*Project Identification Number GC-97-001*

# Study on the Potential Market For Dairy Product Blends Outside the Coverage of Canada's Tariff-Rate Quotas

**A Study Conducted for:**

**The Canadian International Trade Tribunal**

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**March 9, 1998**

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## Executive Summary

The research conducted for this study indicates that Dairy Product Blends (DPB) of the composition 49/51 butteroil/sugar, and other DPB of similar though not determined description, are being imported into Canada at a steadily increasing pace.

DPB are being used as food processing ingredients. The high importation rate of the DPB indicates that they are being adopted by the food processing industry at an equally fast pace. Further, this growth in importation indicates that DPB present low barriers to use in the food processing industry.

Our research concludes that DPB of butteroil/sugar composition are being used in the preparation of ice cream, other than premium ice cream. Further, it is technically feasible for a DPB with a butteroil component and a salts/emulsifier component to be used in the manufacture of processed cheese.

Our period of investigation focused on the term January – September 1997, as this is the largest time period in calendar year 1997 for which production numbers of dairy products are available. During that time period, we estimate that approximately 7,800 – 11,100 tonnes of DPB, valued at $ 19.5 - $ 28 million dollars, were utilized in the production of ice cream. In the manufacture of this ice cream, approximately 5,425 – 7,800 tonnes of domestic butterfat valued at $30 - 42 million dollars were displaced. In addition, approximately 4,225 – 5,800 tonnes of sugar were displaced, valued at $ 4.57 - $ 6.02 million dollars.

Our research also indicates that it is technically feasible for a portion of the DPB imported into Canada to be used in the manufacture of processed cheese. We estimate that during the period January – September 1997, approximately 275 – 824 tonnes of DPB, valued at $ 0.7 – $ 2.0 million dollars, could have been utilized in the production of processed cheese. In the event that this occurred, approximately 137 - 412 tonnes of domestic butterfat, valued at $ 0.7 - $ 2.23 million dollars, would have been displaced. An amount of sweetener solids, salts and emulsifiers would also have been displaced.

In total, we estimate that during the period January – September 1997, a range of 8,046 – 11,900 tonnes DPB valued at $ 20.2 – $ 30.0 million dollars displaced 5,562 – 8,142 tonnes of butterfat valued at $ 30 - $ 44 million dollars. In addition, 4,300 – 5,800 tonnes of sugar valued at $ 4.65 – $ 6.29 million dollars was displaced in the usage of the stated amount of DPB. An amount of whey powder, salts and emulsifiers were also displaced in the use of the DPB in the manufacture of ice cream and processed cheese.

Our investigation indicates that substitution of butterfat and sugar in an ice cream formula, or substitution with another type of DPB in a processed cheese formula, is technically feasible and commercially likely. In addition, substitution represents significant cost savings to manufacturers of these products. For the above noted time period, and in the above referenced displacement of domestic butterfat and sugar by imported DPB, we estimate that manufacturers using DPB saved approximately $ 14.0 – $ 20.0 million dollars.

The exact volume and value of DPB imported into Canada is yet to be confirmed. However, for the calendar year 1997, results from surveys conducted by the Canadian International Trade Tribunal report volume at 8,752 tonnes and price at $ 2.52/kg. Although the price is consistent with our findings, the volume reported appears to be underestimated. For example, this volume of DPB would affect less than 12% of all ice cream produced during the period January – September 1997. This low percentage does not correspond with our technical and market assessment which, as described above, yields a higher usage of DPB in the production of ice cream and processed cheese. Our estimate suggests that utilization of imported DPB would affect 13 – 19% of all ice cream produced and 5 – 15% of all processed cheese produced between January – September 1997.

We estimate that the current usage of DPB in Canada in the ice cream and processed cheese sectors is not at its maximum level. Due to the ease of use of DPB and the economic incentives implicit in their composition, we predict a penetration level much higher than the one currently in operation. We estimate a maximum potential penetration level of 60% in the ice cream sector and 25% in the processed cheese sector.

Had this maximum potential usage been implemented in the period January – September 1997, it is estimated that 31,500 tonnes of DPB would have been employed. This, in turn, would displace 22,000 tonnes of domestic butterfat valued at approximately $ 115.0 million dollars. Since total domestic butterfat production for industrial purposes was 130,000 tonnes for the period January – September 1997, the maximum potential usage of DPB would have displaced 16% of domestic butterfat production for industrial purposes.

The amount of sugar displaced in the employment of the maximum penetration of DPB in the ice cream and processed cheese sectors is estimated at 16,600 tonnes, valued at $ 18.0 million dollars.

The maximum usage of DPB during the period January – September 1997 would have generated net savings to ice cream and processed cheese manufacturers in the amount of $ 52.0 million dollars.

Our assessment indicates that while it is technically feasible, it is unlikely that DPB are being separated into their components for subsequent use of the individual components, for economic reasons.

# A Study on the Potential Market for Dairy Product Blends Outside the Coverage of Canada's Tariff-Rate Quotas

## A Background

The Canadian International Trade Tribunal (the Tribunal) has been directed to conduct an inquiry into the importation of dairy product blends (DPB) outside the coverage of Canada's tariff-rate quotas. DPB are mixtures of dairy products and other food substances for use in the preparation of products such as ice cream, confectionery products and bakery goods. The Tribunal contracted Margaret Treloar, Ph.D., of Treloar Product Development International Inc., and Carol Culhane, P.H.Ec., MBA, of International Food Focus Ltd., to conduct a study of the factors that influence the domestic market for such imports.

This report provides information regarding: i) the performance and functionality of particular DPB in Canadian processed foods; ii) the comparative performance and functionality of the dairy products/ingredients displaced by particular DPB; iii) the volume and value of DPB used in Canadian processed foods; iv) the volume and value of dairy products/ingredients displaced by the use of DPB in Canada; v) the potential volume and value of dairy products/ingredients that could be displaced by the use of DPB, considering technical feasibility; and vi) advantages and disadvantages of substituting dairy products with DPB.

The sources of information used in this study are listed in Appendix 1. As well, our assessments have incorporated information obtained from:

- background information provided by the Tribunal,
- our knowledge of the food science and technology of relevant ingredients, finished products and manufacturing processes,
- publicly available information from literature, trade publications, Statistics Canada and food industry database sources,
- our knowledge of the factors affecting the assimilation of a new ingredient into the Canadian food processing sector,
- our knowledge of the economic parameters, including cost incentives and operating margins, in the Canadian food processing industry, and
- information generally available from food industry contacts.

## B Products and Period Covered

DPB are the subject of this study. These products are presently classified under the Tariff Item Code 2106.90.95.00. It should be noted that ingredients and products other than DPB are also imported under Tariff Item Code 2106.90.95.00. It has been confirmed that DPB are being imported into Canada for use mainly by the dairy processing industry.

DPB are being used primarily as a substitute for milkfat in processed foods such as ice cream and processed cheese. While this study has addressed many different DPB, the first priority for our analysis was the dominant item in the category_ a blend of butteroil/sugar. Butteroil/sugar is a mixture containing approximately 49% butteroil and 51% sugar. We have also reviewed the potential impact of other DPB, e.g., butteroil/sugar blends of different proportions than those mentioned above, such as butteroil/emulsifier blends, chocolate crumb, etc.

The report includes analyses and assessments regarding the market for dairy ingredient inputs, DPB inputs, and end products based on 1997 market data. As well, to the extent that 1997 data are not yet available, and where useful in understanding trends, the study includes data available from prior years.

The subsequent sections of this report describe, firstly, the chemical composition and functionality of dairy ingredients and DPB, and secondly the estimated magnitude, both in terms of volume and dollars, of the use of DPB in Canada and the dairy ingredients and other food ingredients displaced by their use. The body of the report concludes with an outline of the advantages and disadvantages of the use of DPB in Canada, from the perspective of the researchers and our interpretation of the pertinent information gathered.

## C Overview of Composition and Properties of Relevant Dairy Products

### i) Some Definitions

Dairy ingredients used in the formulation of various food products include milk in fluid, condensed or dry form as well as various sub-fractions of milk obtained through different processing procedures. Dairy ingredients are selected to perform various functions including nutrition, water binding, fat holding, emulsification, viscosity, gelation, and foaming, as well as to provide textural and flavour attributes.

When referring to dairy ingredients and dairy products we are talking about cow's milk (hereafter called "milk") and products made from cow's milk.

Milk is a complex fluid in which more than one hundred separate chemical compounds have been found. The major components are water, fat, lactose, casein, whey proteins and minerals. Fat exists in milk in an oil-in-water emulsion, with fat globules varying from 0.1 to 22 microns in diameter. The production of different dairy products relies on this physical structure.

Milk is commonly described in terms of three main components:

- milkfat; also referred to as butterfat,
- milk solids non fat (MSNF); also referred to as skim solids or serum solids, and
- water.

The term "total solids" is a sum of milkfat and MSNF. The terms % milkfat, %MSNF and % total solids are used widely to characterize milk, dairy ingredients and many finished products made from milk (ice cream, cheese, yoghurt, etc.).

## ii) Relevant Dairy Ingredients: Composition and Function

a) Composition of Milk

The approximate average composition of milk is shown in the following list. It should be noted that the exact composition of individual milk samples or lots varies based on many factors such as season, animal health, characteristics of the feed, etc.

*Average Milk Composition*

| Component | Proportion (% by weight) |
|---|---|
| Water | 87.4% |
| Milk Solids | 12.6 % |
| *Within the Milk Solids:* | |
| Fat | 3.7 % |
| Milk solids non fat | 8.9% |
| *Within the Milk Solids Non Fat:* | |
| Lactose | 4.8 % |
| Protein | 3.4 % |
| Minerals | 0.7 % |

*Milkfat*

Milkfat occurs in microscopic globules in an oil-in-water type of emulsion. It contains an unusually wide variety of fatty acids in comparison to most other fat sources, which accounts for the appealing melting profile in products containing milkfat, particularly butter. The milkfat component of dairy products is of major interest in this study because the predominant current format of DPB is a blend containing milkfat and sugar.

*Milk Solids Non Fat*

Lactose, the major carbohydrate of milk, falls under this classification. Minerals in milk, such as calcium and magnesium, play diverse functional roles in dairy products. For example, in heat stability and alcohol coagulation of milk; age-thickening of sweetened condensed milk; feathering of coffee cream; rennin coagulation; and firmness of curd during cheese-making.

*Milk Proteins*

There are several different milk proteins that have specific properties. Extensive development work has led to the design and production of many specialized dairy ingredients utilizing specific functionality of dairy proteins. While these ingredients are imported for use in Canadian food products, they are not the focus of the present study as they are not outside the tariff-rate quotas. However, there is the possibility of specialized blends of dairy proteins and non-dairy ingredients that would be outside the tariff-rate quotas. This possibility will be reviewed below in Section D ii) Other Dairy Product Blends.

b) Dairy Ingredients

As mentioned above, milk may be used as an ingredient for the production of many food products. Most dairy ingredients are processed from milk before being further processed into food products. In general, this is due to the high moisture content of milk which makes it expensive to transport and relatively unstable particularly in relation to microbial spoilage and development of rancidity. Thus, the main dairy ingredients utilized in food processing are concentrated versions of milk or specific fractions of milk, with most of the moisture removed. These are briefly described below.

Milk is processed after harvesting to produce different homogeneous fluid products through blending and standardization of fat content. For lower fat products, the fat content is reduced through separation procedures generating lower fat milk and cream. Similarly, fat can be increased generating creams of differing fat content. Cream is further processed to produce butter. Butter and cream can be further processed to produce more concentrated products such as butteroil and anhydrous milkfat, respectively. Milk and cream products, of various fat content, and butter serve both as finished products and as ingredients. The production of butter is described in more detail in the following section in connection with the production of butteroil. (See section D i), below.)

A series of ingredients are obtained by reduction/removal of water from skim, partially skimmed or whole milk. Milk powders are prepared by vacuum evaporation or condensation and subsequent drying in spray or drum dryers. Skim milk powder (SMP) is an economical source of MSNF. Different processing conditions, mainly the heat treatment during drying, are used to create powders with different functionalities. For example, high heat imparts a high moisture-absorbing quality to the ingredient that is desirable in meat, confectionery and bakery products. On the other hand, a low-heat product possesses optimum sensory characteristics and is ideal for use in dairy products and beverages. Medium-heat powder is used in ice cream and other products in which water absorption and flavour are important. Whole milk powder is also produced and used in food products. Due to its fat content, it has a more limited shelf life and is not as widely used as SMP as an ingredient.

Condensed products are another commonly used source of milk solids in dairy applications, e.g., in the manufacture of ice cream, frozen yogurt and other frozen desserts. Condensed whole milk is used largely by the confectionery industry. These concentrated milk products are frequently custom made for processors for specific applications. Evaporated milk is a heat-sterilized product with extended shelf life. However, it has limited uses as an ingredient because of cooked flavour and yellowish colour. Sweetened condensed whole or skim milk is also used as a dairy ingredient, particularly in the confectionery industry. These products contain 60 % sugar in the water phase. The sugar acts as a preservative, significantly enhancing keeping quality of the ingredient.

## D Overview of Composition and Properties of Dairy Product Blends

### i) Butteroil/Sugar Blends

The major product in the category of DPB being imported outside Canada's tariff-rate quota is a mixture containing roughly 49% butteroil and 51% sugar. This conclusion is based on our assessment of usage potential and import quantities as outlined in subsequent sections of the report.

*Butter*

Butter is a concentrated milkfat product produced from cream through a process of:

- churning of pasteurized cream at a specific temperature to generate a phase inversion (oil-in-water emulsion in cream converts to a water-in-oil emulsion),
- separation of fat and liquid phases (liquid phase is buttermilk),
- further processing of the fat phase to develop the butter emulsion and crystal structure (this step may include addition of salt),
- standardization of the moisture content, and
- packaging into retail or bulk containers.

Butter contains not less than 80 % milkfat. As well, it contains traces of protein and phospholipid that have emulsification properties.

*Butteroil*

Butteroil is obtained by extracting the water and non-fat content from butter through a process of rinsing and centrifugation. It contains not less than 99.6 % milkfat and is fundamentally concentrated butter. In certain applications, advantages of butteroil in food processing trace to the removal of the moisture component of butter, resulting in reduced splattering and burning in frying applications, control of fat bloom in chocolate confection and increased puff for pastries and pie shells.

*Butteroil/Sugar Blend*

Butteroil is combined with sugar to create the DPB that is the focus of this study. To produce the blend, the butteroil and sugar are co-melted to form a homogeneous suspension suitable for pumping and packaging. Because there is virtually no moisture content in butteroil, the sugar is not in solution in the butteroil. It would be more accurately described as a suspension of sugar crystals in the butteroil crystal matrix. The degree of suspension depends on the temperature of the mixture. The combination product may be homogenized by some producers to assist in maintaining the suspension. The product is cooled after filling into bag-in-a-box packaging.

The product is shipped and stored refrigerated or frozen to assure shelf life as well as suspension of the sugar in the butter. The latter consideration may be related to assuring that the ratio of butteroil to sugar remains constant throughout the suspension and that it will meet the tariff code requirements when tested at the point of importation into Canada. As well, a homogeneous suspension would facilitate use in manufacturing.

Separation of Butteroil and Sugar Components

Due to the nature of the butteroil/sugar combination, i.e., a suspension stabilized by a temperature-dependent crystal structure, it is likely that the main components of the blend could be readily separated. For example, on applying heat, the butteroil will rise to the top and the sugar will settle. There would be traces of sugar in the butteroil fraction obtained this way. However that would not deter its use in an application which called for a low level of sweetness. A more elaborate process, involving rinsing to remove the sugar solids and centrifugation to separate the butteroil, could be used to "recover" the butteroil from the blend.

However, it would be unlikely that a food processor would pursue this separation due to the added cost of the process steps needed to make the separation. The cost of the separation process would largely counteract the cost advantage of using the blend. Further, this type of equipment would more likely be available at a dairy processing plant where butter is produced than at a food product manufacturing facility utilizing dairy products as ingredients. This issue is explored in more detail in Section H, below.

Butteroil/sugar blends would be of most interest to manufacturers of products containing milkfat and sugar. In these cases, and, formula requirements permitting, the DPB can be directly substituted for the equivalent amounts of milkfat and sugar that are components of the blend. Where the DPB would replace butter and sugar (or other sweetener solids), for example, the formula would be adjusted to accommodate the different moisture content of the blend in comparison to butter and sweetener. (See sample calculation in Section E i).

**ii) Other Dairy Product Blends**

In view of the time available for this study and the sensitivity among suppliers and manufacturers regarding this subject, we have not been able to obtain data regarding the identity of the specific products being imported outside the coverage of Canada's tariff-rate quotas. As outlined in the following sections, our assessment has explored the current use of the blend of 49 % butteroil and 51 % sugar ("the 49/51 DPB") based on suitable food product applications. As well, we have estimated the potential usage of the 49/51 DPB. In this section, we will review other blends that would be technically feasible and may presently, or will in future, be imported for use in food production.

a) Economic Proposition of Butteroil/Sugar Blends

The 49/51 DPB appears to be manufactured for the purpose of creating a dairy ingredient that has appropriate functionality as well as being able to be imported in compliance with the current import restrictions of less than 50 % dairy content. That is, this is the blend with the highest possible butteroil content that will meet the import constraint. Moreover, this level of butteroil content provides the maximum cost benefit to purchasers. There would be little advantage in preparing blends with lower butteroil content as the cost advantage traces to the lower cost for the butteroil fraction versus the domestic price for milkfat. In addition, as discussed later, the sugar portion of the blend is premium priced to the domestic price of sugar.

Thus, for the blend to remain an economical proposition, there is a limit to the amount of the lower-cost portion, in this case, sugar, which can be added to the butteroil portion.

The "blended" price of the two components of the blend must present an economic saving to the food processor. For customized DPB, such as one with lower butteroil content that would replace all the butter and all the sugar in a product (e.g., when the product contains more sugar than butter), the cost advantages would be decreased due to both the reduced butteroil concentration and to the added costs of made-to-order blends.

b) Dairy Product Blends for Other Product Applications

As mentioned above, the potential applications for the 49/51 DPB are products that contain both milkfat and sugar, such as ice cream products which represent a substantial volume in Canada. Similarly, there is potential for blends that are designed for other high volume applications which incorporate significant amounts of dairy ingredient. These potential applications include processed cheese, chocolate confectionery products, bakery products, snack food seasoning, certain dairy product substitutes and other products. A review of ingredient statements of a wide variety of grocery products confirms the potential for a DPB in these categories and can provide insight into the potential size of the market for innovative blended products. A selection of relevant ingredient statements is provided in Appendix 2.

