized in certain manufactured products such as ice cream, flavored milk, frozen desserts, yogurt, and others such as food colouring, cookies, chocolate-solids.

A raw material may be involved in manufacturing of a number of finished products. For example, cream may serve as a raw material for such varied finished products as fluid milk and cream, butter, ice cream, and cultured products. Considerable variation is encountered in the raw materials employed in the manufacturing of a single product such as ice cream.

4.3 Process/Handling Operations

A great variety of operations are encountered in the dairy products industry, but in oversimplification these manufacturing operations can be divided into two groups, those essentially common to the entire industry such as receiving, storage, transfer, clarification, separation, pasteurization and packaging; and those employed in more limited segments of the industry such as churning, flavoring, culturing, and freezing.

The following sections describe the general raw materials transfer handling process starting with the arrival of the raw materials at a dairy products facility through the processing steps in the manufacturing procedures.

4.3.1 Transportation

Although most liquid raw materials arrive at dairy processing plants in tank truck quantities, some plants do receive liquid ingredients in 10-gallon cans. Other raw materials, such as sugar, corn syrup and preserves, arrive either in liquid or solid forms by trucks and railcars.

4.3.2 Manufacturing Process/Unit Operation

The following manufacturing unit processes are typically employed by the Dairy Products Industry for processing milk and other non-dairy ingredients into various dairy products:

- Raw materials storage - storing raw milk and other ingredients in controlled refrigerated storage tanks and subzero rooms, the latter is primarily for the storage of various fruits;
- Clarification/Separation - Straining and separating the various components of the liquid products by centrifugal devices or mechanical filters;
- Pasteurization - heating the milk products in either continuous flow units or batch type units;
- Homogenization - breaking up the butterfat particles and keeping them in suspension by the use of pressure pumps;
- Deodorization - removal of the off-odors and flavors in the raw milk by vacuum steam injection treatment;
- Evaporation - removal of water in milk, cream and/or whey by heating with steam in a vacuum chamber;
- Churning - agitating, separating, and gathering of the oily globules for butter;
- Cooking - cooking and inoculating the milk products with a culture for cheese production;
- Flavoring - blending of the other ingredients such as liquid fruit juice, artificial flavors into the products (ice cream);
- Solid Injection - adding of nuts and fruit pulp into the products (ice cream);
- Storage of processed products - cold storage for the manufactured products; and
- Package - bottling and packaging the products for the end users.

The generic dairy products manufacturing processes are presented in the following figures (Figure 4.1 to Figure 4.16).

