INITIAL ANALYSIS OF THE ECONOMIC IMPACT OF WATER POLLUTION CONTROL COSTS UPON THE DAIRY PRODUCTS INDUSTRY.

37

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to

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by

Economic Research Service
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Table of Contents

List of Tables

INITIAL ANALYSIS OF THE ECONOMIC IMPACT OF WATER POLLUTION CONTROL COSTS UPON THE DAIRY PRODUCTS INDUSTRY

by

Floyd A. Lasley and Clark R. Burbee
Animal Products Branch, Marketing Economics Division
Economic Research Service
United States Department of Agriculture

This study is one of a series commissioned by the Environmental Protection Agency to provide an initial assessment of the economic impact of water pollution control costs upon industry, and to provide a framework for future industrial analysis.

For the purpose of this initial analysis, the water pollution control requirements were assumed to be those developed in 1972 as effluent limitation guidance by the EPA Office of Permit Programs. Costs were developed by the EPA Economic Analysis Division on the basis of treatment technologies assumed necessary to meet the effluent limitation guidance.

Because of the limitations of time and information available, these studies are not to be considered definitive. They were intended to provide an indication of the kinds of impacts to be expected, and to highlight possible problem areas.

This document is a preliminary draft. It has not been formally released by EPA and should not at this stage be construed to represent Agency policy. It is being circulated for comment on its technical accuracy and policy implications.

IMPACT OF POLLUTION CONTROL COSTS UPON THE DAIRY INDUSTRY

Impact analysis of necessity focuses upon differences. In this report we have concentrated our attention upon those differences in the dairy industry which should be expected to significantly influence the impact of pollution control measures. These characteristics include pricing of raw milk and milk products, financial variables, size groupings of plants by subindustry, employment, and relation to the community.

In addition to the above, type and volume of plant effluent, standards for performance, implementation timetables and alternative methods considered acceptable are extremely important in estimating impact.

Each of the variables ~~are~~ is considered in this report. However, these findings should be considered in light of other work and as subject to revision under further analysis.

Considerable data were obtained from Vermont, Wisconsin, and Oregon. These three States were selected because of their differences and the role of dairying in each. These State data were useful in interpreting the more aggregate data for the United States. Aggregates and averages can be quite misleading when considering cost impact of a change such as pollution control. Specific plants in specific communities will close, contract, or expand their operations.

This study focuses upon the impact of pollution control cost in the dairy processing industry. It does not consider impact of changes in milk production, transportation, or retailing. Neither does it consider adjustments which might result from cost increases due to pollution control in other industries which provide inputs for the dairy industry, ie. feed, chemical, steel, equipment, refrigerant, container, and ingredient manufacturers.

Initial Analysis of the Economic Impact of Water Pollution Control Costs Upon the Dairy Products Industry

Summary

Pollution control requirements will have an economic impact upon the dairy industry. It will not be uniformly felt throughout the industry but will be a differential impact. Differences will be noted among the sub-industries, among plants of different volume groupings, and among geographical regions. Variation will also result from plant location regarding concentration of population, access to municipal sewage systems, access to land for private disposal, and concentration of milk supplies.

Financial characteristics of the firm, including competitive industry structure, will greatly affect the impact of pollution control costs upon individual firms and, thereby upon the industry. The dairy industry is made up of a large number of small plants (and firms) with relatively low dollar returns. These small plants have been going out of business at a rapid rate for several years.

The short term impact upon the small and medium size dairy plants will largely depend upon how the pollution control costs are financed. Assuming that the additional costs can be passed on to consumers, if the costs can be met as increased operating costs to the plant the exit rate will be increased. If the plant must finance these as capital investment costs, then there would be a mass exodus at the cut-off date.

Very few of the small plants, and perhaps only about 50 percent of the medium size plants could make the capital outlay required for private treatment facilities or for their share of expanded municipal treatment systems. They do not have the financial capability, either from internal funds or from the capital funds market.

Most large volume plants could be expected to successfully finance facilities for pollution control. This does not mean to minimize the magnitude of their problems, but to recognize that these plants can solve them and remain viable.

Fluid milk plants are in the best position. The large proportion of them are already using municipal systems, they are larger in size, and probably can better make the in-plant adjustments necessary. Most will probably discontinue making cottage cheese in the fluid plant unless they have adequate volume and facilities for handling the whey. Further specialization and interplant transfers of packaged products so as to minimize BOD loadings from product loss can be expected. The cheese industry will be most affected by pollution control--physically and financially. Although a few large plants have been constructed recently, cheese plants are predominantly small-volume. They are located in smaller towns and rural areas. Few have used municipal systems for treatment of plant effluent. Land disposal or dumping into waterways have been the most common methods of disposing of whey and plant effluent.

It is not feasible for cheese makers to treat whey as an effluent. Most whey will have to be processed and utilized. Although much work has been done to develop new uses for whey and new methods for processing it, condensing and drying are the most practical at present. Small cheese plants cannot afford to do either. Generally, this puts them in the position of being dependent upon a large plant to take their whey for processing. A decision by one dryer can effectively close down several cheese makers as they would have no outlet for their whey.

This study has assumed that sweet whey will be processed and the returns will offset the extra costs. This will not be true in all cases. The exceptions probably will be critical to the individual plants concerned but not to the industry.

Joint-treatment -- Joint-treatment with municipal systems will be the most favorable solution for those plants with this alternative. In fact, when plants pay their pro rata share of treatment costs, the benefit will be mutual. Both plant and community will realize lower effluent treatment costs than if each treat separately.

In conducting this study, we found a great deal of confusion, and no little consternation, regarding joint-treatment for plant and community. Generally they were taking opposing views, with very few recognizing the potential for mutual benefit. We would suggest that constructive effort toward acquainting community leaders and industry personnel with the advantages would be effort well spent.