*Dairy Product Blends for Processed Cheese*

While processed cheese does not contain large amounts of sugar or other sweetener solids, there is potential for DPB designed for use in processed cheese. (Refer to sample formulation in Appendix 3.) We believe that some blends are being imported for this purpose. This assessment is based on technical feasibility, ingredient statement information and industry experience. A DPB designed for processed cheese would likely contain the maximum allowable butteroil or anhydrous milkfat content for the reasons mentioned above. The balance of the product would be sweetener solids more conducive to processed cheese, e.g., glucose solids, dextrose, etc., and emulsifying salts commonly used in processed cheese manufacturing. The market for these blends will increase as the development of lower fat content processed cheeses continues to increase. The latter products contain higher levels of sweetener and other soluble solids due to higher moisture content. Thus, they provide a larger "formula space" to accommodate DPB. It is likely that, for these sophisticated formulations, the availability of a designed pre-blend of functional ingredients would offer not only cost benefits but convenience and quality benefits to the processed cheese manufacturer.

*Dairy Product Blends for Milk Chocolate Confectionery*

The incorporation of the milk portion of milk chocolate historically represented an important technical challenge in the production of milk chocolate. To deliver the required physical and sensory properties of chocolate, as well as the required keeping qualities, the moisture content is extremely low. However, as reported above, the moisture content of milk is very high. It is the approximate 12.6 % milk solids portion of whole milk that is incorporated into milk chocolate.

While whole milk powder has been used in chocolate production, the development of the "milk crumb" or "chocolate crumb" process provided significant improvements in finished product quality and concomitant increases in sales of milk chocolate. Chocolate crumb is produced through a process of sweetening and condensing of whole milk, blending with chocolate liquor, and drying. The resulting DPB has a relatively long shelf life and is used for further processing into chocolate products. A typical composition for chocolate crumb is:

| | |
|---|---|
| Chocolate liquor | 13.5 % |
| Sugar | 53.5 % |
| Milk solids | 32.0 % |
| Moisture | 1.0 % |

Depending on the cost of the blend, it may offer economic advantages to chocolate product manufacturers. As well, this type of DPB offers convenience advantages to the processor and finished product quality advantages to the consumer.

*Other Dairy Product Blends*

Based on our assessment, it appears that the main economic benefits of blends relate to the milkfat portion of the blend. The large cost advantage of the 49/51 DPB traces to the butteroil portion of the blend. It is likely that the 49/51 DPB can be used in many different products, as outlined in Section G, below. However, there is potential for other blends to be designed for at least some of those product categories, e.g., snack foods, sauces, etc., given there is sufficient economic advantage to justify production of the blend. From a technical perspective, blends of skim milk powder and sugar, for example, may provide advantages to manufacturers. Blends of this type have been imported in the past. As mentioned above, we do not know how much of these blends may be imported presently although we understand it is likely much less than the amount of 49/51 DPB.

It is also technically feasible to produce blends of other dairy and non-dairy ingredients that may offer significant cost advantages to manufacturers. For example, caseinates (made from one type of milk protein) are used in many different food products for functions such as emulsification, whipping and texture-modifying. They are used, for example, in desserts, dressings, soups, sauces, coffee whiteners, breads, cookies, frozen dairy products, processed cheese, and other products. Blends containing specialized dairy ingredients, such as caseinates, as well as other dairy and non-dairy ingredients are feasible and could likely be designed to offer cost and convenience benefits to manufacturers. An example could be "imitation" or "simulated" cheese for use in pizzas, etc.

## E Comparison of Dairy Product Blends and Dairy Products

### i) The Butteroil/Sugar Blend

Butteroil/sugar blends would be of most interest to manufacturers of products that contain milkfat and sugar. In considering the use of the 49/51 DPB as an ingredient, it can be compared to the butter and sugar that it would replace in a formula. For example, where the DPB would replace butter and sugar, the formula would be adjusted to accommodate the lower moisture content of the blend compared to the moisture content of the butter and sweetener. This is shown in the following chart showing formulas for an imaginary food product.

| Ingredient | Original Formula % by Weight | Butter-Replaced Formula % by Weight |
|---|---|---|
| Butter | 15.0 | --- |
| Sugar | 25.0 | 12.4 |
| 49/51 DPB | --- | 24.8 |
| Water | --- | 2.8 |
| Other ingredients | 60.0 | 60.0 |
| Total: | 100.0 | 100.0 |

Similar calculations would be done to replace butter or cream, using milkfat and MSNF content to determine replacement ratio, and for sweeteners other than sugar, using % solids to calculate the amount of sweetener that can be replaced.

For many applications, the manufacturer could expect very comparable functionality from the blend in comparison to the original formula ingredients. The butteroil will contribute close to the same functionality as butter including flavour and texture characteristics. This indicates good potential for straightforward substitution into many formulations.

The main disadvantage between the original combination and the blend is that the blend will be lacking in the trace proteins and phospholipids that are present in butter. For use in products relying on these molecules for emulsification, for example, the blend will not perform equivalently to the ingredients being replaced. This is the case, for example, in a "premium" ice cream that relies on the dairy ingredients for the required stabilization.

The main technical advantage between the original combination and the blend is that the blend will have superior keeping quality compared to butter due to the reduced water content. As well, there is a significant economic advantage that will be discussed below.

### ii) Other Dairy Product Blends

As with the butteroil/sugar blends, other blends made by dry blending or co-melting dairy and non-dairy ingredients can be expected to provide comparable functionality to the ingredients that they replace. The major incentive for such replacements would be the relative costs of the ingredients.

# F Methodology: Technical and Market Assessment Methodologies

## i) Technical Methodologies

Our assessment of technical feasibility of replacement of dairy ingredients by DPB is based on consideration of information from several sources. There is extensive food science and technology literature regarding dairy ingredients and dairy ingredient-containing food products. As well, there are government regulations regarding many dairy ingredients and dairy products. Sources consulted are listed in Appendix 1. Food products that could utilize the 49/51 DPB, or other DPB, were identified through product knowledge as well as through a review of ingredient statements of current processed foods (see Appendix 2). Based on prior experience in food formulation development and food processing, it is possible to calculate representative formulas for standard food products and to estimate replacement rates that would yield equivalent product performance.

From published information and informal market surveys such as "store checks", we estimated the proportion of the main product categories that might presently be using the 49/51 DPB. These figures were used in the summary estimation of the current usage of DPB in the categories of frozen dairy products and processed cheese. (See Section H for details.)

To estimate the potential amount of DPB that could be used in specific products or product categories, we used the following procedure:

- identify likely product candidates (e.g., ice cream);
- estimate representative formulas for the product category or sub-category, e.g., economy or regular ice cream;
- estimate comparable formulas incorporating a technically appropriate quantity of DPB;
- calculate the relative cost of the relevant portions of each formula, i.e., the ingredients that differ between the two formulas;
- estimate the production volume for the product, sector or sub-category;
- estimate the portion of all production that may contain DPB by sub-category; and
- calculate the estimated amount(s) and dollar value of dairy ingredient(s) that could be replaced, calculate the amount of DPB and any other ingredients that would be used in the replacement, and estimate the net cost savings potentially achieved by the manufacturer.

## ii) Market Assessment Methodologies

*Volume Information*

Our assessment of the market size of the replacement of dairy ingredients by DPB in Canada relied on, for the most part, food manufacturing and dairy processing production/volume information published by Statistics Canada. Production volume information of dairy-based end products such as ice cream and processed cheese was collected for the calendar years 1993 – 1996. (See Appendix 4.) Regarding calendar year 1997, similar information was available only for the period from January to September.

To provide an impact analysis for the calendar year 1997, we commented on the impact for the period January to September, 1997. Category breakdown of the ice cream sector was determined with the use of the Ice Cream Benchmarking Study (see References, Appendix 1) and The Dairy Review, published by Statistics Canada.

A detailed explanation of how these data were interpreted is provided in Section H.

*Pricing Information*

The sources of pricing information used in this report are as follows:

- DPB price – Canadian International Trade Tribunal Research Branch[1];
- Butter/Whey Powder/Other Solids prices – Canadian Dairy Commission (CDC) web-site for years 1995 and 1996; CDC customized report for period January – June 1997; and
- Sugar price – verbal report from Redpath Ltd. for years 1993-1997.

## G Dairy Product Blends and Potential Finished Product Utilization

### i) The Butteroil/Sugar Blend

There are many products that could incorporate the 49/51 DPB to advantage. The primary reason for a manufacturer to use the blend is the lower cost of the imported blend compared to the cost of sugar and domestic butter or cream that would be replaced. The largest advantage will therefore accrue to products with high content of milkfat and sugar, or other sweetener solids. (The term "sweetener solids" encompasses sugar, glucose solids and the "dry" portion of the commonly used liquid sweeteners: liquid sugar, glucose, high fructose corn syrup, etc.)

*Frozen Dairy Dessert Products*

The most likely candidates for the 49/51 DPB are products in the frozen dairy dessert category. These products contain significant amounts of milkfat, coming from milk ingredients, cream and/or butter, as well as comparable or greater amounts of sugar or other sweetener solids. Further, this category has large production volume in several sub-categories. The sub-categories include

- different quality levels of ice cream, commonly referred to as economy, regular and premium;
- different quality levels of ice cream mix, sold for conversion into frozen dessert products at point of consumption, e.g., fast food restaurants, dairy bars, etc., or for further processing and incorporation into frozen novelties and other dessert products, e.g., chocolate-coated bars, ice cream layer cakes, etc.
- other products including milk shake mix, ice milk, sherbet, frozen yogurt, etc.

[1] Canadian International Trade Tribunal, Research Branch, Consolidated Response to Importers' Questionnaire. "Table 4, Total Apparent Imports Butteroil Blends". This table is included for reference in this report as Table 2b.

The production quantities for different sub-categories are considered in Section H of this report wherein we analyze the potential usage of 49/51 DPB in frozen dessert products in detail. For the purpose of this introductory overview, it may be noted that the categories are differentiated based on ingredients and associated finished product attributes. There are standards under the Canadian Food and Drugs Act and Regulations as well as the Canadian Agricultural Products Act, Dairy Products Regulations detailing requirements for various sub-categories, e.g., ice cream mix and ice cream. The standards are focused on minimum % solids and on minimum, and in some cases maximum, % milkfat.

In general the lower prices of the economy products reflect lower milkfat content and higher usage of stabilizers to deliver the desired texture of the finished dessert products. By contrast, premium products contain higher amounts of dairy ingredients, often to the exclusion of stabilizers or other ingredients. In the latter case, the attributes of the finished product are more dependent on the behaviour of the dairy ingredients. For example, premium ice cream could be expected to be more sensitive to the replacement of butter by butteroil. This is related to the different properties of butter and butteroil at the molecular level. The economy products can likely accommodate a relatively higher proportion of DPB because their attributes, particularly texture and mouthfeel, are less dependent on the properties of the dairy ingredient. They rely more heavily on other structural ingredients, e.g., stabilizers. This assessment is also expanded upon in Section H.

*Technical and Economic Factors Affecting Feasibility of DBP Utilization*

A list of potential candidates for replacement of milkfat and sugar by 49/51 DPB is summarized in Utilization Chart 1, below. Our assessment of the feasibility of DPB utilization, as summarized in the following chart, is based on two primary considerations.

1. Determination of whether or not a specific finished product "could technically contain 49/51 DPB" (Column 3 in the Chart) is based predominantly on the composition of food products in the category. If the products contain both milkfat and sugar/sweetener components, and if there is not a specific functional requirement for butter in the formula, then the usage of DPB is considered to be technically feasible (marked "Yes" in Column 3).
2. An economic analysis was made to determine whether the products "would likely contain 49/51 DPB" (Column 4 in the Chart). For some products, e.g., packaged biscuits and cookies, the economic unfeasibility relates to the cost paid by these manufacturers for domestic butter. This assessment is reviewed in detail in Section H ii) e), below. For other products, e.g., processed cheese, the amount of sweetener used is very low, with the result that insufficient quantities of 49/51 DPB could be accommodated in the formula to generate worthwhile savings. However, other types of blends might offer sufficient savings, as outlined in Section D ii) b), above, and Section G ii), below.

**Utilization Chart 1**
**Dairy Product Blend of 49 % Butteroil and 51 % Sugar**

| Finished Product | Currently Contains 49/51 DPB* | | Could Technically Contain 49/51DPB | | Would Likely Contain 49/51 DPB (Economically Feasible) | |
|---|---|---|---|---|---|---|
| | Yes | No | Yes | No | Yes | No |
| Frozen Dairy Products | ✓ | | ✓ | | ✓ | |
| Processed Cheese | | | ✓ | | | ✓ |
| Biscuits, Cookies | | | ✓ | | | ✓ |
| Cakes, Pastries | | | ✓ | | ✓ | |
| Fresh Baked Goods | | | ✓ | | ✓ | |
| Chocolate Bars | | | ✓ | | | ✓ |
| Other Chocolates | | | ✓ | | | ✓ |
| Confectionery | | | ✓ | | | ✓ |
| Coffee Whitener | | | ✓ | | ✓ | |
| Sauces, Dressings | | | ✓ | | ✓ | |
| Snack Foods | | | ✓ | | ✓ | |
| Spreads, Dips | | | ✓ | | ✓ | |

* Information not available to confirm or deny current use in products other than frozen dairy products.

### ii) Other Dairy Product Blends

As mentioned in Section D ii) b), there are many products that could possibly incorporate other DPB to advantage. As well, there is significant potential for blends designed for incorporation into specific products to confer both cost and functionality benefits. Examples of these blends are provided in Section D ii) b). For these reasons, we anticipate DPB are available, or could be developed, that would be technically and economically feasible. The main reason for a manufacturer to use these blends would still likely be a lower cost of the imported product compared to domestic ingredients, predominantly butter, cream or milk powders. The largest advantage will therefore accrue to products with high milkfat or other milk solids, and high sugar, or other sweetener solids, content. The potential candidates for replacement are summarized in the following chart. The criteria for feasibility are the same as used in the previous section.

**Utilization Chart 2**
**Other Dairy Product Blends**

| Finished Product | Currently Contains DPB* | | Could Technically Contain DPB | | Would Likely Contain DPB (Likely Economically Feasible**) | |
|---|---|---|---|---|---|---|
| | Yes | No | Yes | No | Yes | No |
| Frozen Dairy Products | | | ✓ | | ✓ | |
| Processed Cheese | ✓ | | ✓ | | ✓ | |
| Biscuits, Cookies | | | ✓ | | ✓ | |
| Cakes, Pastries | | | ✓ | | ✓ | |
| Fresh Baked Goods | | | ✓ | | ✓ | |
| Chocolate Bars | | | ✓ | | ✓ | |
| Other Chocolates | | | ✓ | | ✓ | |
| Confectionery | | | ✓ | | ✓ | |
| Coffee Whitener | | | ✓ | | ✓ | |
| Sauces, Dressings | | | ✓ | | ✓ | |
| Snack Foods | | | ✓ | | ✓ | |
| Spreads, Dips | | | ✓ | | ✓ | |

* Information not available to confirm or deny current use of DPB in these products other than processed cheese.

** Economic feasibility will depend on costs and volume.

## H Volume and Value Data for Domestic Production of End Products Using Dairy Inputs and Dairy Product Blends

### i) DPB Volume Information: Quantification and Growth of Importation of DPB

*High Trial and Adoption Rate of DPB into Canada During 1995*

Tariff Item Code 2106.90.95.00 was implemented in January 1995. This study begins with a review of the importation of items under 2106.90.95.00. Statistics gathered indicate that these imports grew quickly throughout calendar year 1995, as shown in Table 1 below.

**Table 1**
**Importation of Tariff Item Code 2106.90.95.00 into Canada, 1995[2]**

| Month | Amount (tonnes) | Value ($mm) |
|---|---|---|
| Jan | 130 | 0.43 |
| Feb | 241 | 0.86 |
| Mar | 219 | 0.77 |
| Apr | 281 | 0.93 |
| May | 326 | 0.83 |
| Jun | 301 | 0.98 |
| Jul | 339 | 1.10 |
| Aug | 298 | 0.86 |
| Sep | 233 | 0.56 |
| Oct | 257 | 0.63 |
| Nov | 198 | 0.49 |
| Dec | 480 | 1.16 |

This indicates steady growth of the importation of products into Canada under Code 2106.90.95.00 during 1995. On a tonnage basis, monthly, from the beginning to the end of the calendar year, importation showed an upward trend. This may reflect a quick adoption rate and growth rate of DPB usage by Canadian food processors if the upward trend was based on the DPB portion of the items being imported under this code.

*Increased Importation of Tariff Item Code 2106.90.95.00 from January 1995 to December 1997*

A separate Statistics Canada trade query report requested for this study indicated that importation of items under Tariff Item Code 2106.90.95.00 grew 76% between calendar years 1995 and 1996 and a further 204% between calendar years 1996 and 1997, as shown in Table 2a below.

**Table 2a**
**Annual Growth Rate of Importation of Tariff Item Code 2106.90.95.00**

| Year | Amount (tonnes) | % Change in Amount* | Total Value ($mm) | % Change in Value* |
|---|---|---|---|---|
| 1995 | 3,307 | n/a | $ 9.63 | n/a |
| 1996 | 5,842 | + 76.6% | $ 15.14 | + 57% |
| 1997 | 17,801 | + 204% | $ 49.08 | + 224% |

* compared to preceding year

[2] Statistics Canada data; Tariff Item Code 2106.90.95.00 contains DPB and other ingredients and products.

*Increased Adoption of DPB by Canadian Food Processors from 1993 to 1997*

Concurrent with our study, the Tribunal obtained information about specific products which are being imported under Tariff Item Code 2106.90.95.00, including the 49/51 DPB and other DPB. The information was gathered through survey questionnaires sent to producers, manufacturers and importers. The consolidated response of the Importers' Survey conducted by the Research Branch of the Tribunal indicates that the importation of DPB into Canada grew 191% between calendar years 1995 and 1996 and a further 157% between calendar years 1996 and 1997, as shown in Table 2b below.