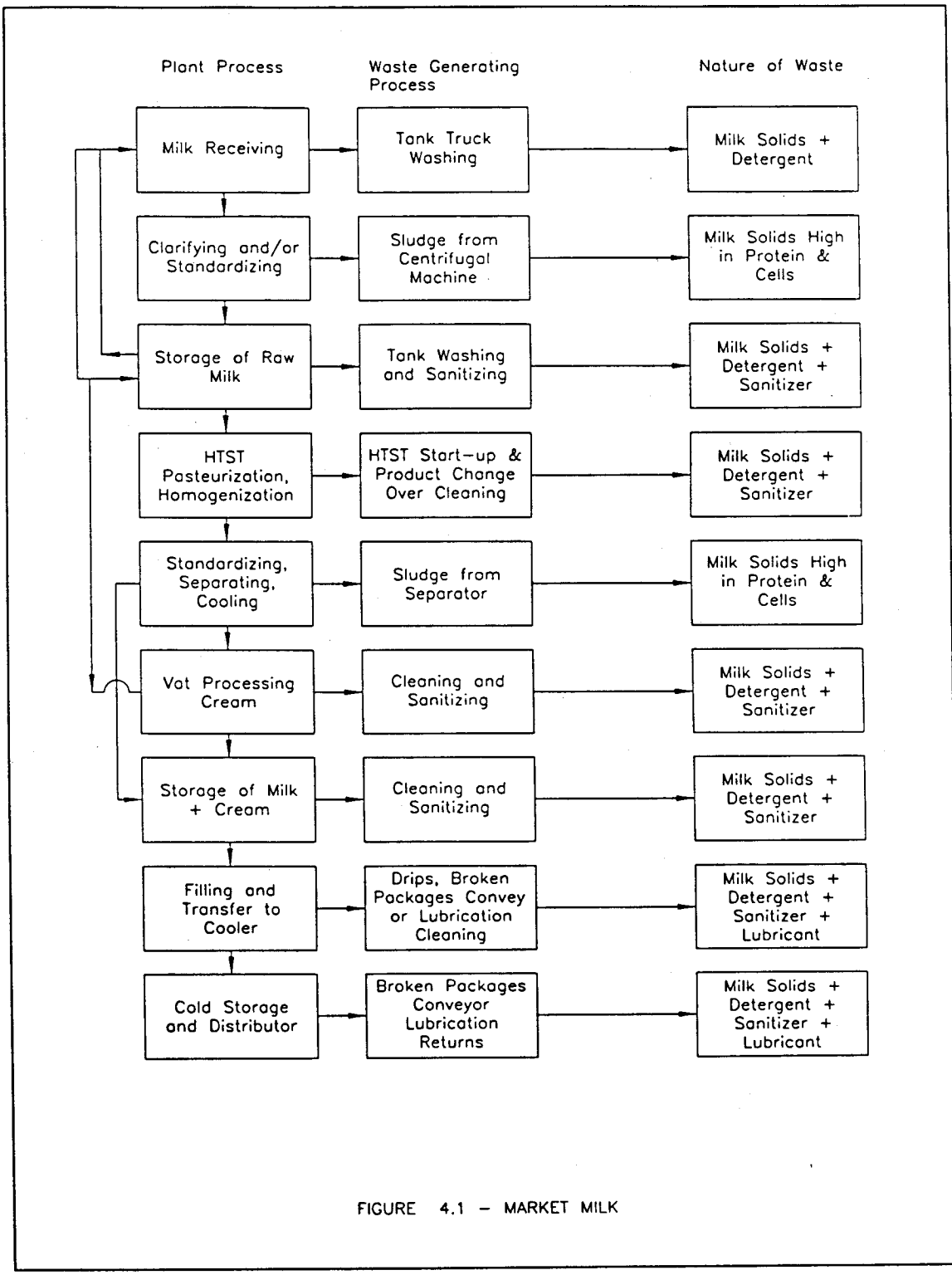


FIGURE 4.1 – MARKET MILK

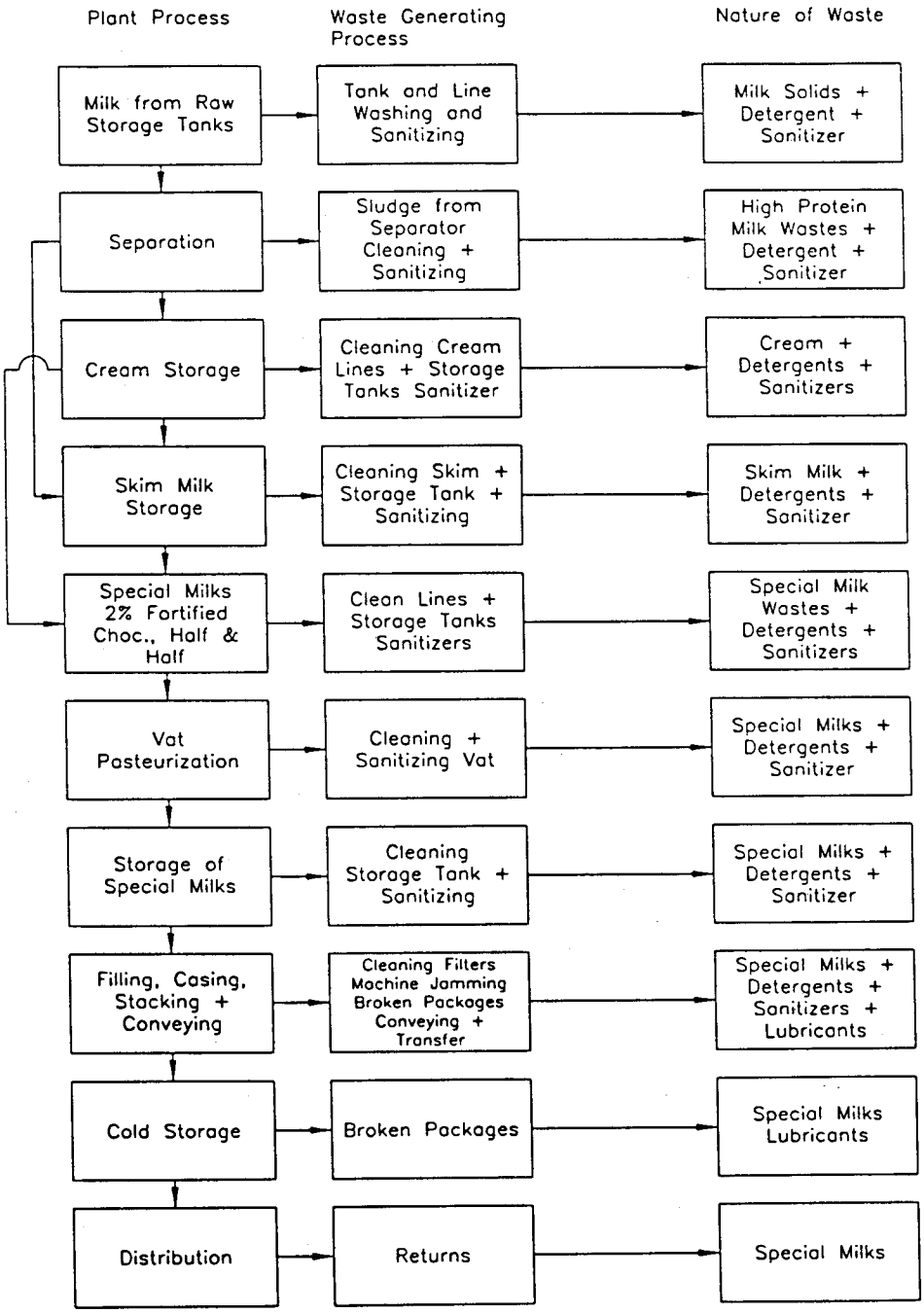


FIGURE 4.2 – MARKET MILK–SUBPROCESS–SKIM MILK, CREAMS AND SPECIAL MILKS BY BATCH PROCESSING – ALTERNATIVE 1

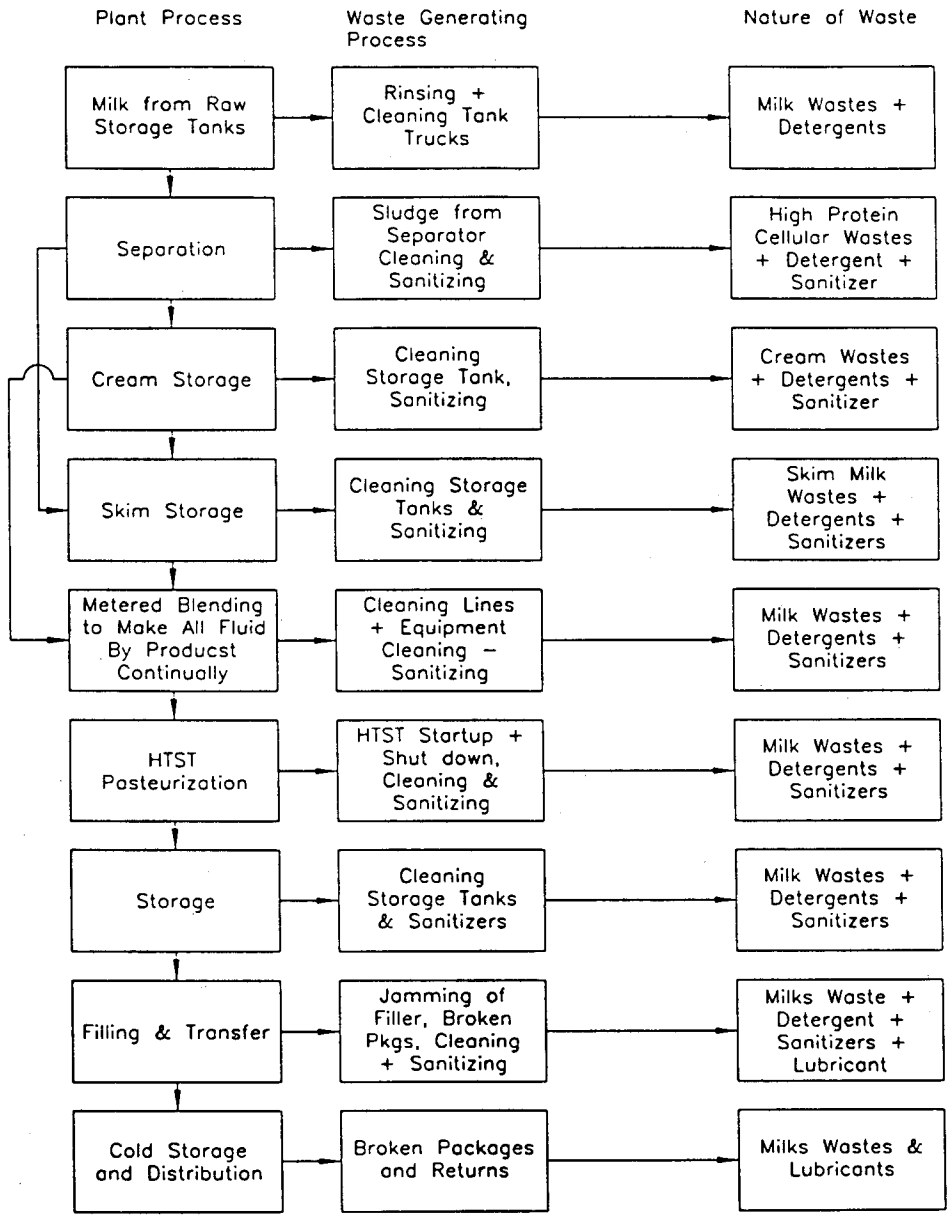


FIGURE 4.3 - MARKET MILK-SUBPROCESS-SKIM MILK-CREAMS AND SPECIAL MILKS BY CONTINUOUS PROCESS - ALTERNATIVE 2

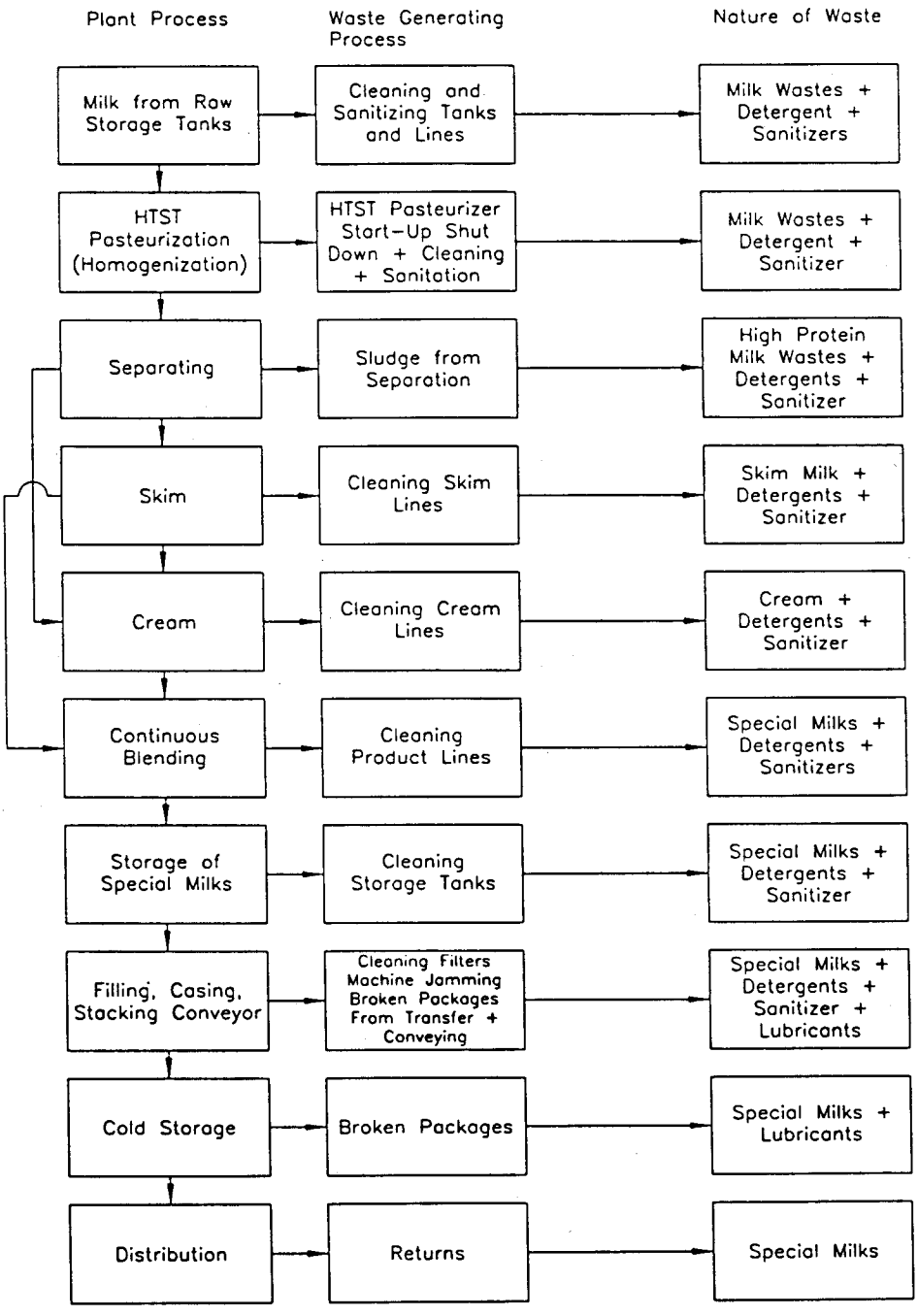


FIGURE 4.4 – MARKET MILK–SUBPROCESS–SKIM MILK–CREAMS AND SPECIAL MILKS BY CONTINUOUS PROCESS – ALTERNATIVE 3

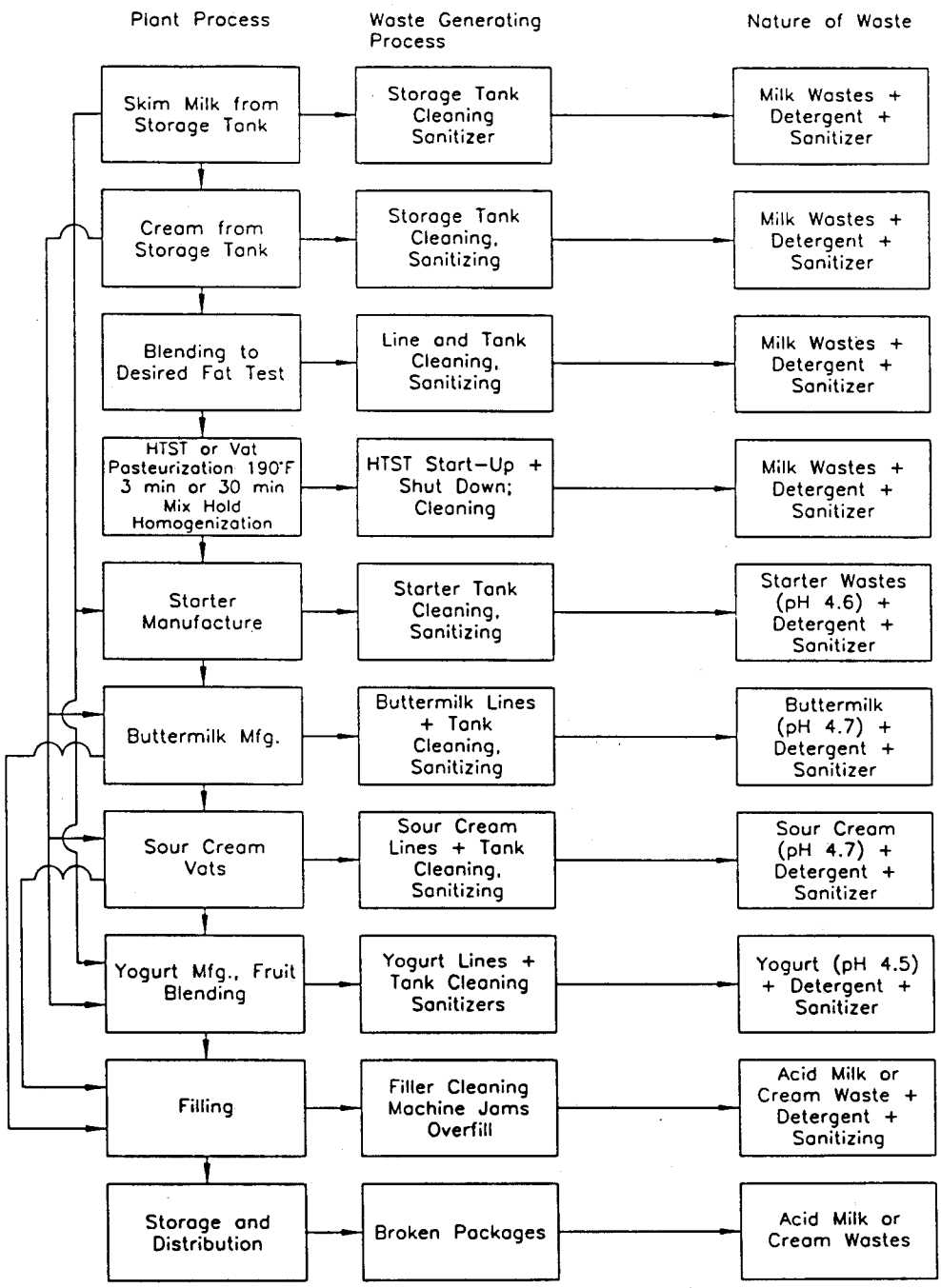


FIGURE 4.5 – MARKET MILK–SUBPROCESSES–BUTTERMILK, AND YOGURT SOUR CREAM

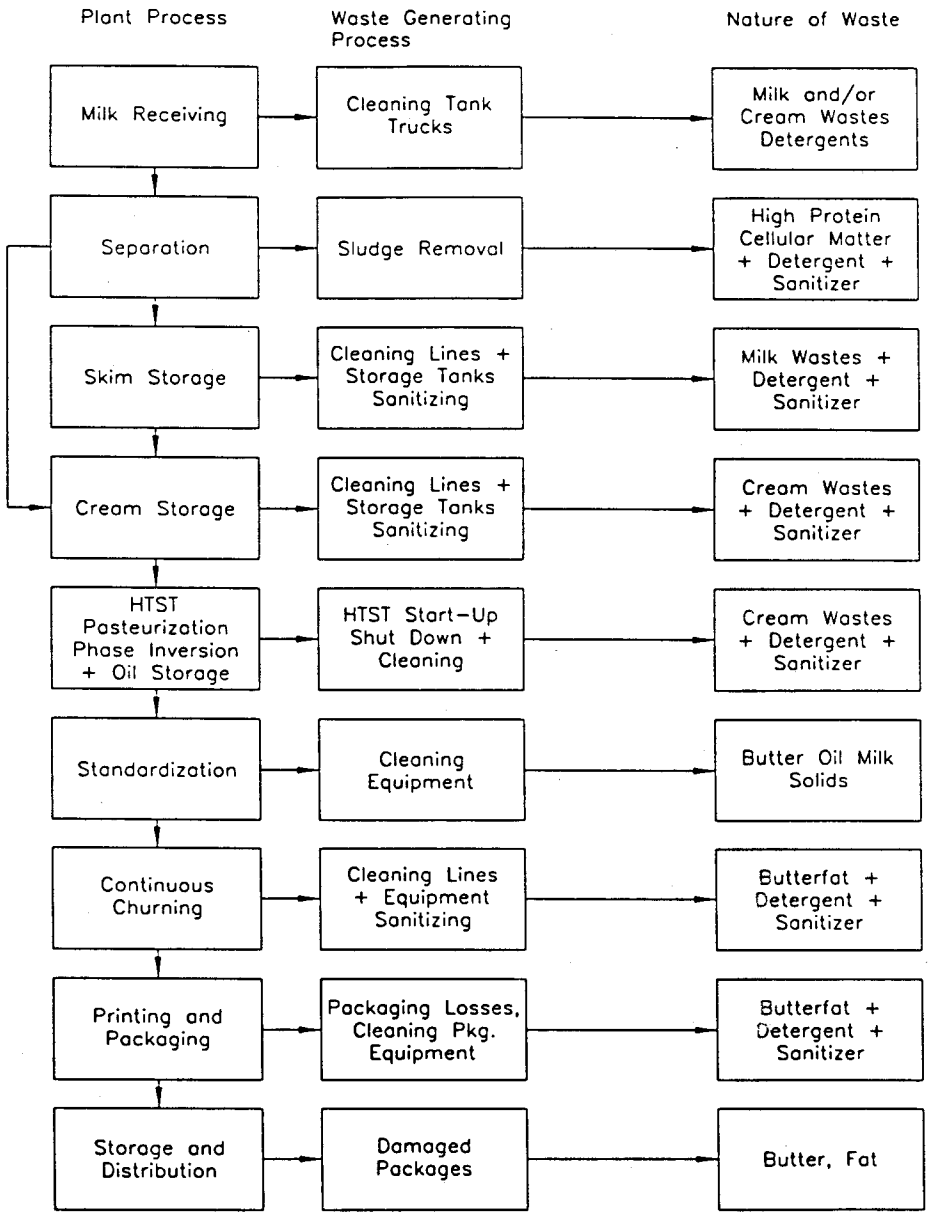


FIGURE 4.6 – BUTTER–CONTINUOUS PROCESS

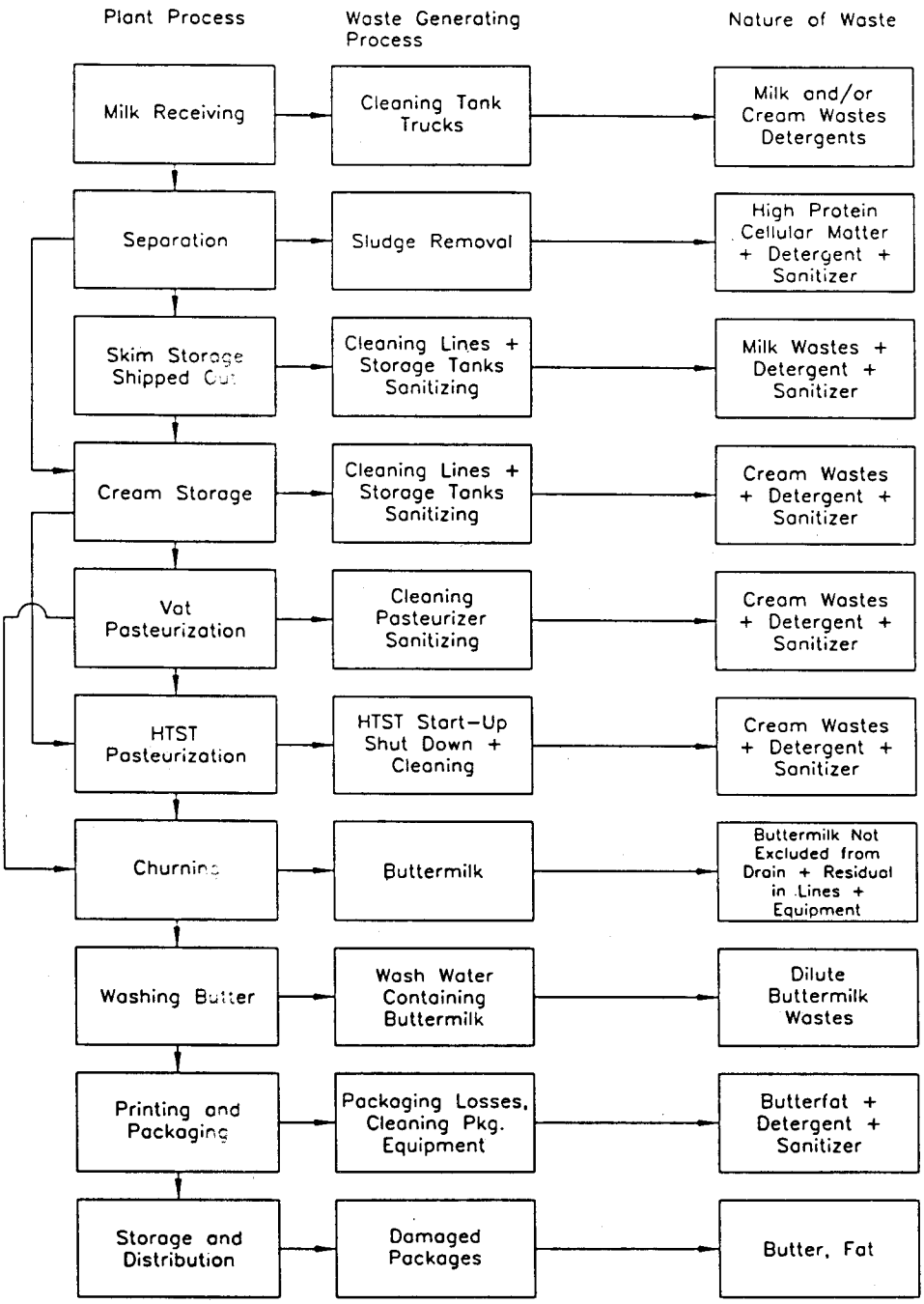


FIGURE 4.7 – BUTTER–CHURN PROCESS

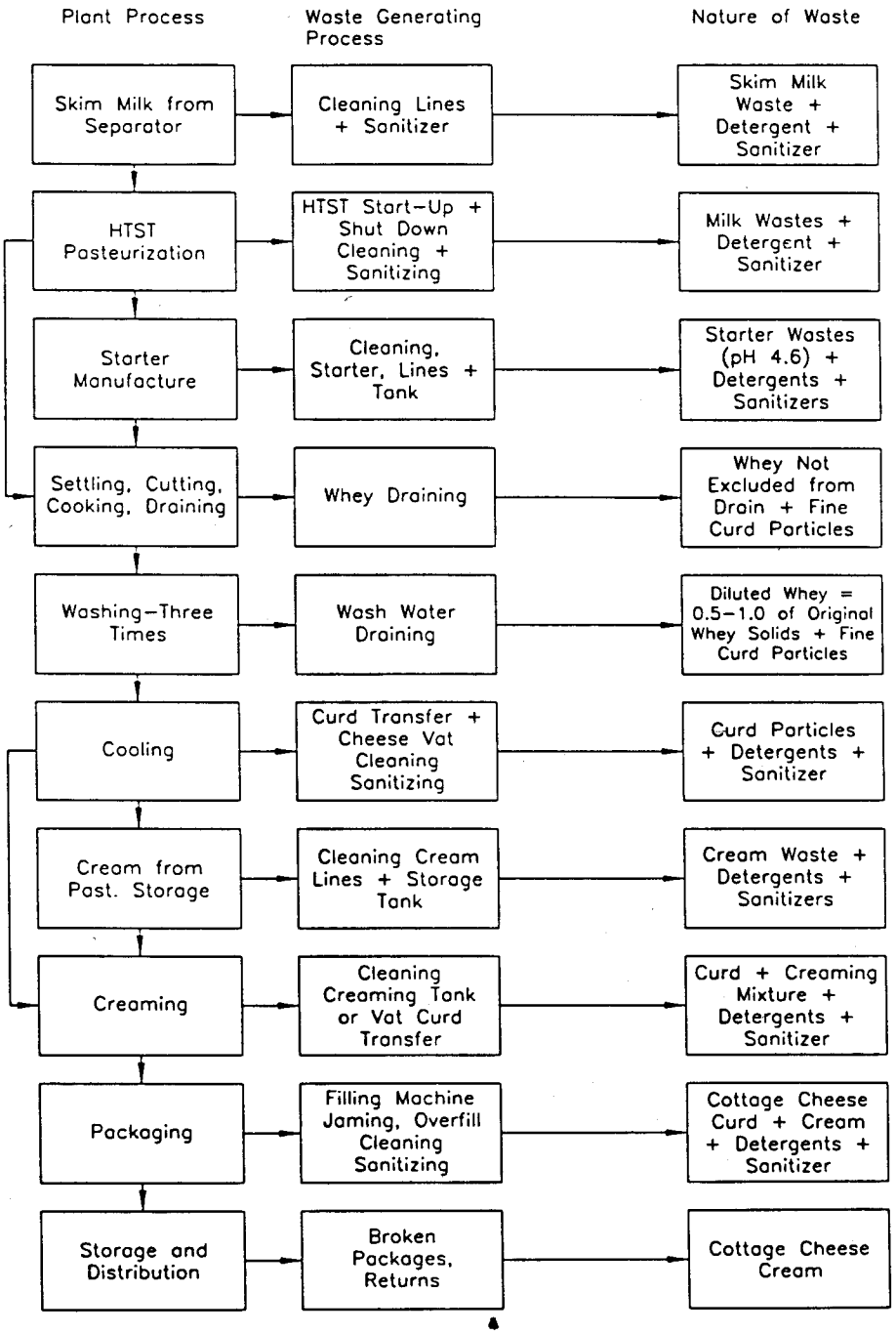


FIGURE 4.8 – COTTAGE CHEESE

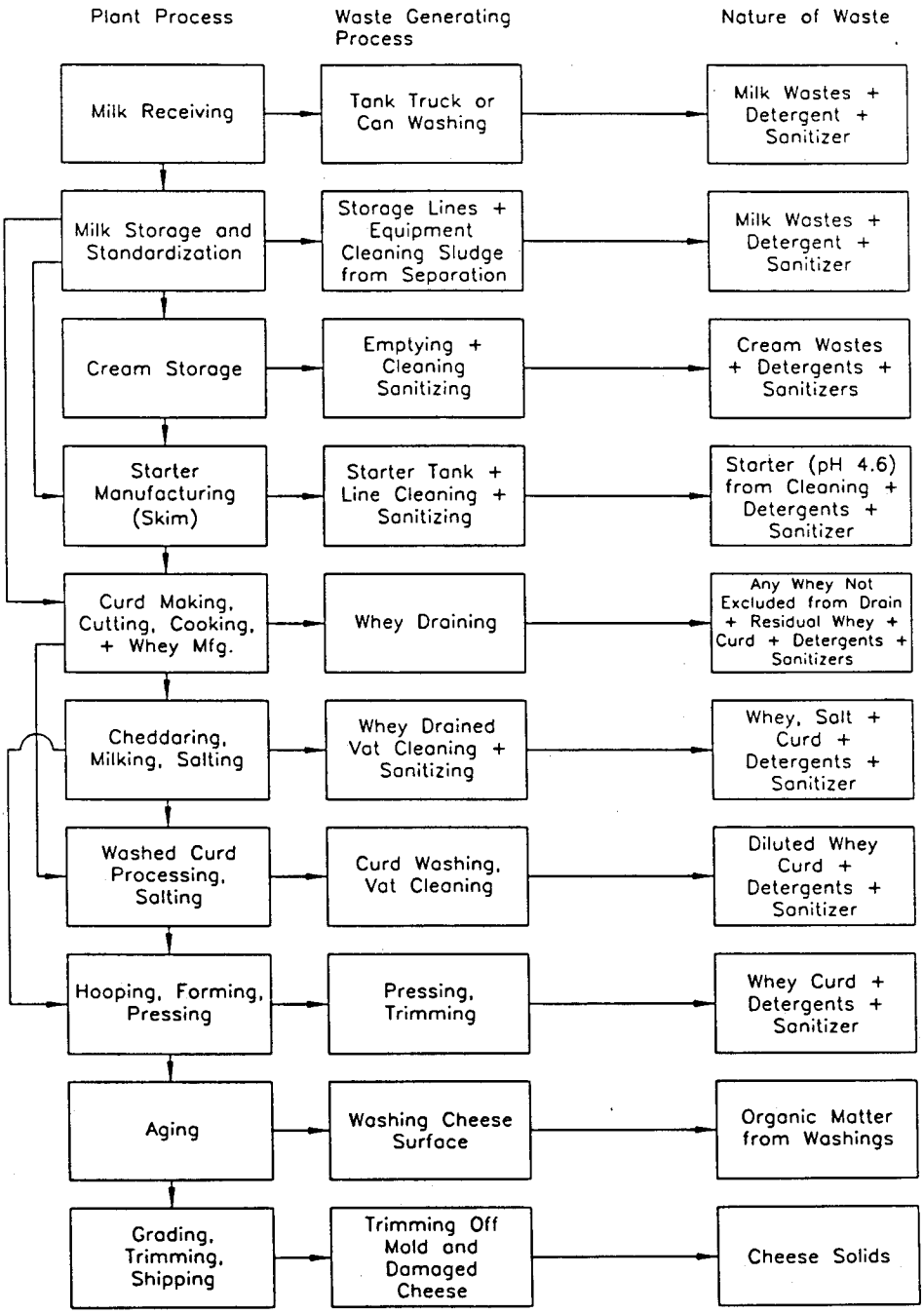


FIGURE 4.9 – CHEDDAR CHEESE MANUFACTURE

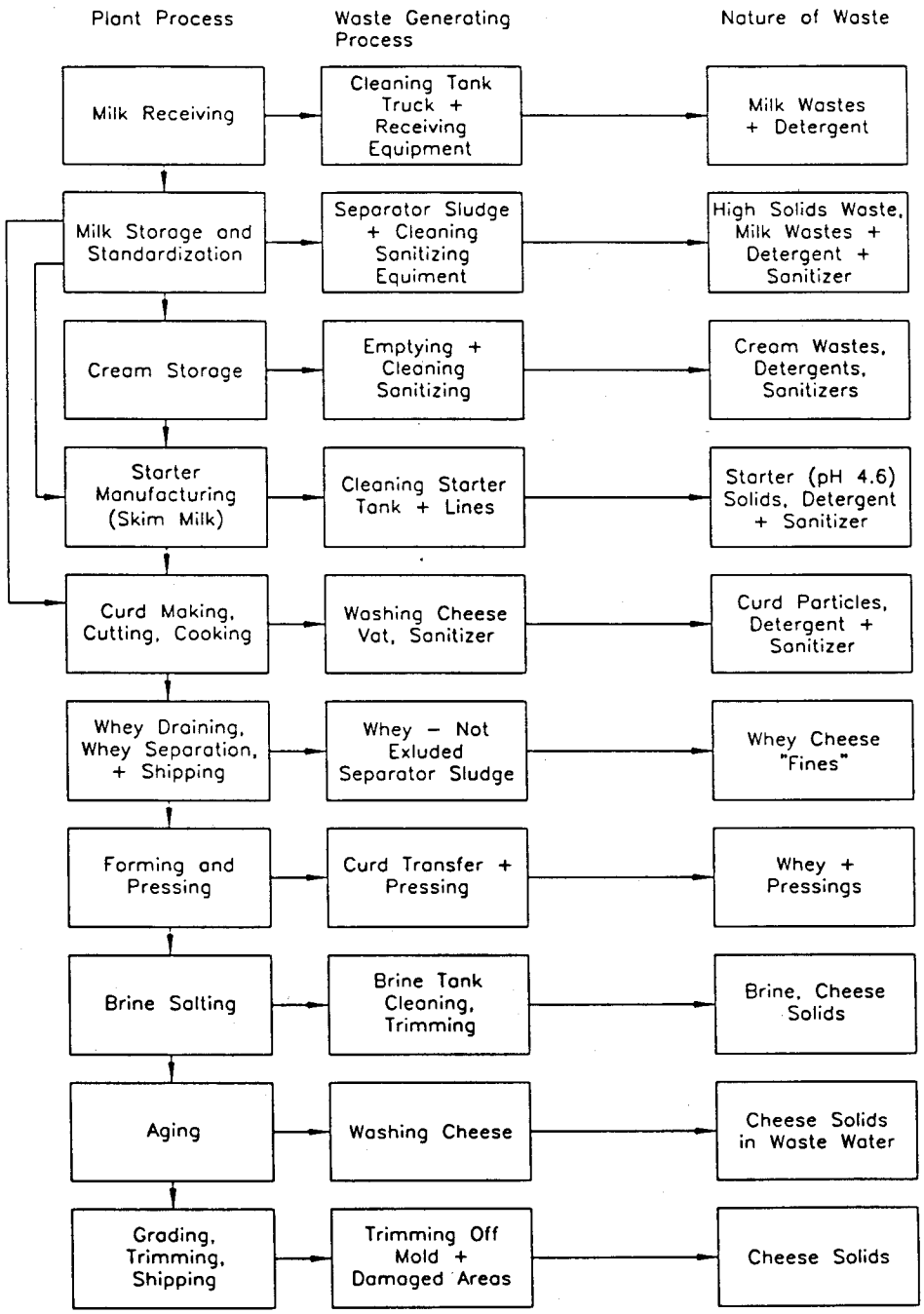


FIGURE 4.10 – SWISS CHEESE MANUFACTURE

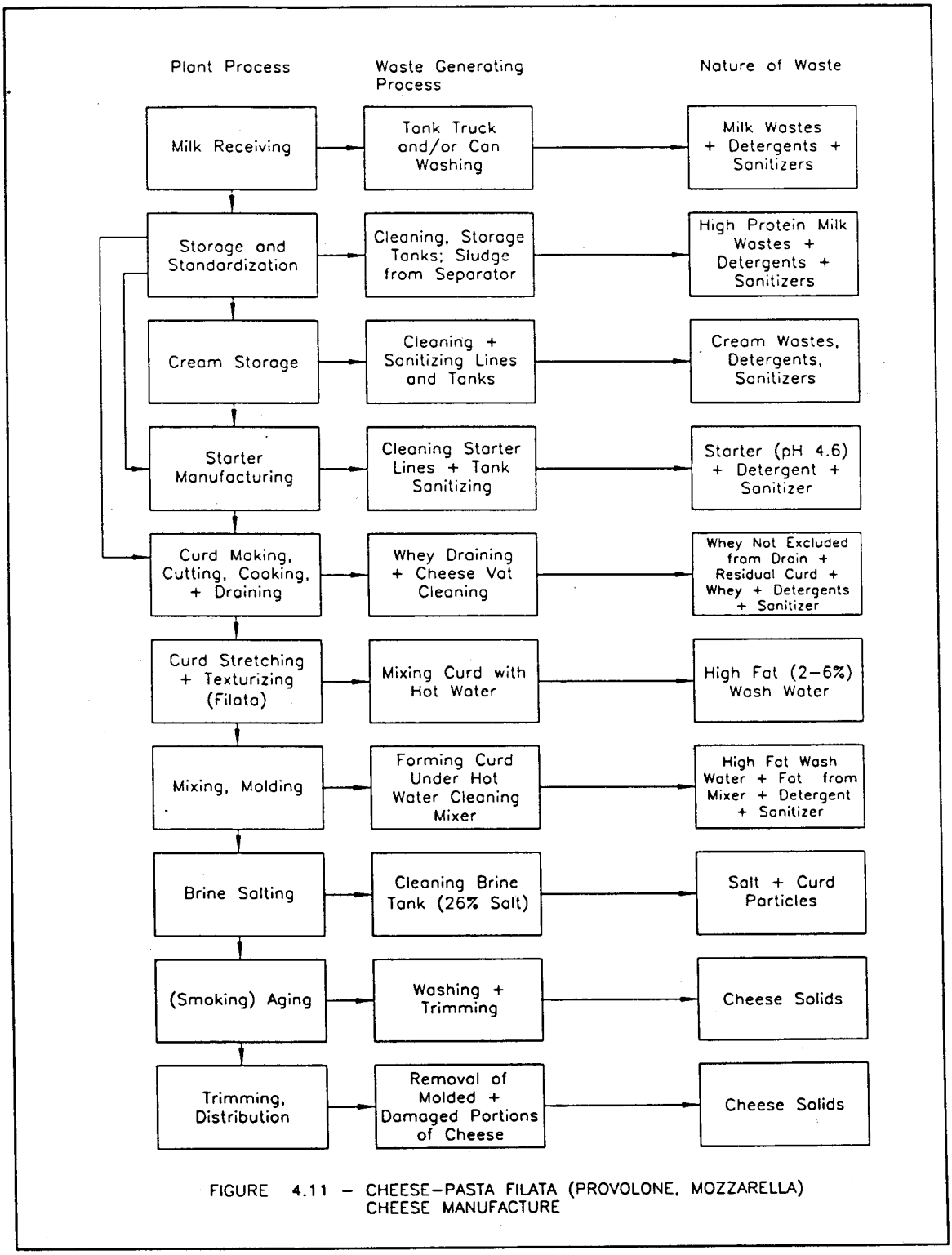


FIGURE 4.11 – CHEESE–PASTA FILATA (PROVOLONE, MOZZARELLA) CHEESE MANUFACTURE

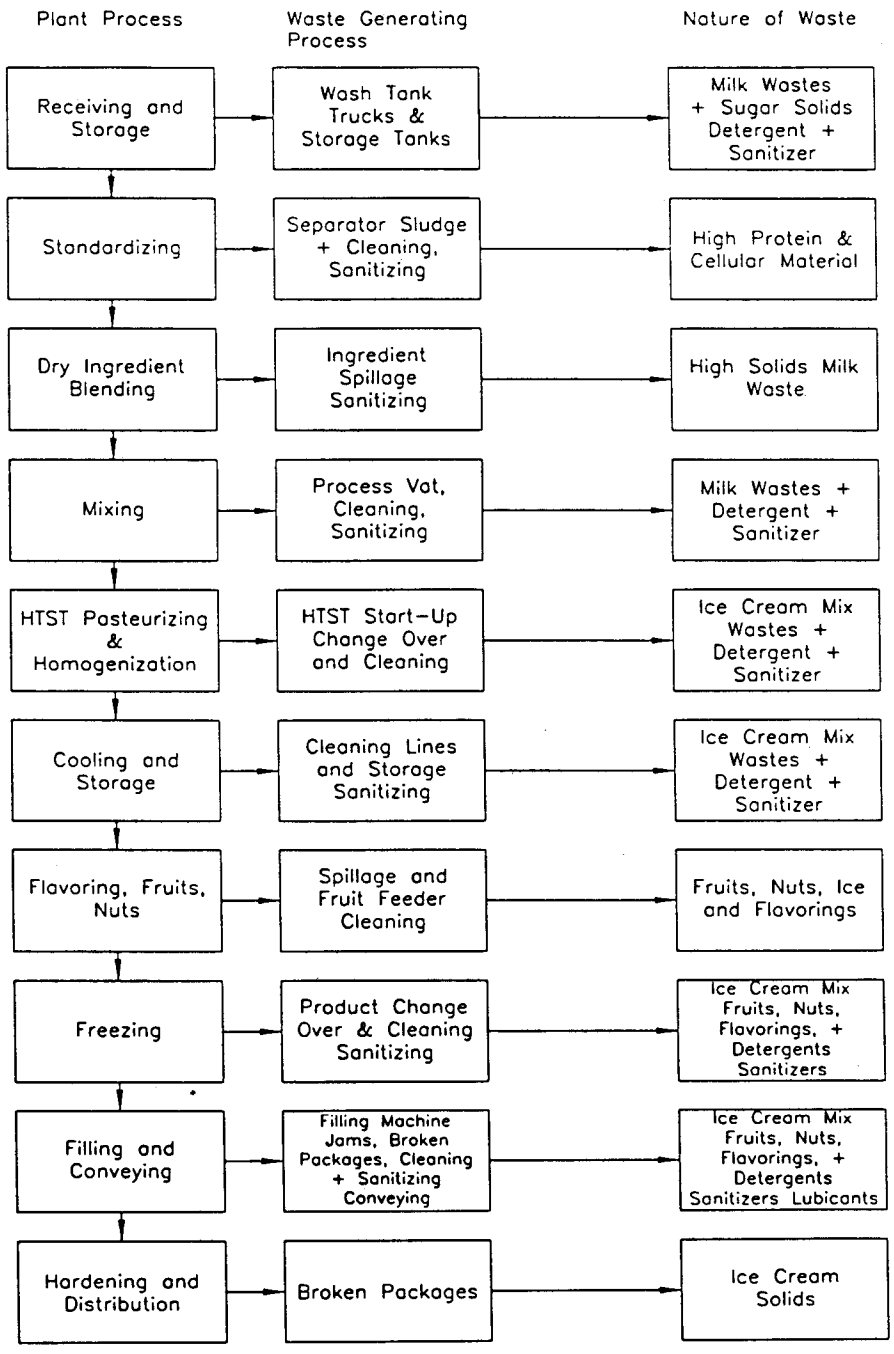


FIGURE 4.12 – ICE CREAM

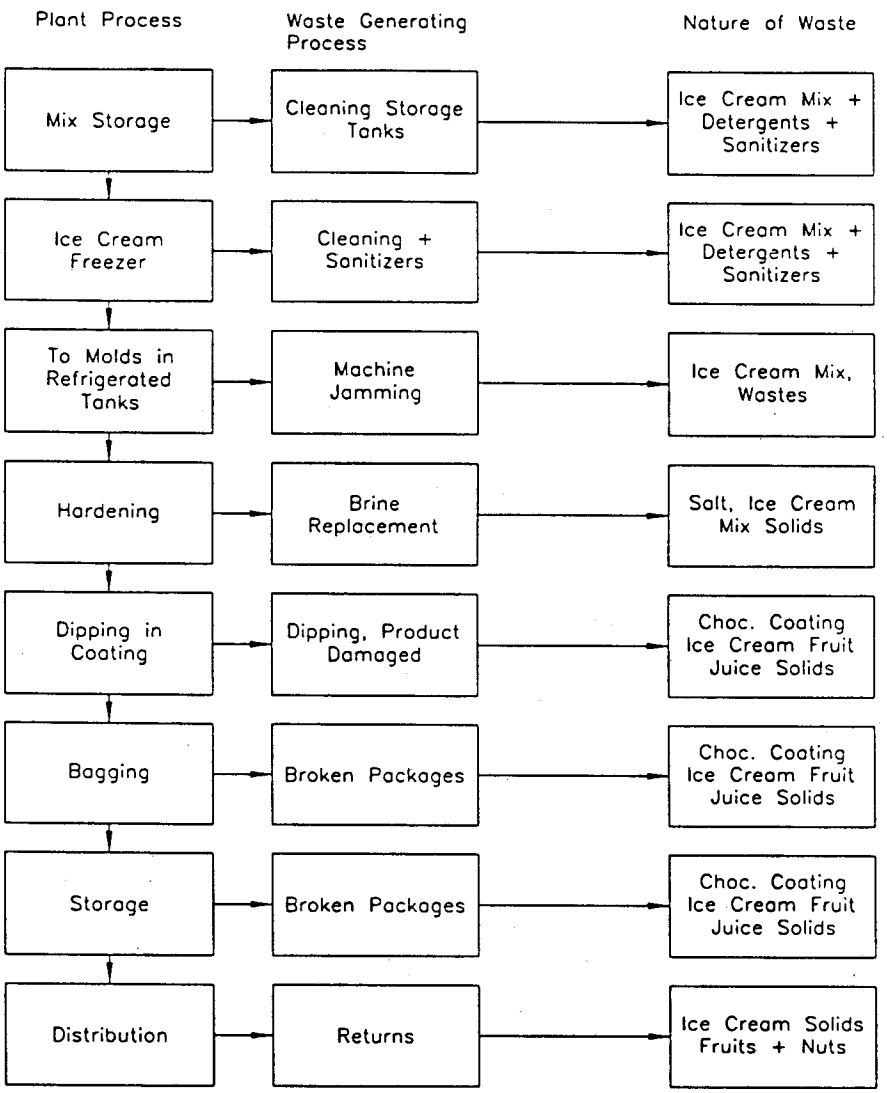


FIGURE 4.13 – ICE CREAM–SUBPROCESS STICK NOVELTIES

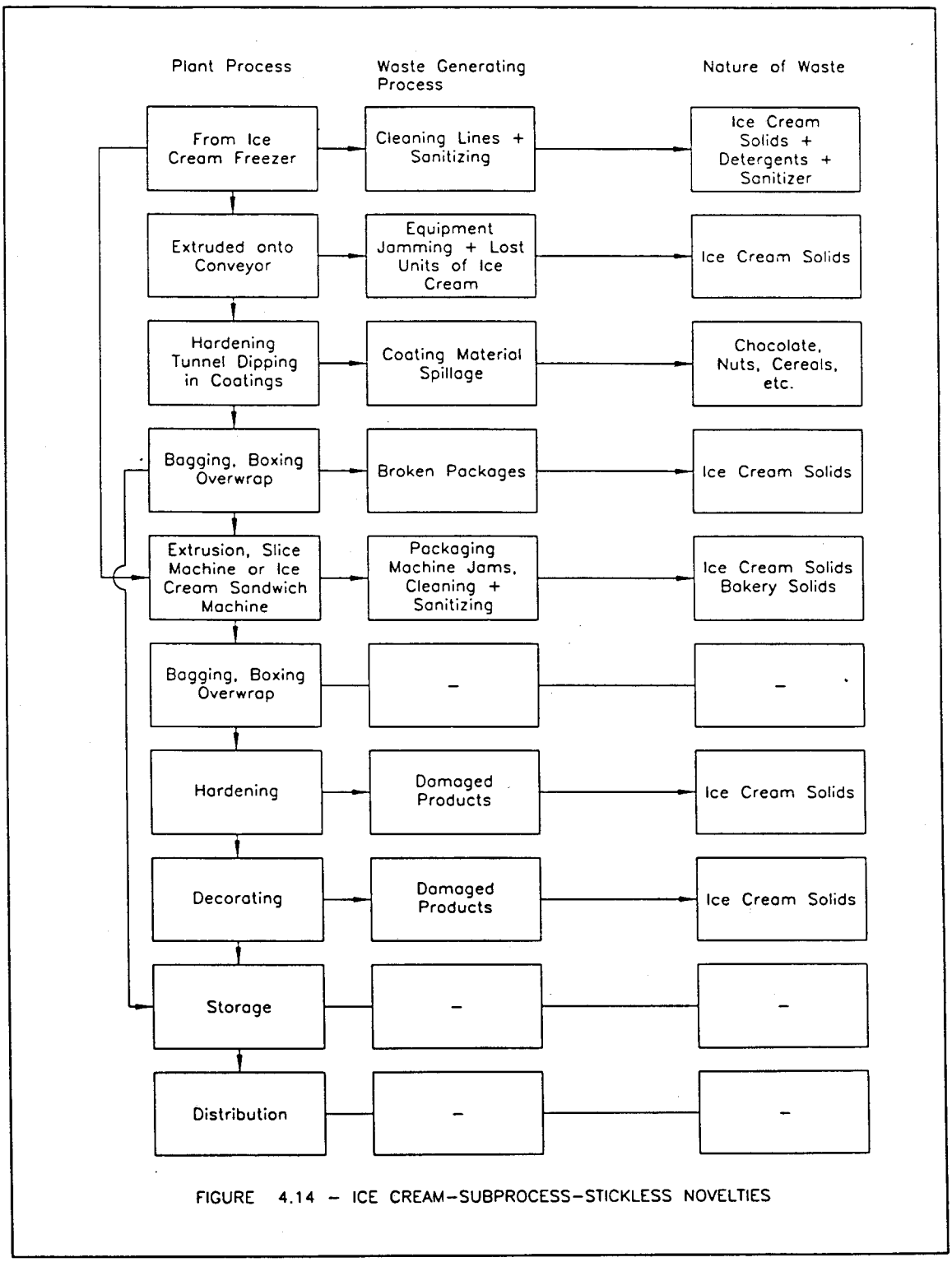


FIGURE 4.14 – ICE CREAM–SUBPROCESS–STICKLESS NOVELTIES

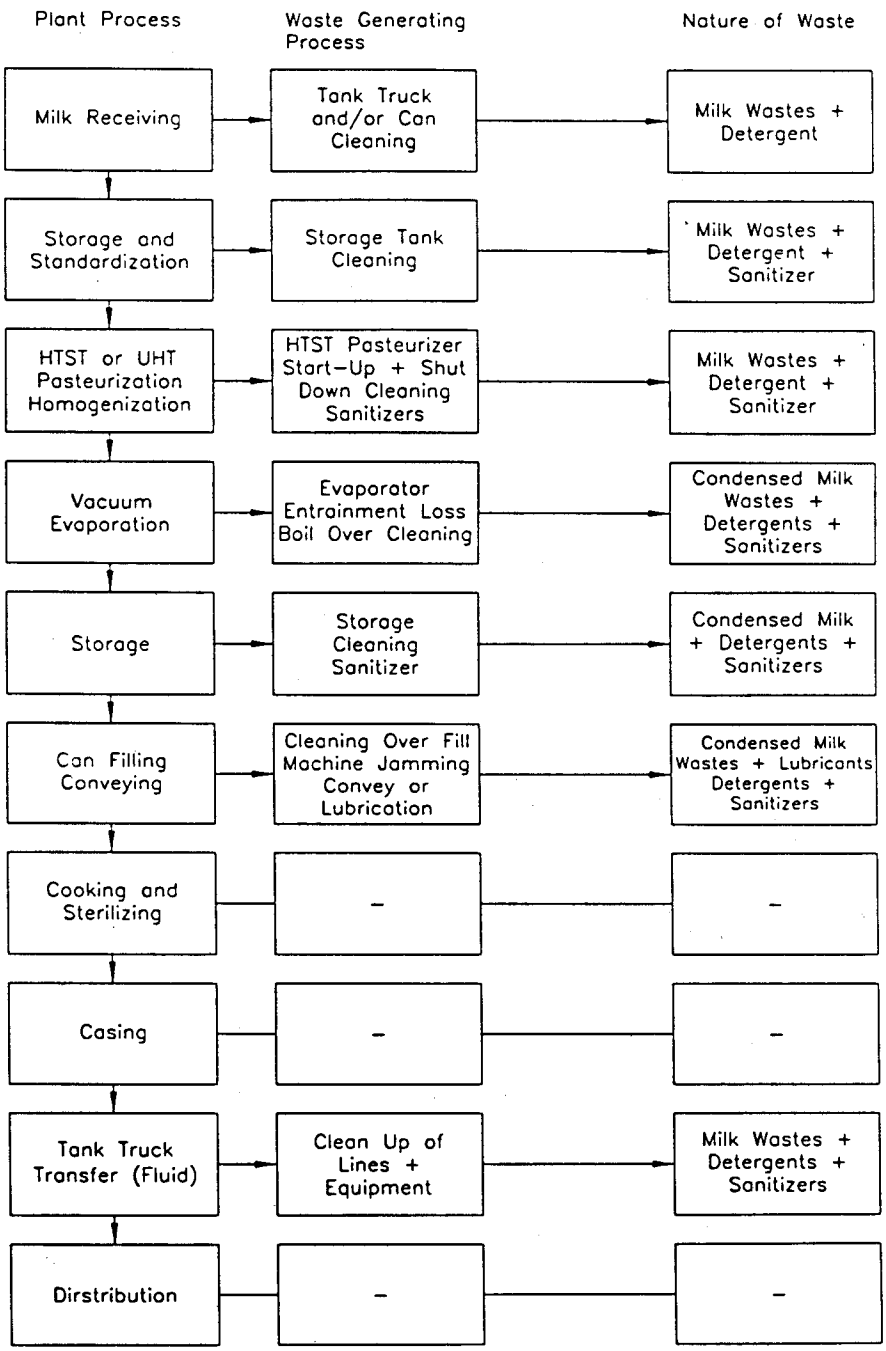


FIGURE 4.15 – CONDENSED MILK PROCESS

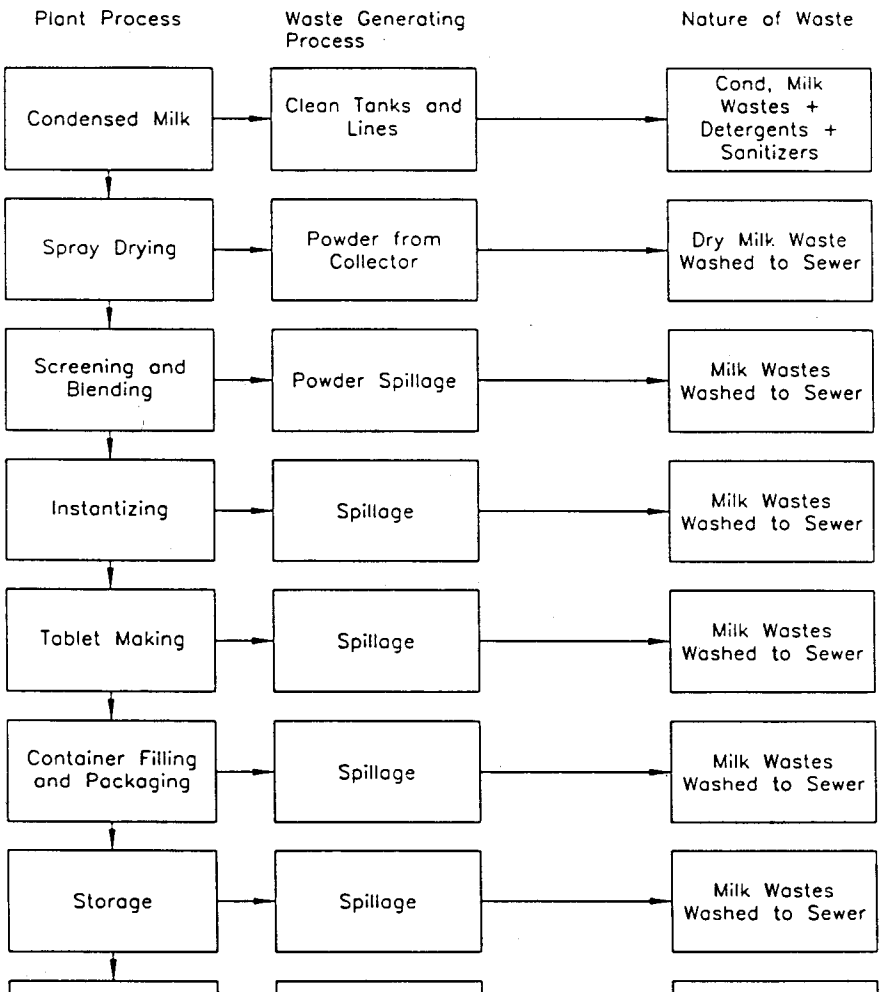


FIGURE 4.16 – SPRAY DRYING PROCESS

4.4 Pollutants

Based on the technical information obtained from the various studies undertaken by the regulatory agencies in Canada and the United States for the Dairy Products Industry, the pollutants of concern include the following:

- Biological Oxygen Demand (BOD_5);
- Total Suspended Solids (TSS);
- pH, Acidity and Alkalinity;
- Temperature;
- Phosphorous;
- Nitrogen;
- Chloride;
- Process Wastewater Volume; and
- Oil and Grease.

Without a good wastewater characteristics data base for the dairy products industry in the Lower Fraser Basin, only the generic information on the above listed pollutants are presented below. The data were extracted from United States Environmental Protection Agency, Office of Research and Monitoring, *Dairy Food Plant Wastes and Waste Treatment Practices,* March 1971 (EPA Report 12060).

4.4.1 Biological Oxygen Demand (BOD_5)

The majority of waste material in dairy plant wastewaters is organic in nature, consisting of milk solids and organic components of cleaners, sanitizers and lubricants. The BOD_5 concentration of raw wastewaters in the dairy products processing industry typically ranges are shown as follows:

BOD_5	High	Low
Concentration - mg/l	4,000	1,000
Waste Load - kg/1000 kg M.E.	16.4	0.41

Note: M.E. = Milk Equivalent, a unit derived from the correlation that 100 kg BOD_5 (processed) is equal to 1000 kg of whole milk (received), which is approximately 10% by weight.

4.4.2 Total Suspended Solids (TSS)

The concentrations of suspended solids in raw dairy plant wastes vary widely among the different dairy operations. Dairy products wastewaters typically contain up 2,000 mg/l of suspended solids, most of which are organic particulate derived from the milk

(coagulated milk, fine particles of cheese curd) and other materials (pieces of fruits and nuts from ice cream operations) processed. The mean suspended solids loads are as follows:

Suspended Solids	High	Low
Waste Load - kg/1000 kg M.E.	2.9	0.03

Note: M.E. = Milk Equivalent

4.4.3 pH, Acidity and Alkalinity

The pH of the raw dairy wastewaters varies from 4.0 to 10.8 with an authentic mean of 7.8. The main factor affecting the pH of dairy plant wastewaters is the types and amount of cleaning and sanitizing compounds discharged to waste at the processing facility. A review of the historical effluent data from the local operating facilities indicates that many of the reported process wastewaters had been consistently exceeded a pH value of 11.5.

4.4.4 Temperature

In general the temperature of the wastewater will be affected primarily by the degree of hot water conservation, the temperature of the cleaning solutions, the relative volume of cleaning solution in the wastewater. Higher temperatures can be expected in plants with condensing operations, when the condensate is wasted. The temperatures of raw dairy wastewaters are shown as follows:

Temperature	High	Low	Mean
Measurement - °C	38	8	24

4.4.5 Phosphorus

Phosphorus concentrations (as PO_4) of dairy wastewaters are shown below. Part of the phosphorus contained in dairy wastewater comes from the milk or milk products that are wasted. Wastewater containing 1% milk would contain about 12 mg/l of phosphorus. The bulk of the phosphorus is originated from the wasted detergents and cleaner, which typically contain significant amounts of phosphorus. The wide range of concentrations reflect varying practices in detergents usage and recycling of cleaning solutions.

Phosphorus (as PO_4)	High	Low	Mean
Concentration - mg/l	210	9	28

4.4.6 Nitrogen

The reported ammonia nitrogen and total nitrogen in the dairy wastewaters are shown below. Milk alone would contribute about 55 mg/l of nitrogen at a 1% concentration in the wastewater. Quaternary ammonium compounds used for sanitizing and certain detergents can be another source of nitrogen in thewastewaters.

Nitrogen	High	Low	Mean
Ammonia Nitrogen Concentration - mg/l	13.4	1.0	5.5
Total Nitrogen Concentration - mg/l	115	1.0	64

4.4.7 Chloride

The principal sources of chloride in the wastewaters may include brine used in refrigerator systems and chlorine based sanitizers. Milk and milk products may be part of the load; at a 1% concentration of milk in the wastewater, milk would contribute 10 mg/l of chloride. Reported chloride concentrations are shown as follows:

Chloride	High	Low	Mean
Concentration - mg/l	1930	46	483

4.4.8 Process Wastewater Volume

Wastewater flow covers a very broad range and the reported ranges are shown below. It should be noted that wastewater flow does not necessarily represent total water consumed, because some plants recycle condenser and cooling water and/or use water as a necessary ingredient in the product.

Wastewater	High	Low
Volume - l/1000 kg M.E.	9000	542

Note: M.E. = Milk Equivalent

4.4.9 Oil and Grease

The concentration of oil and grease in wastewater is a special concern for facilities discharging to the municipal treatment system. Discharge limits will vary between municipalities. Currently, GVRD limits the discharge of oil and grease to 150 mg/l.

4.5 Waste Management Methods

Dairy plant wastes consist mainly of lost raw materials, intermediate and finished products and the cleaning materials required to clean and sanitize shipping containers and processing space and equipment all carried in the process wastewaters being discharged by the plant. Whey is a by-product of most cheese manufacturing operations and is found to be a significant pollution problem. The waste generating processes of major significance in the Dairy Products Processing Industry include:

- washing, cleaning and sanitizing of all piping, pumps, processing equipment, tanks, tank trucks and filling machines;
- start-up, product changeover and shut down of High Temperature and Short Time (HTST) and Ultra High Temperature (UHT)pasteurizers;
- loss in filling operations through equipment jams and broken packages; and
- lubrication of casers, stackers and conveyors.

Wastes from the listed manufacturing processes are presented in the generic process flow figures (Figure 4.1 to Figure 4.16) in Section 4.3. Although these waste generating sources vary in different dairy products manufacturing plants, they are inherently controllable through the understanding of the origins of the wastes and the application of good management practices. The following is a list of the parameters that can assist any dairy products processing facility to address the environmental concerns:

- Waste materials (media)
- Waste stream origin
- Active ingredients
- Hazardous properties
- Treatment/disposal methods
- Reduction, recycling, and treatment activities
- Stormwater management
- Best management practices

4.5.1 Wastewater Treatment

The are two sources of contaminated wastewater from the dairy products processing facilities. The first source is the wastewater generated from washdown of processing equipment and associating piping/pumping systems. The second source is stormwater that has been commingled with the spillage of raw materials, intermediate, and finished products.

The wastewater/stormwater treatment can be classified in terms of the rate limiting pollutant parameters:

- BOD_5
- Total Suspended Solids
- pH, acidity and alkalinity
- Phosphorus
- Ammonia nitrogen
- Chloride
- Temperature

Presented below is a summary of the wastewater treatment technologies used in dairy products processing operations.

BOD_5 and Total Suspended Solids

Wastewater/stormwater from dairy products processing facilities can contain high levels of organic contaminants measured as biochemical oxygen demand. The BOD_5 contaminant is associated primarily with the milk products/solids (i.e. milk, cheese curd and fines, ice cream). A small fraction of the BOD_5 in the wastewater originates from the organic components of non-dairy ingredients (e.g. sugar and syrup), cleaners, sanitizers and lubricants released from the mechanical conveying systems.

The study conducted by US EPA in 1971 indicated that the BOD_5 and solid concentrations in the wastewater from the dairy products processing plant are closely correlated, and the relationship ratio (solid to BOD_5) was found to be around 0.4. Since the treatment cost to remove BOD_5 in the liquid phase is higher than the treatment cost to remove BOD_5 in the solid phase, it would be logical for the dairy product processing facility to reduce the effluent BOD_5 in the solid phase.

To minimize treatment cost, wastewater treatment systems are designed to remove the BOD_5 while it is still associated with the milk solids. Common physical separation such as screens or centrifuges are used to remove major portion of the BOD_5 prior to discharging to the city sewer. Some of the centrifuges are equipped with automatic Clean In Place (CIP) system and collect the sludge as solid wastes.

After separating the bulk of the solids in the process effluent, the remaining soluble BOD_5 in the wastewaters can be treated as follows:

- on-site biological treatment system such as trickling filters or activated sludge process; and/or
- discharging into the municipal sewerage treatment system.

pH, Acidity and Alkalinity

The pH of the wastewater from the dairy product processing facilities is primarily affected by the type and amount of cleaning and sanitizing compounds discharged to waste at the plant. The effluent characteristic can also be influenced by the amount of whey released accidentally or intentionally from the cheese manufacturing processes.

Though a number of individual waste streams within a dairy products processing facility may exhibit undesirably high or low pH, most of the operating facilities have been combining the waste streams in holding tanks to neutralize the extreme conditions of the process wastewaters. After the initial mixing and neutralization, additional chemicals such as caustic soda (NaOH) and sulphuric acid are used to bring the pH of the combined effluent within the range established in the discharge permit or suitable for biological treatment.

Phosphorus, Nitrogen, and Chloride

Phosphorus, nitrogen and chloride were identified as pollutants of concern by US EPA in their 1971 study. The major source of these pollutants was the detergents and sanitizers used by the processing facilities in their routine cleaning and sanitizing operations. Milk is also a source of these pollutants. Some of the chloride in the process effluent may be related to the leakage of brine used in refrigerator system.

To minimize these pollutants in the wastewater, some operating facilities have adopted best management practices to reduce the use of detergents in the cleaning procedures. Some facilities have phased out the single-use cleaning practice and changed some of the processing steps to include CIP equipment and procedures.

4.5.2 Stormwater Management

Dairy products processing facilities have implemented many stormwater control measures to minimize the impacts of contaminated stormwater to the receiving water. These control measures are commonly called best management practices and is defined as physical, structural, and/or managerial practices, that when used either singly or in combination, prevent, or reduce pollution ofstormwater.

There are many types of best management practices, but in general they can be classified into two groups:

- Source control
- Runoff control/treatment.

Presented in the followings are stormwater best management practices implemented by dairy products processing plants in the Lower Fraser Basin.

Source Control

Source control BMPs include:

- Regular maintenance of the raw materials handling area (receiving station)
- Regular maintenance of the stormwater conveyance system
- Providing roofs over raw materials handling and storage areas
- Providing secondary containment for fuel, oils, and liquid chemicals
- Segregating the stormwater.

Regular Maintenance of the Raw Materials Handling Area

Spilled dry bulk materials (sugar and nuts) are reclaimed either by front end loaders (Bob Cats) for large spills or by dry sweeping or washdown for small spills. Drip pans have been utilized to capture spills and leaks from connecting hoses.

Regular Maintenance of the Stormwater Conveyance System

Several dairy products processing facilities have constructed drainage ways and catch basins for conveying stormwater offsite. Captured and settled solids in the catch basins are regularly removed to maintain the efficiency of the treatment system.

Providing Roofs over Raw Materials Handling and Storage Areas

Roofs or enclosed structures are designed to keep rain from coming into contact with the raw materials and finished products handling activities. Many dairy products processing plants have provided roofs/enclosed structures for the receiving stations, loading docks for finished products, and in areas handling damaged and returned commodities.

Uncontaminated roof runoff can be discharged directly into the city storm sewer system or to the close-by receiving streams.

Providing Secondary Containment for Fuel, Oils, and Liquid Chemicals

Secondary containment structures are designed to:

- Contain the spilled materials

- Simplify facility cleanup
- Prevent stormwater contamination
- Prevent site contamination.

Segregating the Stormwater

Stormwater segregation is implemented by several dairy product processing plants. Stormwater containing milk products is treated on-site or discharged to the city sanitary sewer system for treatment, while the uncontaminated stormwater is discharged to city storm sewer system or to receiving waters.

Runoff Control/Treatment

Runoff control/treatment BMPs include:

- Site grading and curbing
- Catch basins/detention ponds
- Stormwater treatment.