Flexibility -- Dairy plant people and municipal employees expressed concern over another major problem. They are quite concerned that tolerance levels may become intolerable. Although the plant and community may have invested large sums and provided a treatment system deemed quite adequate by best available expertise, there is still a possibility of mishap resulting in a temporary overload. Such mishaps are more likely to occur with industry sources than with residential sewage loads. In fact, it may not be feasible to so overinvest in facilities and operating procedures that a mishap could be absolutely avoided. There is tremendous difference in the cost of adequately meeting control needs 99.99% of the days and providing for 100% plus adequacy.

Employment -- Labor displacement will be felt mostly in small rural communities. Heavy milk producing areas where cheese, butter, powder and condensed products are manufactured will lose some jobs in the dairy industry as plants are closed because of pollution control. Larger cities should not be much affected by loss of jobs or relocation of dairy plants due to pollution control requirements.

Price Impacts -- As presently envisioned dairy plant pollution control costs should not greatly affect the price of dairy products. This effect should result in price increases below 2%, except cottage cheese. Additional supplies of dried whey, almost doubling last year's marketings, will put pressure on nonfat dry milk, perhaps dropping the price to the support level.

Consumer Demand -- The potential price increases should not reduce consumer demand for dairy products except in the case of cottage cheese. If cottage cheese manufacturers cannot find a more economical method to dispose of acid whey than conventional treatment, the cost increase could significantly reduce quantity demanded.

Suppliers -- Milk producers should not be affected by adjustments of dairy product manufacturers to the proposed environmental standards. Some producers may realize different milk prices as a result of plant relocations that alter milk utilization ratios and therefore blend prices.

Community Effects -- Numerous rural communities in the Lakes Region are already being adversely affected by the structural changes in the dairy industry. A small number of additional communities in this region will be adversely affected if they cannot provide plants with waste treatment services.

Foreign Trade -- The increases in domestic costs for dairy products are not expected to affect the foreign trade situation. Imports are already regulated by a quota system and the Federal government can effectively regulate imports to prevent foreign countries from taking advantage of any increase in price differentials that might result from higher domestic prices. Exports under government programs are not expected to be affected unless surpluses disappear. Commercial exports are not of major importance to the industry; and the impact on exporting firms is expected to be minor.

Dairy Industry

Dairy processing is divided into five major categories: butter, SIC 2021; natural cheese, SIC 2022; condensed and evaporated products, SIC 2023; ice cream, SIC 2024; and fluid and fluid products (cottage cheese), SIC 2026. While there is considerable product specialization in processing, a substantial number of establishments engage in multiple product processing. In 1967, the primary product specialization ratios were: butter, 71 percent; cheese, 93 percent; condensed and evaporated products, 82 percent; ice cream, 97 percent; and fluid milk, 90 percent.

Butter industry

The output of butter, number of establishments and employment has been decreasing for years. Total shipments of butter decreased from 1.4 billion pounds produced by 1320 plants in 1963 to 1.1 billion pounds produced by 619 plants in 1970. The decrease is attributed to the availability and consumer acceptance of lower priced non-dairy spreads such as oleomargarine. Further decreases in output and consumption are expected.

The number of plants primarily engaged in butter production decreased from 766 in 1963 to 408 in 1970. Of the 408, 308 are classified as small plants employing less than 20 persons. These plants are estimated to have accounted for 20 percent of the industry's output. Ninety-one plants employed from 20 to 99 employees each and accounted for an estimated 70 percent of the industry's output. The remaining nine plants each employed more than 100 employees and accounted for the remaining 10 percent of the industry's output (Table 1).

Employment in the butter industry has decreased rapidly, from 12,000 in 1963 to 7,200 in 1970. Approximately 75 percent of the employment is in plants with 20 or more employees.

Table 1 : Number and employment of dairy processing plants classified by industry and number of employees, 1963, 1967, 1970

SIC	Product	Year	Number of employees						Total	
			1 - 19		20 - 99		100 +			
			Plants	Employment	Plants	Employment	Plants	Employment	Plants	Employment
2021	Butter	1963	588	3,773	166	6,590	12	1,629	766	11,992
		1967	402	2,300	129	5,200	9	1,200	540	8,700
		1970	308	1,700*	91	4,200*	9	1,200*	408	7,197
2022	Cheese (natural)	1963	932	5,150	178	7,076	28	5,730	1,138	17,956
		1967	788	4,500	206	8,400	32	6,900	1,026	20,000
		1970	598	3,800*	209	8,800*	39	8,400*	846	21,090
2023	Condensed & evaporated	1963	115	970	135	6,296	31	4,989	281	12,255
		1967	122	1,000	138	6,600	31	5,200	291	13,200
		1970	114	1,000*	121	5,500*	22	4,200*	257	10,725
2024	Ice cream	1963	694	4,539	321	13,987	66	10,617	1,081	29,143
		1967	525	3,100	261	11,400	64	10,100	850	24,600
		1970	397	2,400*	243	11,000*	49	9,000*	689	22,416
2026	Fluid products	1963	2,670	19,006	1,448	65,375	501	100,669	4,619	185,050
		1967	1,845	11,300	1,146	53,200	490	100,900	3,481	165,200
		1970	1,326	8,000*	1,090	50,000*	408	82,700*	2,824	140,678

* Estimated values

The butter industry is located primarily in the Lakes Region, an area extending from northern New England to Minnesota and Iowa. The States in the region accounted for two thirds of total butter production in 1970, and 60 percent of the 619 plants that produced butter. The 273 plants in Minnesota, Wisconsin, and Iowa produced 52 percent of the butter in the U.S. Butter plants are generally located in small communities in rural areas close to the milk supply. The plants produce large quantities of skim and buttermilk by-products and the larger plants have the facilities to condense or dry these products. In 1967, 25 percent of the dried milk production came from plants in the butter industry. The industry is also an important source of bulk fluid milk and cream for other segments of the dairy industry.