**Table 2b**
**Annual Growth Rate of Importation of DPB[3]**

| Year | Amount (tonnes) | % Change in Amount* | Total Value ($mm) | % Change in Value* |
|---|---|---|---|---|
| 1993 | 433 | n/a | $ 0.949 | n/a |
| 1994 | 147 | - 66% | $ 0.312 | - 67% |
| 1995 | 1,167 | + 693% | $ 2.878 | + 822% |
| 1996 | 3,404 | + 191% | $ 8.676 | + 201% |
| 1997 | 8,752 | + 157% | $ 22.026 | + 153% |

* compared to preceding year

Table 2b further indicates a quick adoption rate and steady growth rate of DPB usage by the food processing industry in Canada.

*Low Commercial Barriers to Entry*

The common barriers to entry of a new ingredient into the food processing industry include:

i. necessity to purchase new and expensive capital equipment;
ii. added cost that does not provide added value;
iii. difficulty in modifying formula for use of the new ingredient;
iv. difficulty in storing the new ingredient;
v. difficulty in training personnel how to use the new ingredient;
vi. difficulty in obtaining a reliable and consistent supply of the new ingredient;
vii. rejection by consumers due to product quality or labelling requirements;
viii. objection by the Canadian Food Inspection Agency due to non-compliance with the Food and Drugs Act or other regulatory constraints.

The high adoption rate and growth rate of DPB usage by the food processing industry in Canada suggest that none of the barriers to entry (i. – viii. above) are significantly operative with respect to the use of DPB by the Canadian food processing industry.

[3] Consolidated Response to Canadian International Trade Tribunal Importers' Survey. March 1998.

*Researchers' Estimation of DPB Imported into Canada January – September 1997*

Later sub-sections of this section of this report illustrate that our total estimated volume of current DPB usage for the period January – September 1997 represents 54% - 80% of the total tonnage imported into Canada under Tariff Item Code 2106.90.95.00[4]. As aforementioned, the Tribunal has been able to obtain an estimate of the volume of DPB imported into Canada for calendar years 1993 to 1997 (Table 2b, page 20). Adjusting for the period of investigation of January – September 1997, the proportional amount of this figure, the reported usage of DPB, is estimated to be 7,001 tonnes.[5] We calculate that the reported importation of DPB as per the Tribunal survey may be underestimated, and further, estimate that the volume may be significantly larger as shown in the table below:

**Table 2c**
**Estimated and Reported Importation of DPB January – September 1997**

| Description | Our Estimated Range DPB | Reported DPB (Tribunal) Adjusted[5] | Tariff Item Total |
|---|---|---|---|
| tonnes | 8,046 – 11,900 | 7,001 | 14,844 |
| % of Tariff Item Total Amount | 54 – 80% | 47% | 100% |

We estimate the importation of DPB for the period January to September 1997 to be in the range of 8,046 to 11,900 tonnes. Our process of estimation included consideration of the following factors:

i. Total volume in Tariff Item 2106.90.95.00 from January-September 1997 was 14, 844 tonnes (see footnote 4).
ii. Other products in this Tariff Item include prepared foods such as pudding cups and baby food.
iii. Items such as those in ii. occupy significantly less grocery store shelf space than do ice cream products.
iv. Numerous store checks conducted for this study indicate a proliferation of dairy-based end products with potential DPB usage.
v. Following from iv., the reported proportion of DPB in Tariff Item 2106.90.95.00 appears to be low.
vi. Due to the economic incentives implicit in DPB, it can be assumed that they may be the dominant factor in the growth of category 2106.90.95.00.

[4] Statistics Canada Trade Query indicated total tonnage for Tariff Item Code 2106.90.95.00 for January – September 1997 amounted to 14,844 tonnes.
[5] Apply 80% factor to 8,752 to account for ¾ of calendar year and higher production period over summer.

vii. Category 2106.90.95.00 grew 204% between 1996 and 1997 (See Table 2a, page 19).

viii. The reported volumes obtained by the Tribunal show a growth rate of only 157% between calendar years 1996 and 1997 (See Table 2b, page 20)

ix. If growth in DPB is the dominant factor in the growth of Tariff Item 2106.90.95.00, this is not reflected in the reported DPB volumes collected by the Tribunal

Our consideration of factors i. to ix., above, is reflected in our estimated range of 8,046 to 11,900 tonnes of DPB imported for the period January to September 1997.

**ii) Input Price Information and Economic Considerations**

The ability of DPB to replace domestic milkfat in formulations, with respect to functionality and consumer acceptance, is only one part of the evaluative process a prospective food processor will undertake in the determination of whether to make use of a DPB. An equally significant part of the total evaluative process is economic considerations. Specifically, the processor will compare the price of the DPB and the domestic prices of the individual components of the DPB.

Regarding the butteroil/sugar blend, which is 49% butteroil and 51% sugar, the two components for which the price must be evaluated are the inputs of domestic butterfat and domestic sugar.

a) List Price for Domestic Classes of Milkfat

The Canadian Dairy Commission administers the classification and pricing of milk produced and sold in Canada. There are five Classes of milk. Class 1 is "fluid milk" which is meant for end use by consumers. Classes 2-5 are "industrial milk", meaning for intermediate purchase and use by industrial dairy and food processors. Class 2-5 industrial milk "is classified and made available for use in dairy products and products containing dairy ingredients at prices which vary according to end use."[6] The Canadian Dairy Commission monitors the volume of dairy components accessed under these classes.

As shown in Table 3 below, prices between the Classes vary. Table 3 illustrates a brief description as well as the weighted average price of the butterfat component in each class, for the period January-June 1997.[6, 7]

[6] Canadian Dairy Commission Web-site Report "Milk Classification System" http://www.agr.ca/cdc/spclass.html

[7] Price Report prepared by the Canadian Dairy Commission

**Table 3**
**Milk Class Description and Weighted Average Prices 1997**

| Class | General End Use | Weighted Average Price of Butterfat Component ($/kg) |
|---|---|---|
| 1 | Fluid Milk | $ 5.46 |
| | | |
| 2 | Yoghurt and Ice Cream | $ 5.42 |
| 3 | Cheddar and Specialty Cheeses | $ 5.47 |
| 4 | Butter, Powders and Condensed milk for Ingredient Purposes | $ 5.45 |
| 5 | All other dairy products for further processing; Confectionery | $ 2.87 - $ 3.18<br>$ 2.63 |
| | | Weighted Average Price of Cheese Ingredient ($/kg) |
| 5 | Cheese ingredients for further processing | $ 2.96 – $ 3.04 |

b) List Price for Domestic Industrial Sugar

List prices for industrial sugar for the years 1993 to 1997 were obtained from Redpath Limited, a sugar refinery headquartered in Toronto, Ontario, as shown in Table 4 below. No allowances have been made for discounts such as volume purchases or payment terms.

**Table 4**
**List Price for Domestic Industrial Sugar 1993-1997**

| Year | $/kg |
|---|---|
| 1993 | 0.81 |
| 1994 | 0.91 |
| 1995 | 0.97 |
| 1996 | 0.97 |
| 1997 | 1.08 |

c) List Price for Imported Dairy Product Blends

The Research Branch of the Tribunal obtained average annual prices for DPB for the calendar years 1993 to 1997, as shown in Table 5 below.[3]

[3] Consolidated Response to Canadian International Trade Tribunal Importers' Survey. March 1998.

**Table 5**
**Reported Price for Imported Dairy Product Blends**

| Year | Annual Average $/kg |
|---|---|
| 1993 | $2.19 |
| 1994 | $2.13 |
| 1995 | $2.47 |
| 1996 | $2.55 |
| 1997 | $2.52 |

d) Comparison of Input Prices of Domestic Butterfat and Domestic Sugar to Input Price of Imported Dairy Product Blend for Calendar Year 1997

Comparison of the Class prices of domestic butterfat to the price of the imported DPB illustrates that it is definitely not economically feasible for some food processors to utilize the DPB while it may be economically feasible for others. For example, packaged cookie and chocolate bar manufacturers fall into the former category, while ice cream manufacturers fall into the latter category.

**Table 6**
**Comparison if Input Prices of Domestic Milkfat and Domestic Sugar to Input Price of Imported Dairy Product Blend for Calendar Year 1997**

| Special Milk Class | General End Use | Weighted Average Price of Domestic Butterfat ($/kg) | Annual Average Price of Imported DPB ($/kg) | Annual Average Price of Domestic Sugar ($/kg) |
|---|---|---|---|---|
| 1 | Fluid Milk | $ 5.46 | $ 2.52 | $ 1.08 |
| 2 | Yoghurt and Ice Cream | $ 5.42 | $ 2.52 | $ 1.08 |
| 3 | Cheddar and Specialty Cheeses | $ 5.47 | $ 2.52 | $ 1.08 |
| 4 | Butter, Powders and Condensed milk for Ingredient Purposes | $ 5.45 | $ 2.52 | $ 1.08 |
| 5 | All other dairy products for further processing; Confectionery | $ 2.87 - $ 3.18<br>$ 2.63 | $ 2.52 | $ 1.08 |
| | | Weighted Average Price of Cheese Ingredient ($/kg) | | |
| 5 | Cheese ingredients for further processing; | ~$ 2.96 – 3.04 | $ 2.52 | $ 1.08 |

e) Economic Reasons for Eliminating Use of DPB by Confectionery and Packaged Cookie Manufacturers

The DPB of primary focus is the 49/51 DPB. Confectionery manufacturers and packaged cookie manufacturers obtain butterfat at the Class 5 prices of $ 2.63/kg - ~$ 3.02/kg. The reason why it is not economically feasible for these manufacturers to utilize the 49/51 DPB is two-fold.

Firstly, on a kg for kg basis, for every kg of butterfat derived from the DPB, a confectionery manufacturer would pay a very large premium price for the sugar component of the dairy product blend. On a kg for kg basis, for every kg of sugar derived from the DPB, these manufacturers would pay ~$ 1.44 extra for the sugar ($ 2.52/kg for DPB, versus $ 1.08/kg for domestic industrial sugar). Secondly, although they would save ~$ 0.11/kg on the milkfat input ($ 2.52/kg for DPB, versus $ 2.63/kg for domestic Class 5 milkfat), this minimal cost saving would not offset the premium paid for the sugar.

The same premium price for sugar would also apply to the packaged cookie manufacturer. The cookie manufacturer stands to save ~$.0.50 for every kg of milkfat, while paying a premium of $ 1.44 for every kg of sugar. Based on this economic assessment, we concluded that it was not likely that the 49/51 DPB was utilized by biscuit, cookie or confectionery manufacturers. (Recall Utilization Chart 1, page 17) Based on this evaluation, we eliminated the confectionery and packaged cookie sector from the market assessment of the use of DPB in Canada in calendar year 1997.

f) Benchmark Economic Calculations for Use of DPB by Ice Cream Manufacturers

The price for milkfat to be used in the manufacture of ice cream in Canada is priced according to Class 2 levels ($ 5.42/kg) as shown in Table 6. Also shown was that the 1997 list price for sugar was $ 1.08/kg and the average unit value for DPB was $ 2.52/kg. Milkfat and sugar are major ingredients in ice cream formulae. They are present to a lesser extent in processed cheese. The DPB in question is 49% butteroil/51% sugar, on a % by weight basis. For general discussion purposes, it can be estimated that doubling the DPB in a modified formula will approximately equate the milkfat content of the original recipe.

On a general kg for kg basis, this equals a saving on the cost inputs of milkfat and sugar of $ 0.73/kg, as shown in Table 7a, below. That is, when one kg of DPB replaces ½ kg butter plus ½ kg sugar, the net cost saving is $ 0.73. Similarly, when one kg butter, and its accompanying 1 kg of sugar, are replaced by 2 kg of DPB, the savings are $ 1.46.

**Table 7a**
**1997 kg/kg Price Comparison of Inputs of Butterfat and Sugar to Dairy Product Blend**

| Input/Calculation | $/kg | Total kg | $/kg |
|---|---|---|---|
| Sugar | $ 1.08 | 0.5 | $ 0.54 |
| Butterfat | $ 5.42 | 0.5 | $ 2.71 |
| Total | | 1 | $ 3.25 |
| DPB | $ 2.52 | 1 | $ 2.52 |
| $ Difference/kg | | | $ 0.73 |

Individual formulas for ice cream products vary greatly. The total amount of the cost saving will fluctuate from formula to formula. The amount of the 49/51 DPB that can be incorporated will depend on milkfat content (contributed by ingredients such as butter, cream, milk, etc.) and sugar content in the candidate product. For example, when milkfat content is low and sugar is high, the amount of 49/51 DPB that can be potentially utilized will be limited by the milkfat content. As well, it may be limited by requirements for finished product quality, as mentioned above. Similarly, where there is high milkfat content but low sugar content, the replacement rate by 49/51 DPB will be limited by the sugar content. The total cost saving will depend on the amount of DPB used in the product.

Due to the potentially very large cost savings indicated by this benchmark calculation, we proceeded to estimate the aggregate cost impact in the use of DPB in a number of ice cream formulas, as well as in processed cheese, as detailed in subsequent sections of this report.

g) Input Prices Relative to the Price of the 49/51 Butteroil/Sugar Dairy Product Blend

The scope of this study did not allow for a price sensitivity analysis of the dairy and sugar input prices relative to the price of the imported DPB. However, a simple analysis was conducted limited to the 1997 price relationship.

The kg/kg cost saving of $ 0.73/kg generally indicates the minimum dollar amount that each of the domestic inputs of butterfat and sugar would need to fall in price to compete with the constant price of DPB on a kg/kg basis. This amount is $ 0.73x2, or, ~$ 1.50. This is illustrated in two examples below.

**Table 7b**
**1997 kg/kg Price Comparison of Inputs (Butterfat, Sugar, DPB)**
**Scenario 1: Butterfat drops in price by $1.50/kg; other prices remain constant**

| Input/Calculation | $/kg | Total kg | $/kg |
|---|---|---|---|
| Sugar | $ 1.08 | 0.5 | $ 0.54 |
| Butterfat | $ 3.92 | 0.5 | $ 1.98 |
| Total | | 1 | $ 2.52 |
| DPB | $ 2.52 | 1 | $ 2.52 |
| $ Difference/kg | | | $ 0.00 |

The same result would occur if each of the inputs of domestic butterfat and sugar were to decrease by ~$0.75 each, as illustrated in the following scenario. These changes would, collectively, negate the cost saving of the DPB on a kg/kg basis, as shown in Table 7c.

**Table 7c**
**1997 kg/kg Price Comparison of Inputs (Butterfat, Sugar, DPB)**
**Scenario 2: Sugar drops in price by $0.75/kg; Butterfat drops in price by $0.75/kg; DPB price remains constant; other prices remain constant**

| Input/Calculation | $/kg | Total kg | $/kg |
|---|---|---|---|
| Sugar | $ 0.33 | 0.5 | $ 0.175 |
| Butterfat | $ 4.69 | 0.5 | $ 2.35 |
| Total | | 1 | $ 2.52 |
| DPB | $ 2.52 | 1 | $ 2.52 |
| $ Difference/kg | | | $ 0.00 |

Similarly, if the DPB were to increase in price by $0.73 to $3.25/kg, the cost saving on a kg/kg basis would be negated (See Table 7a). Thus, there are many factors that affect the potential cost saving that could be achieved utilizing DPB. It is also important to note, as mentioned above, that few end-product formulas utilize butterfat and sugar on an equal basis. Either butterfat or sugar content will set the limit for the maximum amount of 49/51 DPB that can be incorporated into a product.

The estimation of representative formulas for products which appeared to offer significant cost saving opportunities, and the calculation of ingredient costs relative to butterfat displacement in those products, became the major investigative point of our study. These calculations were used to assess the current and potential financial impact of the 49/51 DPB in the Canadian food processing industry in 1997. Comparable estimates were made for a DPB suitable for use in processed cheese. (See Section H v), below.)

h) Low Economic Feasibility of Separating the DPB

We were asked to examine whether the DPB being imported into Canada could be separated and the individual components of butteroil and sugar used separately. As shown in Table 7a, above, the savings on a kg/kg basis of the DPB over the inputs is $ 0.73. To determine the economic advantage that could be gained by acquiring butteroil from the DPB, it would be necessary to account for the labour and overhead costs of separating the DPB into its individual components.[8] We estimate that these costs would likely offset the potential kg/kg saving of $ 0.73. Also, as mentioned in Section D, the equipment necessary to achieve the separation is not likely to be routinely located in the food manufacturing facilities which will use DPB as a food ingredient. Thus, we believe it to be unlikely that the DPB imported into Canada are being separated into components which are subsequently put to use.

With regard to capturing the cost savings implicit in the kg/kg saving of $0.73, we estimate that the use of the DPB as a substitute for milkfat and sugar is relatively straightforward and simple. Where this is not the case, the additional cost of manufacturing inputs such as time, labour, etc., would erode the cost savings traceable to the food ingredients.

### iii) Ice Cream Categories and Potential Volume and Value of Use of Dairy Product Blends

a) Categories of Ice Cream

The Canadian Food and Drugs Act permits the use of or addition of milkfat to ice cream and to ice cream mix.[9] The Guide to Food Labelling and Advertising[10] requires, for example, that butter added to a food be declared as either “butter” or as “milk ingredient”. Similarly, added butteroil may be declared as “butteroil” or as “milk ingredient”. Further, combinations of ingredients, e.g., cream plus butter plus butteroil added via DPB, would be labeled as “milk ingredients”. An overview of sub-categories of the frozen dairy dessert products category was provided in Section D i), above.

When ice cream is made with high dairy ingredient (predominantly cream) and little or no additives, it usually occupies a “premium” category in the Canadian ice cream market. As mentioned above, these products offer the least potential for replacement of milkfat by DPB due to quality requirements and formulation constraints. Further, the ingredient statements on current premium ice creams indicate they are not presently utilizing DPB. For these reasons, premium ice cream was not investigated in the following evaluation of the potential use of DPB.

[8] Labour would be required to perform and/or supervise the separation operation. As well; the components must be packaged or stored, and possibly shipped, subsequent to separation, thereby consuming a portion of overhead costs. The utilization of the equipment required would be an additional overhead allocation.
[9] Canadian Food and Drugs Act. Section B.08.061..062
[10] Agriculture and Agri-Food Canada. Guide to Food Labelling and Advertising. Section II, page 15.