Site Grading and Curbing

Site grading and curbing is used to prevent:

- Pooling of the stormwater and washwater
- Off site migration of contaminated stormwater and washwater
- Mixing of segregated flows.

Catch Basins/Detention Ponds

Catch basins/detention ponds are designed to remove particulate solids by gravity settling. They are effective only for the larger size fractions and for the non-colloidal fraction of the solids in the wastewater. Colloidal particulate require the addition of coagulants for settling.

Stormwater Treatment

Contaminated stormwater is often combined with process wastewater and routed to on-site wastewater plant for treatment or discharged into the city sanitary sewer system. On-site treatment methodology is dependent on the characteristics of the pollutants.

4.6 Environment Permit Requirements

Air emissions and wastewater/stormwater discharges for many dairy products plants are regulated by environmental agencies.

The discharge of air contaminants into the environment is regulated by the Greater Vancouver Regional District (GVRD).

The discharge of wastewater/stormwater is regulated either by the Greater Vancouver Regional Discharge and the City of Vancouver for discharges of non-domestic wastewaters into the sanitary sewerage systems or by the BC Ministry of Environment, Lands and Parks (BCMOELP) for discharges to the receiving waters and outside of the geographical regions regulated by GVRD.

4.6.1 Air Emissions

Since the operating facilities in the Lower Fraser Basin do not use large silos to store dry bulk raw materials, they do not generally require an air discharge permit from GVRD. Some operations with on-site boiler systems may require an air discharge permit from GVRD.

There are some fugitive emission from the operating facilities, such as leakage of refrigerant from the cooling, refrigeration, and freezing systems and the spillage of solvent and/or fuel from the maintenance shop and vehicle re-fueling stations.

4.6.2 Wastewater/Stormwater Discharges

Of the twenty one (21) dairy products processing plants in the Lower Fraser Basin, only eight (8) processing facilities have wastewater discharges that are regulated by GVRD and two (2) are regulated by the City of Vancouver.

The regulated dairy processing facilities and their associated regulatory agencies are presented in Table 4.4 .

Table 4.4 Regulated Dairy Processing Facilities	
Regulatory Agency	**Facility Name**
GVRD	Agrifoods International Cooperative Ltd. - UHT Plant
GVRD	Agrifoods International Cooperative Ltd. - Milk Plant
GVRD	Agrifoods International Cooperative Ltd. - Ice Cream Plant
GVRD	Flamingo Foods Ltd.
GVRD	Formost Foods
GVRD	Landmark Dairy
GVRD	Lucerne Foods - Milk Plant
GVRD	Lucerne Foods - Ice Cream Plant
City of Vancouver	Avalon Dairy
City of Vancouver	Bari Cheese

Depending on the type of wastewater treatment system having on-site, the wastewater discharge permit issued by GVRD and the City of Vancouver contain limits of the following pollutants:

- Total Suspended Solids (TSS);
- Oil and Grease (O&G); and
- pH

pH of the discharge is generally limited to the range of 5.5 to 9.5 in the City of Vancouver and 5.5 to 10.5 for GVRD. The concentrations of the TSS and O&G in the process effluent from the dairy products processing plant are limited to 600 mg/l and 150 mg/l respectively.

4.6.3 Current Wastewater Management Practices

Table 4.5 summarizes the current wastewater management practices for the above permitted dairy products processing facilities.

Table 4.5 Dairy Products Processing Facilities - Current Wastewater Management Practices	
Pollutant of Concern	**Wastewater Treatment Practices**
Total Suspended Solids	• Pre-treatment with trade waste interceptor and discharge into the GVRD Sewerage System • Pre-treatment with centrifuge and screen and discharge into the GVRD Sewerage System Screening
Oil & Grease	• Pre-treatment with trade waste interceptor and discharge into the GVRD Sewerage System • Pre-treatment with grease trap and discharge into the GVRD Sewerage System • Pre-treatment with oil/water separator and discharge into the GVRD Sewerage System
pH, Acidity & Alkalinity	• Pre-treatment with caustic and/or acid in both batch and continuous operations and discharge into the GVRD Sewerage System • Commingling of the acidic and alkaline streams for neutralization

5^O Procedures for the Development of Pollution Prevention Plans

Presented in Table 5.1 depicts the steps to be conducted for the preparation and development of an assessment procedure/program for a Pollution Prevention (P2) Plan.

Table 5.1 Pollution Prevention Plan Development Overview

Step	Task	Sub - Task Description
1	Establishing and Organizing a P2 - Assessment Program	A) Select team members to develop pollution prevention plan B) Develop pollution prevention/reduction goals C) Identify potential obstacles D) Prepare the program plan E) Obtain funding
2	Compilation of Background Information	A) Develop industry/facility profile
3	Conducting Environmental Review	A) Compile facility data B) Conduct site inspection C) Identify potential pollution prevention options D) Organize pollution prevention options E) Review pollution prevention options by cost & benefits F) Prioritize pollution prevention options
4	Conducting Feasibility Assessment	A) Conduct feasibility assessment 1. Technical Evaluation 2. Environmental Evaluation 3. Economic Evaluation B) Prepare and review the assessment report
5	Writing Pollution Prevention Plan	A) Write the facility Pollution Prevention Plan
6	Implementation of Pollution Prevention Plan	A) Select projects for implementation B) Obtain funding C) Implement the selected projects
7	Measuring Pollution Reduction Progress	A) Monitor pollution prevention progress

5.1 Establishing and Organizing a P2 - Assessment Program

Establishing and organizing a P2-Assessment Program is Step 1 of the process as shown in Table 5.1. There are many tasks involved in this step and they are further described below.

Task A: Select Team Members to Develop Pollution Prevention Plan

Select team members for the development of the pollution prevention plan. The study team members should have substantial technical, business, and communication skills as well as thorough knowledge of the company policy and philosophy.

The areas of expertise to consider include:

- Management
- Engineering
- Quality control
- Operation and maintenance
- Accounting and purchasing
- Legal
- Health and safety
- Environmental.

Task B: Develop Pollution Prevention/Reduction Goals

Identify the scope and objectives/goals of the pollution prevention plan. The goals serve to focus effort and build consensus. The goals should be:

- Well-defined (long term and short term objectives)
- Meaningful to all employees
- Challenging and achievable
- Flexible and adaptable.

Task C: Identify Potential Obstacles

The study team needs to identify potential obstacles for pollution prevention options. The obstacles vary from facility to facility.

For dairy products processing facilities, potential obstacles are primarily technical and economic in nature. For existing operating facilities, some pollution prevention options are either economically or technically unfeasible, and sometimes unacceptable because of human nature (workers' attitude).

Task D: Prepare a P2 - Assessment Program

A P2-Program should contain all of the elements described above. A timeline containing realistic target dates for each stage of the study should be included in the P2-Assessment Program.

Task E: Obtain Funding

The study program may require collection and analysis of samples. In addition to the sampling/analysis cost, some facilities may find it necessary to retain a consultant to perform some aspects of the study program. These costs will need to be considered in the planning of the program. The company may need to allocate funding prior to the start-up of the study program.

Output from Step 1:

A Pollution Prevention Assessment Program

5.2 Compilation of Background Information

As indicated in Table 5.1, Compilation of Background Information is Step 2 in the assessment program. This step consists of a single task.

Task A: Develop an Industry/Facility Profile

The industry/facility profile is a characterization of the various industries within the industrial sector and the industrial facility under consideration. The profile should contain information on raw materials, processes, waste materials and waste management practices for the industry and the specific facility. The information may assist the team in selecting study areas and in identifying pollution prevention options.

For the dairy products processing operation, the facility profile should contain information on:

- Types and quantity of dairy products processed and manufactured
- Raw materials handling system
- Storage system
- Air emission sources
- Air pollutant characteristics
- Air pollutant management/control practices
- Wastewater and stormwater sources
- Wastewater and stormwater characteristics
- Wastewater and stormwater management/control practices
- Fuel, lubricant, and chemical storage
- Environmental permit requirements and performance
- Solid waste management and disposal practices

Review published literature to develop background information on dairy products processing operations, air emissions and wastewater/stormwater management methods, and stormwater best management practices currently practiced by other dairy products processing facilities.

The industry background information can be compiled from:

Dairy Food Plant Wastes and Waste Treatment Practices, March 1971, United States Environmental Protection Agency (EPA Report 12060).

Development Document for Effluent Limitations Guidelines and New Source Performance Standards for Dairy Products Processing Point Source Category, May 1974, United States Environmental Protection Agency (EPA-440/1-72-021-a).

Guide for the Best Management Practices - Storm Water Management for Selected Industrial Sectors in theFraser Basin, PCA Consultants Ltd., March 1995.

Output from Step 2:

An Industrial/Facility Profile of a Dairy Products Processing Facility

5.3 Conducting Environmental Review

The purpose of environmental review is to identify all waste streams, their sources and the costs of treatment and disposal. The information is then used to identify areas of opportunity for pollution prevention. The environmental review program is designed to provide a focus for consideration of pollution prevention and to minimize data collection and pollution prevention evaluation costs.

Conducting Environmental Review is Step 3 in the assessment program. There are many tasks listed in this step and they are further described below.

Task A: Compile Facility Data

The activities for the environmental review program are:

- Plant data collection
- Site inspection including observations of the immediate environment adjacent to the facility
- Identification of pollution prevention potentials
- Development of prioritization criteria
- Prioritization of pollution prevention potentials.

In an all-media approach, identify the air emissions and wastewater/stormwater sources and quantify the waste loadings (conventional parameters, such as BOD_5 and TSS) to the receiving environment. Identify the costs of wastewater treatment and/or disposal.

The information and requirements for the facility data compilation program are presented in Table 5.2.

Table 5.2 Environmental Review - Plant Data Compilation Program	
Category	**Facility-Specific Information**
Dairy Products Processed and/or Manufactures	• Volume of dairy products processed and/or manufactured • General shipment schedule • Active Ingredients or Components of Concern
Unloading	• Spillage control system • Operating Schedule/Periods • Site cleanup method
Process Unit Operation	• Spillage control system • Wastewater generation rate • Quantity of spillage • Site cleanup method • Wastewater treatment/disposal method • Operating schedule
Storage	• Storage method • Dust control system
Loading for Transport	• Spillage control method • Quantity of spillage • Volume of damaged products
Fuel, Lubricants, Chemicals	• Quantity of materials • Spill prevention and cleanup method
Wastewater/Stormwater Management Practices	• Wastewater/stormwater treatment method • Quantity of wastewater • Quantity of contaminated stormwater
Environmental Permit Requirements	• Air emission sources and Bylaw Fee • Air emission source test data • Wastewater sources • Wastewater discharge data

For this environmental review, compile these data from existing sources. Reserve any extensive and costly data collection programs for the detailed assessment.

Examples of existing and readily available data sources are presented in Table 5.3.

Table 5.3 Plant Data Compilation Program - Data Sources	
Category	**Facility-Specific Information**
Raw Materials	• Shipment records and manifests
Process Unit Operation and Storage	• Equipment list and specifications • Equipment layouts and logistics • Vendor/supplier data sheets • Operating manuals and process description • Operator data logs
Fuel, Lubricants, Chemicals	• Purchasing records • Equipment specifications
Wastewater Treatment System	• Process flow diagram • Equipment list and specification • Equipment layouts and logistics • Monitoring data
Stormwater Management Practices	• Site plans and elevation plans
Waste Materials (Solids)	• Shipment records and manifests
Environmental Permit Requirements	• Air emission permit • Wastewater discharge permit • Laboratory records • Environmental audit reports • Waste shipment manifests

Worksheets A-1 to A-5, presented in Appendix B, will assist plant personnel in identifying the data requirements and in organizing the compiled data. These worksheets are generic to dairy products processing operations. Some customization will be required to develop facility-specific worksheets.

Based on the site-specific data, prepare the dairy products processing flow diagrams showing:

- Types and quantities of all dairy products processed and manufactured
- Sources/locations and quantities of air emissions
- Sources/locations and quantities of raw materials, by-products, and products spillage
- Sources/locations, quantities and characteristics of wastewater/stormwater.

Output from Step 3 - Task A:

- **Completed Data Worksheets,**
- **Raw Materials and Waste Materials Mass Balances,**
- **Unit Operations of the Facility,**
- **Waste Flow Diagrams.**

Task B: Conduct Site Inspection

The mass balance calculations and flow diagrams should be reviewed to ensure correctness. A thorough and detailed site inspection of the targeted process areas will be conducted to identify operating parameters and other factors that were missing or poorly documented. The site inspection will assist in developing thorough understandings of the processing unit operations and thereby identifying pollution prevention opportunities.

Presented in Table 5.4 are guidelines for preparing and conducting site inspection.

Table 5.4 Site Inspection Guidelines

Pre-inspection Activities	• Evaluate data compiled along with mass balance calculations and flow diagrams to gain familiarity with the targeted processes and to identify additional data requirement. • Review existing documents such as operators' manuals and purchasing and shipping records. • Prepare an inspection agenda that identify the targeted processes and the data requirement. • Schedule the inspection to coincide with operations of targeted processes.
On-site Inspection Activities	• Monitor the raw materials handling process from the point where bulk materials enter the plant site to the point where finished products and wastes exit. • Identify all suspected sources of air emissions. • Identify all wastewater discharges including leaks and spills. • Monitor the process unit operations to identify unmeasured or undocumented releases of products and wastes. • Interview operators in the targeted dairy products processing areas to identify operating parameters, wastewater generation, and spill reduction opportunities. • Evaluate the general conditions of the processing equipment. • Examine housekeeping practices throughout the facility. • Check for spillage and leaks at the equipment/vehicle maintenance area. • Check waste storage area for proper waste segregation. • Photograph or videotape the targeted processing areas.
Post-inspection Activities	• Update mass balance calculations and flow diagrams with new or correct information. • Conduct follow-up site inspections to collect additional data or to clarify questions identified during data analysis.

Output from Step 3 - Task B:

- **Updated Worksheets,**
- **Mass Balances**
- **Dairy Products Processing Flow Diagrams.**

Task C: Identify Potential Pollution Prevention Options

The worksheets (Worksheet B-1 to B-3) presented in Appendix B are designed to assist dairy products processing facilities in systematically evaluating waste generating sources and in identifying pollution prevention options.

The worksheets are organized into three (3) sections:

- Stormwater best management practices
- Process unit operations
- Wastewater/stormwater collection/treatment.

A no response will indicate a potential area to implement pollution prevention measures.

Output from Step 3 - Task C:

A Listing of Pollution Prevention Options

Task D: Organize Pollution Prevention Options

After completing the Pollution Prevention Potential Assessment Worksheets, the assessment team should organize the identified waste minimization options ("no" responses) within the environmental management hierarchy.

The environmental management hierarchy is presented below.

1. Source reduction
2. On-site reuse and recycling
3. Off-site reuse and recycling
4. Material and/or energy recovery
5. Residual waste management

This organization emphasizes the evaluation and implementation of source reduction pollution prevention options. Other non-pollution prevention waste management options will be assigned lower priorities in evaluation and implementation.

In the dairy products processing facility environment, the major sources of pollution and associated pollutants are:

- Washing and cleaning out of products remaining in the processing equipment and storage vessels (dairy products, detergents, andsanitizers)
- Spillage and processing losses of products (dairy products)
- Wastage of spoiled, returned, and by-products (dairy products)
- Vehicle and equipment maintenance (fuel, lubricants, chemicals)
- Site cleanup (washwater).

Because spillage and wastage of raw materials, by-products, products, and other washing/sanitizing chemicals usually incur high treatment/cleanup costs and legal liabilities, pollution prevention options for these areas should receive higher priorities. Other sources that are lower in potential environmental and safety liabilities should be lower in ranking.

Presented in Table 5.5 is the recommended organization of pollution sources/pollution prevention options for dairy products processing facilities.

Table 5.5 Recommended Organization of Pollution Sources

Waste Management Approach	Relative Order	Pollution Sources (Pollutants)	Example of Selected Pollution Prevention Options
Source Reduction (Process Unit Operations Best Management Practices)	1a (Highest)	• Raw Materials unloading/receiving (dry and liquid bulk materials)	• Pave and grade area to contain spills • Provide secondary containment • Implement tank filling procedures to prevent spills and overfilling
		• Dairy Processing Unit Operation	• Minimize product change-over • Minimize start-up and shut-down frequency • Evaporator entrainment • Minimize splashing and container breakage in automatic packing equipment • Regularly clean up spilled product to reduce the volume of wastewaters
		• Storage	• Pave and slope the open stockpile area to minimize pooling of water • Secondary containment structure • Enclosed storage area
		• Loading for transport	• Install and maintain proper belt cleaning equipment to remove products adhered to the belt
Source Reduction (Stormwater Best Management Practices)	1b	• Fuel, lubricants, chemicals storage • (gasoline, diesel, oil and grease, solvents, chemicals)	• Secondary containment structure • Inspect and contain leaks and repair the source (increase frequency of inspection ?) • Develop spill prevention and emergency cleanup plan
		• Loading/unloading of liquid materials • (gasoline, diesel, oil and grease, solvents, chemicals)	• Pave and grade area to contain spills • Implement tank filling procedures to prevent spills and overfilling
		• Vehicle/equipment maintenance • (oil and grease, solvents)	• Pave and grade area to contain contaminated stormwater
		• General site • (oil and grease, dry bulk raw materials)	• Pave and grade site to segregate contaminated stormwater from un-contaminated stormwater

Table 5.5 Recommended Organization of Pollution Sources (Continued)

Waste Management Approach	Relative Order	Pollution Sources (Pollutants)	Example of Selected Pollution Prevention Options
On-site Reuse and Recycling	2	• Processing	• Implement process cleanup before each product change to reclaim uncontaminated products for future use • Recycle low and/or uncontaminated wastewater streams for washdown
		• Storage	• Construct holding vessels to collect washwater allowing neutralization of the wastewaters • Construct holding vessels to collect first flush washwater for product processing steps
Off-site Reuse and Recycling	3	• Wastewater/storm-water treatment	• Construct treatment system to reclaim products for off-site use
Waste Management	4	• Stormwater	• Collect contaminated stormwater for treatment
		• Wastewater/storm-water treatment	• Implement best available technology for wastewater/ stormwater treatment

Output from Step 3 - Task D:

A Listing of Pollution Prevention Options Organized within the Environmental Management Hierarchy

Task E: Review Pollution Prevention Options by Costs and Benefits

Review the pollution prevention options in accordance with the environmental management hierarchy and, with respect to the implementation costs, which include the factors such as rate of return of investment and/or payback periods. Pollution prevention options that do not require significant capital expenditures should be evaluated and implemented first.

Low cost pollution prevention options are usually best management practices. Examples of these low cost options are:

- Improve operation & maintenance procedures.
- Improve housekeeping practices.
- Implement flow/material segregation.

Output from Step 3 - Task E:

A Listing of Pollution Prevention Options Reviewed with Respect to the Implementation Costs or a Cost Parameter Normally Used by the Operating Facility

Task F: Prioritize Pollution Prevention Options

Prioritize the list of identified potential pollution prevention areas/options that require significant capital expenditures. Low cost options such as best management practices that should be implemented first should not be included in this screening process.

The Weighted Sum Method or a similar quantitative method may be used to rank the identified potential process areas and waste streams. This method first assigns a weighing factor for each of the selection criteria in relation to their importance. Each waste stream is then rated on each criterion. Finally, the rating of each waste stream for a particular criterion is multiplied by the weight of the criterion. The waste stream's overall rating is the sum of the products of rating times the weight of the criteria.

Presented in Table 5.6 is an example of the weighted sum method for prioritizing waste streams and/or processing areas for detailed pollution prevention assessment.

Table 5.6 Weighted Sum Method for Prioritizing Waste Streams and/or Processing Areas

Waste Stream Prioritizing Criteria	Relative Weight (W)	Score Option 1 (S1)	Weighted Score Option 1 (WxS1)	Score Option 2 (S2)	Weighted Score Option 2 (WxS2)	Score Option 3 (S3)	Weighted Score Option 3 (WxS3)
Environmental Regulations Compliance	9	2	18	5	45	5	45
Hazardous Properties of the Waste	5	10	50	2	10	2	10
Impacts to Environment/Public Health	5	5	25	2	10	2	10
Quantity of Waste Generated	10	10	100	10	100	5	50
Waste Treatment/Disposal Costs	10	10	100	10	100	5	50
Potential Future Liability Reduction	7	10	70	3	21	2	14
Other Waste Management Potential	5	2	10	10	50	10	50
Safety of Employees	8	8	16	3	24	2	16
Sum of Criteria Scores ($\Sigma(W \times S)$)			389		360		245

Other criteria, such as cost savings and return of investment may also be included in the above table for prioritizing options. However, these criteria are normally used in the subsequent phase of the P2-program to conduct the more detailed evaluations.

The above example uses a scale of 0 to 10 for ranking each of the criteria and waste stream in relation to their importance with 0 for low and 10 for high. For this example, Option1 ranks the highest with a score of 389. Option 2's score is 360 and Option 3's score is 245. In this case, if resources are limited, Option 1 should be selected for the detailed phase of the assessment, for the identification of pollution prevention options.

The waste stream prioritizing criteria presented in the table are appropriate for the dairy products processing facility environment. However, each operating dairy products manufacturing plant should develop a set of facility-specific selection criteria to rank it's own pollution prevention options.

Presented in Table 5.7 are some of the criteria that need to be considered when selecting potential pollution prevention areas.

Table 5.7 Typical Criteria for Selecting and Prioritizing Process Areas and Waste Streams for Detailed Assessment

Regulatory	• Compliance with current and anticipated environmental regulations • Required chemicals to be banned or phased out by governmental regulations • Potential environmental and safety liability • Hazardous properties of the waste (including toxicity, flammability, corrosivity, and reactivity)
Process Unit Operation	• Potential for removing bottlenecks and change-over frequency • Potential recovery of valuable raw materials and by-products • Maintaining product quality • Compatibility of the new equipment, or procedures with current mode of operations • Additional labor requirement • Impact on current operation during system implementation • Minimizing wastewater discharges • Reducing or alternate energy use • Potential impacts to other receiving environments
Waste Management	• Costs of waste management (pollution control, treatment, and disposal) • Quantity of waste • Potential for removing bottlenecks • Potential for implementing on-site reuse or recycling
General	• Safety hazards to employees • Impact to public health

Output from Step 3 - Task F:

A Prioritized List of Pollution Prevention Options

5.4 Conducting Feasibility Assessment

The objective of feasibility assessment is to evaluate appropriate pollution prevention options for implementation, based on the prioritized list identified in the environmental review program. These pollution prevention options should be evaluated to ensure that they are technically, environmentally, and economically feasible.

Conducting Feasibility Assessment is Step 4 in the assessment program. There are many tasks involved in this step and they are further described below.

Task A: Conduct Feasibility Assessment

To maximize the available resources, emphasis should be focused initially on the high priority waste streams and/or processing areas. Lower priority waste streams and/or processing areas should also be evaluated but implementation may be executed at a later stage.

A-1. Technical Evaluation

Technical evaluation for complex pollution prevention options, equipment or process related options, may require detailed study to determine applicability and for developing final design. The study may include ease of incorporating new equipment or processing steps into existing operations; down time for modification; and increase/decrease in maintenance. For these types of options, equipment, labor, waste disposal costs should be compiled either based on published data or vendor quotations to be used to determine economic feasibility. Pollution prevention options that were determined to be without technical merits should be eliminated or removed from further consideration.

A-2. Environmental Evaluation

Technically viable pollution prevention options should be evaluated with respect to a set of environmental criteria. These environmental criteria should be selected to ensure no adverse environmental impacts as a result of implementing the reduction measure.

Examples of environmental criteria include:

- Effect on other processing areas or waste streams
- Risk of pollutant transfer to other media
- Energy consumption.

A-3. Economic Evaluation

After consideration of the technical and environmental criteria, economic analysis should be conducted for the selected pollution prevention options. The economic analysis should seek to compare the total costs of the current practice to the total costs of the pollution prevention alternative.

For pollution control activities, regulatory compliance and oversight costs must be included in the analysis. Other regulatory (environmental, health and safety) related costs, that are often allocated to overhead rather than directly to the pollution production areas, include report writing, data collection, regulatory research, and permit fees. If these costs are not correctly accounted for, the benefits of pollution prevention can be underestimated.

To ensure complete accounting of all environmental related expenses and intangible costs and benefits, pollution prevention options should be evaluated using the Total Cost Assessment accounting method developed by USEPA. This assessment method modifies the standard accounting system to improve the competitiveness of prevention-oriented investments.

There are four elements of Total Cost Assessment:

- Expanded cost inventory;
- Extended time horizon;
- Use of long-term financial indicators; and
- Direct allocation of costs to processes and products.

Presented in Table 5.8 are costs and other factors that should be considered in using the Total Cost Assessment approach in economic evaluation of pollution prevention options.

Table 5.8 Total Cost Assessment		
Expanded Cost Inventory	**Direct Costs**	Capital Expenditures • Buildings • Equipment and installation • Utility connections • Project engineering Operation and Maintenance Expenses or Revenue • Labor • Waste disposal • Water and energy • Value of recovered commodity
	Indirect Costs	Administrative costs Regulatory compliance costs • Permitting • Record keeping and reporting • Monitoring manifesting Insurance Workman's compensation On-site waste management On-site pollution control Equipment operation Training
	Liability Costs	Penalties Fines Personal injury Property damage Natural resources damage cleanup costs
	Less-Tangible Benefits	Improved product quality Enhanced company image Reduced health maintenance costs Increased productivity due to improved employee relationships Improved relationships with regulators
Expanded Time Horizon	Because many of the liability and less-tangible benefits of pollution prevention will occur over a long period of time, therefore economic assessment for pollution prevention projects should be based on a long time frame.	
Long-Term Financial Indicators	The financial indicators should meet the following criteria: • Account for all cash flows during the project • The time value of money Acceptable indicators meeting these criteria include: Net Present Value of an investment, Internal Rate of Return, and Profitability Index.	
Direct Allocation of Costs	Single Pool Concept	Distribute the benefits and costs of pollution prevention across all products and services. A general overhead or administrative cost is included in all transactions.
	Multiple Pool Concept	Distribute the benefits and costs of pollution prevention at the department of other operating unit level.
	Service Center Concept	Distribute the benefits and costs of pollution prevention to only those activities that are directly responsible.

Output from Step 4 - Task A:

A Listing of Technically, Environmentally, and Economically, Feasible Pollution Prevention Options

Task B: Prepare and Review the Assessment Report

Prepare a report containing the results of the Feasibility Assessment Program. This report should include:

- Proposed pollution prevention options
- Option screening results
- Feasibility analysis results.

Output from Step 4 - Task B:

A Detailed Assessment Program Report

5.5 WRITING A POLLUTION PREVENTION PLAN

Preparing and writing a Pollution Prevention Plan is Step 5 in the assessment program.

Task A: Writing a Pollution Prevention Plan

The major task in this step will include part or all of the following elements:

- A written policy articulating management and corporate support for the pollution prevention plan and a commitment to implement planned activities and achieve established goals.
- The scope and objectives of the pollution prevention plan. Scope includes the facilities, or processes that the plan will cover.
- A description of the facility including:
    - Types and quantity of material(s) handled
    - Unit operations including raw material handling system
    - Storage system
    - Environmental permit requirements.
- An industry/facility profile characterizing the various operations within the dairy products processing industrial sector and the facility under consideration.
- A program or schedule to perform an environmental review or a summary of review results, including:
    - Air emission sources
    - Air pollutant characteristics
    - Air pollutant management/control practices
    - Wastewater and stormwater sources
    - Wastewater and stormwater characteristics
    - Wastewater and stormwater management/control practices
    - Fuel, lubricant, and chemical storage
    - Environment permit requirement and performance.
- A program or schedule to perform a detailed assessment or a summary of assessment results, including:
    - Facility-specific criteria for prioritizing candidate processes and waste streams for pollution prevention projects
    - Criteria for prioritizing pollution prevention options
    - Prioritized listing of feasible pollution prevention options.

- A selection of pollution prevention options to be implemented. For each selected options, the process area(s) it affects should be identified, and estimates of the amount of the reduction of the wastes specified.
- A five year implementation schedule which presents the planned pollution prevention implementation activities for each of the five calendar years following the completion of the pollution prevention plan.
- A schedule to assess the result of the implementation of the pollution prevention activities.

Presented in Appendix C is an example pollution prevention plan format for dairy products processing facilities.

Output from Step 5:

A Detailed Pollution Prevention Plan for the Facility

5.6 IMPLEMENTATION OF POLLUTION PREVENTION PLAN

Implementation of a Pollution Prevent Plan is Step 6 in the assessment program. There are many tasks listed in this step and they are further described below.

Task A: Select Projects for Implementation

The company executives, with inputs from the study team, will need to make final decisions on which projects will be implemented. The decision on the implementation schedule will also be made at this point.

Projects that do not require a significant capital expenditure, have a high likelihood of succeeding. and may have immediately noticeable results should be selected and implemented first.

Low cost pollution prevention projects are largely related to management practices. Examples of these best management practices are:

- Improve operation & maintenance procedures
- Improve housekeeping practices
- Improve inventory control
- Develop/improve spill prevention plans.

Capital expenditure projects should be selected based on the priority listing. An implementation schedule should be developed in consideration of the overall budget.

Task B: Obtain Funding

The company will need to allocate funding for capital expenditure projects. Funding for lower ranking projects may be delayed until subsequent capital budgeting periods.

Task C: Implement the Selected Projects

Implement projects according to the program schedule.

Best management practice projects may require changes in company policies and employee training programs.

For projects that involve equipment modification or new equipment, the implementation program generally include the following steps:

- Planning
- Design/engineering
- Procurement
- Construction
- Commissioning
- Operator training.

Output from Step 6:

Implemented Selected Pollution Prevention Options

5.7 MEASURING POLLUTION REDUCTION PROGRESS

The objective of pollution prevention progress assessment is to conduct quantitative evaluation of pollution reduction after implementation. The information is then used by dairy product processing staff in evaluating pollution prevention successes and failures and to guide future pollution prevention implementation efforts. The results of the evaluation may also identify new pollution prevention options.

Measuring the progress in pollution reduction is Step 7 in the assessment program.

Task A: Monitor Pollution Prevention Progress

Collect data to quantify the pollution reduction progress. Examples of waste reduction monitoring parameters are:

- Quantity of recovered raw materials, by-products, and finished products
- Quantity of commodity disposed off site
- Quantity of wastewater/stormwater treated
- Reduction on waste toxicity.

Normalize the pollution reduction data to the economic level. Define the plant's economic level as:

- Total hours the process operated
- Annual dairy products throughput.

Prepare an annual pollution reduction progress report to document and track the facility's efforts. The report should contain information on:

- Progress toward the reduction goals
- Pollution prevention options implemented
- Material handling process or other areas affected
- Changes in throughput level
- Quantity of waste reduced/recycled/treated
- Problems encountered during implementation of pollution prevention options.

Output from Step 7:

An Annual Pollution Reduction Progress Report

6 O Economic Evaluation

In May 1990, US EPA retained University of Tennessee Waste Minimization Assessment Center to identify and evaluate, through visits to industrial sites and facilities, opportunities for hazardous waste minimization in small and medium sized companies. Among the various industrial operations, a dairy product processing plant was visited and reviewed. Results of the recommended waste minimization programs including the economic evaluations are presented in Appendix E.

A Canadian waste minimization project was recently conducted in Oka, Quebec. Economic benefits as well as the approach taken by the company in the development of the pollution prevention strategies are presented in Appendix E.

These examples demonstrate that pollution prevention is a much better alternative than the traditional end-of-pipe treatment approach in the protection of the environment. By eliminating or minimizing the generation of wastes in the first place, the industry does reduce the high costs of treating and disposing those unnecessary waste products.

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Appendix A - Pollution Prevention Environmental Review Worksheets

Pollution Prevention Environmental Review Worksheets

Worksheet A-1 **Facility Information**

Prepared by:	Date:

General Facility Information

Parent Organization	Subject Facility
Name:	Name:
Address:	Address:
City:	City:
Province/Postal Code:	Province/Postal Code:
Telephone:	Telephone:
Lead Person:	Lead Person:

Facility Production Information

SIC Code(s) (post PRIMARY in No. 1)

1. 2. 3.

Dairy Products Processed/Manufactured:

•
•
•

Quantity Processed/Manufactured (previous calendar year):

•
•
•

Schedule of Operation:

Seasonal Operating Schedule:

Regulatory Information (check all that apply)

• Wastewater Permit	Permit No.
• Air Permit	Permit No.
• Solid Waste Permit	Permit No.
• Special Waste Permit	Permit No.
• Other (please list)	Permit No.