Cheese, natural and processed

Cheese production has been increasing for some time. Production increased from 1.6 billion pounds produced by 1283 plants in 1963 to 2.2 billion pounds produced by 963 plants in 1970. The output of cheese is expected to increase during the foreseeable future.

The number of plants in the cheese industry decreased from 1,138 in 1963 to 846 in 1970, with the decrease confined to small plants employing less than 20 employees. The number of small plants decreased from 932 in 1963 to 598 in 1970. Larger plants employing from 20 to 99 employees increased from 178 to 209 during the same period. Plants employing 100 persons or more also increased from 28 to 39. The adjustment is apparently in response to economies of size in processing resulting in greater efficiency and lower unit costs. The small plants were estimated to account for 15 percent of total production, the 20-99 employee plants 40 percent and the large plants 45 percent of output in 1970.

Employment in the cheese industry has increased since 1963, the only sector of the dairy processing industry to show an increase. Total employment increased from 18,000 in 1963 to 21,000 in 1970. Employment in small plants, 1-19 employees, decreased to an estimated 3,800 in 1970. Employment in the 20-99 category has increased to an estimated 8,800 in 1970. The larger plants have also increased employment with an estimated 8,400 employees in 1970. Employment in cheese manufacturing is expected to continue to increase but only in large scale operations with attrition occurring in the smaller scale plants.

The natural cheese industry, like the butter industry is primarily located in the Lakes Region. Of the 2.2 billion pounds produced in 1970, almost 75 percent, 1.6 billion pounds, was produced by plants located in the Lakes Region. Three States, Wisconsin, Minnesota, and New York, produced 58 percent of the natural cheese in 1970 with Wisconsin accounting for 43 percent of total U.S. output. Fifty-eight percent or 561 plants produce cheese in the three States, over half the cheese plants, 481, are located in Wisconsin.

Cheese plants, like butter plants, are generally located in rural communities near the source of milk supplies. Plants tend to specialize but some plants manufacture butter (most often whey butter), dry milk or whey, and many serve as fluid milk supply plants.

The major by-product of the natural cheese industry is sweet whey. Whey is generally condensed or dried or shipped to condensing or drying plants by the cheese plants. But only 50 to 60 percent of total sweet whey output is processed into human or animal food items. Some of the remainder is fed to hogs and the balance is disposed of by various practices as a waste product. It is the disposal of surplus whey that is a major source of water pollution.

The positive trend in cheese production and limited market for whey products increases the problem. Currently, dried whey is utilized in the baking, beef, and ice cream industries but the major use, 53 percent, is in livestock and poultry feeds. High processing and transportation costs relative to other feed ingredients limits the use of dried whey in animal feeds.

The output of natural cheese and sweet whey is expected to increase during the foreseeable future. The prospects for increasing the utilization of whey will depend upon new processing technology, factor costs, and the ability to increase the penetration into existing or new markets. To date, no information is available to ascertain the potential market utilization of sweet whey.

Condensed and evaporated products

The condensed and evaporated products industry includes the condensing of whole and skim milk products, drying of whole, skim, and whey products and manufacture of miscellaneous items such as ice cream mixes. U.S. output of finished products in this industry has decreased from 11.1 to 10.8 billion pounds between 1963 and 1970. Output of condensed and evaporated products decreased from 3.4 to 2.7 billion pounds, dried products from 2.7 to 2.4 billion pounds, and mixes increased from 5.0 to 5.7 billion pounds.

The number of plants in this industry decreased from 281 in 1963 to 257 in 1970. (New data indicate plant numbers increased in 1971), The small plants, employing 1-19, decreased by one to 114, the medium size plants, employing 20-99, from 135 to 121, and the large plants from 31 to 22. It is estimated the small plants produce 5 percent of the output, The middle size plants 50 percent, and the large plants 45 percent. It is expected that both output and plant numbers will continue to decrease. Employment in this industry has also decreased from 12,300 in 1963 to 10,700 in 1970. The small plants employed an estimated 1,000 in 1970, the middle size plants 5,500, and the large plants 4,200.

This industry is also heavily concentrated in the Lakes Region near sources of whole, skim, and whey inputs. Ohio, Wisconsin, New York and Michigan are important States for condensed products, but there are condensing plants in other regions of the U.S. Dried milk production is centered in Minnesota, Wisconsin, and Iowa with these States accounting for over half the total output.

An estimated 250 plants probably manufacture all the condensed products and 150 plants dry milk or fluid by-products. These plants are generally located in rural areas in small size communities. Plants in this industry are also important in producing butter and marketing fluid milk.

Ice cream

Output of ice cream and frozen desserts has increased steadily since 1963. With production of 717 million gallons of ice cream and 333 million gallons of frozen dessert in 1963, output increased to 763 million gallons of ice cream and 425 million gallons of desserts in 1970. However, the output of ice cream has been very stable since 1967.

The number of plants has decreased over the same time period. Primary plants of the industry decreased from 1,081 to 689, with the closings occurring in all size catagories. The number of small plants (1-19 employees) decreased from 694 to 397, medium size plants (20-99 employees) from 321 to 243, and large plants (100 or more employees) from 66 to 49. Besides the primary plants, there are thousands of over-the-counter operations that manufacture and sell frozen desserts and some ice cream. These operations are quite small and located in population centers.

Employment in the ice cream industry has decreased with plant numbers. The number employed declined from 29,100 in 1963 to 22,400 in 1970, and this trend is expected to continue. Employment by plant size is estimated at 2,400 for the small, 11,000 for the medium and 9,000 for the large.

Ice cream industry plants are geographically dispersed and located primarily in major population centers near the demand source. Twenty-five percent of the plants are located in California, New York and Pennsylvania, and production is greatest in the major population areas. The industry pro-

insignificant quantities of other dairy products.