Numerous store checks confirmed that a wide variety of "regular" and "economy" ice creams carry the label ingredient declaration of "milk ingredients". This indicates a strong likelihood that DPB are being used in the preparation of regular and economy ice creams. Thus, a separate category of evaluation for each of "regular" ice cream and "economy" ice cream was prepared.

"Milk ingredients" were also declared for ice cream "novelties" such as chocolate-coated ice cream bars and for some frozen dairy desserts, such as ice cream layered cakes. It is likely that "ice cream mix" (the product before air is incorporated to form the finished frozen dessert) is being used in the preparation of these items. The use of ice cream mix would facilitate transportation of the ice cream component prior to further processing. Ice cream mix is also used to a significant degree in the foodservice sector whereby incorporation of air at time of mixing facilitates transportation and storage of the product prior to sale. Production data indicate substantial volumes of ice cream mix are produced for further processing into finished frozen dessert products. These data are summarized in Appendix 4. Thus, a separate category of evaluation for "ice cream mix", further segmented into "regular ice cream mix" and "economy ice cream mix", was also prepared.

In summary, the four largest categories of the frozen dairy dessert category were examined to evaluate the potential volume and cost impact of the use of DPB in their manufacture:

i. "regular" ice cream,
ii. "economy" ice cream,
iii. "regular" ice cream mix, and
iv. "economy" ice cream mix.

b) Market Shares of Ice Cream Sub-categories

The Ice Cream Benchmarking Study[11] indicates that "economy" ice cream comprises approximately 15% of the ice cream category, and that "premium" ice cream comprises no more than 10% of the ice cream category. The Statistics Canada Catalogue no. 23-001QX The Dairy Review[12] indicates that, for a few recent years, ice cream mix has comprised approximately 30% of total ice cream production. It was estimated that half of ice cream mix is of a "regular" quality; the remaining half of an "economy" quality. "Regular" ice cream, by deduction, comprises approximately 45% of the ice cream category.

Production volume numbers for ice cream and ice cream mix were obtained from the Statistics Canada document The Dairy Review. The estimated category mix of the Canadian ice cream sector is summarized in Table 8 below.

[11] Ice Cream Benchmarking Study. June 1995. Prepared by Competitive Analysis Centre Inc. for the National Dairy Council of Canada; co-sponsored by Agriculture and Agri-Food Canada.
[12] Statistics Canada Catalogue no. 23-001QX The Dairy Review. Periods: December 1994; October-December 1995; October-December 1996; July-September 1997.

**Table 8**
**Estimated Market Share by Ice Cream Category**

| Sub-category | % of Ice Cream Category |
|---|---|
| Premium | 10 |
| Economy | 15 |
| Regular | 45 |
| Economy Mix | 15 |
| Regular Mix | 15 |
| Total | 100 |

### iv) Volume and Value of the Dairy Inputs Displaced, and of DPB Utilized, in the Manufacture of Ice Cream in Canada January –September 1997

a) Economy Ice Cream Category and Penetration of DPB

Economy ice creams are the lower cost products in the category. In general, these products include higher proportions of lower cost ingredients, e.g., lower cream and/or butter content and higher skim milk powder content. To modify an economy ice cream formula to accommodate a DPB, the DPB would replace all or some of the milkfat and sugar or other sweetener solids in the original recipe. Skim milk powder would be retained in the DPB formula. DPB might be included at a level that would replace part or all of the milkfat-contributing ingredients. Representative prototype formulas for original and DPB-containing products are provided in Appendix 3 a).

Store checks conducted for this study indicated a range of product quality in the economy ice cream category. Examples of price ranges and ingredient statements are included in Appendix 2. This range in quality further segments the category. Manufacturers have differentiated their products to occupy different market positions and offer the "economy" consumer a range of choices. For example, while one manufacturer is content with the lowest-quality position in the category, another manufacturer may prefer to occupy the highest-quality position in the economy category. Due to this segmentation, there is likely a range in both the depth and breadth of DPB usage, owing to the possibly different properties of the 49/51 DPB compared to milkfat, as well as to the manufacturers' desire to maintain and protect their market position.

The prototype formula shown in Appendix 3 illustrates the impact of the 49/51 DPB when it is used to replace 100% of the milkfat in the economy ice cream formula. However, it is realistic to assume that many manufacturers would elect to replace only some of the milkfat in a formula or to use DPB in only some of the varieties being made. Some manufacturers of economy ice cream may prefer not to use DPB.

It may be noted that the growth in usage of DPB described earlier likely reflects gradual incorporation of DPB at higher replacement rates and in more varieties as the manufacturer develops experience using DPB.

The net result of the choice of replacement rate, usage in individual varieties, and segmentation is the "penetration" of DPB in the economy sector. We estimate that the penetration of DPB in the economy ice cream sector is 20-25%.

*Economic Indicators*

Pertinent economic indicators, such as the amount of butter displaced per kilolitre of economy ice cream, and their respective values, illustrate the estimated highest impact of the use of DPB in the production of economy ice cream in Canada during the period January – September 1997. That is, these are the results when 100 % of the milkfat content is displaced by 49/51 DPB. (For detailed formula calculations, refer to Appendix 3.) The indicators and their respective values are outlined in Table 9a below.

**Table 9a**
**Volume and Value Data for Domestic Production of Economy Ice Cream**
**January – September 1997 (per kilolitre)**

| DPB Utilized (kg) [13] | Butter Displaced (kg)[14] | Replace-ment Ratio DPB/ Butter[15] | Sugar Displaced (kg)[16] | Replace-ment Ratio DPB/Sugar [17] | Whey Powder Added (kg)[18] | Net Potential Savings[19] $ |
|---|---|---|---|---|---|---|
| 110.70 | 66.96 | 1.6/1 | 56.70 | 1.9/1 | 2.70 | $134.69 |

Using the production volume data for ice cream (Appendix 4) and the estimated volume of the economy ice cream sub-category (Table 8, above), we can estimate the quantity of economy ice cream produced in the period under review (Ja-Se'97). At an estimated "net usage" or "penetration" of 20 - 25 % for DPB usage, the production of economy ice cream prepared with DPB can be estimated as shown in the following table (Table 9b).

[13] kg DPB Utilized per kilolitre finished ice cream
[14] kg Butter displaced by the DPB, per kilolitre finished ice cream
[15] Replacement Ratio: DPB/Butter
[16] kg Sugar Displaced by the DPB, per kilolitre
[17] Replacement Ratio: DPB/Sugar
[18] kg Whey Powder Added to accommodate use of the DPB, per kilolitre
[19] Dollar savings per kilolitre

**Table 9b**
**Volume and Value Impact Data for Domestic Production of**
**Economy Ice Cream January – September 1997 (11,400 – 14,300 kilolitre)**

| | DPB Utilized | | Butter Displaced | | Sugar Displaced | | Whey Powder Added | |
|---|---|---|---|---|---|---|---|---|
| *~Net Usage* | *20%* | *25%* | *20%* | *25%* | *20%* | *25%* | *20%* | *25%* |
| Volume (tonnes) | 1,262 | 1,581 | 765 | 957 | 648 | 810 | 0.04 | 0.05 |
| Value ($mm) | $ 3.18 | $ 3.99 | $ 4.15 | $ 5.18 | $ 0.70 | $ 0.87 | - $ 0.16 | - $ 0.20 |

b) Regular Ice Cream Category and Penetration of DPB

Regular ice cream is the next higher quality level sub-category. In general, these products will contain higher amounts of dairy ingredients with greater usage of cream and butter than in economy ice cream products. To modify a regular ice cream formula to accommodate a DPB, the DPB would replace all or some of the milkfat from butter and/or cream or other milk products, and sugar in the original recipe. Prototype formulas are provided in Appendix 3. In the prototype containing DPB, the milkfat from butter is replaced with DPB and the cream is maintained at the original level.

Similar to the segmentation of economy ice cream, store checks conducted for this study indicated segmentation of the regular ice cream category. Due to this segmentation, there is likely a range in both the depth and breadth of DPB usage, owing to the different properties between DPB and butterfat, as well as the manufacturers' desire to maintain and protect their market position. The prototype formula shown in Appendix 3 illustrates the impact of DPB when 100% of the butter is replaced in the regular ice cream formula. However, it is realistic to assume that some manufacturers would elect to replace only some of the butter and/or cream in a formula. As well, some manufacturers of regular ice cream may prefer not to use DPB. The net result of this choice and segmentation is the "penetration" of DPB in the regular ice cream sector. We estimate that the penetration of DPB in the regular ice cream sector is 5 - 10 %.

*Economic Indicators*

Pertinent economic indicators, such as the amount of butter displaced per kilolitre of regular ice cream, and their respective values, illustrate the estimated highest impact of the use of DPB in the production of regular ice cream in Canada during the period January – September 1997. The indicators and their respective values are outlined in Table 10a below.

**Table 10a**
**Volume and Value Data for Domestic Production of**
**Regular Ice Cream January – September 1997 (per kilolitre)**

| DPB Utilized (kg) | Butter Displaced (kg) | Replacement Ratio DPB/Butter | Sugar Displaced (kg) | Replacement Ratio DPB/Sugar | Net Potential Savings $ |
|---|---|---|---|---|---|
| 81.0 | 48.60 | 1.6/1 | 40.5 | 2/1 | $ 103.03 |

We used the same approach to calculate production volumes for regular ice cream as for economy ice cream (preceding section). At an estimated "net usage" or "penetration" of 5 - 10%, there would be production of 8,700 – 17,100 kilolitres of regular ice cream utilizing DPB. This usage generates the volume and financial impact on dairy inputs and DPB shown in Table 10b.

**Table 10b**
**Volume and Value Impact Data for Domestic Production of Regular Ice Cream**
**January – September 1997 (8,700 - 17,100 kilolitre)**

| | DPB Utilized | | Butter Displaced | | Sugar Displaced | |
|---|---|---|---|---|---|---|
| *~Net Usage* | *5%* | *10%* | *5%* | *10%* | *5%* | *10%* |
| Volume (tonnes) | 694 | 1,389 | 417 | 833 | 347 | 694 |
| Value ($mm) | $ 1.75 | $ 3.50 | $ 2.26 | $ 452 | $ 0.37 | $ 0.75 |

c) Economy Ice Cream Mix and Penetration of DPB

Ice cream mix is essentially an intermediate product. It may be sold for further processing to produce novelties, ice cream-containing frozen desserts, or products converted to frozen desserts (air incorporation and freezing processes) at restaurant and other foodservice locations. The representative prototype formula used for "economy ice cream mix" is an ice cream mix in which both cream and butter have been replaced with DPB. (Refer to prototype formulas in Appendix 3.) This formula represents the least cost sub-category in the ice cream sector.

Since no butter or cream remains in the prototype DPB formula, the quality of the ice cream may be lessened relative to the original. However, the effects of the substitution may be masked, for example, with flavours such as chocolate and/or added ingredients such as chocolate coating, candy pieces, etc. Thus, it is estimated that a substantial number of ice cream "novelties", such as coated ice-cream bars, are prepared using ice cream mix in which most or all of the butter and cream have been replaced by DPB.

As with the other sub-categories, there will be variations in ice cream quality requirements in products made using economy ice cream mix. The prototype formula shown in Appendix 3 illustrates the impact of DPB when 100% of the cream and butterfat is replaced in the economy ice cream mix formula. However, it is realistic to assume that some manufacturers would elect to replace only some of the cream and butterfat in a formula. Some manufacturers may prefer not to use DPB. Thus, usage of DPB will vary from product to product and from manufacturer to manufacturer. As a result, we estimate that the penetration of DPB in the economy ice cream mix sector is 25-35%.

*Economic Indicators*

Pertinent economic indicators, such as the amount of butter displaced per kilolitre of economy ice cream mix, and their respective values, illustrate the estimated highest impact of the use of DPB in the production of economy ice cream mix in Canada during the period January – September 1997. The indicators and their respective values are outlined in Table 11a below.

**Table 11a**
**Volume and Value Data for Domestic Production of**
**Economy Ice Cream Mix January – September 1997 (per kilolitre)**

| DPB Utilized (kg) | Butter + Cream Displaced (kg) | Replacement Ratio DPB/Butter+ Cream. | Sugar Displaced (kg) | Replacement Ratio DPB/Ssugar | Net Potential Savings $ |
|---|---|---|---|---|---|
| 242 | 198 | 1.22/1 | 121 | 2/1 | $575.69 |

An estimated "net usage" or "penetration" of 25-35%, results in production of 14,300 – 20,001 kilolitres of economy ice cream mix prepared with DPB. This usage generates a volume and financial impact on dairy inputs and DPB, as shown in Table 11b.

**Table 11b**
**Volume and Value Impact Data for Domestic Production of**
**Economy Ice Cream Mix January – September 1997 (14,300 – 20,001 kilolitre)**

| | DPB Utilized | | Butter/Cream Displaced | | Sugar Displaced | |
|---|---|---|---|---|---|---|
| *~Net Usage* | *25%* | *35%* | *25%* | *35%* | *25%* | *35%* |
| Volume (tonnes) | 3,457 | 4,840 | 2,829 | 3,960 | 2,054 | 2,420 |
| Value ($mm) | $ 8.71 | $12.20 | $15.33 | $21.46 | $2.22 | $2.61 |

d) Regular Ice Cream Mix and Penetration of DPB

By "ice cream mix" it is intended to depict an intermediary ice cream product which is made into other ice cream containing products or served to the consumer in a foodservice context, as described in the preceding section. In our sample calculations for "regular ice cream mix", we have depicted an ice cream mix containing cream and butter in which only the butter has been replaced with DPB. The cream in the original formula is retained in the DPB formula. The prototype formulas are shown in Appendix 3.

We estimate that regular ice cream mix is utilized in the foodservice industry to prepare soft-serve ice cream cones and sundaes, milkshakes, milkshake products, etc. The prototype formulas shown in Appendix 3 illustrate the impact of DPB when 100% of the butter is replaced in the regular ice cream mix formula. However, it is realistic to assume that some manufacturers would elect to replace only some of the milkfat (from butter, cream or milk ingredients) in a formula. Some manufacturers may prefer not to use DPB. There will be variations in ice cream quality, as for the other sub-categories. Thus, we expect the usage of DPB will vary from product to product and from manufacturer to manufacturer. As a result, we estimate that the penetration of DPB in the regular ice cream mix sub-category is 25-35%.

*Economic Indicators*

Pertinent economic indicators, such as the amount of butter displaced per kilolitre of regular ice cream mix, and their respective values, illustrate the estimated highest impact of the use of DPB in the production of regular ice cream mix in Canada during the period January – September 1997. The indicators and their respective values are outlined in Table 12a below.

**Table 12a**
**Volume and Value Data for Domestic Production of Regular Ice Cream Mix**
**January – September 1997 (per kilolitre)**

| DPB Utilized (kg) | Butter Displaced (kg) | Replacement Ratio DPB/Butter | Sugar Displaced (kg) | Replacement Ratio DPB/Sugar | Net Potential Savings $ |
|---|---|---|---|---|---|
| 165 | 99 | 1.6/1 | 82.5 | 2/1 | $ 209.88 |

An estimated "net usage" or "penetration" of 25 - 35 %, would result in production of 14,300 – 20,000 kilolitres of regular ice cream mix prepared with DPB. This usage generates a volume and financial impact on dairy inputs and DPB, as shown in Table 12b.

**Table 12b**
**Volume and Value Impact Data for Domestic Production of**
**Regular Ice Cream Mix January – September 1997 (14,300 – 20, 000 kilolitre)**

| | DPB Utilized | | Butter Displaced | | Sugar Displaced | |
|---|---|---|---|---|---|---|
| *~Net Usage* | *25%* | *35%* | *25%* | *35%* | *25%* | *35%* |
| Volume (tonnes) | 2,357 | 3,300 | 1,414 | 1,980 | 1,179 | 1,650 |
| Value ($mm) | $ 5.94 | $ 8.32 | $ 7.67 | $ 10.73 | $ 1.27 | $ 1.78 |

e) Total Ice Cream Sector Estimated Volume and Value Impact

The aggregate effect of this utilization, displacement and savings values are shown in Table 13a on page 37. In this table, we have summarized the data for the four sub-categories of the ice cream sector which were evaluated in detail.

Based on the estimated cumulative net usage in the ice cream sector of 12.75 – 18.75%, we estimate that 7,800 – 11,100 tonnes of 49/51 DPB were utilized in products in these sub-categories of the ice cream sector between January and September 1997. The estimated value of the DPB utilized is $19.5 – 28.0 million dollars.

In the same time period, resulting from the utilization of DPB, we estimate that 5,425 – 7,800 tonnes of butter, or the equivalent amount of milkfat from related sources, were displaced. The value of the displaced butter is estimated to be $29.4 – 41.9 million dollars. Amounts of sugar and whey powder were also displaced or usage otherwise altered. We estimate that this commercial activity generated a net savings to ice cream manufacturers of $13.6 - $19.4 million dollars for the period January – September 1997.