Pollution Prevention Environmental Review Worksheets		
Worksheet A-2		**Bulk Raw Materials Information**
Prepared by:	Date:	
Operations	Description	
	Commodity 1	Commodity 2
Bulk Raw Materials Name		
Milk Products Sub-Categories 1. Milk 2. Cream 3. Condensed or dried milk 4. Whey		
Non-Dairy Ingredients Sub-Categories: 1. Sugar 2. Corn Syrup 3. Fruits 4. Flavors 5. Nuts 6. Fruit Juice 7. Salt		
Annual Throughput (Past Year) of the above items: • • • • •		
Delivery Mode		
Unloading Mode		
Storage Mode		
Loading Mode		

Pollution Prevention Environmental Review Worksheets			
Worksheet A-3	**Unit Operation and Process Stream Mass Balance Data Information**		
Prepared by:	Date:		
Process Stream Data/	Stream Number ( )		
Attribute			
Stream Name			
Stream Description (via initial to final process operation)	Input:	Output:	
Operating Schedule/Duration			
Process Flow Rate (kg/hr or kg/day)	**Minimum**	**Average**	**Maximum**
Raw Materials			
Liquid Ingredient Name: • •			
Dry Ingredient Name: • •			
Other			
Products (kg/hr or kg/day)			
By-Products /Intermediates (kg/hr or kg/day)			
Waste Products (kg/hr or kg/day)			
Effluent Volume			
BOD_5			
TSS			
O&G			
Cleaning and Sanitizing Agents:			
Caustics			
Acids			
Detergents			
Others			
Other Parameters			
Temperature			
pH, Acidity/Alkalinity			
Others			
Wastewater Disposal Method			

Pollution Prevention Environmental Review Worksheets

Worksheet A-3 (Continue) — **Unit Operation and Process Stream Mass Balance Data Information**

Prepared by: Date:

Process Stream Data/ Attribute	Description Stream Number ( )
Stream Name	
Stream Description (via initial to final process operations)	

Storage of Raw Materials, By-Products/Intermediates, Products	**Raw Materials**	**By-Products/ Intermediates**	**Products**
Storage Method			
Air Emission Rate			
Air Emission Control System			
Stormwater Volume			
Stormwater Disposal Method			
Loading for Transport			
Loading System/Method			
Stormwater Volume			
Stormwater Disposal Method			
Spillage Locations			
Spillage Quantities			
Site Cleanup Method			

Pollution Prevention Environmental Review Worksheets	
Worksheet A-4	**Waste Management Information**
Prepared by:	Date:
Attribute	Description
Maintenance Shop	
Types and Quantities of Fuel	
Fuel Storage System	
Quantity of Oil	
Waste Oil Disposal Method	
Waste Coolant Disposal Method	
Types and Quantities of Chemicals	
Chemical Storage Method	
Type and Quantities of Solvents	
Solvent Disposal Methods	
Spill cleanup Method	
Wastewater/Stormwater Management Practices	
Treatment System	
Discharge Volume	
Final Discharge Point	
Stormwater BMPs	
Environmental Permit Requirements	
Air Emission Permit Limits	
Air Emission Data	
Air Emission Bylaw Fee	
Wastewater Permit Limits	
Wastewater Discharge Data	
Sewer Fee	

Pollution Prevention Environmental Review Worksheets	
Worksheet A-5	**Cost Information**
Prepared by:	Date:
Attribute	Cost
Air Emissions	
Air Emission Control Equipment	
Air Emission Control Operating and Maintenance	
Spillage	
Spillage Cleanup	
Wastewater/Stormwater	
Treatment System	
Treatment Operating and Maintenance	
Stormwater BMPs	
Stormwater BMPs Operating and Maintenance	
Indirect Costs	
Environmental Administrative	
Regulatory Compliance	
Waste Disposal	

Appendix B - Pollution Prevention Potential Assessment Worksheets

Pollution Prevention Potential Assessment Worksheets	
Worksheet B-1	**Process Unit Operation**
Prepared by: Date:	
Loading and Unloading of Raw Materials (Receiving Station)	
Milk and Dairy Products by Tank Truck	
The loading/unloading area is paved with Portland cement concrete and graded to prevent run-on of uncontaminated stormwater from adjacent areas.	• yes • no
Loading/unloading docks are designed so that spills that are not completely retained can be discharged to the city sewer, process treatment, or a dead-end sump.	• yes • no
Drip pans are placed at locations where spillage may occur such as hose connections, hose reels, and filler nozzles. Drip pans should also be used when making and breaking connections.	• yes • no
Implement tank filling procedures to prevent spills and overfills.	• yes • no
Covered loading/unloading station.	• yes • no
Tank truck exterior washing at the station.	• yes • no
Tank truck interior rinsing/washing at the station	• yes • no
Conveying/Stacking of Cans and Dry Bulk Materials	
Use proper conveyor speeds for the commodities being transferred.	• yes • no
Use pneumatic conveying system for the transfer of dry bulk materials	• yes • no
Conduct regular reclaim spilled materials using sweepers or front end loaders (e.g. Bob Cat).	• yes • no
Install drip tray underneath the conveyor to catch spills and drippings.	• yes • no
Use fork lift to handle and stack bulk materials in cans and bags	• yes • no

Pollution Prevention Potential Assessment Worksheets	
Worksheet B-1 (Continue)	**Process Unit Operation**
Prepared by: Date:	
Storage of Raw Materials	
Milk, Dairy Products and Other Liquid Ingredients	
Implement silo tank filling procedures to prevent spills and overfills.	• yes • no
Capture and reuse silo tank and processing piping and equipment rinsings.	• yes • no
Use refrigerated silo tanks for storage of all dairy products.	• yes • no
Use Glycol refrigeration systems.	• yes • no
Use Ammonia refrigeration systems.	• yes • no
Non-Dairy and Other Dry Ingredients	
Use silo for storage of dry ingredients.	• yes • no
Control silo emission levels with fabric filters (baghouses).	• yes • no
Clean filter bags periodically to maintain high removal efficiency and to reduce pressure loss.	• yes • no
Conduct regular reclaim spilled materials using sweepers or front end loaders (e.g. Bob Cat).	• yes • no
Pasteurizing, Homogenizing, and Standardizing	
Use CIP centrifuge or similar process equipment for solid separation.	• yes • no
Capture and reuse silo tank, blending vat, processing piping and equipment rinsings	• yes • no
Capture and reuse CIP sludge, and HTST start-up, shut-down and change over by-products.	• yes • no
Capture CIP sludge as solid waste	• yes • no
Churning & Continuous Process for Butter	
Use churning for butter production.	• yes • no
Use continuous process for butter production.	• yes • no
Dispose by-products (buttermilk and skim milk) into the waste collection and treatment system.	• yes • no
Capture, reuse and reprocess the by-products by the use of other unit operation, such as drying	• yes • no

Pollution Prevention Potential Assessment Worksheets	
Worksheet B-1 (Continue)	**Process Unit Operation**
Prepared by: Date:	
Cheese Manufacturing	
Cottage Cheese	
Collect, reuse and/or concentrate whey on-site.	• yes • no
Collect and ship whey off-site for processing and disposal.	• yes • no
Dispose whey and washwater to wastewater treatment system.	• yes • no
Remove and recover the fines (fine curd particles) with mechanical devices.	• yes • no
Use mechanical washing for the curd.	• yes • no
Natural and Process Cheese	
Collect, reuse and/or concentrate whey, whey draining, and curd pressing on-site.	• yes • no
Collect and ship whey and pressing off-site for processing and disposal.	• yes • no
Dispose whey, pressings and washwater to wastewater treatment system.	• yes • no
Remove and recover the fines (fine curd particles) with mechanical devices.	• yes • no
Use additional unit operations on-site to process collected whey to other products on-site, such as reverse osmosis, evaporation, and spray drying.	• yes • no
Conduct brine salting	• yes • no
Ice Cream and Frozen Deserts	
Ice Cream	
Collect and reuse change-over and start-up by-products from HTST units, i.e. product recovery system.	• yes • no
Install drip shield on ice cream filling equipment to collect products during filling machine jam.	• yes • no
Use mechanical sweeper to recover spillage of dry ingredients and fruits.	• yes • no
Collect and recover products from jam filling machine and broken packages.	• yes • no
Novelties	
Conduct extrusion onto conveyor system.	• yes • no
Conduct dipping in coating.	• yes • no
Collect and recover products from jam filling machine and broken packages.	• yes • no

Pollution Prevention Potential Assessment Worksheets	
Worksheet B-1 (Continue)	**Process Unit Operation**
Prepared by: Date:	
Condensed and Evaporated Milk	
Conduct HTST or UHT pasteurization.	• yes • no
Conduct vacuum evaporation.	• yes • no
Recover entrainment loss from evaporators and boil over.	• yes • no
Conduct spray drying.	• yes • no
Packaging and Cold Storage	
Conduct case washing on-site.	• yes • no
Use automatic shut-off valves on water lines to the case washers.	• yes • no
Recover the damaged and returned products as animal feeds.	• yes • no
Conduct mechanical sweeping of spillage	• yes • no
General Processing Areas	
Use air blow down system for cleaning of process piping.	• yes • no
Install auto shut-off valves on all water hoses.	• yes • no
Cover all drains with wire screen to solids from going down the floor drain system.	• yes • no
Provide adequate temperature controls on coolers to prevent freezing-on.	• yes • no
Provide drip shields on surface coolers and fillers.	• yes • no
Provide product-recovery system to collect products at time of change over.	• yes • no

Pollution Prevention Potential Assessment Worksheets	
Worksheet B-2	**Stormwater Best Management Practices**
Prepared by:	Date:
Fuel/Lubricant/Chemical Storage	
Above-Ground Storage Tank	
Surrounded by secondary containment structure. Containment volume is the larger of either 10 percent of the volume of all tanks or 110 percent of the volume of the largest tank. The floor within the containment is covered with an impervious surface to prevent ground water contamination in the event of spills. Double-wall tanks maybe used in place secondary containment	• yes • no
Overfill protection on storage tanks.	• yes • no
Oil/water separator for treating petroleum contaminated stormwater runoff.	• yes • no
Regular cleaning of oil/water separator	• yes • no
During the wet season, accumulated stormwater is released frequently.	• yes • no
Secure the designed storage area to prevent unauthorized person accessing storage tanks and causing spills.	• yes • no
Segregate and store incompatible or reactive materials in separate containment areas to prevent the mixing of chemicals should spills occur.	• yes • no
Regular inspect all containers for deterioration and leakage. Inspect the lids of drums to ensure they are in place and properly secured. Immediately contain leaks and repair the source.	• yes • no
Use drip pans for opened tanks/drums to contain minor spills and drips during transfer.	
Develop spill prevention and emergency cleanup plan.	• yes • no
	• yes • no
Loading and Unloading of other Liquid Materials	
The loading/unloading area is paved with Portland cement concrete and graded to prevent run-on of uncontaminated stormwater from adjacent areas.	• yes • no
Loading/unloading docks are designed so that spills that are not completely retained can be discharged to the city sewer, process treatment, or a dead-end sump.	• yes • no
Drip pans are placed at locations where spillage may occur such as hose connections, hose reels, and filler nozzles. Drip pans should also be used when making and breaking connections.	• yes • no
Implement tank filling procedures to prevent spills and overfills.	• yes • no

Pollution Prevention Potential Assessment Worksheets	
Worksheet B-2 (Continue)	**Stormwater Best Management Practices**
Prepared by: Date:	
Vehicle/Equipment Maintenance/Washing	
Vehicle/Equipment Maintenance	
The area should be paved with Portland cement concrete and graded to prevent stormwater runoff and the run-on of uncontaminated stormwater from adjacent areas.	• yes • no
Oil/water separator for treating petroleum contaminated stormwater runoff.	• yes • no
Regular cleaning of oil/water separator.	• yes • no
Waste solvents are properly disposed by registered waste hauler.	• yes • no
Vehicle/Equipment Washing	
The vehicle and equipment washing areas are enclosed to prevent the entry of precipitation and contain the wash water.	• yes • no
Outdoor vehicle and equipment washing areas are paved with Portland cement concrete and graded to prevent stormwater run-on from adjacent areas and to contain the wash water. Wash water is discharged to the city sewer or to oil/water separators or detention ponds.	• yes • no
General Housekeeping	
Regularly use front end loaders and vacuum sweepers to reclaim spilled dry raw materials. Washdown is minimized.	• yes • no
Conduct daily inspection of the processing areas for leaks and immediately repair the source.	• yes • no
Regularly inspect and clean catch basins and drainage inlets to ensure proper operation. Catch basins should be cleaned if the depth of deposits are equal to or greater than 1/3 of the depth from the basin to the invert or the lowest pipe into or out of the basin.	• yes • no
Stormwater Flow Segregation	
The plant site is graded or curbed to prevent the runoff of contaminated stormwater and the run-on of uncontaminated stormwater from adjacent areas. Uncontaminated stormwater and stormwater runoff from rooftops may be discharged to the storm drain below the treatment system or directly to the receiving water.	• yes • no
Contaminated stormwater is collected and sent to runoff treatment.	• yes • no
The processing areas are graded to minimize dispersion and to improve sweeping and washdown.	• yes • no
Areas requiring washdown are paved and curbed to contain the washwater from reaching storm drains. The washwater is conveyed to runoff treatment.	• yes • no

Pollution Prevention Potential Assessment Worksheets			
Worksheet B-3	**Wastewater/Stormwater Collection/Treatment**		
Prepared by:	Date:		
Recovery of Spilled Material			
Provide separation and recovery of spilled material close to the source of spillage.	• yes	• no	
Construct tanks and vessels to collect and blending of washdown water resulting from the cleaning of the processing equipment and processing areas.	• yes	• no	
If acceptable, return materials recovered for other processing activities.	• yes	• no	
Wastewater Treatment			
Segregate washwater from areas that handled different products to provide optimal waste treatment.	• yes	• no	
Convey contaminated stormwater to on-site wastewater treatment facilities or to the city sanitary sewer system.	• yes	• no	
Install catch basins at various locations along the drainage ways to allow the bulk of the solids to settle to minimize the loading to the wastewater treatment plant and the city sanitary sewer system.	• yes	• no	
Implement best available technology for the treatment of wastewater.	• yes	• no	

Appendix C - Pollution Prevention Plan Worksheet

Pollution Prevention Plan

(1) Facility Pollution Prevention Policy:

Facility Name: _____

Facility Location: _____

Management Policy:
Write a management policy expressing support for planning and a commitment to implement planned activities and achieve established goals.

Scope and Objectives:
Identify the facilities and/or processes to be covered by the plan. State the objectives to be achieved through planning and implementation.

Management Signature:
The owner, chief executive officer, or other person with the authority to commit management to the plan must sign the plan.

Prepared by: _____ **Date:** _____

Pollution Prevention Plan

(2) Facility Information:

General Facility Information	
Parent Organization Name: Address: City: Province/Postal Code: Telephone: Lead Person:	Subject Facility Name: Address: City: Province/Postal Code: Telephone: Lead Person:
Facility Production Information	
SIC Code(s) (post PRIMARY in No. 1) 1. 2. 3. Manufacturing Processes: Product or Service: Production or Service Level(s) (previous calendar year): Schedule of Operation: Seasonal Operating Schedule:	
Regulatory Information	
• Liquid (Effluent) Waste Permit	Permit No.
• Air Permit	Permit No.
• Solid Waste Permit	Permit No.
• Special Waste Permit	Permit No.
• Other (please list)	Permit No.

Pollution Prevention Plan

(3) Facility Profile:

Write a facility profile describing the dairy product processing operations. The facility profile should contain information on:

- Types and quantity of dairy products processed/manufactured
- Raw materials, intermediates, and products handling systems
- Storage systems
- Air emission sources
- Characteristics of air pollutants
- Air management practices
- Wastewater and stormwater sources
- Characteristics of wastewater and stormwater
- Wastewater and stormwater management practices
- Fuel, lubricant, and chemical storage
- Environmental permit requirements and performance.

Drawings and flow diagrams that describe the facility, material handling process, air emission control systems, and wastewater/stormwater treatment process should also be included in the facility profile.

Pollution Prevention Plan

(4) Summary of the Environmental Review:

1. List each source of air emission and product spillage.

Location	Product Type	Estimated Quantity	Disposed or Recycled
Unloading/Receiving			
Process Unit Operations			
Storage			
Loading for Transport			

2. List each source of wastewater and contaminated stormwater.

Location	Estimated Volume	Pollutant Concentration	Discharge Point
Unloading/Receiving			
Process Unit Operations			
Storage			
Loading for Transport			

3. List each Waste Material which contain hazardous substances or active agents of concern.

Waste Material	Amount Produced	Hazardous Substances or Active Agents	Amount of Hazardous Substances or Active Agents	Generating Area

Current and Past Pollution Prevention Activities:

Describe any reduction, recycling, stormwater BMPs, and treatment activities currently underway at the facility.

Describe any hazardous substance use or hazardous waste reduction activities already completed. If possible, estimate the reductions achieved and the implementation cost and any cost saving achieved.

Pollution Prevention Plan

(5) Prioritized Potential Pollution Prevention Areas/Options:

Locations/Areas	Ranking	Potential Pollution Prevention Options	Media air/water/solids
Unit Operations			
Unloading/Receiving	1		
	2		
	3		
Process Unit Operations	1		
	2		
	3		
Storage	1		
	2		
	3		
Loading for Transport	1		
	2		
	3		
Wastewater/Stormwater Collection/Treatment			
Recovery of Spilled Material	1		
	2		
	3		
Wastewater Treatment	1		
	2		
	3		
Stormwater Best Management Practices			
Fuel/Lubricant/Chemical	1		
	2		
	3		
Vehicle/Equipment Maintenance/Washing	1		
	2		
	3		
General Housekeeping	1		
	2		
	3		
Stormwater Flow Segregation	1		
	2		
	3		
Other Areas			
	1		
	2		
	3		
	4		
	5		

Pollution Prevention Plan

Weighted Sum Method to Prioritize Potential Pollution Prevention Areas/Options

Waste Stream Prioritizing Criteria	Relative Weight (W)	Score Option 1 (S1)	Weighted Score Option 1 (WxS1)	Score Option 2 (S2)	Weighted Score Option 2 (WxS2)	Score Option 3 (S3)	Weighted Score Option 3 (WxS3)
Sum of Criteria Scores $\Sigma(W \times S)$)							

Pollution Prevention Plan

(6) Proposed Pollution Prevention Options:

List the proposed prioritized feasible pollution prevention options. For each option, the process(s) it affects should be identified, and estimates of the amount of the reduction in pollutants generated or discharged.

Option Category	Locations/ Areas	Pollution Prevention Options	Media (air, water, solids)	Pollutant Reduction
Source Reduction				
On-site Reuse				
Off-site Reuse				
Material and/or Energy Recovery				
Residual Waste Management				

Pollution Prevention Plan

(7) Five-Year Pollution Prevention Implementation Plan:

1. Develop a schedule for implementing the pollution prevention options selected. Indicate when, in the next five years, the options or phases of options will be implemented. Provide an expected completion date if implementation will take longer than five year.

Pollution Prevention Options	Estimated Implementation Date (month/year)					
	Year 1	Year 2	Year 3	Year 4	Year 5	Later

2. Provide estimates of the total costs and benefits to be realized from implementing the selected pollution prevention options over the five year life of the plan.

Pollution Prevention Options	Estimated Total Costs and Benefits (costs/savings)					
	Year 1	Year 2	Year 3	Year 4	Year 5	Later

Appendix D - Dairy Products Processing Facility Summaries

1^O Plant Profile Report - Plant No.1

1.1 General Description

Plant No. 1 is a dairy products processing plant (SIC 1041). This plant produces UHT milk products and fruit juices. Permit Conditions and process description information were collected from Greater Vancouver Regional District (GVRD) files. Excerpts from these files are included in the following.

1.2 Facility Background (1995)

Type of Operation	juice and milk packaging plant
Production	150,000 litres
Operating Period	24 hours/day, 5 days/week
Number of Employees	30
Site Size	5.2 acres

1.3 Process Description

Juice concentrate bought on the open market is transported and stored in plastic drums. The concentrate is added to the process tanks and mixed with conditioned water to the desired concentration. The mixture is sterilized using Ultra High Temperature (U.H.T.) technology. The sterilizing process uses ultra high temperatures, therefore allowing very short contact times. This allows optimum sterilization with very little temperature effects on the final product.

After sterilization, the product is piped to a holding tank prior to packaging. The juice filling machines can be packaged in either 250 mL or I L sized Tetra-Paks. All tanks and piping are interconnected.

In addition, the plant can similarly process and package milk. A separate system is used specifically for milk. They receive the type of milk they want to package from their main processing plant in the Lower Mainland. However, milk only accounts for 8% of their total production.

1.4 Potential Waste Water Pollution Sources

Most of the waste water generated within the plant is from the wash-down and disinfection of plant processing and packaging equipment. This equipment includes all tanks, process lines, fillers, and pasteurizers which come in contact with a food product.

1.4.1 "Clean in Place" (CIP) System

Most of this equipment is "cleaned- in-place", that is, there is a central facility for preparing, cleaning and sanitizing solutions which are then pumped through all lines and vessels. Normal practice is as follows:

- warm water rinse
- caustic cleaning solution
- warm water rinse
- phosphoric acid sanitizing solution
- warm water rinse

The caustic solution is recirculated for re-use and is not discharged to sanitary sewer. The rinses and the phosphoric acid solution are discharged to sewer. This practice of discharging the sanitizing solution in addition to producing an acidic product presumably accounts for the low pH of the discharge.

1.4.2 Equipment Washdown

To conform with health regulations, all equipment must be cleaned and sanitized daily. Sanitizing is also carried out just prior to start-up if it is deemed necessary.

Some smaller equipment is cleaned by hand with the wash and rinse water being directed to floor drains. Any product spills, which are rare, also go to floor drains.

1.4.3 Boiler Blow Down and Cooling Water

Other sources of waste water in the plant are boiler blow downs and some water used as cooling water on the milk pasteurization equipment. Water is used initially to cool the milk in the first part of the unit and a closed system known as an Ice Builder provides additional cooling for the other processing steps. However, the milk line is used only 3 days per month.

1.4.4 Storm Water

There is no storm water discharged to the sanitary sewer.

1.4.5 Truck Washing

No comment available.

1.4.6 Loading and Unloading of Raw Materials and Finished Products

No comment available.

1.4.7 Spill Containment and Response

The chemical storage room has no direct connection to sanitary sewer. The chemicals stored in this room are mainly small quantities of food grade cleaning chemicals used in the CIP process as well as that used to clean the floors. The plant has a spill response plan which includes the use of absorbent materials as well as the notification to the Greater Vancouver Regional District. In addition, the milk silo has a containment system to minimize the risk of discharging milk to the storm sewer system.

1.4.8 Solid Waste Issues

There are no solid waste issues applicable to this operation as there are no treatment works in place.

1.5 Permit Conditions

1.5.1 Requirements for the monitoring of the discharge to sewer.

Plant No. 1 is required to sample the discharge during one normal operating day (24 hours, 5 days/week) once per month and analyze for the following parameters:

- pH
- Biochemical Oxygen Demand
- Chemical Oxygen Demand
- Total Suspended Solids
- Oil & Grease (total)

This monitoring program is consistent with other juice and milk processors under Permit. The Permit previously required that one sample per quarter be collected on a day when milk was being processed. This has been relaxed based on the effluent results submitted to date to GVRD. It should be noted that milk only makes up 8% of the total production.

1.5.2 Requirements for the quantity and quality of the discharge to sewer.

The Permit sets out requirements for the quantity and quality of the discharge to Sewer.

1. AUTHORIZED RATE OF DISCHARGE

Plant No. 1 shall not exceed the following:

- Maximum discharge flow rate: 1100m^3/day

2. AUTHORIZED DISCHARGE CRITERIA

(a) Plant No. 1 shall not discharge Prohibited Waste, Cooling Waste, Storm Waste, Special Waste, or other Waste as defined in the GVRD Bylaw.

(b) Plant No. 1 shall not discharge Restricted Waste as defined in the GVRD Bylaw, with the following exceptions:

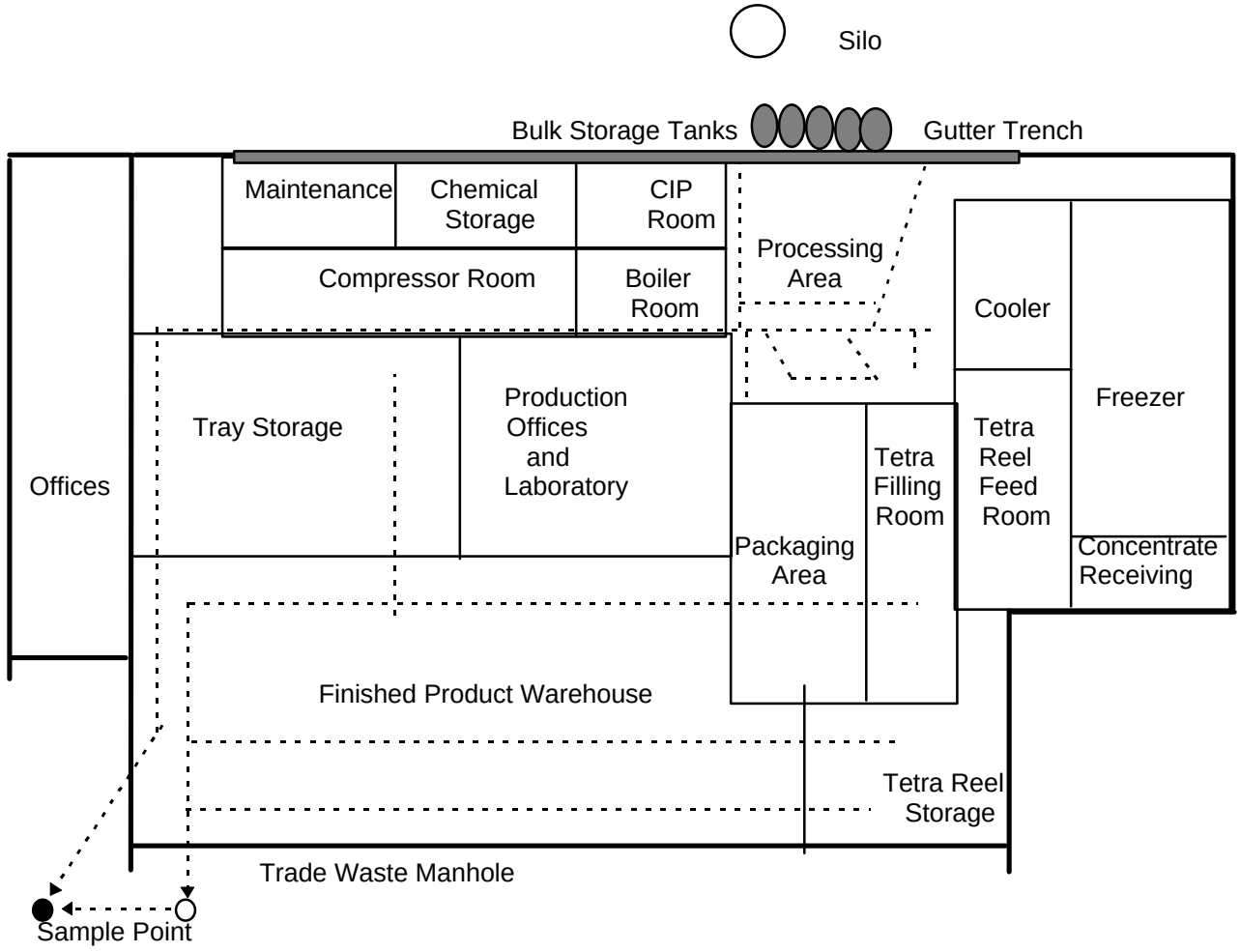
Parameter	Sample Type	Maximum Concentration	Effective Date
Oil and Grease (total)	Grab	150 mg/L	March 31, 1995
pH	Grab	5.5 to 10.5	December 31, 1995

Last Amended March 31, 1995

1.6 Comments

This plant is primarily a juice packaging plant with only 8 per cent of its production in milk packaging. It was issued a permit in 1992 but had never taken the steps to meet pH compliance. This was mainly due to the uncertain future of the plant. This issue was resolved in late 1994 and the plant installed a proper pH monitoring and data logging system which was commissioned in early 1995.

Monitoring of pH through 1995 showed the plant was still not in compliance because of low pH. A compliance program was agreed to by both parties. In February 1996 the plant proposed to install a pH neutralization system. This was scheduled for implementation in June 1996.



Attachment 1-1

Schematic of Approved Sampling Point

2O Plant Profile Report - Plant No. 2

2.1 General Description

Plant No. 2 is a dairy products processing plant (SIC 1041 & 1049). This plant produces fluid milk and cultured products. Permit Conditions and process description information were collected from Greater Vancouver Regional District (GVRD) files. Excerpts from these files are included in the following.

2.2 Facility Background (1991)

Type of Operation: Dairy products processing plant
Hours of Operation: 24 hours/day, 6.5 days/week, 52 weeks/year
Number of Employees: 120 production employees

Raw Materials	**Quantity used**
Raw Milk	2,200,000 L/week
Sucrose	60,000 lbs/week
Glucose	15,000 lbs/week
Milk Powder	500,000 L/week
Juice Concentrates	

Products	**Production Level**
Milk & cultured milk products	2,200,000 L/week
Juices	60,000 L/week

2.3 Process Description

This plant processes and packages a wide variety of milk products and juices. They receive raw milk via tanker truck from Fraser Valley milk producers and transfer it to a storage silo. The raw milk is pasteurized using a High Temperature Short Time (HTST) pasteurizer. The pasteurized milk is then centrifuged to remove the cream and the milk is transferred to batch tanks. From the batch tanks, the milk can be used for the formulation of 1%, 2% & whole milk, as well as the production of cultured products

such as yogurt, sour cream, cream cheese andbutterrmilk. The resulting products are then packaged and transferred to the refrigerated storage facility prior to distribution.

Juices are produced by adding water & sugar to juice concentrate shipped in from around the world. The mixture is then pasteurized and packaged before distribution.

2.4 Potential Waste Water Pollution Sources

Most of the waste water generated within the plant is from the cleaning and sanitizing of processing and packaging equipment. This equipment includes all tanks, lines, silos, trucks, fillers and packaging equipment which comes into contact with a food product.

2.4.1 "Clean in Place" (CIP) System

Most of this equipment is "cleaned in place" where cleaning and sanitizing solutions are prepared in a central facility and pumped through all lines and vessels. The cleaning and sanitizing process normally consists of:

- Pre-rinse
- 2.0 % sodium hydroxide cleaning solution at 180§F.
- Rinse
- 50 ppm sodium hypochlorite sanitizing solution or Phosphoric acids/Nitric acid based sanitizing solution
- Rinse

The production equipment connected to the CIP system is linked to a pH neutralization tank. Hence most of the alkaline compounds used in CIP are neutralized prior to releasing to the sanitary sewer. The Vat Pasteurizers are not connected to the neutralization tank.

2.4.2 Equipment Washdown

To conform with health regulations, all equipment must be cleaned and sanitized daily if the equipment is in use. Caustic wash water is dumped to sewer at the end of the day. Sanitizing is also carried out just prior to startup if the equipment has been sitting for any length of time.

Most product tanks are sanitized with the acid solution to remove caustic bloom and milk stones that can form within the piping. For more sensitive equipment, sodium hypochlorite is used as a substitute sanitizing agent.

Wash and rinse water from the external cleaning of equipment is directed to floor drains, as are any spills of raw materials or products that may occur.

2.4.3 Other In-Plant Sources

No comment available.

2.4.4 Storm Water

No comment available.

2.4.5 Truck Washing

No comment available.

2.4.6 Loading and Unloading of Raw Materials and Finished Products

No comment available.

2.4.7 Spill Containment and Response

No comment available.

2.4.8 Solid Waste Issues

Spoiled or off-spec products are either reprocessed, if possible, or shipped out as animal feed. There are no solid waste issues applicable to this operation as there are no treatment works in place.

2.5 Permit Conditions

2.5.1 Requirements for the monitoring of the discharge to sewer.

The permit sets out requirements for the monitoring of the discharge of non-domestic waste from a dairy products processing plant.

A. DISCHARGE SAMPLING AND ANALYSES

Plant No. 2 shall carry out the following sampling and analysis program.

1. CONTINUOUS DISCHARGES

(a) Plant No. 2 shall measure, using an approved flow monitoring device, the daily discharge during each month of Operation. The following information shall be recorded:
- Total flow for the month (m^3)
- Number of operating days during the month
- Average daily flow for the month (m^3/day)
- Maximum daily flow for the month (m^3/day)

(b) Plant No. 2 shall continuously monitor and record the pH of the discharge. Charts shall be kept available for inspector for a minimum period of one year. A summary of pH monitoring data shall be submitted showing all periods when the pH of the discharge was less than 5.5 or greater than 10.5.

(c) One COMPOSITE SAMPLE shall be collected from Sample Point #l during one normal operating day once per month. The COMPOSITE SAMPLE shall consist of equal portions of discrete samples collected on a minimum frequency of once each hour over the period of discharge to SEWER. This sample shall be analyzed for the following parameters:
- pH
- Biochemical Oxygen Demand (BOD_5)
- Chemical Oxygen Demand
- Total Suspended Solids

The sample start and stop times shall be recorded.

(d) The Discharge flow for the periods that the COMPOSITE SAMPLES specified in Section A.1 (c) are collected shall be recorded.

(e) During the period that the COMPOSITE SAMPLE described in Section A.1 (c) is taken, one GRAB SAMPLE shall be collected from Sample Point #1. This GRAB SAMPLE shall be analyzed for the following parameters:
- Oil and Grease (Total)

The sample date and time shall be recorded.

2. BATCH DISCHARGES

(a) Plant No. 2 shall maintain a log of each batch discharge to SEWER from the CIP chemical tanks. For each month of operation, the following information shall be reported for each batch discharge:
- Type of batch discharge
- Volume (m^3)
- Date on which discharging occurred
- pH of discharge

The start and stop times for each batch discharge shall be recorded.

2.5.2 Requirements for the quantity and quality of the discharge to sewer.

The Permit sets out requirements for the quantity and quality of the discharge of non-domestic waste from an ice cream manufacturing plant. Where a compliance program has been specified, existing works or procedures must be maintained in good operating condition and operated in a manner to minimize the discharge of contaminants during the interim period until the new works have been installed.

AUTHORIZED DISCHARGE CHARACTERISTICS

1. AUTHORIZED RATE OF DISCHARGE

Plant No. 2 shall not exceed the following: 2600 m^3/day - maximum

2. AUTHORIZED DISCHARGE CRITERIA

a) Plant No. 2 shall not discharge PROHIBITED WASTE as defined in Schedule A of the GVRD BYLAW.

b) Plant No. 2 shall not discharge RESTRICTED WASTE as defined in Schedule B of the GVRD BYLAW with the following exceptions:

Parameter	Maximum Concentration	Compliance By
pH	between 5.5 and 10.5	
Oil and Grease (total)	150 mg/L	January 1, 1994
Biochemical Oxygen Demand	1000 mg/L	January 1, 1994
Biochemical Oxygen Demand	500 mg/L	January 1, 1996

c) Plant No. 2 shall not discharge SPECIAL WASTE as defined in the GVRD BYLAW.

d) Plant No. 2 shall not discharge STORM WASTE or COOLING WASTE as defined in the GVRD BYLAW.

Last Amended April 15, 1993

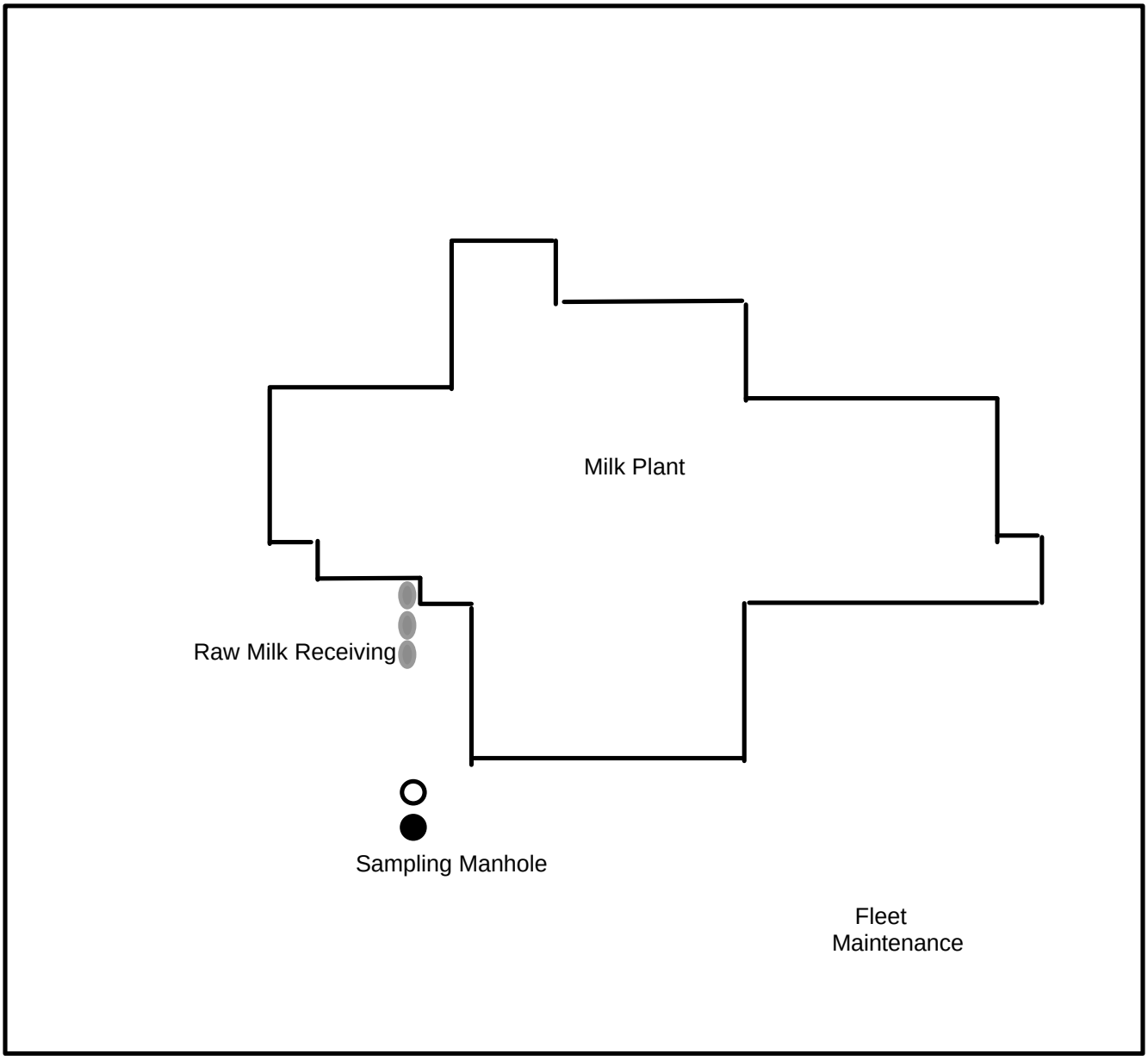
2.6 Comments

This plant has made several changes to its operation since 1991 in order to comply with the limits set by its Discharge Permit. They have only been partially successful. The remaining non-compliance parameters are pH and, Oil and Grease. The plant has embarked on a Compliance Plan, approved by GVRD, to address these two items. The plan consists of a two parts; near term and long term.

The near term plan combines the implementation of BMP's to minimize the wastes going to sewer without any process equipment changes and two projects requiring equipment modifications:

I. implementing a system to recycle and reuse compressor cooling water as part of boiler feedwater, and
II. implementing a system for the retention and neutralization of cleaning effluent from the pasteurizers.

The long term plan is to develop a long range strategy for effluent management. A technical evaluation has been commissioned as the first step.



Attachment 2-1

Schematic of Approved Sampling Point

3O Plant Profile Report - Plant No. 3

3.1 General Description

Plant No. 3 is an ice cream manufacturing plant (SIC 1049). This plant produces ice cream and frozen products. Permit Conditions and process description information were collected from Greater Vancouver Regional District (GVRD) files. Excerpts from these files are included in the following.

3.2 Facility Background (1993)

Type of Operation: Ice cream manufacturing plant
Hours of Operation: 24 hours/day, 7 days/week (in summer)
24 hours/day, 5 days/week (in winter)
Number of Employees: 55 (winter), 105 (summer)

Raw Materials	**Quantity used (kg/week)**
Raw Milk	4,000,000
Sucrose	1,300,000
Glucose	400,000
Milk Powder	500,000
Whey solids	500,000
Flavours, fruit, cocoa, etc.	440,000

Products	**Production Level (L/week)**
Ice cream & frozen water treats	22,000,000

3.3 Process Description

The plant produces ice cream in a variety of flavours and forms including ice cream in pails and cartons as well as numerous novelty items such as ice cream and yogurt bars, fudgesicles and popsicles.

The basic process is as follows:

- raw milk is trucked to the plant and transferred to bulk storage tanks.
- the milk is transferred to batch tanks where liquid sugar (sucrose and glucose) as well as milk and whey powder are blended into the milk.
- the mixture is pasteurized.
- cooled and stored in storage tanks for up to 24 hours before use.
- the mixture is chilled to thicken.
- flavours, fruits, nuts, chocolate etc. are added to produce the final formulation.
- the mixture is then transferred to ice cream machines where the product passes through freezer pipes (pipes enveloped by a closed ammonia freezing system) before being dispensed to the desired container.
- placed in freezer to harden before distribution .