Fluid milk and related products

The fluid milk industry includes fluid processing into various consumer products, the manufacture of cottage cheese, and production of several miscellaneous dairy drinks. This industry is by far the biggest user of whole milk and is the most important segment of the dairy processing industry. Product output increased gradually from 56.2 to 59.5 billion pounds between 1963 and 1970. Cottage cheese output increased from 0.87 billion pounds in 1963 to 0.98 billion pounds in 1970. Output of this industry is expected to continue to increase gradually.

Industry plant numbers have declined rapidly, from 4,619 to 2,824, during the 1963-70 period. The change in plant numbers by size of employment classification during the period was 2,670 to 1,326 in the 1-19 employee group, 1,448 to 1,090 for the 20-99 employee group, and 501 to 408 for the over 99 employee group.

An estimated 800 plants process cottage cheese, but most of these are primarily fluid processing plants. In 1967, 37 plants were classified as primarily cottage cheese processing operations, and 15 had a specialization ratio of 75 percent or more.

The trend in fluid plants is expected to continue to decline. The small plants account for an estimated 5 percent of sales, the medium size plants 35 percent, and the large plants 60 percent. Larger processing plants will decrease in number but increase in size and account for an increasing proportion of sales.

Employment in the industry has shrunk from 185,000 in 1963 to 141,000 in 1970. By employment size classification, the small plants (1-19 employees) were estimated to have 8,000 employees in 1970, the medium size plants (20-99) 50,000 employees and the large plants (over 100) 82,700 employees.

The reduction in employee numbers is expected to continue with consolidation in plant numbers.

Fluid processing plants are generally located in population centers close to their markets. These plants specialize heavily in their primary product but some do manufacture other products such as butter and condensed products. Plants producing cottage cheese have a by-product of acid whey. To date, this product is of little or no commercial value.

Additional plant information

Table 2 provides a further break-out of dairy processing plants by type of product specialization, number, and employment for 1967.

Table 2 : Dairy plants by industry and primary product specialization, 1967

SIC	Product	Plants	Employment (000)
2021	Butter		
	Industry	540	8.7
	75% or more specialization	371	3.6
2022	Cheese		
	Industry	1,026	20.0
	75% or more specialization	970	18.1
20221	Natural cheese		
	Primary product	465	11.9
	75% or more specialization	403	9.2
20222	Process cheese		
	Primary product	58	5.4
	75% or more specialization	48	3.6
2023	Condensed & evaporated milk		
	Industry	291	13.2
	75% or more specialization	220	9.3
20231	Dry milk products		
	Primary product	104	5.6
	75% or more specialization	60	2.7
20232	Canned milk (consumer)		
	Primary product	64	5.1
	75% or more specialization	49	3.8
20233	Concentrated milk (bulk)		
	Primary product	25	.6
	75% or more specialization	18	.2
20234	Ice cream and ice milk mix		
	Primary product	47	1.2
	75% or more specialization	28	.6
2024	Ice cream and frozen desserts		
	Industry	850	24.6
	75% or more specialization	817	23.4
2026	Fluid milk		
	Industry	3,481	165.2
	75% or more specialization	3,249	142.0
20261	Bulk fluid milk and cream		
	Primary product	203	7.3
	75% or more specialization	102	2.4
20262	Packaged fluid milk and related products		
	Primary product	1,721	133.9
	75% or more specialization	1,301	87.8
20263	Cottage, bakers', pot, and farmers' cheese		
	Primary product	37	1.7
	75% or more specialization	15	.5
20264	Flavored milk products		
	Primary product	12	.3
	75% or more specialization	10	D

Source: U.S. Dept. of Commerce, Bureau of Census, 1967 Census of Manufactures Dairy Products MC 67(2)-20B

Pricing Milk -- An Overview

The most significant characteristic in pricing dairy products is the extreme degree of interdependency of the different segments of the dairy industry. Milk that is eligible for the fluid market may be utilized as fluid or in manufacturing other dairy products. Since milk may be used interchangeably in all manufactured products there is extreme competition between manufacturers for supplies of milk and for market outlets. Small differences in price may cause large volumes of milk to move from one utilization to another. The fact that joint products utilize varying proportions of fat and nonfat solids further complicates the pricing problem.

Due to its unique role in our food supply the public has been intensely interested in the price of milk and milk products. Most public pricing activity has considered the perishable nature of milk, the fact that it is bulky and expensive to transport, and problems stemming from the fact that we have a fluctuating supply to be coordinated with a variable demand. In light of these characteristics, the stated goals of most pricing activity have included reference to achieving and maintaining stability, adequate supply, income levels, sanitary requirements, and reasonable prices to consumers.

Two recent developments in the structural organization of milk marketing firms are influencing pricing at all levels from the farm to the consumer. Development of large regional producer cooperatives with increased bargaining strength and the increasing role of supermarkets have brought about marked changes in the marketing of milk and its pricing.

Except for a few isolated markets, fluid-grade raw milk in the United States is priced under Federal orders or State regulations. A classified pricing system is almost universally used. Classified pricing recognizes milk which is indistinguishable in a physical sense can be differentiated in the economic sense and priced by use. Factors other than product use can also enter into pricing decisions. With this system of classified prices fluid milk, Class I, is the preferred or highest price utilization.

In most Federal orders, milk which is used for manufacturing is priced at (or in relation to) the Minnesota-Wisconsin average price for manufacturing milk. Recommendations from recent hearings would add 20 cents per hundredweight to the Minnesota-Wisconsin price for Class 2 milk used to produce cottage cheese, yogurt, and all fluid cream and cream products. Milk for other manufactured products, Class 3, would continue to be priced at the Minnesota-Wisconsin series.