Table 13a: ICE CREAM CATEGORY PROJECTIONS - ESTIMATED CURRENT USAGE RANGE - JA-SE'97

Total Ice Cream Production Ja-Se'97 (kltr): 380,967

**Scenario 1: Estimated Lower Usage Rate**

| Ice Cream Subcategory | Sub-category as a % of Category | Estimated Net % of Products Made Using DPB | Estimated Amount Made Using DPB (kltr) | Estimated Cost Differential using DPB ($/ kltr) | Estimated Total Cost Impact ($mm) | Amount of DPB Utilized (kg/kltr) | Estimated Total Amount of DPB Utilized (tonnes) | Estimated Value of DPB Utilized ($mm) | % of Tariff Item Code 2106.90.95.00 Utilized in the Category | Estimated Amount of Butter Displaced (kg/kltr) | Estimated Total Amount of Butter Displaced (tonnes) | Estimated Value of Butter Displaced ($mm) | Estimated Amount of Sugar Displaced (tonnes) | Estimated Value of Sugar Displaced ($mm) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | (See Note 1) | | (See Note 2) | | (See Note 3) | | (See Note 4) | (See Note 5) | | | (See Note 4) | | (See Note 4) |
| Economy | 15 | 20 | 11,429 | $135 | $1.54 | 110 | 1,262 | $3.18 | 9% | 67 | 765 | $4.15 | 648 | $0.70 |
| Regular | 45 | 5 | 8,572 | $103 | $0.88 | 81 | 694 | $1.75 | 5% | 49 | 417 | $2.26 | 347 | $0.37 |
| Mix Economy | 15 | 25 | 14,286 | $576 | $8.22 | 242 | 3,457 | $8.71 | 23% | 198 | 2,829 | $15.33 | 2,054 | $2.22 |
| Mix Regular | 15 | 25 | 14,286 | $210 | $3.00 | 165 | 2,357 | $5.94 | 16% | 99 | 1,414 | $7.67 | 1,179 | $1.27 |
| Premium | 10 | 0 | 0 | $0 | $0.00 | | | | | | | | | |
| Total: | 100 | 12.75 | 48,573 | | $13.65 | | 7,771 | $19.58 | 52% | | 5,425 | $29.40 | 4,227 | $4.57 |

**Scenario 2: Estimated Higher Usage Rate**

| Ice Cream Subcategory | Sub-category as a % of Category | Estimated Net % of Products Made Using DPB | Estimated Amount Made Using DPB (kltr) | Estimated Cost Differential using DPB ($/ kltr) | Estimated Total Cost Impact ($mm) | Amount of DPB Utilized (kg/kltr) | Estimated Total Amount of DPB Utilized (tonnes) | Estimated Value of DPB Utilized ($mm) | % of Tariff Item Code 2106.90.95.00 Utilized in the Category | Estimated Amount of Butter Displaced (kg/kltr) | Estimated Total Amount of Butter Displaced (tonnes) | Estimated Value of Butter Displaced ($mm) | Estimated Amount of Sugar Displaced (tonnes) | Estimated Value of Sugar Displaced ($mm) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | (See Note 1) | | (See Note 2) | | (See Note 3) | | (See Note 4) | (See Note 5) | | | (See Note 4) | | (See Note 4) |
| Economy | 15 | 25 | 14,286 | $135 | $1.92 | 111 | 1,581 | $3.99 | 11% | 67 | 957 | $5.18 | 810 | $0.87 |
| Regular | 45 | 10 | 17,144 | $103 | $1.77 | 81 | 1,389 | $3.50 | 9% | 49 | 833 | $4.52 | 694 | $0.75 |
| Mix Economy | 15 | 35 | 20,001 | $576 | $11.51 | 242 | 4,840 | $12.20 | 33% | 198 | 3,960 | $21.46 | 2,420 | $2.61 |
| Mix Regular | 15 | 35 | 20,001 | $210 | $4.20 | 165 | 3,300 | $8.32 | 22% | 99 | 1,980 | $10.73 | 1,650 | $1.78 |
| Premium | 10 | 0 | 0 | $0 | $0.00 | | | | | | | | | |
| Total: | 100 | 18.75 | 71,431 | | $19.40 | | 11,110 | $28.00 | 75% | | 7,730 | $41.90 | 5,574 | $6.02 |

Notes:

1. *"Estimated Net % of Products Made Using DPB" reflects net effect of use of DPB to replace butter and sugar. For example, a net effect of 20 % would reflect equivalently the situation where 20 % of the ice cream or mix is made with all the butter replaced with DPB or where 40 % of the ice cream or mix is made with half of the butter replaced with DPB.*
2. *Calculations of the "Estimated Cost Differential" incorporate calculations of the cost of the DPB portion of the formula compared to the cost of the ingredients that would be replaced.*
3. *Calculations of the total amount of DPB utilized are based on estimation of the net effect at 100 % replacement rate in the formula (see Appendix 3). For example, the net effect would be the same where 1/2 as much DPB was used in twice as much finished product.*
4. *Calculations of estimated total value are based on the following costs: DPB @ $ 2.52/kg; Butter @ $ 5.42/kg; Sugar @ $ 1.08/kg; and Whey Powder @ $ 3.89/kg.*
5. *Calculations of proportion of imports under Tariff Item Code 2106.90.95.00 utilized are based on the total import volume of 14,844 tonnes Ja-Se'97.*

f) Total Ice Cream Sector Estimated Potential Maximum Usage

As outlined above, we estimate that the importation of DPB currently impacts a portion of ice cream production, for the four sub-categories evaluated, in the range of approximately 13 – 19 %. Due to the technical feasibility and commercial advantages of replacing butterfat (from butter, cream, etc.) in ice cream formulas, the potential exists for a larger percentage of ice cream manufactured in Canada to be prepared with DPB.

We estimate that it is technically feasible and commercially likely for approximately 60 % of all ice cream manufactured in Canada to be prepared with DPB. Expressed another way, it is reasonable to predict the penetration level of DPB in the ice cream sector could be 60 %. As shown in Table 13b on page 39, penetration could be higher in some sectors, such as economy ice cream. Application of projected penetration factors to the volume of ice cream manufactured January – September 1997 illustrates the potential financial impact of this factor for the period of time specified. As shown in Table 13b, these projections of potential DPB utilization would result in approximately 31,000 tonnes DPB utilized at a value of $ 75.85 mm. This DPB utilization would displace 20,500 tonnes of domestic butter, or equivalent quantities of milkfat from other dairy products (cream, whole milk, etc.), valued at $ 111.14 mm. At the same time, 16,100 tonnes of sugar, or equivalent sweetener solids from other sources, would be displaced at a value of $17.45 mm. Adjustments would also likely occur in usage of other ingredients such as whey powder, skim milk powder, etc., to balance the formulas incorporating the 49/51 DPB.

The net effect of a 60% DPB penetration in the ice cream sector to ice cream manufacturers would be a saving of $ 50.27 mm for the production volume and period specified.

Table 13b: ICE CREAM CATEGORY PROJECTIONS - ESTIMATED POTENTIAL MAXIMUM USAGE - JA-SE'97

Total Ice Cream Production Ja-Se'97 (kltr): 380,967

**Scenario 3: Estimated Potential Maximum Usage Rate**

| Ice Cream Subcategory | Sub-category as a % of Category | Estimated Net % of Products Made Using DPB | Estimated Amount Made Using DPB (kltr) | Estimated Cost Differential using DPB ($/ kltr) | Estimated Total Cost Impact ($mm) | Amount of DPB Utilized (kg/kltr) | Estimated Total Amount of DPB Utilized (tonnes) | Estimated Value of DPB Utilized ($mm) | Estimated Amount of Butter Displaced (kg/kltr) | Estimated Total Amount of Butter Displaced (tonnes) | Estimated Value of Butter Displaced ($mm) | Estimated Amount of Sugar Displaced (tonnes) | Estimated Value of Sugar Displaced ($mm) | Estimated Amount of Whey Powder Displaced (tonnes) | Estimated Value of Whey Powder Displaced ($mm) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | (See Note 1) | | (See Note 2) | | (See Note 3) | | (See Note 4) | | | (See Note 4) | | (See Note 4) | | (See Note 4) |
| Economy | 15 | 80 | 45,716 | $135 | $6.16 | 110 | 5,047 | $12.72 | 67 | 3,061 | 16.59 | 2,592 | $2.80 | 0.17 | $0.65 |
| Regular | 45 | 60 | 102,861 | $103 | $10.60 | 81 | 8,332 | $21.00 | 49 | 4,999 | 27.09 | 4,166 | $4.50 | 0.00 | $0.00 |
| Mix Economy | 15 | 80 | 45,716 | $576 | $26.32 | 242 | 11,063 | $27.88 | 198 | 9,052 | 49.06 | 6,572 | $7.10 | 0.00 | $0.00 |
| Mix Regular | 15 | 60 | 34,287 | $210 | $7.20 | 165 | 5,657 | $14.26 | 99 | 3,394 | 18.40 | 2,829 | $3.05 | 0.00 | $0.00 |
| Premium | 10 | 0 | 0 | $0 | $0.00 | | | | | | | | | | |
| Total: | 100 | 60 | 228,580 | | $50.27 | | 30,099 | $75.85 | | 20,506 | $111.14 | 16,158 | $17.45 | 0.17 | $0.65 |

Notes:

1. *"Estimated Net % of Products Made Using DPB" reflects net effect of use of DPB to replace butter and sugar. For example, a net effect of 20 % would reflect equivalently the situation where 20 % of the ice cream or mix is made with all the butter replaced with DPB or where 40 % of the ice cream or mix is made with half of the butter replaced with DPB.*
2. *Calculations of the "Estimated Cost Differential" incorporate calculations of the cost of the DPB portion of the formula compared to the cost of the ingredients that would be replaced.*
3. *Calculations of the total amount of DPB utilized are based on estimation of the net effect at 100 % replacement rate in the formula (see Appendix 3). For example, the net effect would be the same where 1/2 as much DPB was used in twice as much finished product.*
4. *Calculations of estimated total value are based on the following costs: DPB @ $ 2.52/kg; Butter @ $ 5.42/kg; Sugar @ $ 1.08/kg; and Whey Powder @ $ 3.89/kg.*

**v) Volume and Value of the Dairy Inputs Displaced, and of DPB Utilized, in the Manufacture of Processed Cheese in Canada January –September 1997.**

The Canadian Food and Drugs Act permits the use of or addition of milkfat to processed cheese.[20] The Guide to Food Labelling and Advertising[21] requires that butter added to a food can be declared as either "butter" or as "milk ingredient". Similarly, added butteroil, as an individual ingredient or within a DPB may be labelled as "butteroil" or as "milk ingredient". Our store checks confirmed that a number of processed cheeses or processed cheese "foods" carry label ingredient declarations of "milk ingredient". This indicates a likelihood that DPB may be used in the preparation of some processed cheese products. Further, review of prototype formulas for products in this category confirm potential use of DPB. Thus, a separate evaluation for processed cheese was prepared.

Processed cheese is a highly differentiated category. For example, there is processed cheese; processed cheese with herbs; processed cheese food; processed cheese food with herbs; processed cheese spread; processed cheese spread with herbs; cold-pack cheese; cold-pack cheese food, and others.

a) Processed Cheese and Penetration of DPB

The prototype formulas shown in Appendix 3 illustrate the impact of DPB when 100% of the milkfat from a small amount of butter (or equivalent milkfat-containing ingredient) is replaced in a prototype formula for processed cheese. The DPB could be, for example, a blend of butteroil, glucose solids, emulsifiers and salts, as described in Section D ii). It is realistic to assume that some manufacturers would elect to replace only some of the milkfat in a formula and that some manufacturers may prefer not to use DPB. Further, a portion of processed cheese formulations would not accommodate a DPB due to low content of balancing solids. (Balancing solids are the sweetener solids, salts, etc. that must be in the blend at a level of at least 51 % for inclusion in the Tariff Item Code under consideration.) The degree to which processed cheese manufacturers collectively utilize DPB in the processed cheese category will result in a "net usage" or "penetration" of DPB in the processed cheese category. We estimate the penetration of DPB in the processed cheese category to be 5 – 15%.

*Economic Indicators*

Pertinent economic indicators, such as the amount of butter displaced per tonne of processed cheese, and their respective values, illustrate our estimated highest impact of the use of DPB in the production of processed cheese in Canada during the period January – September 1997. The indicators and their respective values are outlined in Table 14a below.

[20] Canadian Food and Drugs Act. Section B.08.040 - 041.8
[21] Agriculture and Agri-Food Canada. Guide to Food Labelling and Advertising. Section II, page 15.

**Table 14a**
**Volume and Value Data for Domestic Production of Processed Cheese**
**January – September 1997 (per tonne)**

| DPB Utilized (kg) | Butter Displaced (kg) | Replace-ment Ratio DPB/Butte r | Sugar Displaced (kg) | Replace-ment Ratio DPB/Sugar | Salts/Emul-sifiers Displaced | Replace-ment Ratio DPB/S./E. | Net Potential Savings $ |
|---|---|---|---|---|---|---|---|
| 100 | 50 | 2/1 | 30 | 3.3/1 | 20 | 5/1 | $ 102.90 |

At an estimated "net usage" of 5 - 15%, from 2,750 – 8,245 tonnes of processed cheese would be prepared with DPB, having the financial impacts on dairy inputs and DPB, as shown in Table 14b.

**Table 14b**
**Volume and Value Impact Data for Domestic Production of Processed Cheese**
**January – September 1997 (2,750 – 8,245 tonnes)**

| | DPB Utilized | | Butter Displaced | | Sugar Displaced | | Salts/Emulsifiers Displaced | |
|---|---|---|---|---|---|---|---|---|
| *~Net Usage* | *5%* | *15%* | *5%* | *15%* | *5%* | *15%* | *5%* | *15%* |
| Volume (tonnes) | 275 | 824 | 137 | 412 | 82 | 247 | 0.01 | 0.02 |
| Value ($mm) | $ 0.7 | $ 2.08 | $ 0.74 | $ 2.23 | $ 0.09 | $ 0.27 | $ 0.01 | $ 0.04 |

b) Total Processed Cheese Sector Estimated Volume and Value Impact

The aggregate effect of this utilization, displacement and savings values are shown in Table 15 on page 42 for the category of processed cheese.

With an estimated usage in the processed cheese sector of 5-15%, it is estimated that from 275 – 824 tonnes of DPB were utilized by the processed cheese sector between January and September 1997, at an estimated value of $ 0.7 – 2.08 million dollars. In the same time period, and due to this factor, 137 - 412 tonnes of milkfat from butter or other sources (cheese, cream, etc.) were displaced at a value of $ 0.74 – 2.23 million dollars. An amount of sugar, salts and emulsifiers were also displaced.

Table 15: PROCESSED CHEESE AND OTHER FOODS CATEGORY PROJECTIONS - ESTIMATED CURRENT USAGE RANGE - JA-SE'97

Total Processed Cheese Production Ja-Se'97 (tonnes): 54,964

**Scenario 1: Estimated Lower Usage Rate**

| Product Category | % of Category | Estimated Net % of Products Made Using DPB | Estimated Amount Made Using DPB (tonnes) | Estimated Cost Differential using DPB ($/ tonne) | Estimated Total Cost Impact ($mm) | Amount of DPB Utilized (kg/tonne) | Estimated Total Amount of DPB Utilized (tonnes) | Estimated Value of DPB Utilized ($mm) | % of Tariff Item Code 2106.90.95.00 Utilized in the Category | Estimated Amount of Butter Displaced (kg/tonne) | Estimated Total Amount of Butter Displaced (tonnes) | Estimated Value of Butter Displaced ($mm) | Estimated Amount of Sugar Displaced (tonnes) | Estimated Value of Sugar Displaced ($mm) | Estimated Amount of Salts/Emul-sifiers Displaced (tonnes) | Estimated Value of Salts/Emul-sifiers Displaced ($mm) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | (See Note 1) | | (See Note 2) | | (See Note 3) | | (See Note 4) | (See Note 5) | | | (See Note 4) | | (See Note 4) | | (See Note 4) |
| Processed Cheese | 100 | 5 | 2,748 | $102.9 | $0.28 | 100 | 275 | $0.69 | 2% | 50 | 137 | $0.74 | 82 | $0.09 | 0.01 | $0.01 |
| Other Foods | 100 | 0 | 0 | $0 | $0.00 | | | | | | | | | | | |

**Scenario 2: Estimated Higher Usage Rate**

| Product Category | % of Category | Estimated Net % of Products Made Using DPB | Estimated Amount Made Using DPB (tonnes) | Estimated Cost Differential using DPB ($/ tonne) | Estimated Total Cost Impact ($mm) | Amount of DPB Utilized (kg/tonne) | Estimated Total Amount of DPB Utilized (tonnes) | Estimated Value of DPB Utilized ($mm) | % of Tariff Item Code 2106.90.95.00 Utilized in the Category | Estimated Amount of Butter Displaced (kg/tonne) | Estimated Total Amount of Butter Displaced (tonnes) | Estimated Value of Butter Displaced ($mm) | Estimated Amount of Sugar Displaced (tonnes) | Estimated Value of Sugar Displaced ($mm) | Estimated Amount of Salts/Emul-sifiers Displaced (tonnes) | Estimated Value of Salts/Emul-sifiers Displaced ($mm) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | (See Note 1) | | (See Note 2) | | (See Note 3) | | (See Note 4) | (See Note 5) | | | (See Note 4) | | (See Note 4) | | (See Note 4) |
| Processed Cheese | 100 | 15 | 8,245 | $102.9 | $0.85 | 100 | 824 | $2.08 | 6% | 50 | 412 | $2.23 | 247 | $0.27 | 0.02 | $0.04 |
| Other Foods | 100 | 5 | *Not available - See Note 6.* | | | | | | | | | | | | | |

Notes:

1. *"Estimated Net % of Products Made Using DPB" reflects net effect of use of DPB to replace butter, sugar and other solids. For example, a net effect of 5 % would reflect equivalently the situation where 5 % of processed cheese is made with all the butter replaced with DPB or where 10 % of processed cheese is made with half of the butter replaced with DPB.*
2. *Calculations of the "Estimated Cost Differential" incorporate calculations of the cost of the DPB portion of the formula compared to the cost of the ingredients that would be replaced, e.g., butter, sugar or glucose solids, salts and emulsifiers (see Appendix 3).*
3. *Calculations of the total amount of DPB utilized are based on estimation of the net effect at 100 % replacement rate in the formula (see Appendix 3). For example, the net effect would be the same where 1/2 as much DPB was used in twice as much finished product.*
4. *Calculations of estimated total value are based on the following costs: DPB @ $ 2.52/kg; Butter @ $ 5.45/kg; Sugar @ $ 1.08/kg; and Salts/Emulsifiers @ $ 2.50/kg.*
5. *Calculations of proportion of imports under Tariff Item Code 2106.90.95.00 utilized are based on the total import volume of 14,844 tonnes Ja-Se'97.*
6. *Data for production volumes of "Other Foods" which may utilize DPB are not available. See sample list of relevant potential food products and categories in Appendix 2.*

### vi) Other Foods and Potential Volume and Value of Use of Dairy Product Blends

As mentioned earlier in this report, there is wide potential for DPB to replace butter and other ingredients such as sugars and salts in other processed foods. Usage of DPB in these foods has been reviewed in a general sense earlier in this report. A cost impact analysis for usage of DPB in these food products was not conducted. However, a sample list of relevant potential food products and categories is provided in Appendix 2 as well as in Utilization Charts 1 and 2.

### vii) Total Estimated Volume and Value Impact of Imported Dairy Product Blends on the Canadian Food and Dairy Processing Industries

The pertinent economic indicators and their values which illustrate our estimate of the impact of the use of DPB on the production of ice cream and processed cheese in Canada during the period January – September 1997 are shown in Table 16a on page 44.