For stick novelty treats:

- ice cream is dispensed into metal molds
- molds are passed through a brine bath to harden the ice cream
- sticks are added
- packaged
- frozen
- distributed to their customers

3.4 Potential Waste Water Pollution Sources

The sources of waste water are discussed in the following:

3.4.1 Clean in Place (CIP) System

Most of the waste water generated within the plant is from the cleaning and sanitizing of processing and packaging equipment. This equipment includes all tanks, lines, silos, trucks, fillers and packaging equipment which comes into contact with a food product. Most of this equipment is "cleaned in place" where cleaning and sanitizing solutions are prepared in a central facility and pumped through all lines and vessels.

The cleaning and sanitizing process normally consists of:

- Pre-rinse
- 0.5 - 0.75 % sodium hydroxide cleaning solution at 155°F.
- 50 ppm sodium hypochlorite sanitizing solution.
- Rinse

Rinse water is recovered for use as pre-rinse to help neutralize the caustic cleaning solution.

To conform with health regulations, all equipment must be cleaned and sanitized daily if the equipment is in use. Caustic wash water is dumped to sewer at the end of the day. Sanitizing is also carried out just prior to startup if the equipment has been sitting for any length of time.

Ten per cent of the time, product tanks are sanitized with the acid solution to remove caustic bloom and milk stones that can form within the piping. For more sensitive equipment, sodium hypochlorite is used as a substitute sanitizing agent.

3.4.2 Equipment washdown

Wash and rinse water from the external cleaning of equipment is directed to floor drains, as are any spills of raw materials or products that may occur. An alkaline detergent is used to clean the equipment. Spoiled or off-spec products are either reprocessed, if possible, or shipped out as animal feed.

3.4.3 Compressors

Non-contact cooling water is used for the compressors associated with the large refrigeration units required for this operation. This uncontaminated cooling water is discharged to storm sewer.

3.4.4 Novelty products

Some of the novelty products such as yogurt squares are glazed. This process has water sprayed over the surface of the product before being frozen. The water from this process is discharged to sanitary sewer. In addition, the brine used to cool the novelty stick is also discharged to sanitary sewer. The frequency of this discharge is approximately once every month and a half.

3.4.5 Storm Water

No comment available.

3.4.6 Truck Washing

No comment available.

3.4.7 Loading and Unloading of Raw Materials and Finished Products

Raw milk is trucked to the plant and transferred to bulk storage tanks. Minimal spillage results during this operation.

3.4.8 Spill Containment and Response

No comment available.

3.4.9 Solid Waste Issues

No comment available.

3.5 Permit Conditions

The description of this Waste Discharge Permit is listed below:

3.5.1 Requirements for the monitoring of the discharge to sewer.

The requirements are as follows:

1. Plant No 3.shall measure or estimate, the daily discharge during each month of operation and include the following information.
   - Total flow for the month (m^3)
   - Number of operating days during the month
   - Average daily flow for the month (m^3/day)
   - Maximum daily flow for the month (m^3/day)

2. Plant No. 3 is also required to continuously monitor the pH of the discharge and report the periods when the pH was <5.5 and >10.5.

3. One composite sample shall be collected from the sampling manhole during one normal operating day once per calendar month. The sample shall be analyzed for the following parameters:
   - pH
   - Total Suspended Solids
   - Biochemical Oxygen Demand
   - Chemical Oxygen Demand

   The discharge flow for the period that the composite sample was collected shall be recorded.

4. On the same day that the composite sample is taken, a grab sample shall be collected and analyzed for the following parameter:
   - Oil and Grease (total)

5. Plant No. 3 shall submit a report detailing the sampling results and flow measurements for the preceding quarter.

The location of the approved sample point is detailed on the "schematic of approved sample points. See Attachment 3-1.

3.5.2 Requirements for the quantity and quality of the discharge to sewer.

The Permit sets out requirements for the quantity and quality of the discharge of NON-DOMESTIC WASTE from an ice cream manufacturing plant. Where a compliance program has been specified, existing works or procedures must be maintained in good operating condition and operated in a manner to minimize the discharge of contaminants during the interim period until the new works have been installed.

AUTHORIZED DISCHARGE CHARACTERISTICS

1. AUTHORIZED RATE OF DISCHARGE

Plant No. 3 shall not exceed the following: 1000 m^3/day - maximum

2. AUTHORIZED DISCHARGE CRITERIA

a) Plant No. 3 shall not discharge PROHIBITED WASTE as defined in Schedule A of the GVRD BYLAW.

b) Plant No. 3 shall not discharge RESTRICTED WASTE as defined in Schedule B of the GVRD BYLAW with the following exceptions:

Parameter	Authorized Range or Maximum Concentration	Compliance By
Oil and Grease (total)	150 mg/L by Grab Sample	January 1, 1994
pH	between 5.5 to 10.5	
Biochemical Oxygen Demand	1000 mg/L 500 mg/L	January 1, 1994 January 1, 1996

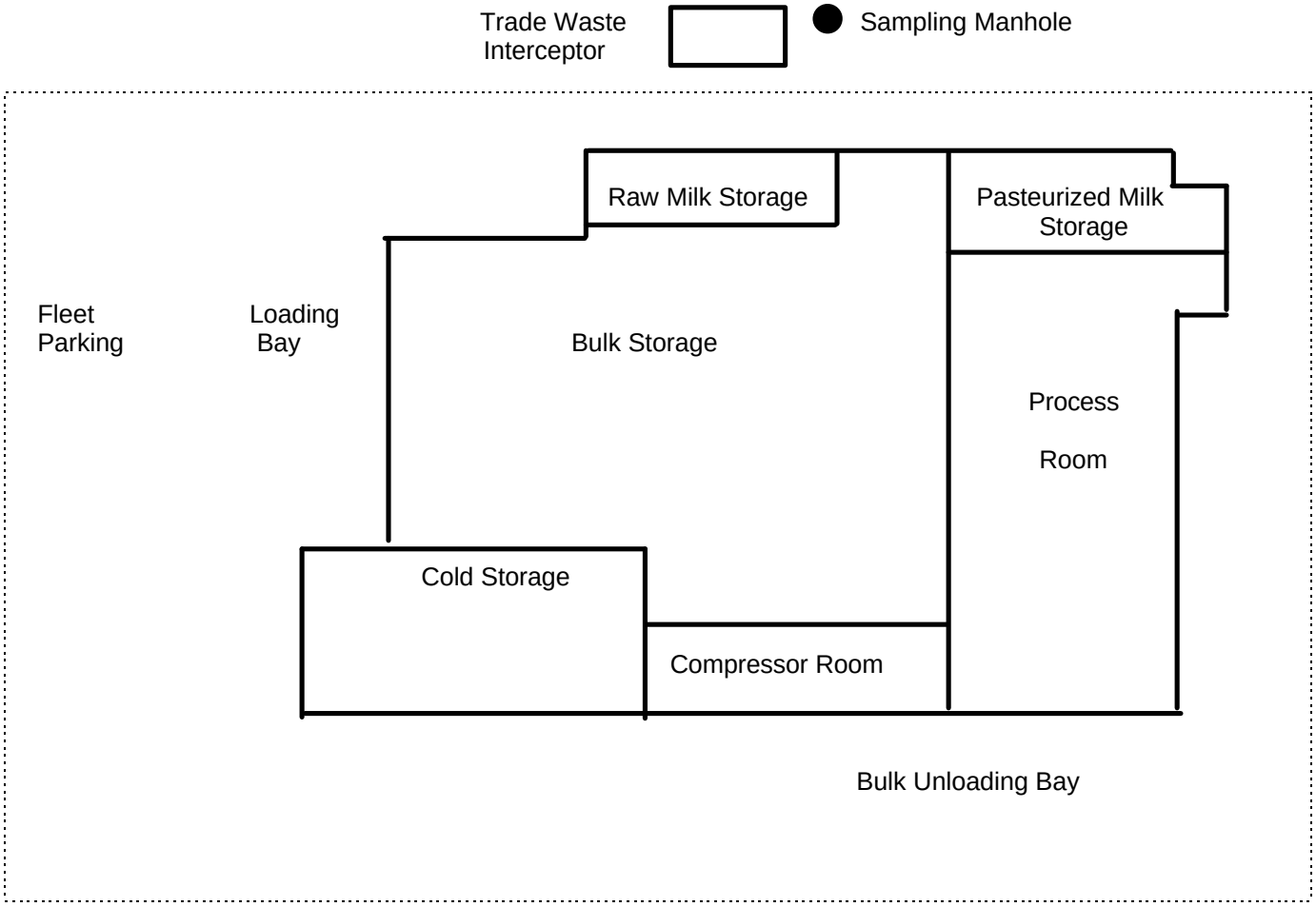
c) Plant No. 3 shall not discharge SPECIAL WASTE as defined in the GVRD BYLAW.

d) Plant No. 3 shall not discharge STORM WASTE or COOLING WASTE as defined in the GVRD BYLAW.

Last Amended April 8, 1993

3.6 Comments

This plant was out of compliance for Oil and Grease, and TSS in 1994. The current status is unknown.



Attachment 3-1

Schematic of Approved Sampling Point

4^O Plant Profile Report - Plant No. 10

4.1 General Description

Plant no. 10 is a dairy products processing plant (SIC 1049). This plant produces cheese. Permit Conditions and process description information was collected from Greater Vancouver Regional District (GVRD) files. Excerpts from these files are included in the following.

4.2 Facility Background (1995)

Type of Operation	Specialty cheese manufacturer
Production	20,000 Ibs cheese/week
Operating Period	6 hours/day, 4 days/week. 50 weeks/year
Number of Employees	6
Maximum Discharge Flow Rate	120 m^3/day
Instantaneous Peak Flow Rate	4.0 L/min
Site Size	1.11 acres

4.3 Process Description

For a schematic diagram of the plant processes, see Attachment 4-1.

The plant uses separated milk which is pasteurized prior to filling the cheese vats. Bacteria and Rennet are added and the solids are separated from the whey. The solids are then sent through a cheese cooker which forms the cheese in the size and shape required. The cooked cheese is dipped in the brine tank and packaged for shipment in vacuum sealed bags.

4.4 Potential Waste Water Pollution Sources

4.4.1 Water Use

Most of the water is used in the cleaning of equipment in between batches with the remainder of the water used for cooling. Cleaning is primarily achieved using caustic and acid cleaners. The steps in the cleaning process are as follows:

- rinse
- caustic wash
- rinse
- acid wash
- final rinse

Primarily, the equipment and piping is "cleaned-in-place" with the exception of the cheese vat which is cleaned manually.

Cooling water used to cool the cheese cooker is discharged to sewer. The cheese cooker contacts the product and therefore is considered contaminated. A closed loop chiller water system is used to cool the storage tanks.

4.4.2 Waste Water Sources

See Attachment 4-1 for a list of each waste water source. As discussed above, waste water is produced from the cleaning of the processing equipment. The equipment to be cleaned are as follows:

- raw milk storage silo
- High-Temperature-Short-Time (HTST) pasteurizer
- cheese vats
- cheese drain tables
- whey storage tank
- separator
- cream storage tank
- cheese cooker

In addition, the whey is filtered to remove solids when it is transferred from the cheese vats to the whey storage tank. The whey is then sent through a cream separator to remove additional butter fat prior to being discharged to sanitary sewer. The separator works like a centrifuge to remove fats in the whey.

4.4.3 Waste water collection system and treatment works

All waste water produced in the operation is discharged to the floor towards floor drains. All drains are covered by grates with holes of 0.5 cm diameter to keep larger chunks of cheese from entering the sewer. The whey is filtered by a fine mesh screen to collect any additional solids to be used to produce cheese. It is then passed through a separator to remove cream/butter fat prior to discharge to sewer.

All discharges from the operation will then pass through a trade waste interceptor.

All acid and caustic wastes are collected in a tank thus neutralizing them prior to discharge to sewer.

4.4.4 Storm Water

Some contaminated storm water will be discharged to sewer where the trucks deliver the raw milk. This is due to the occurrence of slight spills of raw milk when the connection from the tanker to the milk storage silo is uncoupled. The amount of milk lost is minimal. The area which drains to this drain is approximately 400 square feet. This type of arrangement is consistent with other dairies within the District and is done to minimize the impact on the receiving water in the event of a spill from the tanker or milk storage silo. The tankers will not be washed at this operation.

Plant No. 10 shall not discharge Storm Waste, as defined in the GVRD Bylaw, with the exception of the raw milk receiving area drainage.

4.4.5 Truck Washing

No comment available.

4.4.6 Loading and Unloading of Raw Materials and Finished Products

No comment available.

4.4.7 Spill Containment and Response

The plant keeps only enough chemicals in the production area for a days cleaning. The remainder of the chemicals are kept in a dry storage area where there are no floor drains.

4.4.8 Solid waste issues

All solid wastes collected from the screening of the whey is used in product. The solids and grease collected in the trade waste interceptor are pumped out on an intermittent basis.

4.5 Permit Conditions

The description of this Waste Discharge Permit is listed below:

4.5.1 Requirements for the monitoring of the discharge to sewer.

The Permit sets out requirements for the monitoring of the discharge to sewer. Plant No. 10 shall carry out the following monitoring program:

A. DISCHARGE SAMPLING AND ANALYSES

Sample start and stop times, dates, and discharge flows shall be recorded during the period that the samples are taken. All records shall be kept available for inspection for a minimum period of one year.

Continuous Measurements

a) Plant No. 10 shall continuously measure the discharge flow during each month of operation and record the following:

- Total flow for the month (m^3)
- Number of operating days during the month
- Average daily flow for the month (m^3/day)
- Maximum daily flow for the month (m^3/day)

Monthly Measurements

b) One Composite sample shall be collected from the approved sample point during one normal operating day per month. This sample shall be analyzed for the following parameters:
   - pH
   - Total Suspended Solids
   - Chemical Oxygen Demand
   - Biochemical Oxygen Demand (BOD_5)

c) During the period that the Composite Sample is taken, a Grab Sample shall be collected from the approved sample point and analyzed for the following parameter:
   - Oil and Grease (total)

d) During the period that the Composite Sample is taken, Grab Samples shall be collected from the approved sample point every two hours and analyzed for the following parameter:
   - pH

B. LOCATION OF THE APPROVED SAMPLE POINT

The location of the approved sample point is detailed on the Schematic of approved sample points, Attachment 4-2.

4.5.2 Requirements for the quantity and quality of the discharge to sewer.

The Permit sets out requirements for the quantity and quality of the discharge to Sewer.

1. AUTHORIZED RATE OF DISCHARGE

The Permittee shall not exceed the following:

- Maximum discharge flow rate: 120 m^3/day

2. AUTHORIZED DISCHARGE CRITERIA

Plant No. 10 shall not discharge Prohibited Waste, Cooling Waste, Storm Waste, Special Waste, or other Waste as defined in the GVRD Bylaw. Plant No. 10 shall not discharge Restricted Waste as defined in the GVRD Bylaw, with the following exceptions:

Parameter	Sample Type	Limit and Objectives	Compliance By
Oil and Grease (total)	Grab	150 mg/L	Immediate
pH	Grab	5.5 to 10.5	December 31,1995
Biochemical Oxygen Demand	Composite	500 mg/L	January 1, 1998

Plant No. 10 shall not discharge Storm Waste, as defined in the GVRD Bylaw, with the exception of the raw milk receiving area drainage.

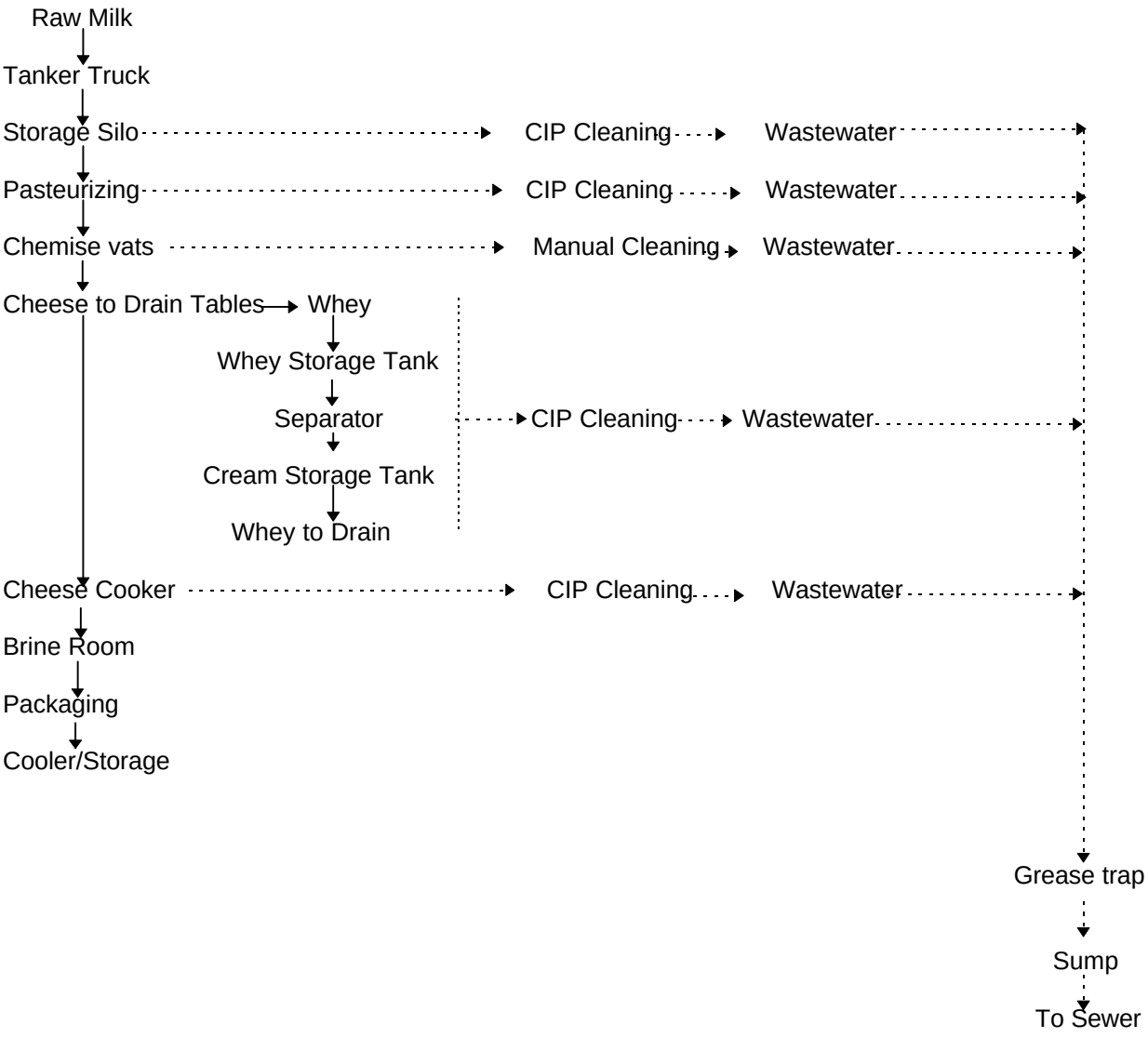
Issued July 21, 1995

4.6 Comments

This plant is a small specialty cheese manufacturer. It has only been in operation at the current location for a short time. In the near term they are expected to be in compliance for all parameters except Biochemical Oxygen Demand. The plant has been given until January 1, 1998 to meet compliance for this parameter.

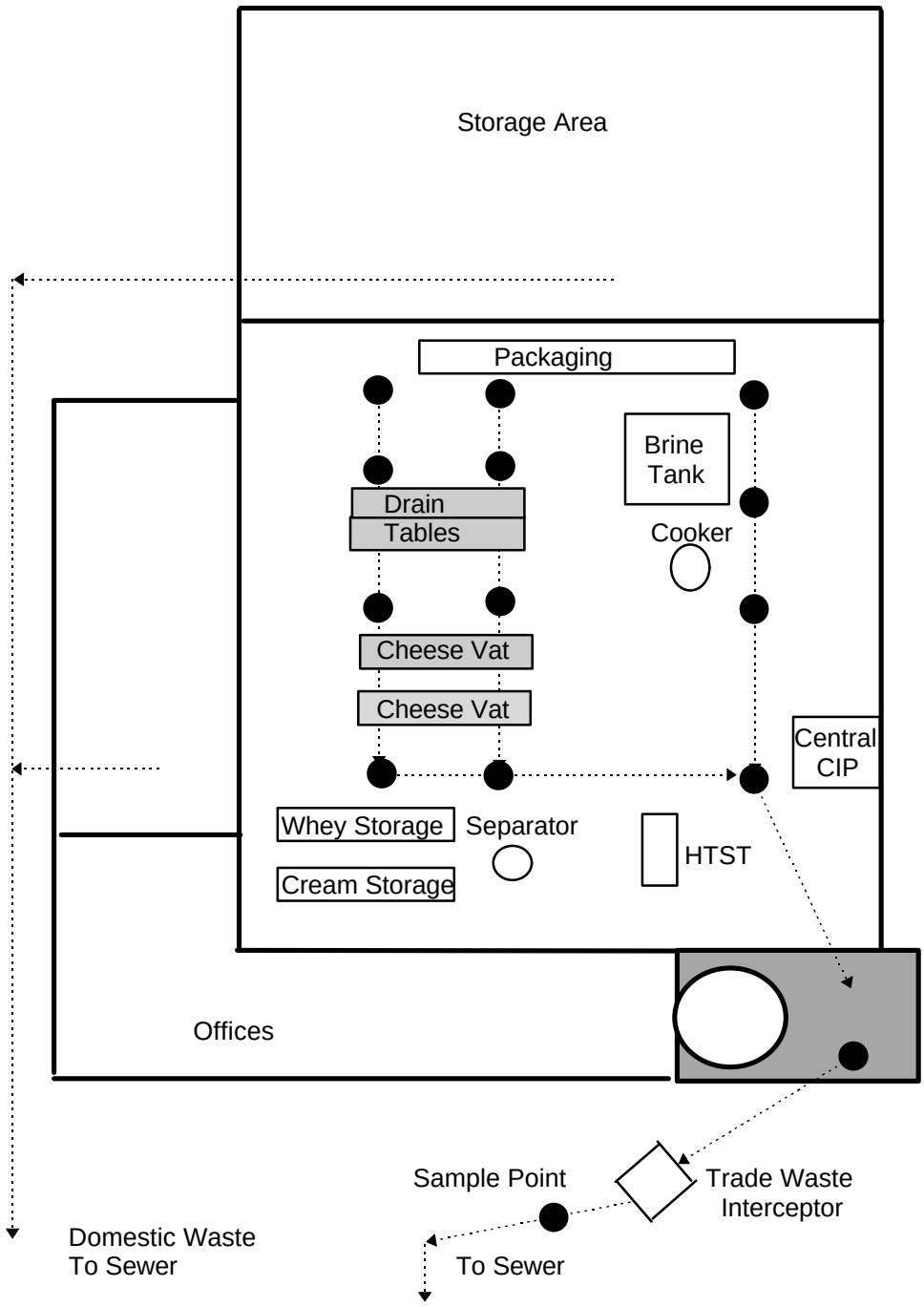
Because of its small size, pH monitoring has not been required from this operation. However, Plant No. 10 is required to collect a sample every two hours on the day of sampling and analyze for pH.

Sources of Waste Water Discharged to Sewer



Attachment 4-1

Schematic Flow Diagram



Attachment 4-2

Schematic of Approved Sampling Point

5^O Plant Profile Report - Plant No. 12

5.1 General Description

Plant No. 12 is a dairy products processing plant (SIC 1041 and SIC 1049). This plant produces fluid milk and ice cream. Permit conditions and process description information were collected from Greater Vancouver Regional District (GVRD) files. Excerpts from these files are included in the following.

5.2 Facility Background (1991)

Type of Operation: A dairy products processing plant
Hours of Operation: 24 hours/day, 7 days/week
Number of Employees: 86

Raw Materials	**Quantity used**
Raw Milk	2,250,000 lb/week

Products	**Production Level**
Fluid Milk	2,000,000 lb/week
Yogurt	30,000 lb/week
Cottage Cheese	15,000 lb/week
Sour Cream	30,000 lb/week
Ice Cream	150,000 lb/week
Juices	60,000 lb/week

5.3 Process Description

5.3.1 Fluid Milk

Raw milk, received in tank trucks, is pumped to refrigerated storage tanks prior to use. It is clarified in a centrifuge device and pasteurized in a continuous flow pasteurization unit. It is homogenized to break up the fat particles so that they remain in suspension. The milk is cooled and sent to storage and packaging.

The milk may be packaged in bottles, cardboard cartons, plastic containers, etc. after which it is sent to cold storage prior to distribution.

5.3.2 Cottage Cheese

In this plant, cottage cheese is produced as a by-product. The pasteurized milk is cooled to the desired "setting" temperature and pumped into cheese vats where it is inoculated with a bacterial culture. At the end of a controlled period of time, the curds are separated from the whey, cut into small pieces, and cooled. The whey is discarded as waste. The cheese is dressed with cream, milk or fruits, and packaged ready for distribution.

5.3.3 Yogurt

Raw milk, received in tank trucks, is pumped to refrigerated storage tanks prior to processing. It is clarified in a centrifuge device and pasteurized in a continuous flow pasteurization unit. It is homogenized to break up the fat particles so that they remain in suspension. The milk is cooled and sent to storage before use. The milk is pumped into vats and milk powder is added. The vat is heated to 110°F and is inoculated with a bacterial culture. The yogurt is allowed to incubate for 5 hours before being pumped to a filling station. Fruit is added when required. The final product is stored at 37 §F before distribution.

5.3.4 Juices

Juices are produced by adding water and sugar to juice concentrate shipped in from around the world. The mixture is then pasteurized and packaged before distribution.

5.4 Potential Waste Water Pollution Sources

Most of the waste water generated within the plant is from the cleaning and sanitizing of processing and packaging equipment. This equipment includes all tanks, lines, silos and packaging equipment which comes into contact with a food product.

5.4.1 "Clean in Place" System

Most of this equipment is "cleaned in place (CIP) where cleaning and sanitizing solutions are prepared in a central facility and pumped through all line and vessels.

The cleaning and sanitizing process normally consists of:

- Pre-rinse
- 0.5 - 0.75 % sodium hydroxide cleaning solution.
- Phosphoric acid/Nitric acid based sanitizing solution
- Rinse

The caustic is reused and is discharged to sewer infrequently. It is kept up to the proper concentration with the addition of fresh caustic

5.4.2 Equipment Washdown

To conform with health regulations, all equipment must be cleaned and sanitized daily if the equipment is in use. Sanitizing is also carried out just prior to startup if the equipment has been sitting for any length of time.

Most product tanks are sanitized with the acid solution to remove caustic bloom and milk stones that can form within the piping.

Wash and rinse water from the external cleaning of equipment is directed to floor drains, as are any spills of raw materials or products that may occur. Spoiled or off-spec products are either reprocessed, if possible, or shipped out as animal feed.

5.4.3 Storm Water

No comment available.

5.4.4 Truck Washing

No comment available.

5.4.5 Loading and Unloading of Raw Materials and Finished Products

No comment available.

5.4.6 Spill Containment and Response

No comment available.

5.4.7 Solid Waste Issues

No comment available.

5.5 Permit Conditions

The description of this Waste Discharge Permit is listed below:

5.5.1 Requirements for the monitoring of the discharge to sewer.

The Permit sets out requirements for the monitoring of the discharge of non-domestic waste. The requirements are as follows:

1. Plant No. 12 shall estimate, using water use records, the daily discharge during each month of operation. The flow shall be measured by an authorized flow measuring device. Plant No. 12 shall include the following information:
   - Total flow for the month (m^3)
   - Number of operating days during the month
   - Average daily flow for the month (m^3/day)
   - Maximum daily flow for the month (m^3/day)

2. One composite sample shall be collected from the sampling manhole during one normal operating day once per calendar month. The sample shall be analyzed for the following parameters:
   - pH
   - Total Suspended Solids
   - Biochemical Oxygen Demand (BOD_5)
   - Chemical Oxygen Demand (COD)

   The discharge flow for the period that the composite sample was collected shall be recorded.

   There will be no Oil & Grease analysis from the composite sample as specified in the previous Order as it is not an authorized practice in "Standard Methods...".

3. On the same day that the composite sample is taken, a grab sample shall be collected and analyzed for the following parameter:
   - Oil and Grease (total)

4. At three month intervals, Plant No. 12 shall submit a report detailing the sampling results and flow measurements for the preceding quarter.

The location of the approved sample point is detailed on the "schematic of approved sample points", Attachment 5-1.

5.5.2 Requirements for the quantity and quality of the discharge to sewer.

The Permit sets out requirements for the quantity and quality of the discharge of non-domestic waste from the ice cream plant. The authorized discharge characteristics are as follows:

1. No Prohibited Waste, as specified in Schedule A of the GVRD Bylaw, shall be discharges to the sewer.

2. No Restricted Waste, as specified in Schedule B of the GVRD Bylaw, shall be discharged to the sewer.

3. No Special Waste, as defined in the GVRD Bylaw, shall be discharged to the sewer.

In addition, specific limits and compliance programs have been initiated for the following parameters:

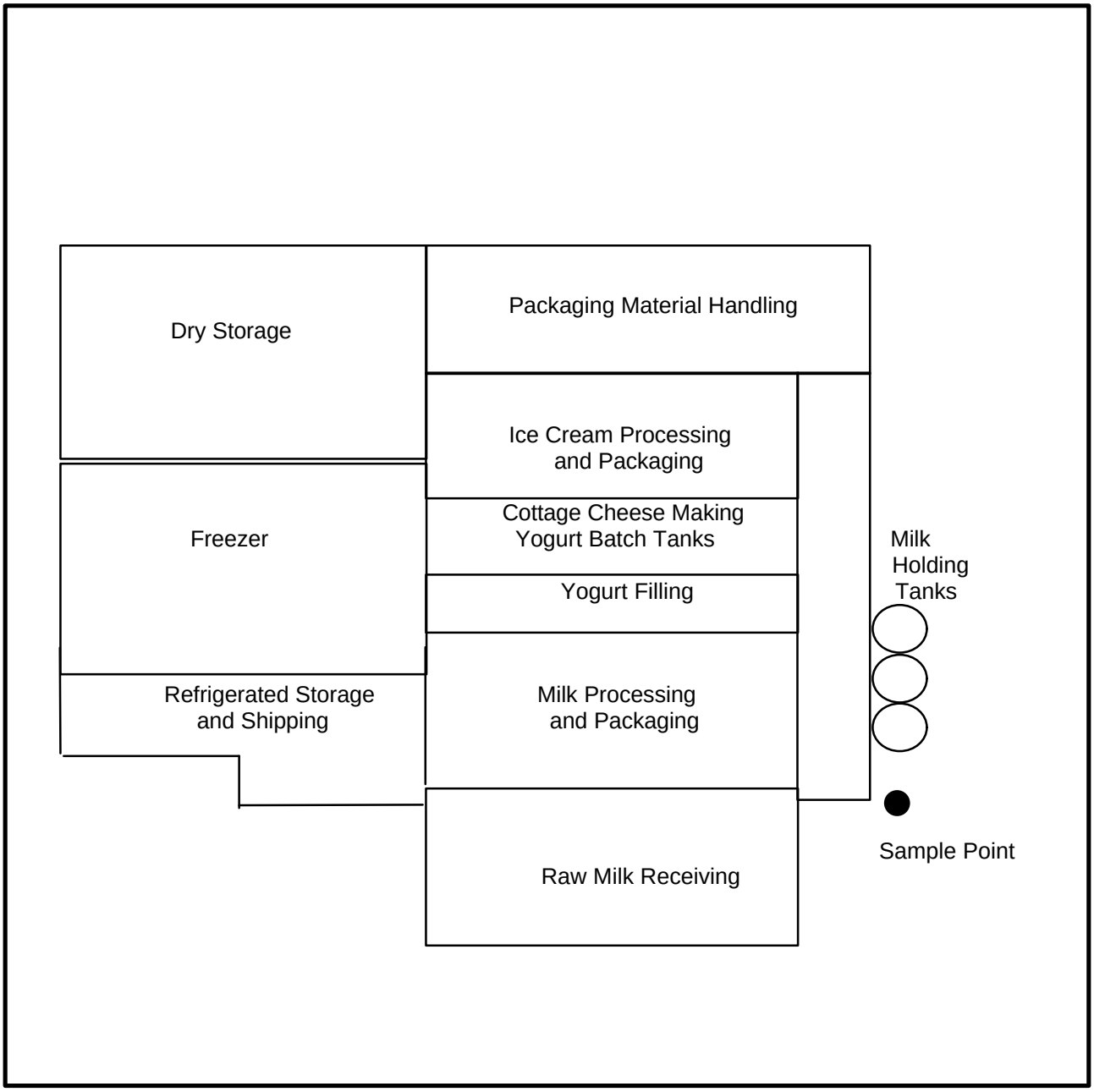
Parameter	Limitation	Compliance Date
Oil and Grease (total)	150 mg/L	November 15, 1992
Suspended Solids	600 mg/L	November 15, 1992
Biochemical Oxygen Demand	1000 mg/L	January 1, 1994
Biochemical Oxygen Demand	500 mg/L	January 1, 1996

AUTHORIZED DISCHARGE RATE Maximum - 600 m^3/day.

Issued Nov.1, 1991

5.6 Comments

The current compliance status of this plant is not known. The plant was not in compliance in 1994 for TSS, O&G and pH. A notice of plant closure has been given.



Attachment 5-1

Schematic of Approved Sampling Point

6 O Plant Profile Report - Plant No. 14

6.1 General Description

Plant no. 14 is a dairy products processing plant (SIC 1041). This plant produces fluid milk. Permit Conditions and process description information were collected from Greater Vancouver Regional District (GVRD) files. Excerpts from these files are included in the following.

6.2 Facility Background (1995)

Type of Operation	Milk and juice bottler
Operating Period	8 hours/day, 5 days/week.
Number of Employees	35 regular including drivers
Maximum Discharge Flow Rate	200 m^3/day
Site Size	<1 acres

Their operation is primarily between 11 pm and 11 am with wash-up occurring from 11 am to approximately 3 pm.

6.3 Process Description

The plant bottles whole milk, 2%, 1%, and skim milk. It has three filling lines for either I L glass, plastic jugs, and cardboard cartons or 2 L glass containers and cartons. They also bottle juices once a week using the existing equipment.

6.4 Potential Waste Water Pollution Sources

All waste water produced by the plant is collected and discharged to sanitary sewer. Domestic waste from this operation has a separate connection to sewer.

The process waste water which has collected in the designated area drains is discharged to a trade waste interceptor prior to discharging into sewer.

All solid waste, with the exception of solids in the trade waste interceptor, are disposed of in a landfill or recycling program. The solids and Oil & Grease collected in the trade waste interceptor are collected and disposed of at the Iona WWTP Trucked Waste facility.

6.4.1 "Clean in Place" System

All caustic solution (pH ~12) used during the cleaning activities, are piped from their 200 gallon storage totes to the equipment through a Clean-ln-Place (CIP) system and is reclaimed for re-use with the exception of the cleaning of the HTST pasteurizer. The cleaning agents used on this equipment cannot be re-used and are blended together prior to discharging into the sewer. Once a week, the waste caustic is used to make up a solution with acid to clean all the equipment to prevent the formation of milk stones. After use, the solution is discharged to sewer.

The caustic storage tanks are contained within a diked area.

6.4.2 Equipment Washdown

All acid and caustic wastes used for the cleaning of the HTST equipment is collected in a 1200 L tank prior to discharging into the sewer. The reclaimed caustic and acid is blended together to neutralize the pH prior to discharging into sewer.

6.4.3 Storm Water

No comment available.

6.4.4 Truck Washing

No comment available.

6.4.5 Loading and Unloading of Raw Materials and Finished Products

No comment available.

6.4.6 Spill Containment and Response

No comment available.

6.4.7 Solid Waste Issues

No comment available.

6.5 Permit Conditions

6.5.1 Requirements for the monitoring of the discharge to sewer.

The Permit sets out requirements for the monitoring of the discharge to sewer. Plant No. 12 shall carry out the following monitoring program:

A. DISCHARGE SAMPLING AND ANALYSES

Sample start and stop times, dates, and discharge flows shall be recorded during the period that the samples are taken. All records shall be kept available for inspection for a minimum period of one year.