Basically, the Minnesota-Wisconsin price series (for manufacturing milk) serves as the mover for most milk in Federal order markets. Prices in other regulated markets generally follow quite closely to this pattern. It is this marginal use price which acts as the price mover for milk in all uses.

The price of manufacturing milk is definitely influenced and undergirded by the price support program. This program supports the price at a level between 75 to 90 percent of parity. Support is accomplished by government purchases of butter, nonfat dry milk, and cheddar cheese at a level which enables manufacturers to pay prices to producers which are equal to the announced support price.

Essentially, minimum prices for manufacturing and fluid milk are set by administrative action. At times actual prices are at these levels. At other times, as at present, market prices may be above the minimum level due to demand and supply conditions as evidenced in the marketplace.

Pricing Milk and Milk Products

Fluid Grade Milk

The concepts of orderly marketing, public interest, adequate supply, and parity price permeate the statutory authorization for Federal milk marketing orders. Inherent in this authorization was a desire on the part of Congress: (1) to remedy a short run condition of disruptively low milk prices and chronic surpluses, (2) to provide a framework for long-run price and income stability for dairy farmers.

Orderliness has several different dimensions. In the short-run context, orderliness implies seasonal adjustment of price to even out milk production while avoiding large short-term Class I price changes like those previously associated with seasonal swings of production relative to demand. In the long-run, it implies prices which achieve a reasonable balance between production and consumption. Orderliness implies short term protection of a market from unwarranted movement of milk supplies. At the same time, it implies adjustment of supply to least cost sources as well as to regional changes in production cost. Orderliness implies a proper relationship between fluid and manufacturing uses. It implies establishment of relations between producers and handlers which facilitate fair, but not disruptive, competition among producers and handlers while encouraging the establishment of reliable channels of trade. At the same time, it implies protecting the rights of producers to choose their market outlet, free of coercion and unreasonable barriers to market entry.

This concept of orderly marketing is implicit in the Act where it is declared to be the policy of Congress

> "...To establish and maintain such orderly marketing conditions...as will provide, in the interest of consumers and producers, an orderly flow of the supply thereof to market throughout its normal marketing season to avoid unreasonable fluctuations in supplies and prices."

The Federal milk order system was developed as a joint enterprise of the Federal government and milk producers. It was designed to raise producer returns by restoring order in a disorderly marketing system and redressing an imbalance of market power between dairy farmers and handlers. Measured in these terms, this institution has provided more orderly marketing and has served the interest of the general public as well as those of producers, cooperatives, and handlers. The public interest has been served by a supply-demand pricing system which has provided an adequate supply of milk at reasonable prices from the standpoint of both producers and consumers.

Approximately 75% of the nations milk supply is Grade A (eligible for fluid use) and about half of all milk is used for fluid purposes. Federal order receipts represent about 60% of total milk markets. Thus, the level of Federal order Class I prices directly influences the blend price received by producers of 60% of the total milk supply.

With a system of classified prices of the general type utilized under Federal orders, manufactured dairy products are the residual use of milk supplies. Fluid-milk products return a higher Class 1 price to producers and have first claim on supply. Semi-perishable products, such as ice cream and cottage cheese, may be made from either local milk supplies or intermediate products shipped in from surplus areas. Hard products such as cheese, butter, and powder, are residual claimants on milk supplies. The relative prices of the products and of milk for these uses determine the allocation of milk among the different uses.

At the present time, Class I prices move up and down with changes in the average price paid for manufacturing grade milk in Minnesota and Wisconsin. The ~~department~~ U.S.D.A has relied on the manufacturing market to reflect the impact of all supply and demand factors operating in the dairy economy. Good measures of manufacturing milk prices have been relatively easy to obtain, and have provided a sensitive measure of changes in the overall supply-demand balance in the dairy economy. The Class I differential is added to the Minnesota-Wisconsin series to obtain the Class I price to producers.

The use of manufacturing milk prices as a mover of Class I prices has provided a needed link between the price support and the milk order program. Under present arrangements, changes in support price levels are directly reflected in Class I prices as well as in prices paid for milk for manufacturing.

Prices established under Federal milk orders are minimum prices. With the development of large regional cooperatives and federations premiums above Federal minimum prices were negotiated in many markets. There was a tendency for average premiums to increase until 1968, and since then premiums have been relatively stable to slightly declining. In most instances these negotiated premiums also reflected additional services provided to the handler by the producer cooperative.

Pricing Milk for Manufacturing

Although most attention is generally given to pricing milk for fluid use, approximately one-half our milk supply is used to manufacture other dairy products. About 1/3 of the grade A milk (eligible for fluid use) is used for manufacturing. The rest is produced by manufacturing grade producers and is not eligible for fluid use.

Manufactured dairy products compete in a wider market than do fluid products. Hard products such as cheese, butter, and powder compete in the national market. Ice cream and cottage cheese, the soft products, are most closely affiliated with fluid markets but are sold and distributed by large plants over a large market area.

In most Federal order markets, that milk which is surplus to fluid needs is priced according to manufacturing milk values. In 30 orders, the surplus class price is the Minnesota-Wisconsin price. In 18 other markets, it is either the Minnesota-Wisconsin price or a butter-powder formula price, whichever is lower. Recent hearings have been held to standardize classification and procedures among the various Federal order markets. As recommended in these hearings, milk would be priced in three classes -

Class I or fluid use, Class 2 for that used to produce cottage cheese, yogurt, and all fluid cream and cream products, and
Class 3 for that used in other manufactured products. With this arrangement, Class 2 would be priced 20¢ above Class 3. Class 3 would continue to be the Minnesota-Wisconsin price.

The Minnesota-Wisconsin price has provided the best measure to date of manufactured milk values. This series, the average of prices received by farmers for manufacturing grade milk in the two States, is used throughout the dairy industry as a basic indicator of changes in milk values. Approximately 1/2 of the manufacturing grade milk sold in the United States is produced in Minnesota and Wisconsin. Prices paid farmers by manufacturing plants in the two States are particularly sensitive to changes in the national milk supply-demand balance as reflected by changes in the wholesale markets for butter, non-fat dry milk, and cheese.