Using the aforementioned methodologies, we estimate that 8,046 – 11,900 tonnes of DPB were utilized in the production of ice cream and processed cheese during the specified period of time. This DPB, valued at from $ 20.2- $ 30.0 million dollars, is estimated to have displaced 5,500 – 8,100 tonnes of domestic butterfat valued at $ 30.1 - $ 44.1 million dollars. In addition, sugars, whey powder, salts and emulsifiers were displaced, in the quantities and at the value shown in Table 16a.

Estimated net savings to food producers due to this commercial activity is estimated to be $ 13.93 - $ 20.2 million dollars for the period specified.

Table 16a: CUMULATIVE TOTALS FOR ICE CREAM, PROCESSED CHEESE AND OTHER FOODS CATEGORY PROJECTIONS - ESTIMATED CURRENT USAGE RANGE - JA-SE'97

Total Ice Cream Production Ja-Se'97 (kltr): 380,967
Total Processed Cheese Production Ja-Se'97 (tonnes): 54,964

**Scenario 1: Estimated Lower Usage Rate**

| Product Category | % of Category | Estimated Net % of Products Made Using DPB | Estimated Amount Made Using DPB | Estimated Total Cost Impact ($mm) | Estimated Total Amount of DPB Utilized (tonnes) | Estimated Value of DPB Utilized ($mm) | % of Tariff Item Code 2106.90.95.00 Utilized in the Category | Estimated Total Amount of Butter Displaced (tonnes) | Estimated Value of Butter Displaced ($mm) | Estimated Amount of Sugar Displaced (tonnes) | Estimated Value of Sugar Displaced ($mm) | Estimated Amount of Other Solids Displaced (tonnes) | Estimated Value of Other Solids Displaced ($mm) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | (See Note 1) | | (See Note 2) | | (See Note 3) | (See Note 4) | | (See Note 3) | | (See Note 3) | | (See Note 3) |
| Ice Cream *(From Table 13a)* | 100 | 12.75 | 48,573 kltr | $13.65 | 7,771 | $19.58 | 52% | 5,425 | $29.40 | 4,227 | $4.57 | 0.04 | $0.16 |
| Processed Cheese *(From Table 15)* | 100 | 5 | 2,748 tonnes | $0.28 | 275 | $0.69 | 2% | 137 | $0.74 | 82 | $0.09 | 0.006 | $0.01 |
| Subtotal: | | | | $13.93 | 8,046 | $20.28 | 54% | 5,562 | $30.15 | 4,309 | $4.65 | 0.046 | $0.17 |
| Other Foods | 100 | 0 | 0 | $0.00 | | | | | | | | | |

**Scenario 2: Estimated Higher Usage Rate**

| Product Category | % of Category | Estimated Net % of Products Made Using DPB | Estimated Amount Made Using DPB | Estimated Total Cost Impact ($mm) | Estimated Total Amount of DPB Utilized (tonnes) | Estimated Value of DPB Utilized ($mm) | % of Tariff Item Code 2106.90.95.00 Utilized in the Category | Estimated Total Amount of Butter Displaced (tonnes) | Estimated Value of Butter Displaced ($mm) | Estimated Amount of Sugar Displaced (tonnes) | Estimated Value of Sugar Displaced ($mm) | Estimated Amount of Other Solids Displaced (tonnes) | Estimated Value of Other Solids Displaced ($mm) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | (See Note 1) | | (See Note 2) | | (See Note 3) | (See Note 4) | | (See Note 3) | | (See Note 3) | | (See Note 3) |
| Ice Cream *(From Table 13a)* | 100 | 18.75 | 71,431 kltr | $19.40 | 11,110 | $28.00 | 74.8% | 7,730 | $41.90 | 5,574 | $6.02 | 0.05 | $0.20 |
| Processed Cheese *(From Table 15)* | 100 | 15 | 8,245 tonnes | $0.85 | 824 | $2.08 | 5.6% | 412 | $2.23 | 247 | $0.27 | 0.02 | $0.04 |
| *Subtotal:* | | | | $20.25 | 11,934 | $30.07 | 80.4% | 8,142 | $44.13 | 5,821 | $6.29 | 0.067 | $0.24 |
| Other Foods | 100 | 5 | *Not available - See Note 5.* | | | | | | | | | | |

Notes:

1. *"Estimated Net % of Products Made Using DPB" reflects net effect of use of DPB to replace butter, sugar and/or other solids.*
2. *Calculations of the "Estimated Total Cost Impact" incorporate calculations of the cost of the DPB portion of the formula compared to the cost of the ingredients that would be replaced, e.g., butter, sugar or glucose solids, salts and emulsifiers (see Appendix 3).*
3. *Calculations of estimated total value are based on the following costs: DPB @ $ 2.52/kg; Butter @ $ 5.42/kg (ice cream) or $ 5.45/kg (processed cheese); Sugar @ $ 1.08/kg; Whey Powder @ $ 3.89/kg; and Salts/Emulsifiers @ $ 2.50/kg.*
4. *Calculations of proportion of imports under Tariff Item Code 2106.90.95.00 utilized are based on the total import volume of 14,844 tonnes Ja-Se'97.*
5. *Data for production volumes of "Other Foods" which may utilize DPB are not available. See sample list of relevant potential food products and categories in Appendix 2.*

*Total Processed Cheese Sector Estimated Potential Maximum Usage*

As aforementioned, the estimated importation of DPB currently impacts only approximately 5 - 15% of all processed cheese manufactured. Due to the technical feasibility and commercial likelihood of DPB replacing butterfat in processed cheese formulas, potential exists for a larger percentage of processed cheese manufactured in Canada to be prepared with DPB.

We estimate that it is technically feasible and commercially likely for approximately 25% of all processed cheese manufactured in Canada to be prepared with DPB. Expressed another way, it is reasonable to predict the penetration level of DPB in the processed cheese sector to be 25%. As shown in Table 16b on page 46, this case would result in approximately 1,374 tonnes DPB utilized at a value of $ 3.5 million dollars. This DPB utilization would displace 687 tonnes domestic butterfat valued at $ 3.72 million dollars. An amount of other solids such as emulsifiers would also be displaced.

The net effect of a 25% DPB penetration in the processed cheese sector to processed cheese manufacturers would be a saving of $ 1.41 million dollars for the volume and period specified.

*Total Ice Cream, Processed Cheese and Other Foods: Estimated Potential Maximum DPB Usage*

As aforementioned, the estimated importation of DPB currently impacts only approximately 13 – 18% of all ice cream manufactured and 5 - 15% of all processed cheese manufactured for the period January – September 1997. Due to the technical feasibility and commercial likelihood of DPB replacing butterfat in ice cream and processed cheese formulas, potential exists for a larger percentage of these products manufactured in Canada to be prepared with DPB.

Table 16b on page 46 illustrates the estimated potential maximum impact on the ice cream and processed cheese sectors in the instance that maximum penetration of DPB into these sectors would occur. The cumulative effect of 60% penetration in the ice cream sector and 25% penetration in the processed cheese sector is shown. This scenario indicates a utilization of 31, 500 tonnes DPB valued at $ 79.3 million dollars. This DPB utilization would displace 21,200 tonnes domestic butterfat valued at $ 115 million dollars. This amount of butterfat represents 16 % of the butterfat produced for industrial usage during the period January – September 1997. (See Appendix 4.) In addition, it is estimated that with maximum potential usage of DPB in these sectors, 16,500 tonnes of sugar would be displaced at a value of approximately $18 million dollars.

Should the estimated maximum penetration of DPB be achieved in the ice cream and processed cheese sectors, this commercial activity would result in net savings to the respective manufacturers of approximately $51 million dollars.

Table 16b: TOTALS FOR ICE CREAM, PROCESSED CHEESE AND OTHER FOODS CATEGORY PROJECTIONS - ESTIMATED POTENTIAL MAXIMUM USAGE RANGE - JA-SE'97

Total Ice Cream Production Ja-Se'97 (kltr): 380,967
Total Processed Cheese Production Ja-Se'97 (tonnes): 54,964

**Scenario 3: Estimated Potential Maximum Usage Rate**

| Product Category | % of Category | Estimated Net % of Products Made Using DPB | Estimated Amount Made Using DPB | Estimated Total Cost Impact ($mm) | Estimated Total Amount of DPB Utilized (tonnes) | Estimated Value of DPB Utilized ($mm) | Estimated Total Amount of Butter Displaced (tonnes) | Estimated Value of Butter Displaced ($mm) | Estimated Amount of Sugar Displaced (tonnes) | Estimated Value of Sugar Displaced ($mm) | Estimated Amount of Other Solids Displaced (tonnes) | Estimated Value of Other Solids Displaced ($mm) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | (See Note 1) | | (See Note 2) | | (See Note 3) | | (See Note 3) | | (See Note 3) | | (See Note 3) |
| Ice Cream *(From Table 13b)* | 100 | 60 | 228,580 kltr | $50.27 | 30,099 | $75.85 | 20,506 | $111.14 | 16,158 | $17.45 | 0.17 | $0.65 |
| Processed Cheese | 100 | 25 | 13,741 tonnes | $1.41 | 1,374 | $3.46 | 687 | $3.72 | 412 | $0.45 | 0.03 | $0.07 |
| *Subtotal:* | | | | $51.68 | 31,473 | $79.31 | 21,193 | $114.87 | 16,570 | $17.90 | 0.198 | $0.72 |
| Other Foods | 100 | 25 | *Not available - See Note 4.* | | | | | | | | | |

Notes:

1. *"Estimated Net % of Products Made Using DPB" reflects net effect of use of DPB to replace butter, sugar and/or other solids.*
2. *Calculations of the "Estimated Total Cost Impact" incorporate calculations of the cost of the DPB portion of the formula compared to the cost of the ingredients that would be replaced, e.g., butter, sugar or glucose solids, salts and emulsifiers (see Appendix 3).*
3. *Calculations of estimated total value are based on the following costs: DPB @ $ 2.52/kg; Butter @ $ 5.42/kg (ice cream) or $ 5.45/kg (processed cheese); Sugar @ $ 1.08/kg; Whey Powder @ $ 3.89/kg; and Salts/Emulsifiers @ $ 2.50/kg.*
4. *Data for production volumes of "Other Foods" which may utilize DPB are not available. See sample list of relevant potential food products and categories in Appendix 2.*

# I Advantages and Disadvantages in Using Dairy Product Blends

We estimate that there are many advantages inherent in the innovative use of dairy product blends, particularly the 49/51 DPB, by certain Canadian processed food manufacturers.

Manufacturers who will reap the benefits of these advantages are those who manufacture foods with both milkfat and sugar content (e.g., many sub-categories of ice cream) or foods with milkfat and "other solids" content, i.e. salt and emulsifiers (e.g., some processed cheese products).

## i) Advantages of Using Dairy Product Blends

Below, we briefly comment on the advantages we judge to be operative in the food manufacturing sector, stemming from the use of imported DPB.

### 1. Access to economies of scale realized by dairy producers in the DPB country of origin.

An analysis of the economies of scale of the milk processing industry in other countries is beyond the scope of this paper. However, it is common knowledge that fluid milk, i.e., milk available to consumers, must be processed relatively close to the locale of consumption. This is due to the high potential microbiological spoilage factor in the product. Secondly, it is the most cost-effective method to deliver a safe product. As mentioned earlier, milk is approximately 87% water, and water is very expensive to transport.

It may be said that as the number of consumers located close to a milk processing plant increases, the economies of scale that milk-processing plant can potentially employ will increase.

Consideration of both population size and population density of Canada, compared to that of industrialized countries other than Canada, will illustrate why it is very unlikely that Canada's milk processors will ever have access to the economies of scale available to their counterparts in some other countries.

**Table 17a[22]**
**Population ('000,000)**

| Country | Canada | USA | France | Italy | UK | Germany | Japan | Mexico |
|---|---|---|---|---|---|---|---|---|
| Population | 29.6 | 263.0 | 58.1 | 57.2 | 58.6 | 81.6 | 125.2 | 91.1 |

[22] Statistics Canada.1997 Canada at a Glance. Pages 12-13.

**Table 17b[23]**
**Population density per square kilometer**

| Country | Canada | USA | France | Italy | UK | Germany | Japan | Mexico |
|---|---|---|---|---|---|---|---|---|
| Persons per sq. km | 3.0 | 28.0 | 106.0 | 190.0 | 239.0 | 229.0 | 332.0 | 46.0 |

Discounting the large amount of non-arable land in Canada, by a factor of, for example, 80%, still generates a low population density for the country of Canada, in comparison to other jurisdictions, as illustrated in Table 17c.

**Table 17c[24]**
**Population density per square kilometer**
**(Canadian non-arable land discounted by 80%)**

| Country | Canada | USA | France | Italy | UK | Germany | Japan | Mexico |
|---|---|---|---|---|---|---|---|---|
| Persons per sq. km | 15.0 | 28.0 | 106.0 | 190.0 | 239.0 | 229.0 | 332.0 | 46.0 |

**1. Low barriers to use and ease of adoption**

As outlined in Section E, DPB present a simple and straightforward substitution for the industrial use of some or all of the milkfat and sugar in an ice cream or processed cheese formula. There appears to very little adjustment required by the manufacturers to avail themselves of the full potential of the DPB.

**2. Low consumer resistance; nil effect on total production**

There appears to be little consumer resistance to the declaration “milk ingredients” as required on a label of a food that has been prepared using the butteroil/sugar blend. While manufacturers may choose to declare the butteroil content separately, they also have the option of declaring that portion of the blend as “milk ingredient”. Our research shows that most have opted for the latter choice. Further, little consumer resistance to this declaration is evident.

Appendix 4 shows total production of the end products analyzed under this study for the calendar years 1993 to 1997, as well as other dairy-based end products. It is shown that volume of sales of categories of ice cream and of processed cheese since the introduction of DPB into Canada has not been negatively affected.

[23] Ibid.
[24] Ibid.

### 3. High degree of specialization in the dairy industry

A Statistics Canada Report, Specialization and Coverage Ratios for the Manufacturing Industries of Canada[25], illustrates both the degree of specialization and the degree of coverage of various industries in Canada. It is shown that the dairy processing industry is highly specialized, and that further, the dairy processing industry produces almost all Canada's dairy products. This indicates that the dairy processing industry is set up, through its highly specialized equipment and perhaps its trained labour, to make only dairy products and little of any other food category. This means that the dairy processing industry has little latitude to branch into other food products. Moreover, firms operating within the dairy processing industry can differentiate their products only within the dairy products sector. They cannot, for example, move into shelf stable goods with the same capital structure.

The relevance of this fact to the use of DPB is that a firm in the dairy processing industry can achieve cost savings only from the category of dairy processed foods. The cost savings had from the use of DPB in ice cream and processed cheese represent a cost advantage which can be maximized only by the dairy processing industry.

### 4. Canada's finite marketplace and diminished economies of scale of varieties

Dairy products are, for the most part (with the exception of shelf-stable processed cheese), highly perishable products and thus, the marketplace is confined to domestic borders. Removal of water, and, specialized transportation equipment at a substantial cost, will allow export of product. However, other markets appear to be well serviced by their host sources of milk and dairy products.

It is very difficult for a firm or even an industry to increase volume without new consumers. Population growth in Canada's domestic marketplace is quite low, estimated at 1.2% annually.[26] Most population growth is due to immigration, and in some cases, some of the nationalities represented, e.g. Asian countries, are unaccustomed to regular dairy product consumption. In many cases, a period of trial occurs before these new Canadian residents become regular consumers of dairy products.

Many food processors in Canada rely on product differentiation to achieve a source of variety with which to retain market share in a finite market. As regards the ice cream sector, a high degree of product differentiation is evident from the many flavours of ice cream available on the market. As well, there are differing levels of quality with parallel price scales. A wide assortment of frozen desserts such as ice cream cakes, ice cream bars, sherbets, etc., is evident in the marketplace. While market share is, in many cases, held constant with this level of product differentiation, the smaller runs of differentiated lines imply lower profit margins, and, in some cases, lower operating margins.

[25] Statistics Canada. March 1997. Specialization and Coverage Ratios for the Manufacturing Industries of Canada. SC 61F0041MPE. John S. Crysdale. Page 25.
[26] Statistics Canada.1997 Canada at a Glance. Pages 12-13.

The savings in the Cost of Goods shown earlier in this report would help defray the loss in margins from the smaller runs of differentiated products.

### ii) Disadvantages of Using Dairy Product Blends

We do not estimate many disadvantages to the use of dairy product blends by the dairy and food processing industries.

#### 1. Limitation to compatible formulas

Use of the butteroil/sugar DPB is limited to those formulas where butterfat and sugar are in the formula. Other DPB will be limited to those formulas which require both or all of their components. Since a premium price is paid for the "other part of the blend", e.g., in the case of butteroil/sugar, for the sugar component, it is economical to the industrial user to use the DPB if and only if all of the DPB can be used in a formula.

#### 2. Limitation by compliance with Canada's Food and Drugs Act

Canada's Food and Drugs Act specifies the standards for a number of finished food products such as bread, cheese, ice cream, etc. If a product standard does not permit the addition of a dairy ingredient such as butterfat, then a DPB containing that ingredient cannot be used in the manufacture of the product in Canada.

#### 3. Potential fluctuation of input prices relative to the price of the DPB

As shown in Section H, it is currently economical to use DPB in Canada due to the cost savings relative to the price of domestic butterfat and domestic sugar. If the price of these inputs were to drop significantly, and the price of the DPB were held constant, then the DPB would not present an economical proposition. Similarly, if the price of the DPB were to rise to the amount that it offsets any savings on the cost of inputs, then the DPB would again, not present an economical proposition.

#### 4. Quality limitations

The potential applications for DPB may be limited by product quality requirements linked to the attributes of the DPB in comparison to the attributes of the ingredients that may be replaced. For example, in premium ice cream, it is unlikely that a high replacement rate could be used due to loss in product quality, as described in Sections G and H.

## 5. Loss of domestic profit

It has been shown that the use of DPB in Canada results in displacement in the volume and value of domestic butterfat and whey powder. It has also been shown that the value of the cost savings to manufacturers from the use of DPB is less than the value of the displaced domestic dairy inputs. This represents a loss of national profit.