Continuous Measurements

a) Plant No. 12 shall continuously measure the discharge flow during each month of operation and record the following:
   - Total flow for the month (m^3)
   - Number of operating days during the month
   - Average daily flow for the month (m^3/day)
   - Maximum daily flow for the month (m^3/day)

Monthly Measurements

b) One Composite sample shall be collected from Sample Point #1 during one normal operating day per month. This sample shall be analyzed for the following parameters:
   - pH
   - Conductivity
   - Total Suspended Solids
   - Chemical Oxygen Demand
   - Biochemical Oxygen Demand (BOD_5)

c) During the period that the Composite Sample is taken, a Grab Sample shall be collected and analyzed for the following parameter:
   - Oil and Grease (total)

Batch Discharges

Plant No. 12 shall maintain a log of each batch discharged to Sewer of CIP cleaning waste, including:

- Volume (m^3)
- Date on which discharge occurred.
- pH of discharge.

B. LOCATION OF THE APPROVED SAMPLE POINT

The location of the approved sample point is detailed on the Schematic of approved sample points", Attachment 6-1.

6.5.2 Requirements for the quantity and quality of the discharge to sewer.

The Permit sets out requirements for the quantity and quality of the discharge to Sewer.

1. AUTHORIZED RATE OF DISCHARGE

Plant No. 12 shall not exceed the following:

- Maximum discharge flow rate: 250 m^3/day

2. AUTHORIZED DISCHARGE CRITERIA

a) The Permittee shall not discharge Restricted Waste with the following exceptions:

Parameter	Sample Type	Limit and Objectives	Effective Date
Oil and Grease (total)	Grab	150 mg/L	September 30, 1995
pH	Grab	5.5 to 10.5	September 30, 1995
Total Suspended Solids	Composite	600 mg/L	September 30, 1995
Biochemical Oxygen Demand	Composite	500 mg/L	January 1, 1996

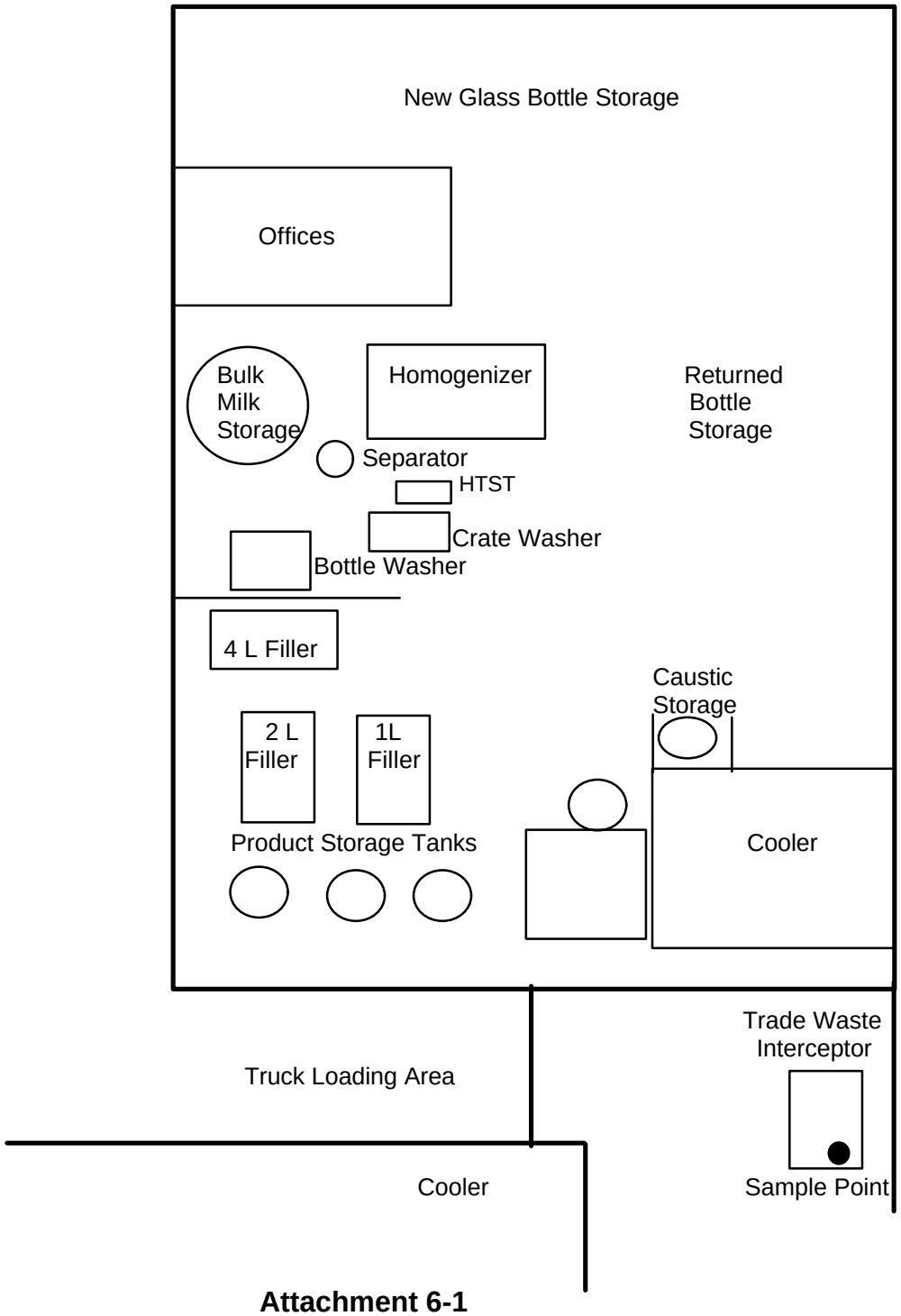
b) The Permittee shall not discharge Prohibited Waste, Cooling Waste, Storm Waste, Special Waste, or other Waste as defined in the GVRD Bylaw. Any Special Waste must be treated to meet the limits in Schedule 1.2, Column 3 of Special Waste Regulation prior to discharge to the Sewer.

6.6 Comments

The monitoring results from this facility are variable with exceedences associated primarily with pH, Total Suspended Solids and Oil & Grease (total). Therefore, a compliance program has been initiated for these parameters.

The company has installed a flow meter on the incoming municipal water and is reading the water usage on a daily basis. They are also subtracting the amount for domestic and product use.

The plant is looking into the installation of a large tank to handle all CIP wastes to ensure that the pH is in compliance with Permit limits.



Attachment 6-1

Schematic of Approved Sampling Point

7^O Plant Profile Report - Plant No. 15

7.1 General Description

Plant no. 15 is a dairy products processing plant (SIC 1049). This plant produces ice cream. Permit Conditions and process description information were collected from Greater Vancouver Regional District (GVRD) files. Excerpts from these files are included in the following.

7.2 Facility Background(1991)

Type of Operation:	An ice Cream manufacturing plant
Hours of Operation:	8 hours/day, 4 days/week in winter 16 hours/day, 4 days/week in summer
Number of Employees:	12

Raw Materials	**Quantity used**
Raw Milk	80,000 lb/week
Sucrose	40,000 lb/week
Glucose	50,000 lb/week

Products	**Production Level**
Ice Cream	200,000 L/week (summer) 125,000 L/week (winter)

7.3 Process Description

The plant produces ice cream in a variety of flavours and forms including ice cream in 2 & 4 L pails and cartons. The basic process is as follows:

Raw milk is received at the plant in tank trucks and is transferred to refrigerated storage tanks before use. Ingredients such as stabilizers, emulsifiers, sugars, etc., are blended with the milk according to the formula of the product. The mixture is pasteurized and homogenized. Homogenization mixes and breaks-up the fat particles so that they remain in suspension. The mixture is cooled and transferred to holding tanks for up to 24 hours.

From storage, the material passes through a further processing operation where nuts, fruits, and flavours are blended in to make the finished product. This is frozen to make the ice cream and/or frozen dessert.

Cream from the milk plant is the main raw ingredient for ice cream. It is blended in large mixing tanks and then pasteurized. After pasteurization, the mixture is placed in bulk storage tanks. From the storage tanks, it is pumped into smaller mix tanks where flavouring is added, and then the product is semi-frozen and packaged. The packaged product is frozen solid in the freezer stacks and then either loaded directly into refrigerated trailers for delivery, or into plant freezer for storage.

The pasteurization process involves heating cream to pasteurize it and then cooling the cream so that it can be made into ice cream. A plate heat exchanger, located in the mix room, is used for the pasteurization and cooling stages. Recirculated hot water from the plant boiler used for heating and cooling is provided by city water in first stage and chiller water in second stage. Water from the first stage is discharged to the process sewer and chiller water from the second stage is recirculated.

7.4 Potential Waste Water Pollution Sources

The plant is serviced by separate sanitary and process sewer systems. The sanitary system serves the offices, washrooms and change rooms. All floor drains in the production area, mix room, cooler, clean-in-place (CIP) system, and area around storage tanks drain to the process sewer. The process sewer passes through a Trade Waste Interceptor and a sampling manhole before discharging to the sanitary sewer.

Wastewater sources that discharge to the process sewer are:

- CIP system
- General wash-down
- Pasteurization process

The sources of waste water are discussed in the following.

7.4.1 "Clean in Place" System

Most of the waste water generated within the plant is from the cleaning and sanitizing of processing and packaging equipment. The equipment includes all tanks, lines, silos and packaging equipment which comes into contact with a food product. Most of this equipment is “cleaned in place” where cleaning and sanitizing solutions are prepared in a central facility and pumped through all

lines and vessels. The ice cream plant has separate CIP units for equipment handling either raw milk or pasteurized milk.

The cleaning and sanitizing process normally consists of: -

- Pre-rinse.
- 0.5-0.75 % sodium hydroxide cleaning solution at 155°F.
- Rinse.
- 50 ppm sodium hypochlorite sanitizing solution.
- Rinse.

To conform with health regulations, all equipment must be cleaned and sanitized daily if the equipment is in use. This results in an average of 12 cycles of the CIP unit per day. Caustic wash water is dumped to sewer at the end of the day. Sanitizing is also carried out just prior to startup if the equipment has been sitting for any length of time.

Ten percent of the time, product tanks are sanitized with the acid solution to remove caustic bloom and milk stones that can form within the piping. The High Temperature Short Time (HTST) pasteurization unit is always sanitized with acid.

The ice cream plant has one CIP system which is used to clean all process piping, tanks, and equipment. It is located inside the plant adjacent to the production area and the mix room. The CIP system is PLC controlled and has the general cycle of pre-rinse, solution wash, and post-rinse. Both the pre-rinse and post-rinse are discharged to the process sewer. Solution wash consists of caustic and acid solutions. For cleaning of piping, tanks, and all equipment except the pasteurization unit, solution washes are recirculated. For cleaning the pasteurization unit, solution washes are discharged to the process sewer. Equipment, piping and tanks are cleaned at the end of production each day.

7.4.2 Equipment Washdown

Wash and rinse water from the external cleaning of equipment is directed to floor drains, as are any spills of raw materials or products that may occur. Spoiled or off-spec products are either reprocessed, if possible, or shipped out as animal feed.

General wash-down consists of washing the outside of equipment, equipment parts not cleaned by the CIP system, walls, floors, etc. The production area and the mix room receive an overall general wash-down at the end of each production shift.

7.4.3 Compressors

Non-contact cooling water is used for the compressors associated with the large refrigeration units required for the dairy processing operation. This uncontaminated cooling water is recycled.

7.4.4 Storm Water

No comment available.

7.4.5 Truck Washing

No comment available.

7.4.6 Loading and Unloading of Raw Materials and Finished Products

No comment available.

7.4.7 Spill Containment and Response

No comment available.

7.4.8 Solid Waste Issues

No comment available.

7.5 Permit Conditions

7.5.1 Requirements for the monitoring of the discharge to sewer.

The Permit sets out requirements for the monitoring of the discharge of non domestic waste from the ice cream plant. This monitoring program commences October 1, 1991. The requirements are as follows:

1. Plant No. 15 shall measure or estimate, the daily discharge during each month of operation and include the following information.
   - Total flow for the month (m^3)
   - Number of operating days during the month
   - Average daily flow for the month (m^3/day)
   - Peak daily flow for the month (m^3/day)

2. Plant No. 15 is also required to continuously monitor the pH of the discharge and report the periods when the pH was <5.5 and >10.5.

3. One composite sample shall be collected from the sampling manhole during one normal operating day once per calendar month. The sample shall be analyzed for the following parameters:
   - pH
   - Total Suspended Solids
   - Biochemical Oxygen Demand (BOD_5)
   - Chemical Oxygen Demand

   The discharge flow for the period that the composite sample was collected shall be recorded.

   The analysis of Oil & Grease from a composite sample is no longer accepted as an authorized method in Standard Methods. Therefore, a grab sample shall be taken to measure Oil & Grease.

4. On the same day the composite sample is taken, a grab sample shall be collected and analyzed for the following parameter:
   - Oil and Grease (total)

5. At three month intervals, the Plant No. 15 shall submit a report detailing the sampling results and flow measurements for the preceding quarter.

   The location of the approved sample point is detailed on the Schematic of approved sample points, Attachment 7-1.

7.5.2 Requirements for the quantity and quality of the discharge to sewer.

The Permit sets out requirements for the quantity and quality of the discharge of NON-DOMESTIC WASTE from an ice cream manufacturing plant. Where a compliance program has been specified, existing works or procedures must be maintained in good operating condition and operated in a manner to minimize the discharge of contaminants during the interim period until the new works have been installed.

AUTHORIZED DISCHARGE CHARACTERISTICS

1. AUTHORIZED RATE OF DISCHARGE

Plant No. 15 shall not exceed the following:

- 300 m^3/day

2. AUTHORIZED DISCHARGECRITERIA

a) Plant No. 15 shall not discharge PROHIBITED WASTE as defined in Schedule A of the GVRD BYLAW.

b) Plant No. 15 shall not discharge RESTRICTED WASTE as defined in Schedule B of the GVRD BYLAW with the following exceptions:

Parameter	Limitation	Compliance Date
Flow	300 m^3/day	
pH	5.5 to 10.5	July 1, 1993
Oil and Grease (total)	150 mg/L	July 1, 1993
Suspended Solids	600 mg/L	July 1, 1993
Biochemical Oxygen Demand	1000 mg/L	January 1, 1994
Biochemical Oxygen Demand	500 mg/L	January 1, 1996

c) Plant No. 15 shall not discharge SPECIAL WASTE as defined in the GVRD BYLAW.

d) Plant No. 15 shall not discharge STORM WASTE or COOLING WASTE as defined in the GVRD BYLAW.

7.6 Comments

This plant has made several changes to its operation since 1991 in order to comply with the limits set by its Discharge Permit. These include :

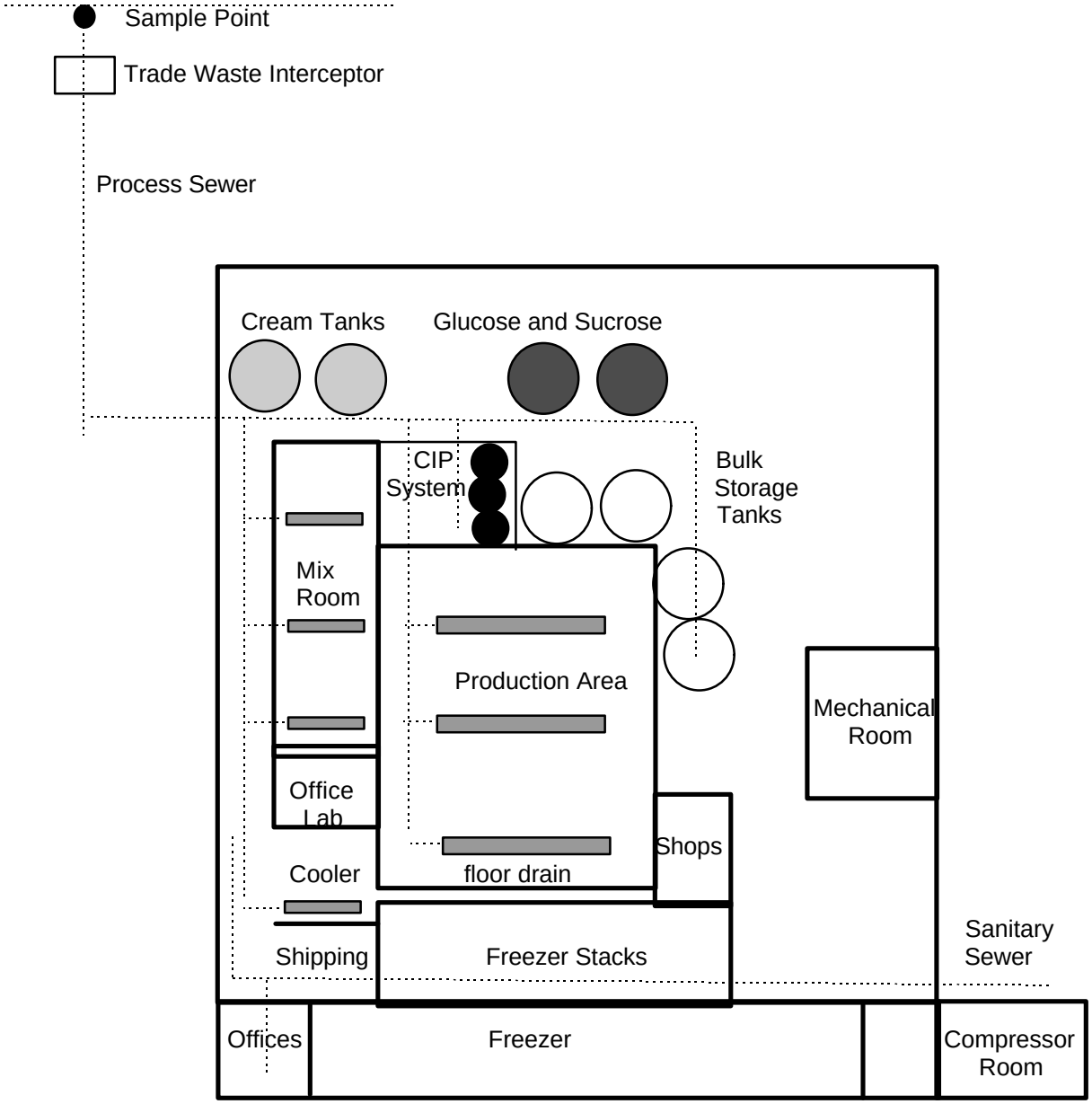
- Continuous flow monitoring equipment was installed to monitor the process wastewater volume being discharged.

- The plant operation has changed from a five day work week to a four day work week with longer hours.

- Additional chemical tankage and a pH measurement and control system was installed.

- A collection system to recover pre-rinse wastewater for use as make-up water in the process was implemented.

The remaining non-compliance parameters are Total Suspended Solids and Total Oil and Grease. The plant has currently embarked on a Compliance Plan, approved by GVRD, to address these parameters. The plan consists of a two part approach. A technical evaluation to determine what process changes or additions are required, and simultaneously the implementation of BMP's to minimize the wastes going to sewer without any process equipment changes. The effect of the BMP's will be evaluated after 6 months. A decision will be made then on what technical change is required.



Attachment 7-1

Schematic of Approved Sampling

8^O Plant Profile Report - Plant No. 16

8.1 General Description

Plant no. 16 is a dairy products processing plant (SIC 1041). This plant packages milk and produces yogurt and cottage cheese. A site evaluation was conducted on November 24, 1994. The plant superintendent was the guide for this plant tour.

Permit Conditions and process description information was also collected from Greater Vancouver Regional District (GVRD) files. Excerpts from these files are included in the following.

8.2 Facility Background (1995)

The plant operates on a three-shift, five-day per week schedule. Of the three shifts, two are production shifts while one is for cleaning. The plant is also staffed during the weekend for cleaning and receiving of materials. With a total work force of 76 employees, this plant processes between 60 to 65 million liters (16 to 17 million gallons) of milk annually.

The plant property is rectangular with an approximate area of 2 hectares (5 acres). With the exception of a narrow green belt surrounding three sides of the property boundary, the entire site is either paved with an asphalt surface or is occupied by the Milk Plant. The Milk Plant occupies a surface area of approximately 6,600 m^2, approximately 33% of the total plant area.

A site plan of this facility is presented in Attachment 8-1.

Raw Materials	**Quantity used**
Raw Milk	3,200,000 lb/week
Products	**Production Level**
Fluid Milk	2,700,000 lb/week
Yogurt	200,000 lb/week
Cottage Cheese	240,000 lb/week
Juices	250,000 lb/week

8.3 Process Description

8.3.1 Fluid Milk

Raw milk, received in tank trucks, is pumped to refrigerated storage tanks prior to use. It is clarified in a centrifuge device and pasteurized in a continuous flow pasteurization unit. It is homogenized to break up the fat particles so that they remain in suspension. The milk is cooled and sent to storage and packaging. The milk may be packaged in bottles, cardboard cartons, plastic containers, etc. after which it is sent to cold storage prior to distribution.

8.3.2 Cottage Cheese

In this plant, cottage cheese is produced as a by-product. The pasteurized milk is cooled to the desired "setting" temperature and pumped into cheese vats where it is inoculated with a bacterial culture. At the end of a controlled period of time, the curds are separated from the whey, cut into small pieces, and cooled. The whey is discarded as waste. The cheese is dressed with cream, milk or fruits, and packaged ready for distribution.

8.3.3 Yogurt

Raw milk, received in tank trucks, is pumped to refrigerated storage tanks prior to use. It is clarified in a centrifuge device and pasteurized in a continuous flow pasteurization unit. It is homogenized to break up the fat particles so that they remain in suspension. The milk is cooled and sent to storage before use. The milk is pumped into vats and milk powder is added. The vat is heated to 110°F and is inoculated with a bacterial culture. The yogurt is allowed to incubate for 5 hours before being pumped to a filling station. Fruit is added when required. The final product is stored at 37° F before distribution.

8.3.4 Juices

Juices are produced by adding water & sugar to juice concentrate shipped in from around the world. The mixture is then pasteurized and packaged before distribution. Once a week, fresh apples are brought in to produce fresh apple juice.

8.4 Potential Waste Water Pollution Sources

8.4.1 "Clean in Place" System

Most of the waste water generated within the plant is from the cleaning and sanitizing of processing and packaging equipment. This equipment includes all tanks, lines, silos and packaging equipment which comes into contact with a food product. Most of this equipment is "cleaned in place" (CIP) where cleaning and sanitizing solutions are prepared in a central facility and pumped through all line and vessels.

The cleaning and sanitizing process normally consists of:

- Pre-rinse
- 0.5 - 0.75 % sodium hydroxide cleaning solution at 155° F.
- Steam sanitation.
- Rinse

Rinse water is recovered for use as pre-rinse to help neutralize the caustic cleaning solution.

To conform with health regulations, all equipment must be cleaned and sanitized daily if the equipment is in use. This results in an average of 12 cycles of the CIP unit per day. Caustic wash water is dumped to sewer at the end of the day. Sanitizing is also carried out just prior to startup if the equipment has been sitting for any length of time.

Ten percent of the time, product tanks are sanitized with the acid solution to remove caustic bloom and milk stones that can form within the piping. For more sensitive equipment, sodium hypochlorite is used as a substitute sanitizing agent

8.4.2 Equipment Washdown

Wash and rinse water from the external cleaning of equipment is directed to floor drains, as are any spills of raw materials or products that may occur. Spoiled or off-spec products are either reprocessed, if possible, or shipped out as animal feed.

8.4.3 Compressors

Non-contact cooling water is used for the compressors associated with the large refrigeration units required for this operation. This uncontaminated cooling water is discharged to storm sewer.

8.4.4 Cottage Cheese Making

Whey, the liquid portion produced during the production of cottage cheese, is drained from the tank and discharged to the sanitary sewer. In addition, the cottage cheese is cooled by rinsing the curd three times with approximately 35 - 40,000 lb of water each rinse. All washes are discharged to sanitary sewer and can total up to 1,440,000 lb/week.

8.4.5 Storm Water

The plant has a garbage receptacle located outside in the dry goods receiving area. Adjacent to this receptacle, there are three catch basins to collect any fluids from the receptacle such as returned, un-useable product. These catch basins discharge to sanitary sewer. However, during rainfall, storm water also collects in these catch basins.

These basins originally discharged to storm sewer but were rerouted because inadvertent discharge of waste cream dumped in the receptacle to the storm sewer.

The car and truck blacktop parking areas are graded to direct stormwater to a series of catchbasins discharging to the city stormwater system.

8.4.6 Truck Washing

After the raw milk is transferred from the tanker to the storage silo, the tanks are washed out of any milk residue and the waste water is discharged to sanitary sewer.

8.4.7 Loading and Unloading of Raw Materials and Finished Products

Raw materials for this plant are milk, cream, fruit fillings, packaging materials, caustic, acid, chlorine, and lubricants. Milk and cream are delivered to the plant via tank trucks. All other materials and chemicals are delivered by trucks. Waste materials leaving the plant include process wastewater to the city sewer, solid wastes to landfill, and empty containers and cartons to the suppliers.

The milk and cream are unloaded from the tankers in the raw milk receiving building. After unloading, the milk and cream are pumped to storage tanks located on the outside of the raw milk receiving building. The storage tanks sit on a raised concrete pad without secondary containment. There is a total of six liquid storage tanks with four for milk (230,000 kig/500,000 lb. each) and two for

cream (36,000 kg/80,000 lb. each). The floor of the raw milk receiving building is tiled and slopes toward a drainage channel located across the front of the two truck bays. Just outside of the door, there is also a drainage channel placed across the driveway. Both of these two drainage channels are connected to the plant's wastewater sewer system discharging to the city sewer. This drainage system conveys spilled milk/cream to the city sewer.

In addition to the raw milk receiving building, there are three truck docks for the loading and unloading of other raw materials. The truck dock at the rear of building is under cover. The loading areas are graded to direct stormwater towards storm drains located around the truck docks. These drains are connected to the plant's wastewater sewer system discharging to the city sewer.

8.4.8 Outdoor Storage of Materials

Outdoor storage of materials for this facility is generally limited to empty drums, milk cartons, and solid wastes. The empty drums are stored temporarily at the northwest corner of the building and outside of the maintenance shop. Empty cartons are stored at the rear of the building near the loading docks. The solid wastes storage container is located in the loading dock area.

There are only two outdoor storage areas of liquid petroleum products for this facility. Just outside of the maintenance area is a 38 m^3 (10,000 gallon) underground tank used to store fuel oil. In the same vicinity is a small enclosed shed (1.2 m x 9 m) for lubricant storage. This shed is placed on a concrete slab. At the time of the site visit, the area around the shed was free of visible oil.

8.5 Permit Conditions

This facility is regulated by the Greater Vancouver Sewerage and Drainage District for the discharge of non-domestic waste to the city sewer.

8.5.1 Requirements for the monitoring of the discharge to sewer.

The permit sets out requirements for the monitoring of the discharge of non-domestic waste from the dairy products processing plant. The requirements are as follows:

1. Plant No. 16 shall measure or estimate, the daily discharge during each month of operation and include the following information.
   - Total flow for the month (m^3)

- Number of operating days during the month
- Average daily flow for the month (m^3/day)
- Peak daily flow for the month (m^3/day)

2. Plant No. 16 is also required to continuously monitor the pH of the discharge and report the periods when the pH was <5.5 and >10.5.

3. One composite sample shall be collected from the sampling manhole during one normal operating day once per calendar month. The sample shall be analyzed for the following parameters:
   - pH
   - Total Suspended Solids
   - Biochemical Oxygen Demand (BOD_5, total)
   - Chemical Oxygen Demand (COD)

   The discharge flow for the period that the composite sample was collated shall be recorded.

   The analysis of Oil & Grease from a composite sample is no longer accepted as an authorized method in "Standard Methods. Therefore, a grab sample shall be taken to measure Oil & Grease.

4. On the same day that the composite sample is taken, a grab sample shall be collected and analyzed for the following parameter:
   - Oil and Grease (total)

5. At three month intervals, Plant No. 16 shall submit a report detailing the sampling results and flow measurements for the preceding quarter.

   The location of the approved sample point is detailed on the "schematic of approved sample points", Attachment 8-1.

8.5.2 Requirements for the quantity and quality of the discharge to sewer.

The Permit sets out requirements for the quantity and quality of the discharge of non-domestic waste from the ice cream plant. The authorized discharge characteristics are as follows:

I. No Prohibited Waste, as specified in Schedule A of the GVRD Bylaw, shall be discharged to the sewer by Plant No. 16.

2. No Restricted Waste, as specified in Schedule B of the GVRD Bylaw, shall be discharged to the sewer.

3. No Special Waste, as defined in the GVRD Bylaw, shall be discharged to the sewer.

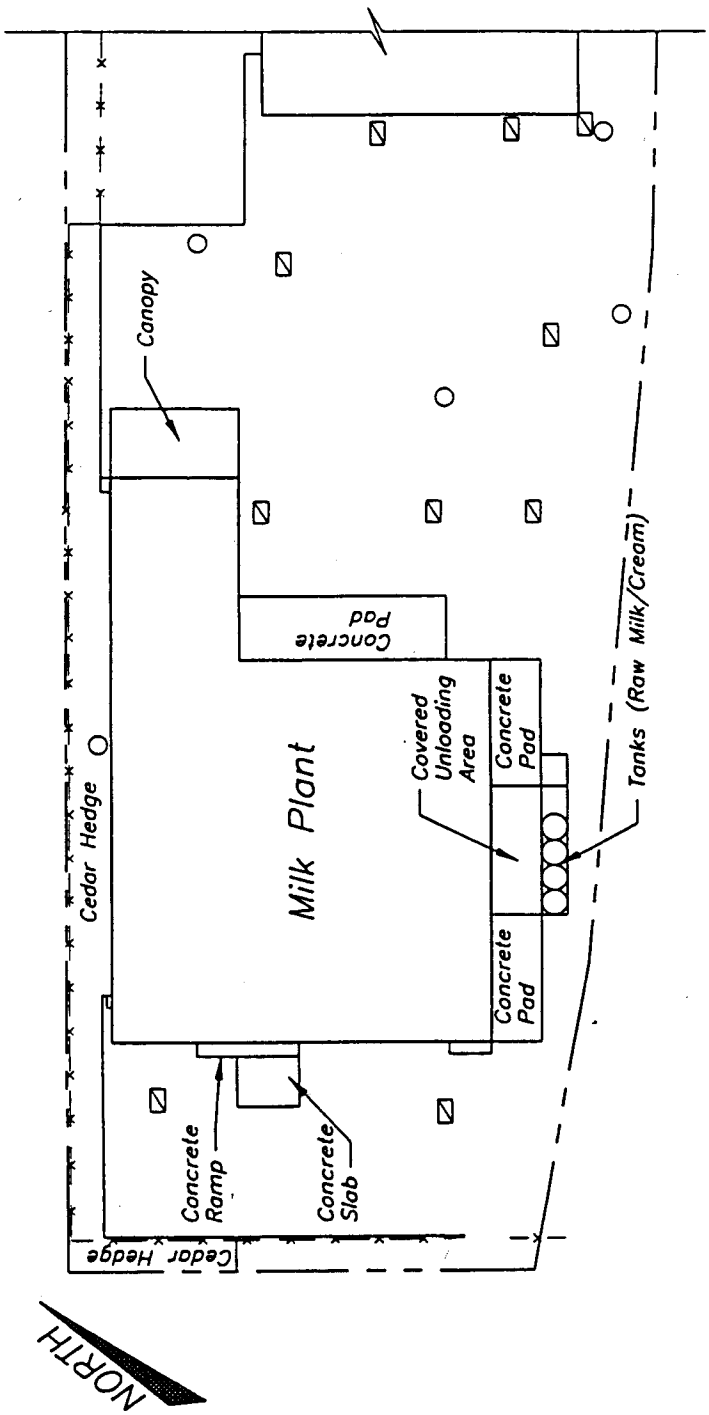
In addition, specific limits and compliance programs have been initiated for the following parameters:

Parameter	Limitation	Compliance Date
Flow	700 m^3/day	
pH	5.5 to 10.5	July 1, 1993
Oil and Grease (total)	150 mg/L	July 1, 1993
Suspended Solids	600 mg/L	July 1, 1993
Biochemical Oxygen Demand	1000 mg/L	January 1, 1994
Biochemical Oxygen Demand	500 mg/L	January 1, 1996

A maximum discharge flow of 700 m^3/d has been set for discharge. This level is slightly greater than the maximum peak discharge to the sewer by Plant No. 16.

8.6 Comments

This plant has made several changes to its operation since 1991 in order to comply with the limits set by its Discharge Permit. The remaining non-compliance parameter is Total Suspended Solids. The plant has currently embarked on a Compliance Plan, approved by GVRD, to address this item. The plan consists of a two part approach. A technical evaluation to determine what process changes or additions are required, and simultaneously the implementation of BMP's to minimize the wastes going to sewer without any process equipment changes. The effect of the BMP's will be evaluated after 6 months. A decision will be made then on what technical change is required.



Attachment 8-1

Schematic of Approved Sampling Point

O
Appendix E - Economic Evaluation Summary Report

University of Tennessee

Waste Minimization Assessment Center

Report No. 42-17

3624 Market Street
Philadelphia, PA 19104
(215) 387-2255

WASTE MINIMIZATION CENTER ASSESSMENT 17

May 1990

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PREFACE

The work described in this report was performed under the University of Tennessee Waste Minimization Assessment Center (WMAC) Program. This Program is funded by the Industrial Environmental Research Laboratory, U. S. Environmental Protection Agency and managed by the University City Science Center, Philadelphia, Pennsylvania.

The objective of the Center is to identify and evaluate, through visits to industrial sites, opportunities for hazardous waste minimization in small and medium sized companies. The evaluation process is based on the data gathered during a series of visits to each client's firm. When measures for hazardous waste reduction involving engineering design and capital investment are found to be attractive to the company, it is recommended that, where in-house capability is not available, the services of a consulting engineering firm be engaged to do detailed engineering design and estimating of implementation costs of the recommended waste minimization opportunities contained in this report.

Disclaimer

The contents of this report are offered as guidance. The Environmental Protection Agency, the University City Science Center, University of Tennessee, and all technical sources referenced in this report do not (a) make any warranty or representation, expressed or implied, with respect to the accuracy, completeness, or usefulness of the information contained in this report, or that the use of any information, apparatus, method, or process disclosed in this report may not infringe on privately owned rights; (b) assume any liabilities with respect to the use of, or for damages resulting from the use of, any information, apparatus, method or process disclosed in this report. This report does not reflect official views or policy of the above mentioned institutions. Mention of trade names or commercial products does not constitute endorsement or recommendation or use.

Finally, it is noted that the recommendations made herein do not address compliance with local, state and federal regulations pertaining to the handling or processing of hazardous materials and waste or to the health effects of such substances. Therefore, follow-up evaluation by company experts or outside consultants should be done to assure compliance with all applicable regulations and for good operating practices.

TABLE OF CONTENTS

1. SUMMARY OF FINDINGS AND RECOMMENDATIONS

The current manufacturing operations in the plant lead to the generation of several significant waste streams. The streams identified in this study are those listed in the table below:

Table 1: Waste Streams

Plant/Process Source	Waste Stream Components	Approximate Annual Production Rate
1. Raw Milk Processing	CIP 1 (Clean In Place) Truck and clarifier washing	873,600 gal
	CIP 2 (Raw milk line washing)	200,200 gal (total for all milk processes)
	*Milk Solids	65,000 gal
	Milk Spills and Leaks (including contaminated milk from HTST press)	394,000 gal (total for all milk processes)
	Drip Pan Waste	65,000 gal (total for all milk processes)
2. Pasteurized Milk	HTST (High Temperature Short Time) Press Water Rinse	162,500 gal (total for milk and fruit drink processes)
	HTST Acid Wash Water	136,500 gal (total for milk and fruit drink processes)
	Milk Spills and Leaks	See Raw Milk Processing
	CIP 3 (Pasteurized milk line washing)	343,200 gal (total for all milk processes)
	Cooling Water	7,488,000 gal (total for all processes)
	Steam Condensate	4,300,000 gal (total for all processes)
	Drip Pan Waste	See Raw Milk Processing

*These are the only wastes which are shipped off-site (as a non-hazardous waste). The remaining liquid waste streams are disposed of without treatment directly to the municipal sewer.