The 1949 Agricultural Act directs the Secretary to support the price of milk at a level between 75 and 90 percent of parity which will assure an adequate supply. The price support program has been carried out primarily by purchases of butter, cheddar cheese, and non-fat dry milk at prices designed to enable manufacturers of dairy products to pay prices to producers for manufacturing milk which would result in U.S. annual average prices for such milk approximating the announced support objective.

Under the price support program, the government stands ready to remove all surplus from the market. Through the purchase of butter, cheddar cheese, and non-fat dry milk, the government has effectively supported the price of milk going into other manufactured dairy products. Because of the close tie-in which has prevailed in Federal market orders and other fluid milk markets between Class I prices and manufacturing milk prices, the price support program also has provided substantial support to Class I prices. Close coordination between Class I price policy and price support action must be maintained.

Product Pricing--Fluid

The fluid milk market, which began as a home delivery operation, has now moved to the supermarket. These supermarkets, and especially the large food chains, are exerting a great deal of influence in marketing practices and pricing of milk and milk products. Perhaps the greatest influence, and the most obvious to the consumer, is that found in the packaged fluid milk market.

Supermarkets have gained a marked advantage in negotiating with fluid processing plants. Increasing delivery cost, especially for servicing small accounts, and a switch from home delivery to large-volume wholesale deliveries has put the small processing plant at a great disadvantage. But the disadvantage is not limited to small plants when dealing with a supermarket.

Retail food chains have developed central procurement programs to obtain their packaged fluid milk products. These central programs may consist of various degrees of vertical coordination: (1) centralized buying and merchandizing of fluid milk; (2) adoption of limited service delivery and performance of services in the marketing channel that traditionally were performed by fluid milk processors; (3) more emphasis on price competition at the processor-food chain level negotiations; (4) innitiation of private-label brands; and (5) full integration into fluid milk processing.

Perhaps the greatest impact upon processors and upon price of the above mentioned changes comes from that of centralized buying. Food chains increasingly are negotiating terms of trade at their division or regional offices rather than at the local stores. These retailers are limiting the brands of milk handled--often to their private label and the brand of the processor supplying the private label. The processor thus has an all-or-nothing bargaining situation. This result, together with the size of the account, has greatly increased the risk associated with servicing store accounts. To compete for supermarket accounts, the processor must be large enough to handle the total volume of business or retail store division, which may involve several market centers. Since retail store divisions are often dispersed over large areas, other fairly large processors in the same vicinity could consequently lose their accounts. Even if such processors continue to compete, the advantage lies with multi-unit processors who have plants covering the entire area served by retail store divisions.

Food chains, through actual integration into fluid milk processing or the threat of such integration, have brought additional pressure into the negotiations with processors. Private label brands, whether processed by the retailer or by a processor, give the retailer additional advantage as this erodes the value of processor brands.

Fluid milk processors, caught between the large retail supermarket on the one side and the expanding large scale producer cooperatives on the other, have lost much of their previous bargaining power in the marketplace. Many smaller markets which previously were local in nature have become part of a much larger market with distribution by plants located some distance away.

The net result of these changes has been a reduced profit margin for processing plants.

Pricing Other Dairy Products

Dairy products other than fluid milk are sold mostly through food stores--almost entirely supermarkets and convenience stores--except for sales of ice cream through specialty ice cream stores and drug stores. While small amounts of these products are sold on home-delivery routes, the quantity is not large enough to be significant. At the retail level fluid dairy products other than whole milk are not regarded as competitive products. Ice cream is widely regarded as an excellent traffic builder and is frequently specialed. It has been treated as a low margin item for most of the post World War II period. Cheese is frequently specialed as is evaporated milk. On the other hand butter is seldom specialed since it no longer posseses the transfer effect it once had in drawing consumers.

Wholesale prices of processor-labeled dairy products other than fluid milk are made almost entirely by the quoted-price system. Large buyers of private-labeled products can obtain products at negotiated prices, while smaller buyers deal with a quoted-price system.

Wholesale prices of butter and cheese fluctuate quite closely according to the changing supply-and-demand situation, so that the pricing system for these products is something of a hybrid between the quoted-price system and supply-and-demand pricing. For most of the other products, prices fluctuate less often, being somewhat less sensitive to changes in supply and demand of raw milk. Butter is particularly sensitive to changes in supply and demand because of its residual nature. Wholesale prices of butter, non-fat dry milk, and American cheese rest on the floor provided by the Support Purchase Program of the U.S. Department of Agriculture so long as the Department is purchasing these products. When supplies become tighter, prices tend to rise above support levels. These products face a national market situation.

Butter represents the balance wheel of the dairy industry as it is usually the lowest return dairy product. Milk is not used for butter manufacture until all other demands have been met, and butter manufacture increases or decreases as necessary to balance total milk production with utilization.

A large percentage of the butter produced at country plants is packed into boxes and sold to primary receivers. These primary receivers assemble butter at central locations where they print and package it for distribution. They also sell bulk butter to wholesalers and to food chain warehouses which then distribute to their own stores. In some instances a chain acting as its own assembler prints and packages under private label for distribution to its own retail stores.

Wholesale butter prices are largely determined by activities of the two butter exchanges: The Chicago Merchantile Exchange and the New York Merchantile Exchange. Prices of bulk butter at manufacturing plants are almost exclusively based on one or the other of these exchange prices. Both these merchantile exchanges provide facilities for cash trading and trading futures contracts for several commodities in addition to butter. Members of the exchange can execute trades on the floor and nonmembers can execute trades through brokers who are members. Trading is conducted by voice on the exchange floor. Offers to sell or bids to buy are posted along with grading quantity.