## 6. Refrigerated/frozen requirement

The DPB must remain in a refrigerated or frozen state for the suspension of the sugar to remain constant throughout the blend. Should the DPB begin to thaw, the sugar may fall out of suspension and the top layer have a higher butterfat content. Presumably, a DPB in such a state would fail to comply with the Tariff Item Code 2106.90.95.00 specifications due to the higher butterfat content detected at the top of the container.

In addition, the DPB must at least be kept refrigerated so as to decrease the potential microbiological contamination of the butteroil portion. This storage requirement may be a disadvantage, but not a large one.

## J Conclusion

Our research indicates that Dairy Product Blends (DPB) of the composition 49/51 butteroil/sugar, and other DPB of similar though not specific description, are being imported into Canada at a quick pace. Since 1995, on a yearly basis, importation volume has grown steadily.

DPB are being used as a food-processing ingredient. Our estimated high growth rate of DPB importation indicates that the food and dairy processing industries are adopting DPB at an equally quick pace. Further, this assessed growth rate indicates that the DPB present low barriers to use in these industries.

Our research concludes that DPB of butteroil/sugar composition are being used in the preparation of ice cream, other than premium ice cream. Further, a DPB with a butteroil component and a salt/emulsifier component is very likely being used in the manufacture of processed cheese.

Our period of investigation focused on the term January – September 1997, as this is the largest time period in calendar year 1997 for which production numbers of dairy products is available. During that time period, we estimate that approximately 7,800 – 11,100 tonnes of DPB, valued at $ 19.5 - $ 28.0 million dollars, were utilized in the production of ice cream. In this manufacture of this ice cream, approximately from 5,425 – 7,800 tonnes of domestic butterfat valued at $ 30.0 - $ 42.0 million dollars was displaced. An amount of sweetener solids was also displaced.

Our assessment indicates that it is both technically feasible and commercially likely for a portion of the DPB imported into Canada to be used in the manufacture of processed cheese. We estimate that in the period January – September 1997, approximately 275 – 824 tonnes of DPB, valued at $ 0.7- $ 2.0 million dollars, could have been utilized in the production of processed cheese. In the event that this occurred, approximately from 137 – 412 tonnes of domestic butterfat may have been displaced, valued at $ 0.7 - $ 2.23 million dollars. In addition, an amount of sweetener solids, salts and emulsifiers would also have been displaced.

In total, we estimate that between the period January – September 1997, a range of 8,046 – 11,900 tonnes DPB valued at $ 20.2 - $ 30.0 million dollars displaced 5,562 – 8,142 tonnes of butterfat valued at $ 30 - $ 44 million dollars. In addition, sugars, whey powder, salts and emulsifiers were displaced in the use of the DPB in the manufacture of ice cream and processed cheese.

Our research indicates that substitution of butterfat and sugar in an ice cream or a processed cheese formula is technically feasible and commercially likely. In addition, substitution represents significant cost savings to manufacturers of these products.

For the above noted time period, and in the above referenced displacement of domestic butterfat by imported DPB, we estimate that dairy processors saved approximately $ 14.0 - $ 20.0 million dollars.

The exact volume and value of DPB imported into Canada is yet to be confirmed. However, the technical and market assessment methodologies implemented throughout this study indicates that the aforementioned DPB utilization affected 13 – 19% of all ice cream manufactured and 5 – 15% of all processed cheese manufactured during the period of investigation, January – September 1997. Thus, we conclude that the current usage of DPB in Canada in the ice cream and processed cheese sectors is not at its maximum level.

Due to the ease of use of DPB in the sectors covered, and the economic incentives implicit in their composition and price, we predict a penetration level much higher than the one currently observed. We estimate a maximum DPB potential penetration level of 60% in the ice cream sector and 25% in the processed cheese sector.

In the application of this estimated maximum potential penetration to the period of investigation, January – September 1997, we assess that 31,500 tonnes of DPB would have been utilized. This in turn, would have displaced 22,00 tonnes of domestic butterfat valued at approximately $ 115.0 million dollars. Since domestic butterfat production for industrial purposes was 130,000 tonnes for the period January – September 1997, the maximum potential usage of DPB would have displaced 16% of domestic butterfat production for industrial purposes.

Utilization of DPB displaces sugar as well as butter. In the maximum potential penetration scenario described above, it is estimated that 16,600 tonnes of sugar would be displaced, valued at $ 18.0 million dollars.

Cost savings are the strongest determinant in the usage of DPB in ice cream and processed cheese. Our assessment indicates that the maximum potential penetration scenario would yield cost savings to ice cream and processed cheese manufacturers of the amount of $ 52.0 million dollars.

Our assessment indicates that while it is technically feasible, it is unlikely that DPB are being separated into their components for subsequent use of the individual components, for economic reasons.

*Signature Page in Originals*

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## Verbal Report:

Redpath Ltd. Toronto, ON February 20, 1998 (Industrial Sugar Prices)

## Appendix 2: Examples of Finished Product Ingredient Statements

### *A) Ice Cream and Frozen Yogurt and Milkshake Products*

***Samples: Economy Ice Cream***

**Equality (A&P label): Vanilla Ice Cream $ 1.89/2 L "brick" pack**

Ingredients: milk ingredients, sugar, glucose, modified milk ingredients, mono- and diglycerides, cellulose gum, guar gum, calcium sulfate, polysorbate 80, carrageenan, colour, artificial flavour.
Prepared for: The Great Atlantic & Pacific Company of Canada Limited, Toronto, Canada

**Good Humor: Vanilla Ice Cream $ 1.99/2 L "brick" pack**
Ingredients: milk ingredients, sugar, glucose-fructose, modified milk ingredients, mono- and diglycerides, cellulose gum, guar gum, calcium sulfate, polysorbate 80, carrageenan, colour, artificial flavour. *May contain traces of peanuts and/or other nuts.
Manufactured by: Good Humor-Breyers, Burlington, Ont.

***Samples: Regular Ice Cream***

**Sealtest: Parlour Ice Cream, Vanilla $ 3.69/2 L cardboard "tub"**
Ingredients: milk ingredients, modified milk ingredients, sugar, glucose, carob bean gum, guar gum, carrageenan, cellulose gum, mono- and diglycerides, polysorbate 80, artificial flavour, colour, citric acid. May contain trace amounts of peanuts or other nuts.
Licensee: Nestle Canada, Inc., North York, Ontario

**Breyers: All Natural Ice Cream, Natural Vanilla with real vanilla bean specks**
**$ 4.99/2 L cardboard rectangular tub**
Contains only: evaporated skim milk, fresh milk, fresh cream, sugar, frozen egg yolk, natural vanilla flavour, pure ground vanilla beans. *May contain traces of peanuts and/or other nuts.
Product of Good Humor-Breyers, Burlington, Ont.

***Samples: Premium Ice Cream***

**Haagen-Dazs: Vanilla Ice Cream $ 4.49/500 mL cardboard cylindrical tub**
Ingredients: cream, concentrated skim milk, sugar, liquid yolk, natural vanilla extract.
Ault Foods Limited, Etobicoke, Ontario

**Master Choice: Quintessential Chocolate Truffle, Premium Ice Cream**
**$ 3.59/1 L cardboard cylindrical tub**
Ingredients: milk ingredients, sugar, cocoa, glucose-fructose, modified milk ingredients, mono- and diglycerides, cellulose gum, guar gum, polysorbate 80, carrageenan. Chocolate Truffles: sugar, partially hydrogenated vegetable oil, glucose, cocoa, peanut oil, chocolate liquor, salt, lecithin.
Prepared for: The Great Atlantic & Pacific Company of Canada Limited, Toronto, Canada

***Sample: Frozen Yogurt***

**Chapman's: Frozen Yogurt, Raspberry $ 2.99/2 L plastic cylindrical tub**
Ingredients: modified milk ingredients, sugar, raspberries, glucose, stabilizer, bacterial culture. Raspberries: sugar, raspberries, water, starch, citric acid, natural flavour, sodium benzoate, sodium citrate, colour (blue #1, red #2). Stabilizer: sucrose, mono and diglycerides, locust bean gum, guar gum, carrageenan. (The total of these ingredients represents less than 0.5 % of the finished product.)
Trade Mark of: David Chapman's Ice Cream Ltd., Markdale, Ontario

***Sample: Frozen Yogurt – Foodservice***

**McDonald's: Low Fat Frozen Yogurt**
Ingredients: milk solids, sugar, corn syrup solids, microcrystalline cellulose, mono and di-glycerides, guar gum, cellulose gum, artificial flavour, carrageenan, colour, bacterial culture.

***Samples: Frozen Dessert – Foodservice***

**Wendy's Frosty Dairy Dessert**
Ingredients: milk solids, sugar or liquid sugar, glucose or glucose solids, dry or condensed whey, cocoa, guar gum, mono and diglycerides, carrageenan, sodium phosphate, dibasic, artificial flavour, natural flavour

***B) Processed Cheese and Related Products***

***Sample: Processed Cheese Spread***

**Equality (A&P label) Light Process Cheese Spread [14% MF 50 % Moisture]**
Ingredients: cheese (milk, bacterial culture, salt, rennet and/or pepsin and/or microbial enzymes and/or lipase, may contain calcium chloride), water, modified milk ingredients, glucose, sodium phosphate, salt, sorbic acid, lactic acid, spices, colour.
Prepared for: The Great Atlantic & Pacific Company of Canada Limited, Toronto, Canada

***Sample: Processed Cheese Slices – Foodservice***

**McDonald's Cheese Slices (Processed)**: cheese (milk ingredients, bacterial culture, salt, rennet and/or microbial enzyme, calcium chloride, lipase), water, butter or whey butter, sodium phosphate and/or sodium citrate, salt, sorbic acid, natural colour and may contain potassium sorbate, citric acid, carboxymethyl cellulose, starch and/or lecithin, calcium chloride.

***Sample: Cheese Sauce – Foodservice***

**Wendy's Cheese Sauce**: Non-dairy creamer (hydrogenated coconut oil, corn syrup solids, sodium caseinate, dipotassium phosphate, mono & diglycerides, sugar, tetrasodium pyrophosphate, lecithin), modified food starch, dehydrated cheddar cheese (milk, cheese cultures, enzymes), cream, partially hydrogenated soybean oil, buttermilk, salt, natural butter flavor, non-fat dry milk, sodium phosphate, dehydrated aged bleu cheese, lactic &

citric acids, monosodium glutamate, xanthan gum, hydrolyzed vegetable protein, and artificial colour (including FD&C Yellow #5 & FD&C Yellow #6).

### *C) Bakery Products*

***Samples: Cookies***

**Christie: Chunks Ahoy! Chocolate Chunk Cookies**
Ingredients: dark sweet chocolate chunks, (chocolate, sugar, dextrose, cocoa butter, soya lecithin, flavour), enriched flour, sugar, butter, vegetable oil shortening, modified milk ingredient, coconut (treated with sulphites), fancy molasses, dried whole egg, sodium bicarbonate, ammonium bicarbonate, salt, soya lecithin, artificial flavour.
Christie Brown & Co., Division of Nabisco, Toronto, Ontario

**Peek Freans Shortcake Biscuits**
Ingredients: Enriched flour, beef fat shortening, icing sugar, vegetable oil shortening, dried egg yolk (may contain colour), salt, milk powder, butter.
Christie Brown & Co., Division of Nabisco, Toronto, Ontario

**Christie Fig Newtons**
Ingredients: figs, Enriched flour, sugar, glucose-fructose or liquid invert sugar, vegetable oil shortening, icing sugar, glucose, raisins, malt flour, salt, skim milk powder, baking soda, corn starch, modified milk ingredients, monocalcium phosphate, ammonium bicarbonate, oil of lemon, potassium sorbate, colour.
Christie Brown & Co., Division of Nabisco, Toronto, Ontario

***Sample: Cereal Bars***

**President's Choice Raspberry Cereal Bars**
Ingredients: Crust: enriched wheat flour, sugar, whole oats, hydrogenated canola and/or soybean and/or cottonseed oil, glucose, corn starch, modified milk ingredients, wheat flakes, honey, fancy molasses, salt, soy lecithin, sodium bicarbonate, natural flavour, sodium propionate, colour. Filling: sugar, raspberries, glucose, glucose-fructose, water, modified corn starch, pectin, natural flavour, glycerine, citric acid, malic acid, calcium citrate, sodium citrate, potassium sorbate, colour

***Sample: Snack Cakes***

**Vachon Relax Cake Bars Chocolate Mousse**
Ingredients: Sugar, hydrogenated palm kernel oil, enriched wheat flour, vegetable oil and palm oil shortening, corn syrup, cocoa, high fructose corn syrup, modified milk ingredients, liquid whole egg, liquid egg white, liquid egg yolk, brown sugar, modified corn starch, salt, corn starch, modified wheat starch, hydrogenated vegetable oil and/or hydrogenated coconut oil, baking powder, sodium bicarbonate, lecithin, soy protein, potassium sorbate, modified cellulose, sorbitan monostearate, polysorbate 60, phosphoric acid, carrageenan, natural and artificial flavour, may contain peanut crumbs.
Culinar Inc., made in Canada.

### *D) Confectionery*

**Cadbury: Caramilk Bar**
Ingredients: Sugar/glucose-fructose, milk ingredients, modified palm, modified vegetable and vegetable oils, unsweetened chocolate, hydrogenated vegetable oil, salt, cocoa butter, soya lecithin, citric acid, sodium bicarbonate, calcium chloride, natural and artificial flavour. Cadbury Chocolate Canada Inc., Toronto, Ontario

**Trebor Allan Inc. Solid Milk Chocolate (bunny)**
Ingredients: milk chocolate consisting of: sugar, cocoa butter, chocolate liquor, skim milk powder, butter fat, soya lecithin (an emulsifier), salt, vanillin (An artificial flavour).

**No name Peanuts Milk Chocolate Covered**
Ingredients: milk chocolate (sugar, cocoa butter, milk ingredients, chocolate, soya lecithin, natural flavour), roasted peanuts, confectioner's shellac, glucose, gum arabic.

**Cadbury Chocolate Canada Inc. Jersey Milk Pure Milk Chocolate**
Ingredients: condensed milk, sugar, cocoa butter, unsweetened chocolate, butter oil, soya lecithin, natural flavour. May contain traces of nuts.

### *E) Other Products*

***Sample: Creamy Salad Dressings (Caesar, Ranch, Cucumber, etc.)***

Kraft: "Classic Twists" Creamy Cucumber Ranch
Ingredients: canola oil, buttermilk (milk solids, bacterial culture, salt) water, cucumber juice, sugar, dried onion, salt, lactic acid, flavour, xanthan gum, sorbic acid, polysorbate 60, propylene glycol alginate, spices and seasonings, calcium disodium EDTA,

***Sample: Side Dishes (rice, pasta "sides")***

**Kraft: Macaroni & Cheese, Cheese & Tomato**
Ingredients: Macaroni – enriched wheat flour.
Sauce Mix – modified milk ingredients, cheese (milk, bacterial culture, salt, rennet, calcium chloride, lipase), dehydrated tomatoes, sugar, modified corn starch, salt, sodium phosphate, citric acid, lactic acid, colour (tartrazine)

***Samples: Salty Snacks***

**The Hostess Frito-Lay Company Sun Chips Multigrain Snacks Simulated Harvest Cheddar Flavour**
Ingredients: Corn, hydrogenated vegetable oil, whole wheat, rice flour, oat flour, seasoning (modified milk ingredients, salt, cheddar cheese solids, buttermilk solids, onion powder, autolyzed yeast, sour cream, blue cheese solids, citric acid, hydrolyzed plant protein, garlic powder, lactic acid, disodium inosinate, disodium guanylate, colour, natural and artificial flavour), sugar.

**President's Choice Sour Cream & Onion Flavour Thin Ripple Cut Potato Chips**
Ingredients: specially selected potatoes, vegetable oil, buttermilk powder, sour cream powder [sour cream solids (milk ingredients, bacterial cultures), maltodextrin, citric acid, BHA], dextrose, cream powder (contains lecithin), salt, onion powder, yogurt powder [yogurt solids (skim milk powder, bacterial cultures), sodium citrate], sodium acetate, sugar, citric acid, acetic acid, flavour, dehydrated parsley, hydrogenated soyabean oil, dry malt extract, garlic powder, silicon dioxide.

***Sample: Liquid Coffee Whitener***

**International Delight Coffee Whitener, Irish Crème**
Ingredients: water, sugar, partially hydrogenated vegetable oil (soybean or canola), corn syrup solids, modified milk ingredients, potassium phosphate, salt, mono and diglycerides, carrageenan, sodium stearoyl lactylate, lecithin, natural and artificial flavours, natural colour. Manufactured in Canada under license for International Delight, Dallas, Texas

## Appendix 3:  Formula Cost Analysis per Category

**Appendix 3: a) Prototype Formulas for Economy Ice Cream**

| | Representative Formula using Butter | | | | Representative Formula: Butter Replaced by 49/51 DPB | | | |
|---|---|---|---|---|---|---|---|---|
| **Ingredient** | Amount (kg/kilolitre) | Ingredient Cost $/kg | Fractional Formula Cost $/kilolitre | Fractional Formula Cost $/k kilolitre | Amount (kg/kilolitre) | Ingredient Cost $/kg | Fractional Formula Cost $/kilolitre | Fractional Formula Cost $/k kilolitre |
| **Skim milk powder** | 37.80 | n/a | $ - | $ - | 37.80 | n/a | $ - | $ - |
| **Whey powder** | 13.50 | $ 3.89 | $ 52.52 | $ 52,515 | 16.20 | $ 3.89 | $ 63.02 | $ 63,018 |
| **Butter** | 66.96 | $ 5.42 | $ 362.92 | $ 362,923 | 0.00 | $ 5.42 | $ - | |
| **Sugar** | 56.70 | $ 1.08 | $ 61.24 | $ 61,236 | 0.00 | $ 1.08 | $ - | $ - |
| **Fructose and glucose** | 32.40 | n/a | $ - | $ - | 32.40 | n/a | $ - | $ - |
| **Stabilizer/emulsifier** | 2.16 | n/a | $ - | $ - | 2.16 | n/a | $ - | $ - |
| **49/51 DPB** | 0.00 | $ 2.52 | $ - | $ - | 110.70 | $ 2.52 | $ 278.96 | $ 278,964 |
| **Water** | 330.48 | n/a | $ - | $ - | 340.74 | n/a | $ - | $ - |
| ***Total weight and pertinent costs*** *(S.G. 540 g/l)* | 540.00 | | $ 476.67 | $ 476,674 | 540.00 | | $ 341.98 | $ 341,982 |

| *Estimated Cost Differential:* | | |
|---|---|---|
| *Cost Differential in $/litre* | *$* | *0.135* |
| *Cost Differential in $/kilolitre* | *$* | *134.69* |
| *Cost Differential in $/k kilolitre* | *$* | *134,692* |

**Notes:**

1. Composition of Formula with respect to Dairy Content:
   % Milkfat = 10
   % MSNF = 10
   % Solids = 36

2. Nominal Composition and Formulation for an "Average" Economy Ice Cream Developed Based on:
   Requirements of the Canadian Food and Drugs Act and Regulations
   Requirements of the Canada Agricultural Products Act, Dairy Products Regulations
   Requirements of the Canadian Guide to Food Labeling and Advertising
   Database information regarding macronutrient profiles for representative products
   Literature survey regarding ice cream composition
   Ingredient statement for representative products
   Database information regarding macronutrient profiles of representative ingredients

3. Cost comparison based only on the dairy ingredients and other ingredients relevant to substitution by a DPB ("Fractional Formula Cost").