3. Buttermilk	Steam condensate Waste Milk Cooling Water Drip Pan Waste CIP 3 Waste	Quantities for waste streams are given above under raw milk processing and pasteurized milk
4. Chocolate Milk	HTST Water Rinse HTST Acid Wash Water CIP 2 Waste Contaminated Milk Drip Pan Waste Steam Condensate Cooling Water	Quantities for waste streams are given above under raw milk processing and pasteurized milk
5. Ice Cream Mix	HTST Water Rinse CIP 2 Waste CIP 3 Waste Contaminated Milk Drip Pan Waste Cooling Water Steam Condensate HTST Acid Wash Water	Quantities for waste streams are given above under raw milk processing and pasteurized milk

6. Fruit Drinks	Filter backwash	100 gal
	Spills From Mixing Tank	2,080 gal
	Spills From Filling Machines	2,080 gal
	HTST Fruit Drink Waste	2,080 gal
	Cooling Water	(See Pasteurized Milk Process)
	Steam Condensate	(See Pasteurized Milk Process)
	HTST Water Rinse	(See Pasteurized Milk Process)
	HTST Acid Wash Water	(See Pasteurized Milk Process)
7. Waste Water	All of the Above Except Milk Solids and Drip Pan Waste to Hog Feed Plus Condenser Water, Daily Sanitizing, Waste Water from Floor Washing, and Cooling Water	37,700,000 gal
8. Blow Molding	Dust	1,300 gal

Based on considerations and analyses summarized below, the following recommendation for waste reduction is made:

Table 2: Waste Minimization Opportunity

Recommended Measure	Waste Stream Identification	Projected Annual Reduction	Net Cost Savings ($/yr)	Payback (yrs)
1. Institute waste management plan	Milk Water	147,810 gal 14,601,600 gal	320,807	2.1

II. PLANT BACKGROUND

A. Facility Characteristics

Assessment Data

Assessment Report Number: 17

Plant Location:

Assessment Audit Dates:

Principal Products: Pasteurized milk, cream, buttermilk, chocolate milk, ice cream mix, and fruit drinks, plastic jugs

SIC Code(s): 2026

Annual Production: Approximately gal/yr

Annual Sales: Approximately million

Number of Employees:

Operating Schedule:

Manufacturing: 17 hrs/dy, 5 dys/wk, 52 wks/yr

1st shift: 7:00 AM - 3:30 PM (Full production)

2nd shift: 3:30 PM - 12:00 AM (Full production)

3rd shift: 12:00 AM - 7:00 PM (Clean up)

Office: 8 hrs/dy, 5.5 dys/wk, 52 wks/yr

8:00 AM - 5:00 PM

Energy Sources: Electricity, Natural gas, Propane (back-up)

Plant Building Characteristics

Number of Buildings: 1

Total Plant Area:

C. Overview of Manufacturing Process

This plant produces several dairy products as well as a fruit drink product. Dairy products produced include pasteurized milk, cream, buttermilk, chocolate milk, and ice cream mix. Raw materials used in the production of dairy products include raw milk, pre-prepared cultures, chocolate powder, fructose, sucrose, milk powder, stabilizers, and vanilla. Fruit drinks of varying fruit juice concentration and flavor are also produced in this plant. Raw materials for juice products include water, preservatives, liquid juice concentrate, sucrose, and fructose. Finally, the plant manufactures milk jugs on-site from HDPE pellets. Unit operations for each process are listed below.

Raw Milk Processing

1. Fresh milk is received in trucks and pumped through a clarifier which removes solids.
2. Filtered milk is then cooled in a cooling press.
3. Five percent of the milk is shipped to other dairies and the remaining 95% is stored in a silo.
4. From the storage silo 40% of the milk enters a centrifuge where cream is separated. The cream (light fraction) and the separated milk (skim milk) (heavy fraction) are then pumped to separate 6,000 gallon storage tanks.
5. The remaining 60% of the milk from the storage silo is mixed in a processing blender with skim milk from the skim milk storage tank as needed to achieve the desired butterfat percentage in each product.
6. From the processing blender the milk is distributed in varying amounts to the pasteurized milk process, chocolate milk process, and the ice cream mix process. Skim milk from the skim milk storage tank is used in the buttermilk process.

Pasteurized Milk:

1. In a batch operation milk is received from the processing blender and the skim milk storage tank and enters a high temperature short time (HTST) press where the milk is pasteurized and homogenized.
2. Milk is then stored in a 10,000 gallon tank.
3. From the storage tank milk is packaged and transferred to a storage cooler before shipping.

Buttermilk:

1. In a batch operation milk is pumped from the skim milk storage tank to one of two processing tanks where the milk is inoculated with "ready-set" cultures and bacterial growth is allowed to occur.

2. Following a period in the processing tanks, milk is packaged and transported to the storage cooler.

Chocolate Milk:

1. In a batch operation milk is pumped from the processing blender to a mixing tank where powdered chocolate and liquid fructose are added.
2. Next, the chocolate milk blend is pasteurized and homogenized in a HTST press.
3. Chocolate milk is then transferred to a storage tank.
4. From the storage tanks chocolate milk is packaged and transported to the storage cooler where it is stored until shipment.

Ice Cream Mix:

1. In a batch operation milk received from the processing blender is pumped to another blender in which it is mixed with cream, milk powder, sugar, stabilizers, and vanilla.
2. Depending on the batch size, the blended mixture is transferred to one or more of three holding tanks.
3. The mixture is then homogenized and pasteurized in a HTST press.
4. Following processing in the HTST press the mixture is stored in two storage tanks.
5. Finally the mixture is packaged and transported to a cooler for storage until shipment.

Fruit Drink:

1. In a batch operation city water is pumped through a charcoal filter for filtering and dechlorinization.
2. Filtered water is then pumped to a mixing tank where preservatives, liquid juice concentrate, and sucrose or fructose are added.
3. The mixture is then pumped to a HTST press, and into a surge tank.
4. Following the surge tank the fruit drink is packaged and transferred to a storage cooler where it remains until shipment.

Blow Molding:

1. New High Density PolyEthylene (HDPE) pellets are mixed with regrind (recycled) HDPE pellets in a blend hopper.
2. From the hopper, the pellets are gravity-fed into an extruder with a mold for blow molding.
3. Resulting jugs from the molds are trimmed of excess plastic, tested for leaks, and labeled. Jugs are manufactured continuously during production hours.
4. Finally, jugs are transferred to the milk filling lines.

B. Previous Waste Management Efforts

1. Waste water streams were redirected and joined with the more milk contaminated waste streams before discharge to the municipal sewer for dilution

2. Drip-pans were installed to contain milk spills and leaks. Waste milk is then transported off-site by a local farmer and used as hog feed.

3. Solids from the clarifier are trucked off-site by a local farmer and used as fertilizer.

C. Waste Management and Materials Cost

In general, plant costs associated with the management of waste relates to several types of direct and indirect expenses. The major categories include:

1. Fees paid to outside organizations to:
   a. process waste on site
   b. pick up and remove waste from site for treatment, disposal and/or reclamation
   c. waste stream sampling and testing
2. Equipment depreciation and operating cost associated with waste processing on-site
3. Plant personnel labor costs for waste stream sampling and testing and for handling and/or on-site recycling
4. Plant personnel record keeping and reporting costs for waste
5. Surcharges for excessive strength waste water above the standard discharge limits
6. Sewer charges assessed by the local POTW

Although some of these costs are often somewhat difficult to assess accurately, based on information provided by plant personnel in your plant, the following summary of waste management costs are presented below.

This dairy is currently not paying any expenses in category 1a. However, in expense category 1b, the company pays an outside organization to haul milk solids from the clarifier and to haul off-site milk waste collected in drip pans to be used as hog feed. Clarifier waste is generated at a rate of 65,000 gallons per year at a total removal cost of $8,008 while there is no cost for hog feed removal. Also, in category 1c the plant is currently paying an organization to monitor, on a weekly basis, plant effluent at a charge of $5,200 per year.

In expense category 2, there is no equipment presently on-site associated with waste processing.

In category 3, the estimated plant labor costs for waste water sampling and testing and for handling waste is estimated as:

$$\left(\frac{\text{hrs}}{\text{wk}}\right)\left(\frac{\text{wks}}{\text{yr}}\right)\left(\frac{\$}{\text{hr}}\right) = \$1{,}872/\text{yr}$$

Expense category 4, associated with office record keeping for waste, is estimated as:

$$\left(\frac{\text{hrs}}{\text{wk}}\right)\left(\frac{\text{wks}}{\text{yr}}\right)\left(\frac{\$}{\text{hr}}\right) = \$13{,}000/\text{yr}$$

The primary cost experienced by this dairy for the disposal of waste, expense category 5, associates with surcharges imposed by the local utility company for the discharge of waste water which is above standard limits for chemical oxygen demand (COD), total suspended solids (TSS), ammonia nitrogen (NH_3-N_2) and oil and grease. Each of these parameters are monitored for the plant efficiency on a weekly basis on a 24-hour composite-sample type method. In addition, pH must be monitored daily by the "grab-sample" technique. At this time, the local utility has decided to not charge the dairy for biological oxygen demand (BOD) non-compliance. Current surcharge rates are presented in the table below:

Table 3: Surcharge Rates

Parameter	Concentration Range	Charge Rate
COD	600 mg/l to 900 mg/l	$0.30/lb
	over 900 mg/l	$0.60/lb
TSS	300 mg/l to 400 mg/l	$0.24/lb
	over 400 mg/l	$0.48/lb
NH_3-N_2	25 mg/l to 30 mg/l	$1.16/lb
	over 30 mg/l	$2.32/lb
Oil and grease	100 mg/l	$200/mo
pH	6-9	$200/mo

A summary of costs incurred during 1989 are presented below:

COD	$111,877/yr
Oil and grease	$1,800/yr
TSS	$3,226/yr
NH3-N2	$63/yr

TOTAL = $116,966/yr

In the final category, total sewer charges assessed by the local POTW for the year 1989 was $58,737.

Thus, a summary of these expenses is:

Fees to outside organizations

($8,008/yr + $5,200/yr + $116,966/yr + $58,737) = $188,911

Internal company expenses:

($1,872/yr + $13,000/yr) = $14,872/yr

TOTAL = $203,783/yr

In order to compute potential cost savings for waste reduction measures presented below in Section IV, it is convenient to break down the above categorized costs into those for specific waste streams. All percentage breakdowns can be obtained by examining respective flow diagrams:

I. Milk solids and waste milk from drip pans:

i.	Off-site removal costs	=	$8,008/yr
ii.	On-site handling and processing costs:		
	Labor: (50%)($1,872/yr)	=	$936/yr
	Administrative: (5%)($13,000/yr)	=	$650/yr
	Subtotal	=	**$9,594/yr**

II Waste Water Surcharges

i.	Off-site removal costs:		
	($116,966 + $58,737 + $5,200)	=	$180,903/yr
ii.	On-site handling and processing costs:		
	Labor: (50%)($1,872/yr)	=	$936/yr
	Administrative: (95%)($13,000/yr)	=	$12,350/yr
	Subtotal	=	**$194,189/yr**
	Total	=	**$203,783/yr**

IV. WASTE MlNlMlZATION OPPORTUNITIES

On rhc following pages a series of analyses of proposed mcasurcs for a waste minimization opportunity (WMO). The write-up contains a summary of your current manufacturing proccsscs. an overall statement of waste generation and a recommended action Also included is the expected amounts of waste reduction and a simple payback for those measures having capital expense costs.

In reviewing the recommendations contained herein, it should be particularly noted that economic savings in most cases address only raw material cost avoidance and reduction of present and future elimination or reduction of waste removal. Other savings not quantifiable in the limited present study include a wide variety of possible future costs rclatcd to thc cited waste such as those related LO changing regulations.

WMO No. 1

INSTITUTE WASTE MANAGEMENT PLAN

Current Practice and Observations

Currently, this dairy has several problem areas including excessive water use, excessive amounts of waste water contaminants, and employee-management coordination in the area of waste minimization and reduction. In the case of this facility all of these problem areas are highly interrelated, therefore, they will be dealt with in a single WMO. First, excessive water is used during the cleanup shift. Plant personnel report that among the 24 hoses used for floor washing water is allowed to flow from all for the entire shift. Also, excessive water is used during milk spill cleanups during the main production shift. It is estimated that 16,224,000 gallons per year are used for cleanup. Other areas of excessive water use include boiler feedwater (due to lack of condensate return), condenser cooling water, and homogenizer piston cooling water (due to a lack of recycling). In all three areas, city water is received, run through its respective process, and then discharged to the sewer with no effort at use minimization or recovery. Water use for each is 4,300,000 gal/yr, 7,363,660 gal/yr, and 7,488,000 gal/yr respectively. Currently the plant is paying $53,833 per year for incoming water and paying an additional $58,737 per year in sewer costs associated with water through flow in the plant.

At present, since all waste streams are piped to a single discharge point, cleanup water, boiler feedwater, condenser cooling water, and homogenizer cooling water are important for dilution of milk waste. The effectiveness of this approach is questionable as the plant currently incurs $116,966 per year in sewer surcharges for excessive strength waste. Sewer surcharges are based on unusually high concentrations of COD, TSS, oil and grease, ammonia nitrogen, and pH. In the last area of concern, it appears that in this dairy employee awareness and training programs have been overlooked as important measures in waste reduction.

Recommended Action

Institute a waste water management plan. This plan should consist of an employee training and awareness program leading to reduced quantities of waste and the on-site processing of high strength waste water.

Anticipated Savings

a. Employee Awareness and Training Program

Plant personnel report approximately 2% of the total amount of milk purchased annually is lost during processing. This corresponds to gallons of milk annually, of which approximately gallons result from milk spills and leaks throughout the plant which are then discharged to the sewer. Based on discussions with plant personnel, 50% to

80% of the milk spills are due to human error. For the purposes of this WMO the more conservative figure of 50% will be used. Through the institution of an on-going aggressive employee awareness program (i.e., correctly placing drip pans under machines, not allowing drip pans to overflow) 75% reduction in waste can be expected. Milk loss reduction will, of course, result in an increase of final product and revenue. This will result in savings of:

Milk Savings:

gal/yr) = 147,810 gallons/yr

Increase Revenue From Milk Loss Reduction:

(147,810 gal/yr)($1.67/gal) = $246,843 /yr

The current wholesale price for processed milk is taken from data provided on the plant background page.

Once milk has been leaked or spilled, water used to wash it into the drain should be minimized. For example, squeegees should be used for initial spill clean up followed by spraying down with water hoses fitted with high pressure nozzles. Hoses should also be fitted with automatic shut-off nozzles to reduce excess water use during the clean-up shift. Due to the excessive amount of water (16,224,000 gal/yr) currently being used during the clean-up shift it is estimated that 90% water reduction can be realized. Even at the reduced water consumption level 6,240 gallons of water will be used for clean-up each day. Water saving will be as follows:

Water savings:

(90%)(16,224,000 gal/yr) = 14,601,600 gal/yr

Water and sewer cost savings:

(2)(14,601,600 gal/yr)($1.55/1,000 gal) = $45,265 /yr

b. Treatment of High Strength Waste Water

This dairy currently discharges high strength waste water well over the local POTW's effluent standards. Once milk spills and water used for clean-up have been minimized it is still expected that the plant will have high strength waste water discharges, just less of it. As discussed earlier, the plant has particular problems with high COD loading levels. Annual surcharges for the excessive strength waste of $116,966 are incurred by the plant. Activated sludge treatment systems have been found to be 90-98% efficient in the removal of COD. BOD, TSS, and nitrogen ammonia are also significantly reduced. This type of system has a relatively low capital cost, however, operating costs can be fairly high due to the energy intensive nature of the system. This system also has the ability to cope with shock loads which makes it well suited to this plant due to its fluctuating COD levels. A part-time

operator is required for proper operation of this system. At 90% reduction of COD levels in the waste water the plant would be in compliance with the POTW and surcharges would be removed.

As discussed earlier in Section C, labor costs will not be affected as plant personnel will want to continue to monitor plant effluent. Administrative costs, however, will be significantly reduced due to the elimination of the paper work involved with surcharge billing. The administrative cost reduction is as follows:

Administrative cost reduction:

(95%)($12,350/yr) = $11,733/yr

The local POTW will most likely require weekly testing of the plant's effluent, therefore, the $5,200 paid annually to an outside company to test the plant's effluent will not be eliminated.

Increased cost due to maintenance, operation (including the cost associated with a half-time operator), and utilities for the activated sludge system is estimated to be $100,000/yr. Therefore, the total cost savings is:

($246,843/yr + $45,265/yr + $11,733/yr + $116,966/yr - $100,000/yr) = $320,807/yr

Implementation

Implementation of this WMO will include the establishment of an employee training program which can be implemented in-house at no cost and the design and construction of an activated sludge system, the purchase and retrofit of high pressure automatic shut-off nozzles, and the purchase of long handled squeegees. The activated sludge system should be located outside in the rear of the plant. Milk contaminated waste should be redirected to the rear of the plant for treatment while "clean" water (i.e., boiler condensate, condenser cooling water, and homogenizer piston cooling water) should be added to post treatment water. This will require some repiping and some additional piping. The costs associated with this WMO are as follows:

Materials:

24 High pressure automatic shut-off nozzles	= $2,400
30 Long handled squeegees	= $3,000
2 Clarifiers ($65,000 each, installed)	= $130,000
Aeration tank	= $85,000
Aeration equipment and controls	= $100,000
Re-piping and plumbing	= $100,000

Labor:

Design:

(2 man-months)(4.3 wk/mo)(40 hrs/wk)($100/hr) = $34,400

Construction:

(5 man-yrs)(12 mo/yr)(4.3 wk/mo)(40 hrs/wk)($20/hr) = $206,400

TOTAL ESTIMATED IMPLEMENTATION COST = $661,200

Based on the above cost savings and implementation, the simple payback period for this WMO is:

$$\frac{\$661,200 \text{ implementation cost}}{\$320,807 \text{ savings}} = 2.1 \text{ years payback}$$

V. APPENDICES

A. Physical Property Data

Substance	Specific Gravity Density	Source of Data
AC30	1.250	MSDS
Mandate	1.270	MSDS
Principal	1.342	MSDS
Milk	(8.63 lb/gal)	Plant Personnel

B. Bibliography of Relevant Publications

1. U.S. Congress, Office of Technology Assessment, Serious Reduction of Hazardous Waste: For Pollution Prevention and Industrial Efficiency, OTA-ITE-317 (Washington, D.C.: U.S. Government Printing Office, September 1986).

2. State of Tennessee, Department of Health and Environment, Division of Solid Waste Management, Tennessee's Hazardous Waste Management Regulations for Generators and Transporters of Hazardous Waste in Tennessee, (Customs House, 701 Broadway, Nashville, Tennessee 37219-5403).

3. State of California, Department of Health Services, Toxic Substance Control Division, Alternative Technology Section, Hazardous Waste Reduction Guidelines For Environmental Health Programs, May 1987 (Toxic Substances Control Division, 714/744 P Street, P. O. Box 942732, Sacramento, CA 94234-7320).

4. Goronszy, Mervyn C., White, John, "Activated Sludge Treatment of High COD Food Processing Wastes," Proc. 1988 Food Processing Waste Conference, Georgia Institute of Technology, GTRI, O'Keefe Building, Room 037, Atlanta, GA 30332.

5. Viessman, Warren, Jr., and Hammer, Mark J., Water Supply and Pollution Control, fourth edition Harper and Row, 1985.

6. Woods, John, "System Makes Sense for Dairy Waste Water," Dairy Field, September 1987: 76-84.

7. Byrne, Maureen, "Cutting The Costs of Effluent Treatment," Food Manufacture, August 1987: 24-27.

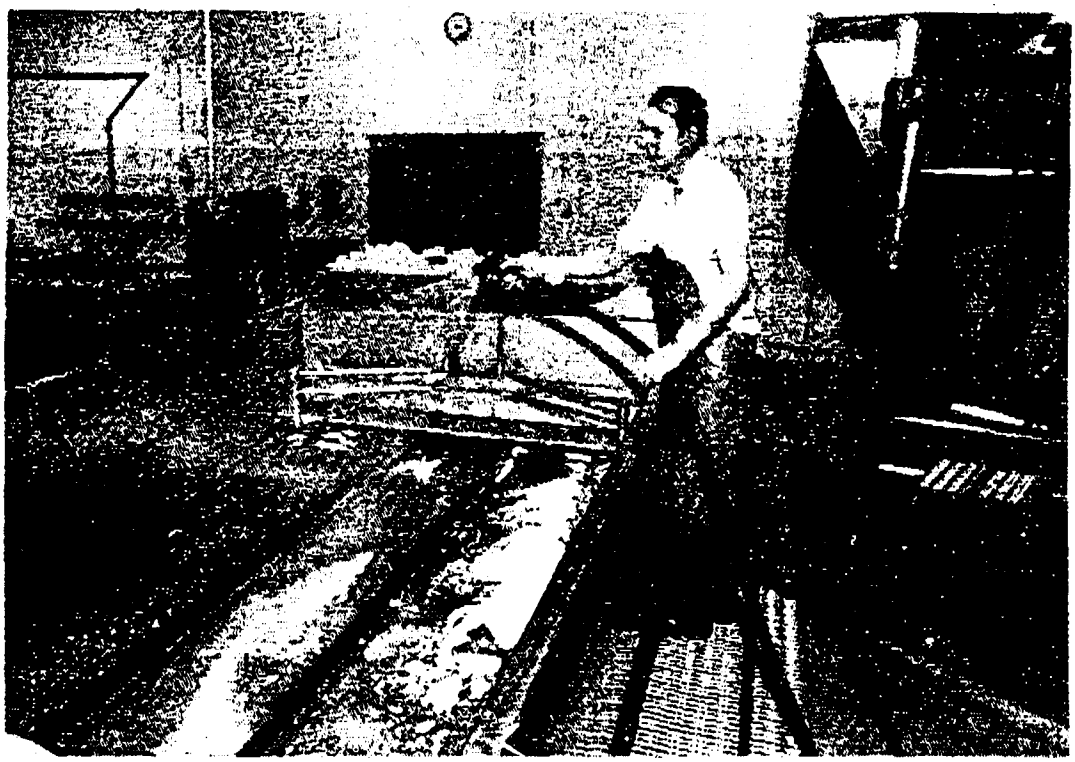
8. The North Carolina Agricultural Extension Service. Cut Waste To Reduce Surcharges For Your Dairy Plant. Food Science Extension, North Carolina State University, Campus Box 7624, Raleigh, North Carolina 27695-7624.

9. The North Carolina Agricultural Extension Service. Liquid Assets For Your Dairy Plant. Food Science Extension, North Carolina State University, Campus Box 7624, Raleigh, North Carolina 27695-7624.

FACT SHEET 1

AGRIBUSINESS SECTOR

CLEAN TECHNOLOGY
Cheese Production



Cleaner effluent at lower cost. What more can you ask for? The Oka cheese factory proves that it is more profitable to produce without pollution than to invest in depollution

Québec

In search of clean effluent

The Coopérative Agropur produces specialty cheeses at its plant in Oka, generating 625 kg of BOD_5 waste a day.

Concerned with the quality of the environment, the cooperative decided to process its waste water. In January 1985, it inaugurated a purification plant that used biological treatment processes. Its objective was to obtain effluent that respected the following criteria:

biochemical oxygen demand (BOD_5): 30 mg/l
suspended solids (SS): 30 mg/l

Following expansion, the pollution load rose. The plant, as designed, could no longer produce the desired results. A sample taken by the ministère de l'Environnement showed that the concentration of pollutants exceeded permissible levels; the department asked the cooperative to take steps to meet environmental standards.

An economical solution

Agropur had to find a solution. Further biological treatment? Perhaps. But at what cost? The only alternative: reduce the amount of pollutants discharged at the source.

Agropur prepared for a thorough examination of the various stages of its industrial process, with three objectives in mind:

- to identify the major sources of pollution in the industrial process;
- for each source, to define the means that could be taken to reduce pollution;
- to evaluate the cost of applying such measures.

Once this exercise had been completed, the cooperative compared the cost of introducing a second water treatment process to the cost of applying measures to reduce pollution at the source. And they bowed to the evidence. Clean technology would save $270 000.

Clean technology would also reduce the loss of raw material by two-thirds, an appreciable extra saving.

The cooperative adopted the alternative solution and decided to involve all its personnel.

QUÉBEC'S CHEESE INDUSTRY HIGHLIGHTS

- **A huge production**

In 1985, dairy production reached 2 840 billion litres of milk, 30 percent of which was used to make cheese

Processing 10 litres of milk gives

- 1 kg of cheese
- 9 kilograms of whey

The whey is used mainly in the preparation of foodstuffs and animal feed.

- **Substantial losses of raw material**

In Québec, between one and 12 percent of the milk processed in the traditional manner is lost in the effluent. The average loss is about five percent.

Clean technology reduces this loss considerably. The Oka cheese factory cut its losses in milk and milk by-products back from nine to two percent.

COMPARATIVE COST OF A SECOND BIOLOGICAL TREATMENT AND THE APPLICATION OF INTERNAL MEASURES TO REDUCE POLLUTION

	Second biological treatment	Internal measures
Capital expenditures	$350 000	$80 000
Operation	$ 20 000	$ 0
Energy	$ 6 250	$ 0

Everyone lends a hand

Teamwork was the order of the day. The technical experts from Agropur's corporate headquarters offered their know-how to the directors at Oka. All the employees of the plant were consulted on the ways to cut back losses and improve procedures. Each and every suggestion was conscientiously examined.

In less than a year, the team had looked into every source of pollution at each stage of the industrial process:

- milk delivery
- pasteurization
- manufacture of cheese
- moulding
- disinfection of pipes.

Steps were gradually taken to recuperate products and by-products, modify the industrial process and introduce state-of-the-art technology.

Recuperating cheese fines using a cotton filter

From the simple to the complex – in three phases

The team tackled all the sources of pollution at each stage of the process. They concentrated their efforts first on the simplest steps to be taken, moving gradually towards the most complex. Three phases are clearly identifiable.

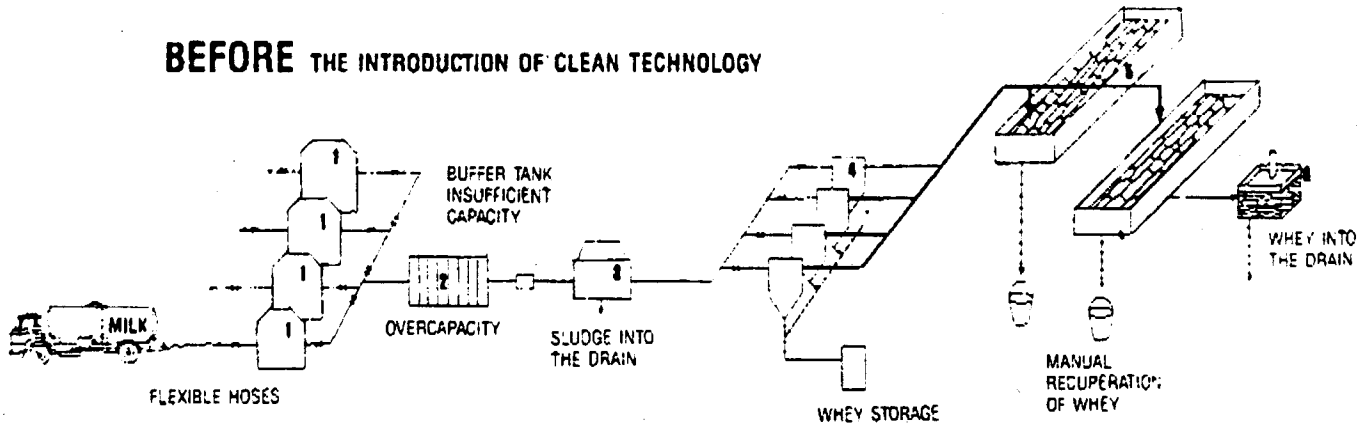
Phase I: Action in which everyone could participate	Milk reception		Manufacture of cheese		Moulding the cheese	
	Action taken	Means used	Action taken	Means used	Action taken	Means used
Operations preceding purification, which did not affect the manufacturing process per se but touched rather on the sound management of water, raw materials and the finished product.	• elimination of losses when stocking silos • reduction in wash water used for equipment and trucks	• rigid pipes with valves • spray guns	• recuperation of cheese fines • recuperation of cheese on floor • recuperation of separator sludge	• cotton filters • rubber dust pan and broom • manual recovery	• recuperation of whey	• drain channels
Results • 40 percent reduction in organic load • 40 percent reduction in hydraulic load • productive use of cheese fines (50 kg per production day) • productive use of whey.						

Phase II: Modifications to the process	Pasteurization		Manufacture of cheese	
	Action taken	Means used	Action taken	Means used
Changes that did not modify the nature of the process but rather improved the process by reducing pollution. They are reversible.	• elimination of milk loss • decrease in the volume of wash and disinfection solutions	• adjustment in the size of the buffer basin and the pasteurizer to provide a continuous flow to the vats	• reduction of the quantity of milk in vat supply lines and, consequently, drop in washing required • reduction of rinse water and disinfecting solutions in pipe supplying tables • recuperation of initial rinse water from whey pipes	• main and valves allowing selective filling of vats • rigid pipe replaced by pipe with ball and socket joint • pumping into the storage tank
Results • 20 percent reduction in organic load • increase in production • decrease in use of wash products				

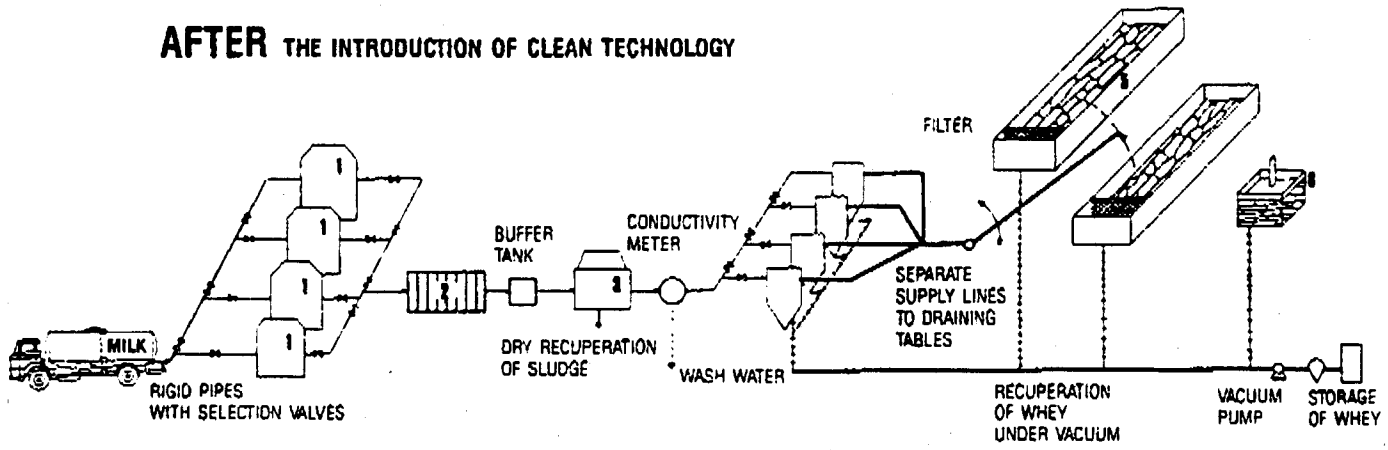
Phase III: Major changes to the process itself	Milk delivery		Manufacture of cheese		At all stages of the process (disinfection)	
	Action taken	Means used	Action taken	Means used	Action taken	Means used
Radical changes to the process, bringing about a noticeable and permanent reduction in pollution.	• reduction in milk losses	• smaller valve	• recuperation of milk and initial rinse water from vat supply lines	• conductivity meter	• elimination of phosphorous	• use of phosphorous-free products
Results • 20 percent reduction in organic matter • elimination of phosphorous • increase in production						

The Oka experience A SUCCESSFUL TEAM EFFORT

BEFORE THE INTRODUCTION OF CLEAN TECHNOLOGY



AFTER THE INTRODUCTION OF CLEAN TECHNOLOGY



MILK	1 STORAGE TANKS	4 CHEESE VATS
WHEY	2 PASTEURIZER	5 DRAINING TABLES
WASTE WATER	3 SEPARATOR	6 CHEESE PRESS
CURDS		

Agropur gains on several planes

- **Respect for environmental standards**

By reducing the organic load by 80 percent before biological treatment, the cooperative obtained a final effluent 98 percent purified. The amount of phosphorus evacuated was cut by 93 percent before treatment.

- **Reduction of treatment requirements**

Measures taken to reduce pollution at the source eliminated the need to double existing biological treatment. Agropur thus saved $270 000.

- **Reduction in loss of raw material**

A **nine percent** loss of milk, in the form of milk or milk derivatives, was reduced to **two percent.** Productivity rose in consequence.

- **Productive use of recuperated fines**

The **recuperation** of cheese fines represented **50 kg** a day of cheese that could be used as a basis for other products.

- **Improved working conditions**

All the steps taken contributed to a safer, more pleasant work environment. The floors throughout the plant are now clean and dry.

- **A barometer for operations**

Since everyone in the plant knows that the quality of the effluent is a reflection of the quality of the plant's operations, they can all contribute to its sound management.

O
Appendix F - Handouts from the Workshop

- **Pollution Prevention - Federal Perspective**
  Ms. Lisa Walls, Environment Canada

- **Pollution Prevention Planning in BC**
  Mr. Derek Knudsen, BC Ministry of Environment, Lands and Parks

- **Pollution Prevention Workshop for the Dairy Processing Industry - GVRD Perspective**
  Mr. Jeffrey Gogol, Greater Vancouver Regional District

Pollution Prevention - Federal Perspective
Ms. Lisa Walls, Environment Canada

Pollution Prevention - Federal Perspective

Lisa Walls
Environment Canada

National Policy and Regulation

- Fisheries Act
- Canadian Council of Ministers of the Environment
- Pollution Prevention Strategy
- Canadian Environmental Protection Act
- National Pollutant Release Inventory

P2 Technical Guidelines

- *Dairy Processing Industry - DRAFT*
- Automobile Recycling Industry
- Commercial Car and Truck Washes
- Fish Processing Operations
- Reference Workbook: Pollution Prevention Plans

Introduction

- Overview of national and federal policy, legislation and guidelines respecting pollution prevention
- Presented by Lisa Walls, Head, Technology and Pollution Prevention Section, Environmental Protection Branch, Environment Canada, Pacific & Yukon Region. Tel. (604) 666-6262

Fisheries Act (Section 50)

- Deposit of deleterious substance prohibited
  - …No person shall deposit or permit the deposit of a deleterious substance of any type in water frequented by fish or in any place under any conditions where the deleterious substance or any other deleterious substance that results from the deposit of the deleterious substance may enter any such water.

CCME

- *A National Commitment to Pollution Prevention*, November 1993
- 13 environment ministers from the federal, provincial and territorial governments undertook to advance P2
- Confirmed shift in emphasis from react and cure to ***anticipate and prevent***

Federal Pollution Prevention Strategy (June 1995)

- Goals and actions aimed at achieving P2 within the federal government, with other governments, the private sector, Canadians, and the international community
- Eg. With the private sector:
  - help SME's improve their environmental performance
  - develop innovative pollution prevention programs

New CEPA

- Renewed CEPA *(Bill C-74)* December 1996
- What's new - P2 ?
  - powers to require pollution prevention planning for substances declared toxic under CEPA
  - national pollution prevention information clearinghouse
  - awards program to recognize voluntary pollution prevention efforts

NPRI

- Stakeholder review on proposed modifications to NPRI
- For 1997 reporting:
  - voluntary reporting of off-site recycling, reuse and recovery (3Rs)
  - mandatory qualitative reporting of P2 activities
- For 1998 reporting:
  - mandatory reporting on NPRI substances transferred off-site for recycling, recovery and re-use

Pollution Prevention Planning in BC

Mr. Derek Knudsen
BC Ministry of Environment, Lands and Parks

Pollution Prevention Planning In BC

Need For Change

Evolution of P2

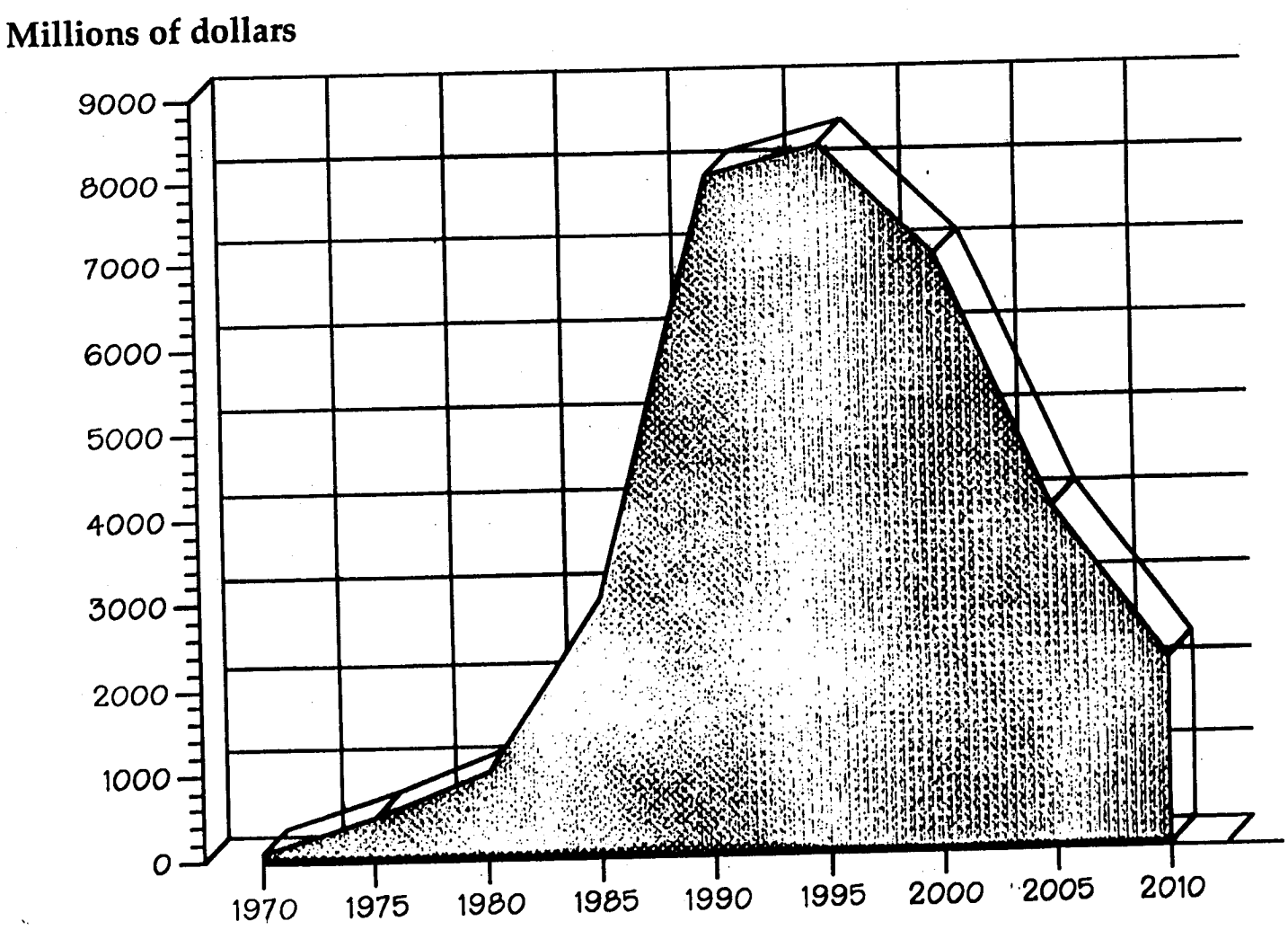
P2 Planning Process in BC

Pollution Prevention Planning

Need For Change

- Public demand for Env. Protection
- Decreasing Gov't resources
- Greater community involvement
- International agreements and standards
- Shift in corporate culture
- Pollution Control reaching effective limits

Historical and projected growth in U.S. hazardous waste management



Source: Environmental Business International Inc. 1994

Pollution Prevention Planning In BC

Evolution of P2

- P2 initiatives are not new
  - ☑ New regulatory mechanisms needed
- P2 results in improved production efficiency
- P2 Enhances Environmental Protection
- P2 results in value-added opportunities

In just one year, the member companies of the Chemical Manufacturers Association captured 640 million pounds of chemical pollutants for recycling.