In the market news service the quoted daily price for each grade is the latest sale, bid, or offer. In the case of a bid, it will not change the quotation from the previous day unless it is a higher price. If an offer, it will not change the quotation from the previous day unless it is a lower price. Thus, it is possible for the quotation to varry from day to day with no trade taking place on the exchanges. However, hundreds of country manufacturing plants sell butter on the basis of these quotations. Relatively small quantities of butter are actually traded on the exchanges.

Prices of print butter to chains, retailers, and food wholesalers are tied directly to the spot market quotations. Sales agreements are in terms of the margin over the price quotation for either New York or Chicago. The amount of margin is the only item to be bargained for at this level of butter marketing.

Retail butter prices are less closely related to the spot market quotations than butter prices at any other level of the marketing system. One reason may be that general mark-up policies of the store chain are followed and then changed only weekly or at some other time even though purchase prices may have changed during the period. Since retail stores are selling in restricted market areas, retail prices for butter show less similarity throughout the nation than do wholesale prices which are made in a national market.

Cheese prices are established on a national market basis. The Wisconsin cheese exchange in Green Bay, Wisconsin, meets each Friday morning for one half hour, at which time trading members and owners of licensed cheese factories may buy or sell American, brick, or Swiss cheese. This is the only cheese exchange in the country. There are no geographic restrictions with respect to either the place of business of individuals or firms trading on the exchange, or the source of cheese bought or sold on it, so prices established through transactions on the Wisconsin cheese exchange have nationwide implications. While exchange prices are not official, they are regarded as an accurate barometer of the value of cheese at any time. Only a very small portion of the cheese produced in this country is sold on the exchange--less than one percent of the total.

The cheese support price acts as a floor for exchange prices, since if exchange prices fall below support prices, firms can buy cheese on the exchange and sell it to the USDA at support price.

Soft products such as ice cream and cottage cheese, tend to be distributed in local markets by the same processors who distribute fluid milk. Because of this and their bulky and perishable nature,pricing also tends to be on a local market basis rather than a national market. However, since manufactured products such as butter, powder, and condensed milk and heavy cream can be used in making these products the cost of their manufacture is rather standard.

These soft dairy products are often differentiated by brand name and by quality differences.

As with fluid milk, supermarkets are very influencial in pricing these products. Those retail food chains which have integrated into fluid milk processing also have integrated into processing these products.

Distribution areas are expanding for these soft dairy products. Extremely large plants are benefiting from marked economies of scale.

Under Federal order pricing these products have been classified as manufactured products and milk being used in their manufacture has generally been priced at manufacturing price. However, a recommended decision based upon evidence received at the recent public hearings on 33 market orders would create an intermediate category for milk going into cottage cheese, yogurt, and all fluid cream and cream products. Milk for products in this class would be priced 20¢ over the monthly Minnesota-Wisconsin milk price series.

Price Impacts

Prices for dairy products will be affected for two reasons. Increased costs of pollution control cannot be absorbed by the processors so these costs can be expected to be reflected in product prices. The second is more difficult to assess. Prices also will be affected by any shift in production because of pollution control.

Much more cheese whey will be condensed and dried. This additional whey product will compete with nonfat dry milk in the market place. If all whey were to be dried, this would be approximately a 69 percent increase over that currently being processed. This increase would be equivalent to a 25 percent increase in nonfat dry milk production, too great an increase for the market to absorb without marked price effects. In fact, there is no ready market for this much additional volume at present.

Since dry whey (human food grade) is only about one-fifth the price of nonfat, whey is being utilized in those food products where it is most acceptable. Most all the additional whey would be expected to go into animal feed which is about two-thirds the price of whey for human use. However, if this additional whey comes onto the market within a short period of time we should expect the market price of nonfat dry milk to fall to the support level. There is no support price for whey. Whey would be driven to the price of animal feed.

The major portion of whey now being condensed or dried is from the larger cheese plants. These plants either dry the whey themselves, or condense it and haul the condensed whey to a drying plant, (or outlet for condensed) or haul the liquid whey to a dryer.

Small plants do not have adequate volume to support their own dryer. Unit costs of condensing and handling are greater than for large plants. Therefore, small plants are further disadvantaged--both absolutely and relatively. With very limited alternatives, these plants are in a poor bargaining position. They must often provide extra service or take a lower price for their whey--or even pay the dryer to take it.

Under present market conditions, we cannot expect increased pollution control costs to be passed on through higher prices for dry nonfat or whey. This would mean the producers of these products would need to be subsidized, either by revenues from other products or by some other form of subsidy.

Perhaps new uses can be found for whey and current uses expanded. This, however, is a long term solution and not immediately applicable. Greater volumes of dry whey will be manufactured, not to meet product demand but to dispose of a byproduct formerly dumped as a waste. With present technology, one might say regulations almost require that this product be produced.

Financial Characteristics of Dairy Firms

Data are not available to permit comparison of financial characteristics of different size groups of firms within each subindustry. However, the Internal Revenue Service Corporation Source Book of Statistics of Income, does permit comparisons of firms in the dairy industry grouped according to size of total assets.

The 1968 tax returns for 2,875 dairy products firms (2,599 regular corporate returns plus 276 firms reporting on Form 1120S) reveal that several financial characteristics show a definite association with size of the business as measured by total assets.

Just over one-half the firms reported total assets under $250,000 (Table 3). These firms had less than 3 percent of the total assets, almost 4 percent of the current liabilities, about 5 percent of total receipts and slightly over 5 percent of the deductions. These small firms realized only 1.7 percent of total net income, and only 1.1 percent of the total income subject to tax. They paid less than 0.7 percent of the income tax (before investment credits).