4. n/a = not applicable

## Appendix 3: b) Prototype Formulas for Regular Ice Cream

| | Representative Formula using Butter | | | | Representative Formula: Butter Replaced by 49/51 DPB | | | |
|---|---|---|---|---|---|---|---|---|
| **Ingredient** | Amount (kg/kilolitre) | Ingredient Cost $/kg | Fractional Formula Cost $/kilolitre | Fractional Formula Cost $/k kilolitre | Amount (kg/kilolitre) | Ingredient Cost $/kg | Fractional Formula Cost $/kilolitre | Fractional Formula Cost $/k kilolitre |
| **Cream** | 54.00 | $ 5.43 | $ 293.22 | $ 293,220 | 54.00 | $ 5.43 | $ 293.22 | $ 293,220 |
| **Skim milk powder** | 51.30 | $ 3.51 | $ 180.06 | $ 180,063 | 51.30 | $ 3.51 | $ 180.06 | $ 180,063 |
| **Butter** | 48.60 | $ 5.42 | $ 263.41 | $ 263,412 | 0.00 | $ 5.42 | $ - | $ - |
| **Sugar** | 81.00 | $ 1.08 | $ 87.48 | $ 87,480 | 40.50 | $ 1.08 | $ 43.74 | $ 43,740 |
| **Stabilizer/emulsifier** | 1.62 | n/a | $ - | $ - | 1.62 | n/a | $ - | $ - |
| **49/51 DPB** | 0.00 | $ 2.52 | $ - | $ - | 81.00 | $ 2.52 | $ 204.12 | $ 204,120 |
| **Water** | 303.48 | n/a | $ - | $ - | 311.58 | n/a | $ - | $ - |
| ***Total weight and pertinent costs*** *(S.G. 540 g/l)* | 540.00 | | $ 824.18 | $ 824,175 | 540.00 | | $ 721.14 | $ 721,143 |

| *Estimated Cost Differential:* | | |
|---|---|---|
| *Cost Differential in $/litre* | *$* | *0.103* |
| *Cost Differential in $/kilolitre* | *$* | *103.03* |
| *Cost Differential in $/k kilolitre* | *$* | *103,032* |

**Notes:**

1. Composition of Formula with respect to Dairy Content:
   % Milkfat = 11
   % MSNF = 10
   % Solids = 36.5

2. Nominal Composition and Formulation for an "Average" Regular Ice Cream Developed Based on:
   Requirements of the Canadian Food and Drugs Act and Regulations
   Requirements of the Canada Agricultural Products Act, Dairy Products Regulations
   Requirements of the Canadian Guide to Food Labeling and Advertising
   Database information regarding macronutrient profiles for representative products
   Literature survey regarding ice cream composition
   Ingredient statement for representative products
   Database information regarding macronutrient profiles of representative ingredients

3. Cost comparison based only on the dairy ingredients and other ingredients relevant to substitution by a DPB ("Fractional Formula Cost").

4. n/a = not applicable

## Appendix 3: c) Prototype Formulas for Economy Ice Cream Mix

| | Representative Formula using Butter & Cream | | | | Representative Formula: Butter & Cream Replaced by 49/51 DPB | | | |
|---|---|---|---|---|---|---|---|---|
| **Ingredient** | Amount (kg/kilolitre) | Ingredient Cost $/kg | Fractional Formula Cost $/kilolitre | Fractional Formula Cost $/k kilolitre | Amount (kg/kilolitre) | Ingredient Cost $/kg | Fractional Formula Cost $/kilolitre | Fractional Formula Cost $/k kilolitre |
| **Cream** | 99.00 | $ 5.43 | $ 537.57 | $ 537,570 | 0.00 | $ 5.43 | $ - | $ - |
| **Skim milk powder** | 110.00 | $ 3.51 | $ 386.10 | $ 386,100 | 115.50 | $ 3.51 | $ 405.41 | $ 405,405 |
| **Butter** | 99.00 | $ 5.42 | $ 536.58 | $ 536,580 | 0.00 | $ 5.42 | $ - | |
| **Sugar** | 165.00 | $ 1.08 | $ 178.20 | $ 178,200 | 44.00 | $ 1.08 | $ 47.52 | $ 47,520 |
| **Stabilizer/emulsifier** | 5.50 | n/a | $ - | $ - | 5.50 | n/a | $ - | $ - |
| **49/51 DPB** | 0.00 | $ 2.52 | $ - | $ - | 242.00 | $ 2.52 | $ 609.84 | $ 609,840 |
| **Water** | 621.50 | n/a | $ - | $ - | 693.00 | n/a | $ - | $ - |
| ***Total weight and pertinent costs*** *(S.G. 1100 g/l)* | 1100.00 | | $ 1,638.45 | $ 1,638,450 | 1100.00 | | $ 1,062.77 | $ 1,062,765 |

| *Estimated Cost Differential:* | | |
|---|---|---|
| *Cost Differential in $/litre* | *$* | *0.576* |
| *Cost Differential in $/kilolitre* | *$* | *575.69* |
| *Cost Differential in $/k kilolitre* | *$* | *575,685* |

**Notes:**

1. Composition of Formula with respect to Dairy Content:
   % Milkfat = 10.6
   % MSNF = 10.3
   % Solids = 36.8

2. Nominal Composition and Formulation for an "Average" Ice Cream Mix Developed Based on:
   Requirements of the Canadian Food and Drugs Act and Regulations
   Requirements of the Canada Agricultural Products Act, Dairy Products Regulations
   Requirements of the Canadian Guide to Food Labeling and Advertising
   Database information regarding macronutrient profiles for representative products
   Literature survey regarding ice cream composition
   Ingredient statement for representative products
   Database information regarding macronutrient profiles of representative ingredients

3. Cost comparison based only on the dairy ingredients and other ingredients relevant to substitution by a DPB ("Fractional Formula Cost").

4. n/a = not applicable

## Appendix 3: d) Prototype Formulas for Regular Ice Cream Mix

| | Representative Formula using Butter & Cream | | | | Representative Formula: Butter Replaced by 49/51 DPB | | | |
|---|---|---|---|---|---|---|---|---|
| **Ingredient** | Amount (kg/kilolitre) | Ingredient Cost $/kg | Fractional Formula Cost $/kilolitre | Fractional Formula Cost $/k kilolitre | Amount (kg/kilolitre) | Ingredient Cost $/kg | Fractional Formula Cost $/kilolitre | Fractional Formula Cost $/k kilolitre |
| **Cream** | 99.00 | $ 5.43 | $ 537.57 | $ 537,570 | 99.00 | $ 5.43 | $ 537.57 | $ 537,570 |
| **Skim milk powder** | 110.00 | $ 3.51 | $ 386.10 | $ 386,100 | 110.00 | $ 3.51 | $ 386.10 | $ 386,100 |
| **Butter** | 99.00 | $ 5.42 | $ 536.58 | $ 536,580 | 0.00 | $ 5.42 | $ - | |
| **Sugar** | 165.00 | $ 1.08 | $ 178.20 | $ 178,200 | 82.50 | $ 1.08 | $ 89.10 | $ 89,100 |
| **Stabilizer/emulsifier** | 5.50 | n/a | $ - | $ - | 5.50 | n/a | $ - | $ - |
| **49/51 DPB** | 0.00 | $ 2.52 | $ - | $ - | 165.00 | $ 2.52 | $ 415.80 | $ 415,800 |
| **Water** | 621.50 | n/a | $ - | $ - | 638.00 | n/a | $ - | $ - |
| ***Total weight and pertinent costs*** *(S.G. 1100 g/l)* | 1100.00 | | $ 1,638.45 | $ 1,638,450 | 1100.00 | | $ 1,428.57 | $ 1,428,570 |

| *Estimated Cost Differential:* | | |
|---|---|---|
| *Cost Differential in $/litre* | *$* | *0.210* |
| *Cost Differential in $/kilolitre* | *$* | *209.88* |
| *Cost Differential in $/k kilolitre* | *$* | *209,880* |

**Notes:**

1. Composition of Formula with respect to Dairy Content:
   % Milkfat = 10.6
   % MSNF = 10.3
   % Solids = 36.8

2. Nominal Composition and Formulation for an "Average" Ice Cream Mix Developed Based on:
   Requirements of the Canadian Food and Drugs Act and Regulations
   Requirements of the Canada Agricultural Products Act, Dairy Products Regulations
   Requirements of the Canadian Guide to Food Labeling and Advertising
   Database information regarding macronutrient profiles for representative products
   Literature survey regarding ice cream composition
   Ingredient statement for representative products
   Database information regarding macronutrient profiles of representative ingredients

3. Cost comparison based only on the dairy ingredients and other ingredients relevant to substitution by a DPB ("Fractional Formula Cost").

4. n/a = not applicable

**Appendix 3: e) Prototype Formulas for Processed Cheese**

| | Representative Formula using Butter | | | | Representative Formula: Butter Replaced by 49/51 DPB | | | |
|---|---|---|---|---|---|---|---|---|
| **Ingredient** | Amount (kg) | Ingredient Cost $/kg | Nominal Formula Cost $/kg | Formula Cost $/tonne | Amount (kg) | Ingredient Cost $/kg | Nominal Formula Cost $/kg | Formula Cost $/tonne |
| **Cheese** | 0.550 | $ 3.01 | $ 1.66 | $ 1,656 | 0.550 | $ 3.01 | $ 1.66 | $ 1,656 |
| **Water** | 0.205 | $ - | $ - | $ - | 0.205 | $ - | $ - | $ - |
| **Skim milk powder** | 0.050 | $ 3.50 | $ 0.18 | $ 175 | 0.050 | $ 3.50 | $ 0.18 | $ 175 |
| **Milk Protein Ingredients** | 0.020 | $ 3.51 | $ 0.07 | $ 70 | 0.020 | $ 3.51 | $ 0.07 | $ 70 |
| **Butter/milkfat** | 0.050 | $ 5.45 | $ 0.27 | $ 273 | 0.000 | $ 5.45 | $ - | $ - |
| **Sugar/glucose solids** | 0.030 | $ 1.08 | $ 0.03 | $ 32 | 0.000 | $ 1.08 | $ - | $ - |
| **Spices, seasonings, salt** | 0.050 | $ 1.00 | $ 0.05 | $ 50 | 0.050 | $ 1.00 | $ 0.05 | $ 50 |
| **Acids (citric, sorbic, lactic)** | 0.020 | $ 1.00 | $ 0.02 | $ 20 | 0.020 | $ 1.00 | $ 0.02 | $ 20 |
| **DPB - M/G/S/E** | 0.000 | $ 2.52 | $ - | $ - | 0.100 | $ 2.52 | $ 0.25 | $ 252 |
| **Stabilizers/emulsifiers/salts** | 0.025 | $ 2.50 | $ 0.06 | $ 63 | 0.005 | $ 2.50 | $ 0.01 | $ 13 |
| ***Total weight and estimated costs*** | 1.000 | | $ 2.34 | $ 2,338 | 1.000 | | $ 2.24 | $ 2,235 |

| *Estimated Cost Differential:* | |
|---|---|
| *Cost Differential in $/kg* | *$ 0.10* |
| *Cost Differential in $/tonne* | *$ 102.90* |

**Notes:**

1. Composition of Formula with respect to key Processed Cheese Parameters:
   % Cheese = 55
   % Milkfat = 23.5
   % MSNF = 39.5
   % Moisture = 41

2. Nominal Composition and Formulation for a "Sample" Processed Cheese Developed Based on:
   Requirements of the Canadian Food and Drugs Act and Regulations
   Requirements of the Canada Agricultural Products Act, Dairy Products Regulations
   Requirements of the Canadian Guide to Food Labeling and Advertising
   Database information regarding macronutrient profiles for representative products
   Literature survey regarding processed cheese composition
   Ingredient statements and label nutrition information for representative products
   Database information regarding macronutrient profiles of representative ingredients

3. Cost comparison based on estimates for costs for all ingredients.

## Appendix 4: Production Numbers 1993-1997

**Production of Milk Products 1993-1997**

| Category | 1993 | 1994 | 1995 | 1996 | Ja-Se '97 | 1997(est.) |
|---|---|---|---|---|---|---|
| Hard Ice Cream (kilolitres) | 300391 | 327058 | 322509 | 314345 | 243135 | 316076 |
| Soft Ice Cream (kilolitres) | 16664 | 17477 | 22025 | 15393 | 14069 | 18290 |
| Ice Cream Mix (kilolitres) | 164958 | 175579 | 174929 | 166111 | 123763 | 160892 |
| ***All Ice Cream (kilolitres)*** | ***482013*** | ***520114*** | ***519463*** | ***495849*** | ***380967*** | ***495257*** |
| Ice Milk Mix (kilolitres) | 20564 | 22297 | 27170 | 30636 | 25654 | 33350 |
| Soft Frozen Yoghurt Mix (kilolitres) | 4108 | 4060 | 3550 | 3474 | 1634 | 2124 |
| Hard Frozen Yoghurt Mix (kilolitres) | 8442 | 5227 | 4776 | 5109 | 4560 | 5928 |
| All Frozen Yoghurt Mix | 12550 | 9287 | 8326 | 8583 | 6194 | 8052 |
| All Ice Milk and Frozen Yoghurt Mix | 33114 | 31584 | 35496 | 39219 | 31848 | 41402 |
| ***Processed Cheese (tonnes)*** | ***71301*** | ***68416*** | ***76422*** | ***75699*** | ***54964*** | ***71453*** |
| Milk Sold for Industrial Purposes (kilolitres) | tbd | 4255292 | 4440352 | 4417596 | 3563719 | 4632835 |
| Milk Sold for Fluid Purposes (kilolitres) | tbd | 2752803 | 2741492 | 2740902 | 2034558 | 2644925 |
| ***Butterfat Production for Ind'l Purposes (tonnes)*** | ***148132*** | ***163451*** | ***164948*** | ***163653*** | ***129946*** | ***168930*** |

Source: The Dairy Review. Statistics Canada

## Appendix 5: Determination of Total Ice Cream Production Volume

Ice cream production numbers were collected based on The Dairy Review published by Statistics Canada. This publication shows production for 1) Ice Cream Mix, 2) Hard Ice Cream, and 3) Soft Ice Cream (in addition to other dairy-based end products).

Ice Cream Mix is an intermediary product in the production of all ice cream. Thus, it has been suggested and subsequently thoroughly debated whether the summation of the above three mentioned categories could result in "double counting" of the ice cream mix in the determination of a total production volume estimate.

We elected to include the volume contribution derived from ice cream mix in total ice cream production volume estimate for the following reasons:

i. Ice cream mix is used to a significant degree in the foodservice sector. It is understood that the ice cream processors who contribute volume reports for the generation of The Dairy Review do not include the portion sold to foodservice when they make a Soft Ice Cream declaration. The reason for this is justified in that the processor cannot guarantee accurate re-constitution of the ice cream mix into soft ice cream once the mix leaves the processor's premises.

ii. The soft ice cream declared in The Dairy Review is only approximately 5% of the hard and soft ice cream total volume. Our food industry experience suggests that soft ice cream consumption is a much larger percentage of all ice cream consumption.

iii. Following from i. and ii., approximately one-third of all food consumed in Canada is consumed through the foodservice sector.[1] Ice cream is among the top ten foods consumed in the foodservice sector (item 9 of the Top 10). The soft ice cream numbers reported in The Dairy Review appear to be too low to account for the volume of soft ice cream consumed in the foodservice sector.

iv. Following from iii., soft ice cream sold in the foodservice sector is most commonly prepared on-site from ice cream mix.

v. A significant number of dairy-based products such as milkshakes, floats, etc. are consumed in the foodservice sector, causing these items to be among the top ten beverages consumed in the foodservice sector.

vi. Following from iv. and v., it appears that the soft ice cream consumed in the foodservice sector and beverages prepared from ice cream mix served in the foodservice sector, are not reflected in the production numbers of Hard Ice Cream and Soft Ice Cream reported in The Dairy Review. It appears that they are accounted for in the Ice Cream Mix sub-category.

[1] Foodservice Facts. Canadian Restaurant and Foodservices Association. 1997.

vii. Ice cream mix is used for items other than hard ice cream and soft ice cream. It is often used in the production of ice cream "novelties" and frozen dairy desserts such as cakes. Neither of the latter appears to be captured by The Dairy Review sub-categorization of hard and soft ice creams.

viii. One government official clearly stated that The Dairy Review is a production report, not a market share report. Further, the mix produced in one period covered was not necessarily a component of the hard and soft ice cream prepared in the same period of coverage. It is quite conceivable that the ice cream mix reported in one period is used to make hard or soft ice cream in a subsequent period of reporting.

ix. The data reported in The Dairy Review is provided by ice cream processors and collected by Statistics Canada. There appears to be no incentive for either parties to "double count".

x. Perhaps it will be made clear what portion of the reported Ice Cream Mix is produced and sold for a) the foodservice sector, b) dairy-based end-products other than Soft and Hard Ice Cream, and, c) Soft and Hard Ice Cream. In this instance, the amount of Ice Cream Mix, as reported in The Dairy Review, will be adjusted to reflect these end-product uses.

## Appendix 6: List of Tables