Find out more about how our members and partners are working for change. Call 1-800-624-4321.

RESPONSIBLE CARE

CHEMICAL MANUFACTURERS ASSOCIATION

Pollution Prevention Planning In BC

P2 Planning Process in BC

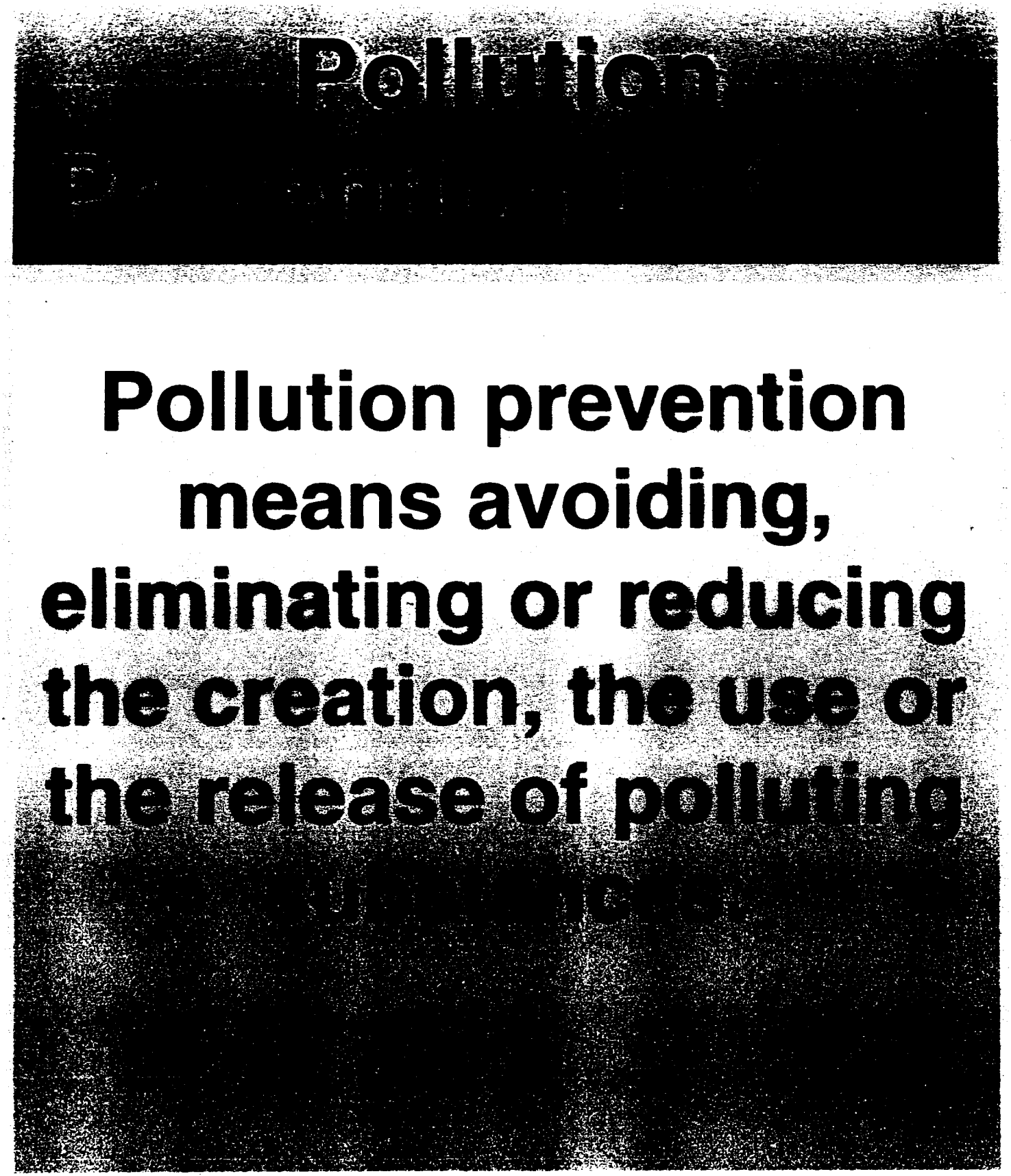
BC's Unique Process

- Integrates community and employee ideas
- Establishes long-term environmental authorizations
- Uses the P2 Hierarchy

Pollution Prevention Planning In BC

P2 HIERARCHY

- Avoidance, elimination, or substitution of polluting products
- Reduction in the use of polluting products
- Elimination of, and reduction in, the generation of polluting by-products
- Reuse and recycling of polluting by-products
- Recovery of energy from polluting by-products, and if necessary
- Treatment or containment of polluting residual by-products
- Remediation of contaminated sites


Pollution
Pollution prevention means avoiding, eliminating or reducing the creation, the use or the release of polluting

Pollution Prevention Planning In BC

5 STEP PROCESS

1. Initiating the P2 Planning Process

- ✓ Initiated by the Company
- ✓ Company and MELP establish steering committee
- ✓ Public advisory committee appointed to provide input
- ✓ Steering committee prepares terms of reference for project

Pollution Prevention Planning In BC

5 STEP PROCESS

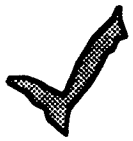
2. Environmental Review

i) The Production System

- Inputs
- Process
- By-products
- Residuals

ii) EMS required for a P2 Authorization

iii) Other EMS Elements



Results in Identification of P2 Opportunities

Pollution Prevention Planning In BC

5 STEP PROCESS

3. Preparing a P2 Plan

- ✓ Identify pollution prevention options for each opportunity
- ✓ Analyze and rank P2 options
- ✓ Select preferred P2actions
- ✓ Prioritize P2 actions for the plan

Pollution Prevention Planning In BC

5 STEP PROCESS

4. P2 Authorization

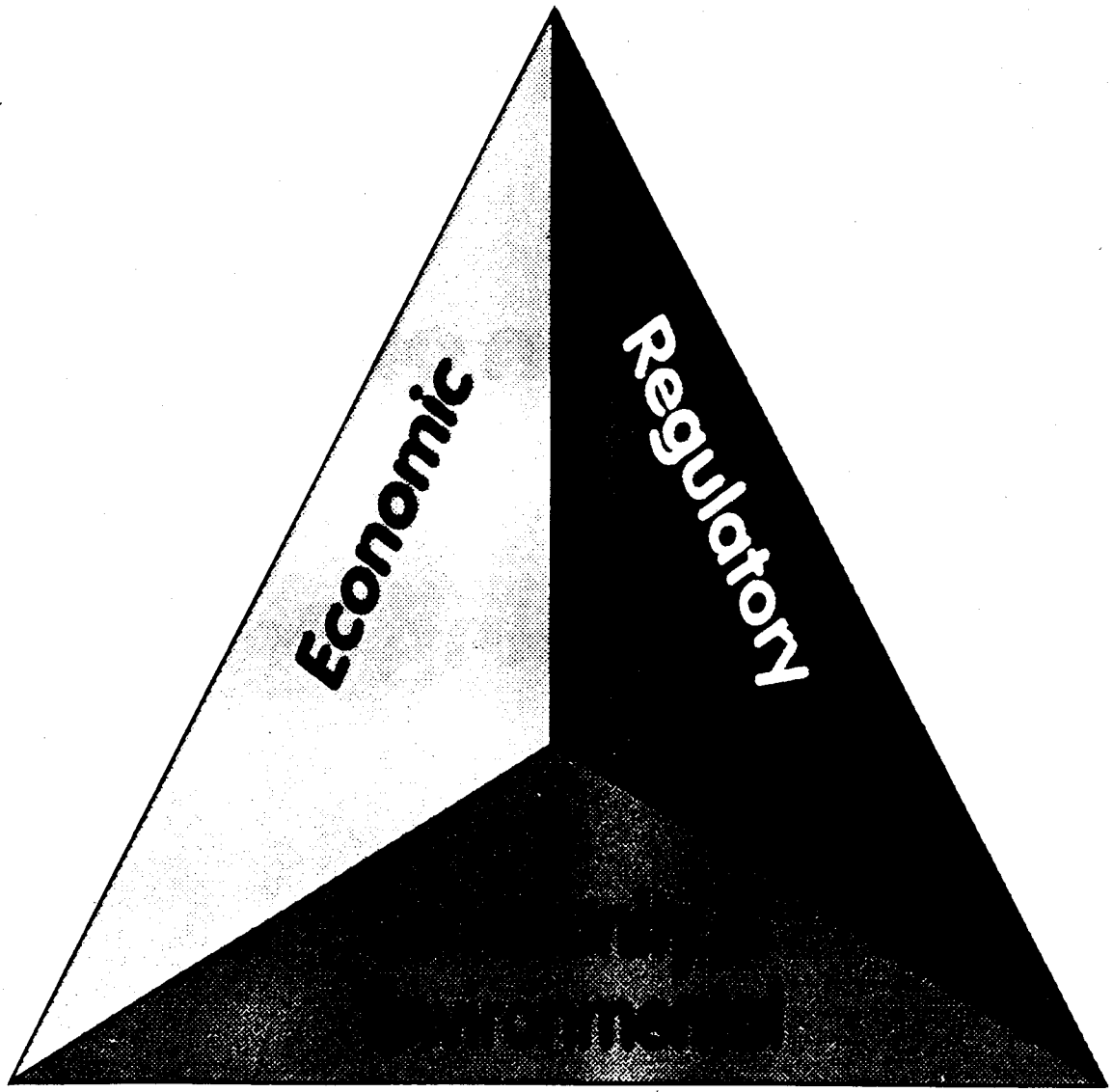
- ✓ Schedule of Actions and Discharge Limits
- ✓ Includes monitoring and reporting

5. Monitoring and Evaluation of the P2 Plan

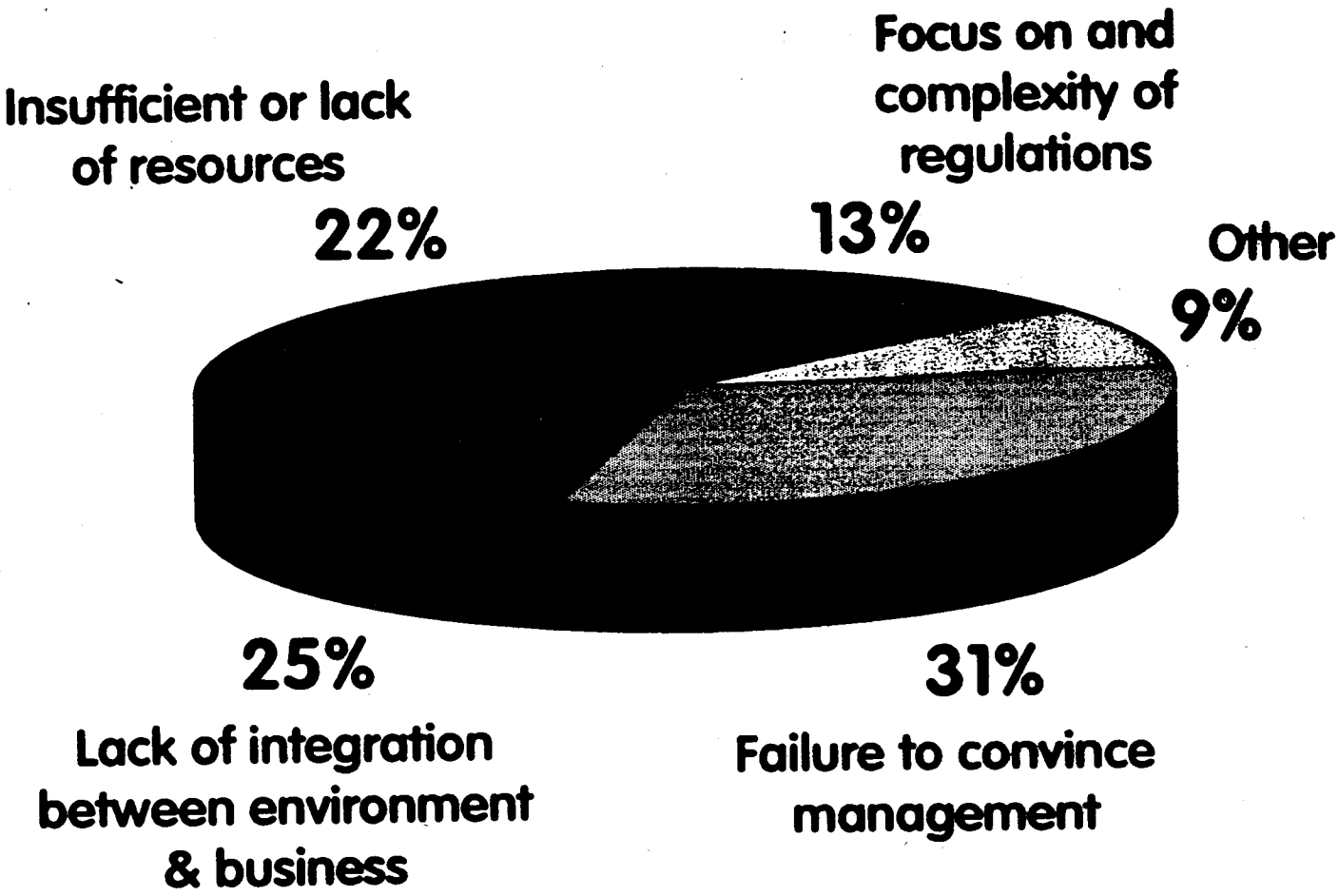
- ✓ Ministry audits the plan

Pollution Prevention Planning In BC

BENEFITS



Internal Roadblocks to Managing Environmental Issues:



Source: Environmental Dimensions, Feb. 9, 1996 based on an A.D. Little International survey.

Pollution Prevention Planning In BC

NEXT STEPS

Seven Demonstration Projects

Ongoing

- **Quarterly meetings with P2 steering committee**
- **Completion of P2 Guide and P2 Toolkit**
- **Training of regional EPP staff**
- **Joint industry / government workshop**
- **Commitment to refine process over time**

BOD/TSS Strategy

- new sewer rate for industry to recover full costs of service(flow, BOD , TSS)
- BOD/TSS strategy and service principles apply to all users of the system
- Bylaw limits of 600 ppm TSS will generally apply
- Bylaw limits of 500 ppm BOD waived
- surcharge fee concept not applied
- no double charging
- business casing for demands of more than 3% of system capacity

Why have we focused on industry?

- Industry wastewater high in strength
- Industry has a relative high demand for capacity-is a major cost driver
- Industry has alternatives to central treatment
- Explicit charges are effective in reducing demand
- Industry has been subsidized by other users

Waste Discharge Permits and Authorizations

Waste Discharge Permits or Authorizations required for

- Category 1 Discharges (>300 m^3 in any 30 days)
- Discharges of Restricted Wastes
- Trucked Liquid Wastes

Sewer Use Bylaw No. 164

- Provides mandate for Source Control to carry out its function.
- Main principles of Bylaw No. 164:
  - Specific types of wastes are prohibited, outright.
  - Specific types of wastes are restricted to an allowable concentration.
  - Waste Discharge Permits or Authorizations required for certain discharges.

Compliance Programs

- Cases of ongoing non-compliance
- Structured plan:
  - problem analysis
  - recommendations & implementation schedule
  - progress and completion reports
- GVRD review and approval
- Failure to commit / complete program:
  - non-compliance list / legal sanctions

Dairy Compliance Programs

- pH 5.5 - 10.5
- Total Suspended Solids (TSS) - 600 mg/L
- Total Oil & Grease (O&G) - 150 mg/L

Components of a Pricing Strategy

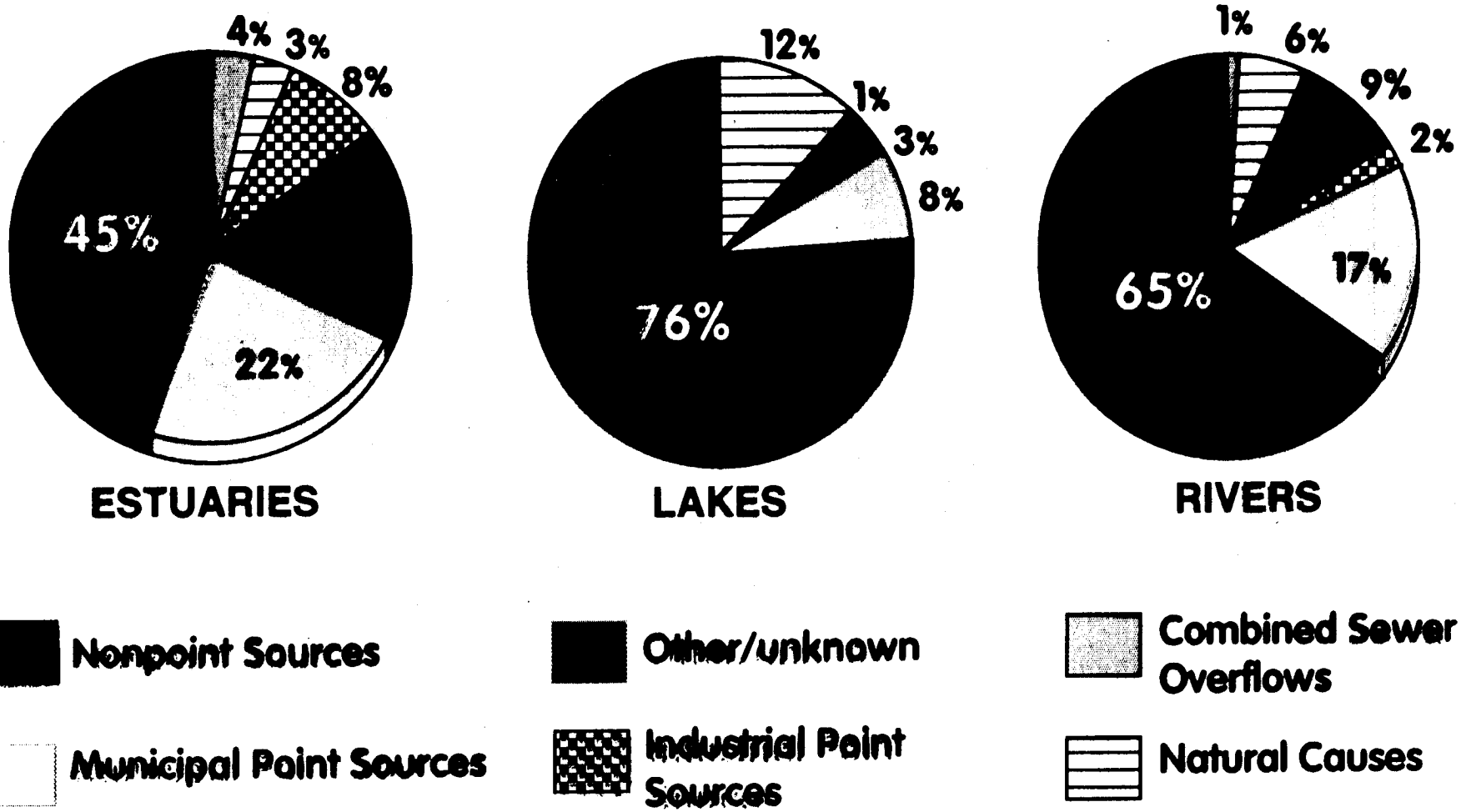
- Usage Charge - to recover O&M costs
- Capacity Charges - to recover capital costs

Pollution Prevention Planning In BC

Concerns With Existing System

- Effectiveness
- Efficiency
- Openness
- Adaptability
- Focus
- Coordination
- Enforcement

Nonpoint Source (NPS) contribution to Water Quality in the U.S.



Pollution Prevention Demonstration Project Schedule

Company	Pre-Envi Review					Environmental Review				P2 Plan				Authorize & Implement				Next Action
	Init'l Mtg	P2PSC	PTOR	PAC	PAC TOR	Workplan	ER	ER Rprt	Public	Analysis	Prioritize	P2 Plan	Public	Auth	Public	Implmnt	Mon&Ev	
Alcan																		PAC endorsed PTOR and PAC TOR. Workplan re drafted. Next PAC and Coordinating Committee meetings January '97.
Cominco*																		Project workplan developed. Company has prepared preliminary ER. Next PAC meeting TBA
Fletcher**																		ER in progress - initial focus on Kraft Mill and Steam Plant. Next PAC meeting scheduled for February 26.
FMC														Postponed			Postponed	P2 plan to be utilized in ISO certification process. Industrial P2 Implementation Unit and Prince Geoge Office assessing P2 Plan
Riverside																		Next Steering Committee and PAC meeting scheduled for January/Feruary; to examine "planned" Opportunities and develop P2 Options for all three mills.
Tilbury																		Next PAC meeting January 16/97 to discuss Scope of ER. Awaiting response from Delta Council regarding their participation in the project
Westcoast																		Next Coordinating Committee & PAC meeting January 13/97. ER in progress.

Init'l Mtg = Initial meeting of MELP & Company
P2PSC = Organize P2 Planning Steering Committee (P2PSC)
PTOR = Develop Project Terms of Reference (PTOR)
PAC = Issue public notice/organize P2 Public Advisory Committee (PAC)
PAC TOR = Develop PAC Terms of Reference (PAC TOR)

Workplan = Develop ER Workplan and Communications Plan
ER = Conduct Environmental Review (ER)
ER Rprt = Prepare ER report (Identify P2 Opportunities)
Public = Notify public and seek input

Analysis = Development & detailed analysis of P2 Options
Prioritize = Select and prioritize P2 Actions
P2 Plan = Prepare Draft P2 Plan
Public = Notify public and seek input

Auth = Prepare draft Authorization
Public = Notify public and seek input
Implmnt = Implement P2 Plan
Mon&Ev = Monitoring and reporting per P2 Plan & Authorization

= Action complete
= Work in progress

* Trail Fertilizer Operation only
** The Fletcher facility is large and complex, and is therefore being divided into ER Focus Areas (ERAF). The completion of all ERFA will constitute a comprehensive ER of the entire site. The ERFA were prioritized by the PAC Company and MELP.

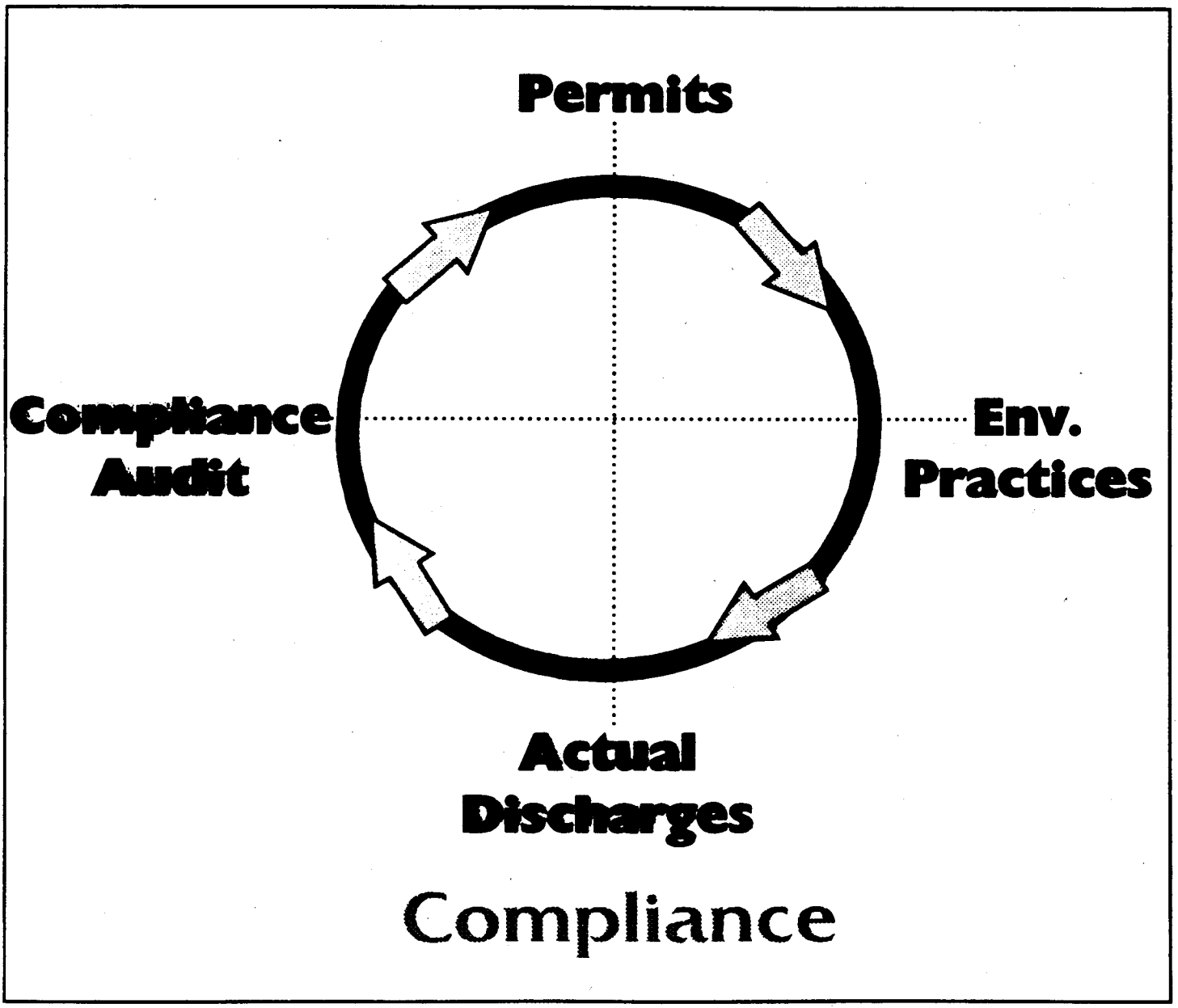
Revised: 12/19/96

Pollution Prevention Planning In BC

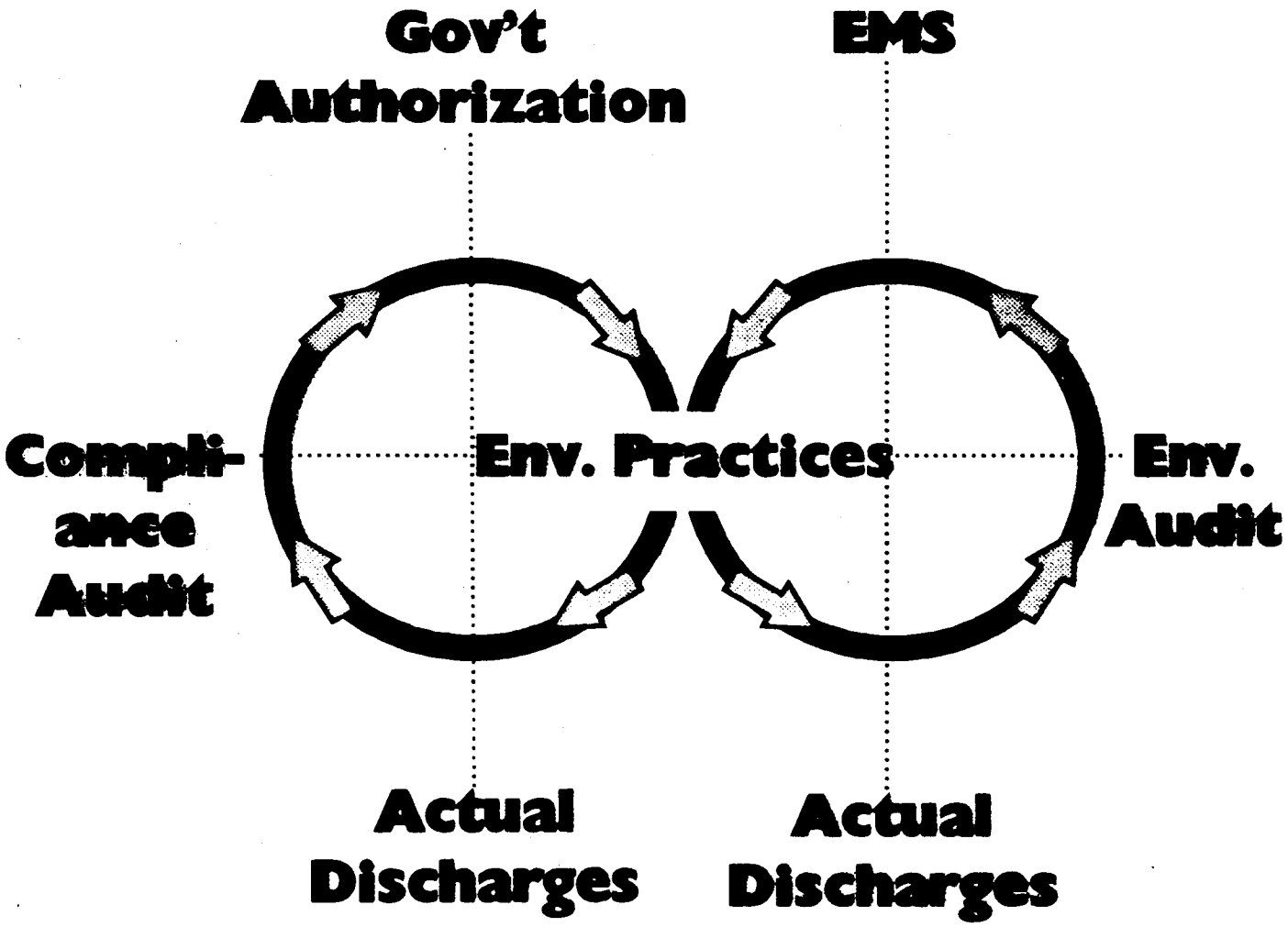
NEXT STEPS (con'd)

- P2 for Small & Med.-sized Enterprises
- Provincial Priority Pollutant Program (P4)
- Airshed/watershed Planning
- Training at Royal Rhodes & Workshops

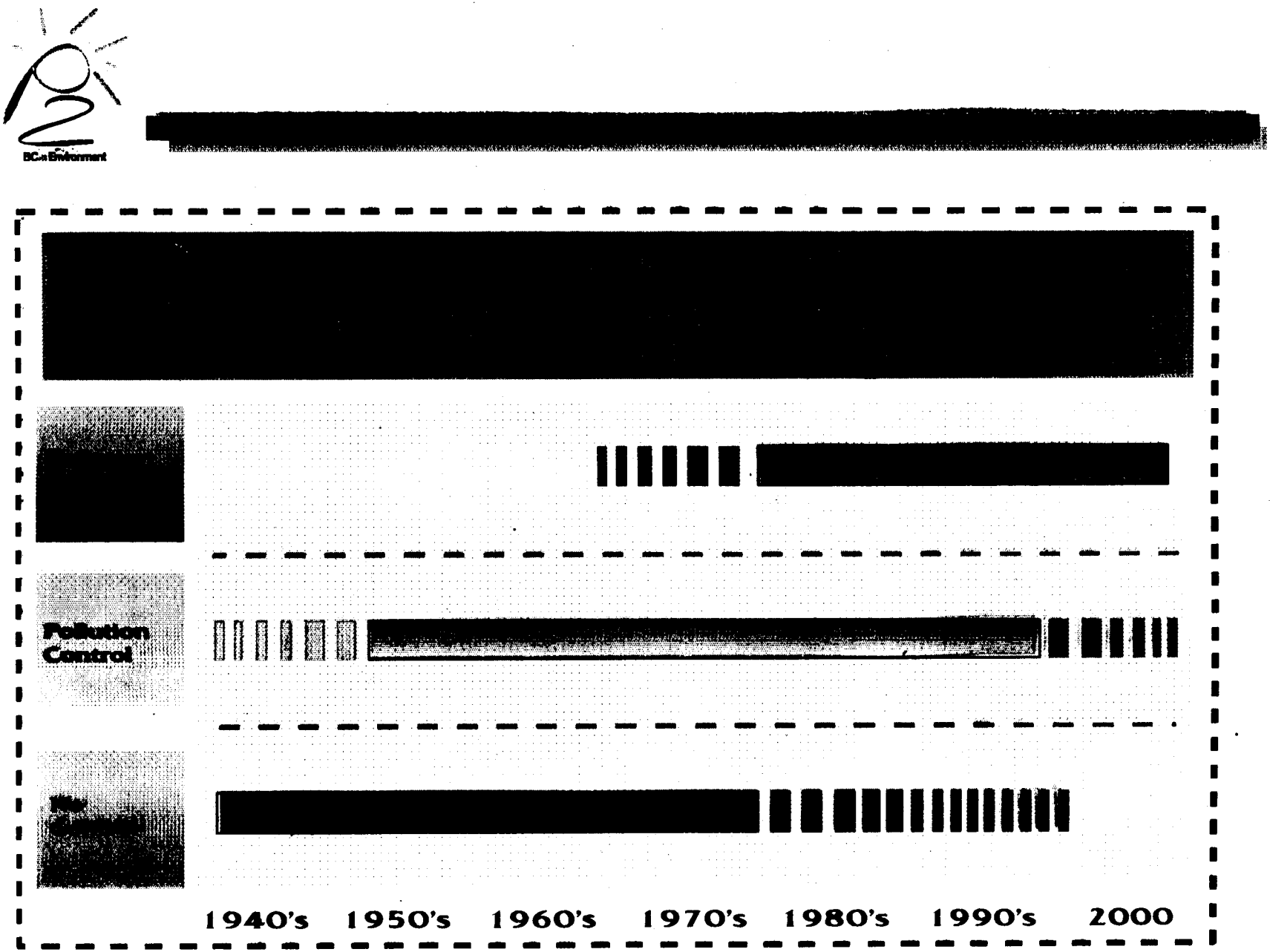
Pollution Control Model



Pollution Prevention Model



Compliance and Commitment


Pollution Control
1940's
1950's
1960's
1970's
1980's
1990's
2000

Product Stewardship
Regulatory Continuum 1990 - 1995

PRIMARY RESPONSIBILITY:	Model 1 GOVERNMENT	Model 2 Gov't & Industry PARTNERSHIP	Model 3 INDUSTRY	Model 4 INDUSTRY
Authorization	Government regulated and operated	Gov't regulated and operated by Gov't and Industry	Gov't regulated and operated by Industry	Self-regulated and operated by Industry
Funding	Funded by tax levy on the specific product	Funded by Industry and by Gov't Gov't funded through general revenues	Industry/Consumer pays	Industry pays and/or profits
Monitoring	Gov't audits its own performance	Gov't audits its own performance and Industry's performance	Gov't audits Industry's performance	Gov't monitors industry and Industry audits performance
Examples	Scrap Tires Lead-Acid Batteries	Paint Re-use Recycling Program	Used Oil Program ODS Program Paint Stewardship Program	Commercial Pesticide Containers