At the other extreme, 25 firms, fewer than 1 percent of the total, reported assets over $10 million. These firms owned 71 percent of the total assets, with 64.5 percent of the current liabilities. They realized 60 percent of total receipts and 59 percent of the total deductions. Most of the net income, 80 percent, was earned by these large firms who reported 84 percent of the income subject to tax, and reported 85.8 percent of the income tax (before investment credit). Only the largest two classes reported a smaller proportion of deductions than receipts, and the largest asset class was the only group whose net income was a higher proportion of the total than was their total receipts (Tables 3, 4 and 5).

Table 3. Income Characteristics of Corporations Classified in the Dairy Products Industry (SIC 2020). Percent of Total for Each Characteristic Represented by Firms in Each Size Grouping According to Total Assets, Computed from Data as Shown in Internal Revenue Service 1968 Corporation Source Book of Statistics of Income. (Summary Form of Table A1.)

Item	Total 1/	Total Assets $1,000		
		Over zero under 250	250 under 5,000	5,000 or more
		Size Group as Percent of Total		
~~Total~~ Number of Returns	2,875	51.72	46.09	2.05
Total Assets	4,867,691	2.98	21.57	75.44
Current Assets	2,498,736	2.80	23.58	73.62
Current Liabilities	1,335,556	3.95	26.32	69.72
Total Receipts	12,288,990	4.90	28.90	65.94
Total Deductions	11,851,518	5.07	29.48	65.19
Depreciation	222,843	3.95	26.64	69.36
Total Receipts Less Deductions	437,472	.26	13.15	86.36
Net Income Less Deficit	447,394	.25	12.82	86.70
Net Income	475,036	1.70	15.27	82.82
Deficit	27,642	25.05	54.88	20.07
Income Subject to Tax	440,392	1.12	11.82	86.83
Income Tax (Before Credit)	224,942	.68	10.44	88.64

1/ Actual numbers and $1,000, not percentages.
Includes 4 firms with zero assets.

Table 4. Comparison of Income Characteristics of Corporations Classified as in the Dairy Product Industry (SIC 2020). Computed from Data as Shown in the Internal Revenue Service 1968 Source Book of Statistics of Income, by Size of Total Assets. (Summary Form of Table A2.)

Item	Total*	Total Assets $1,000: Over zero under $250	$250 under $5,000	$5,000 or more
	Average Per Income Tax Return, $1,000			
Number Returns	2,875*	1,487	1,325	59
Returns With Net Income	1,954	847	1,054	50
Returns With Deficit	921	640	271	9
Total Assets	1,693	98	792	62,245
Current Assets	869	47	445	31,180
Current Liabilities	465	35	265	15,784
Total Receipts	4,274	405	2,680	137,346
Total Deductions	4,122	404	2,637	130,943
Depreciation	78	6	45	2,620
Net Income Less Deficit	156	1	43	6,574
Net Income	165	5	55	6,668
Deficit	10	5	11	94
Income Subject to Tax	153	3	39	6,482
Income Tax (Before Credit)	78	1	18	3,379
Net Income, Those With	243	10	69	7,868
Deficit, Those With	30	11	56	616
Estimate of Cash Flow:				
Returns With Net Income	321	16	114	10,488
Returns With Deficit	48	-5	-11	2,004

* Includes 4 firms with zero assets.

Table 5. Income Characteristics of Corporations Classified as in the Dairy Product Industry (SIC 2020). Computed from Data as Shown in 1968 Corporation Source Book of Statistics of Income, by Size of Total Assets. Average Per Income Tax Returns Expressed as Percentage Relationship Within Each Size Group. (Summary Form of Table A3.)

Item	Total*	Total Assets $1,000: Over zero under 250	Total Assets $1,000: 250 under 5,000	Total Assets $1,000: 5,000 or more
Number Returns	2,875	1,487	1,325	59
	Percent			
Percent of Returns With Net Income	68.0	57.0	79.5	84.7
Current as Percent of Total Assets	51.33	48.18	56.11	50.09
Current as Percent of Total Liabilities	27.44	36.33	33.48	25.36
Receipts as Percent of Assets	252.46	414.43	338.23	220.66
	Items as Percent of Total Receipts			
Total Deductions	96.44	99.81	98.38	95.34
Depreciation	1.81	1.46	1.67	1.91
Net Income	3.87	1.34	2.04	4.86
Deficit	.22	1.15	.43	.07
Net Income Less Deficit	3.64	.19	1.62	4.79
Income Subject to Tax	3.58	.82	1.47	4.72
Income Tax (Before Credit)	1.83	.26	.66	2.46

* Includes 4 firms with zero assets.

Although the financial condition of individual firms cannot be ascertained by studying averages, the impression gained as to the probable relative condition is meaningful. Firms must have some minimal amount of assets to effectively process and distribute dairy products. To remain a viable competitor requires a flow of income sufficient to provide those assets, either from internally generated capital funds or from the capital funds market. Neither source will continue readily available unless returns compare with alternative enterprises.

Technology has made it possible, and competition coupled with marginal costs has made it almost mandatory, for plants to replace some labor with equipment. Generally, this has increased both fixed costs and economies of scale, placing smaller plants in a more disadvantageous position. As a group, the very small firms, with assets below $50,000, have current liabilities greater than their current assets (Table A4). Reported net income was less than reported deficits for this group, although two-thirds of this group did realize some net income (Table A5). In other words, as a group, these smallest plants have no source of funds from the business--either from current assets or from earnings--to permit investment in plant or in pollution control facilities. When their total assets are used up most of these plants will be out of business whether or not they are faced with additional investment or operating costs. Requirements which they could not meet would hasten their demise.

The next smallest firms, those with assets over $50,000 but less than $100,000, fared even worse as a group. Only one-third of this group reported any net income, and deficits reported were greater than net income. The group did have a better balance between current assets and current liabilities with current assets more than double current liabilities. This suggests that some part of these firms were operating successfully, and perhaps could obtain funds for investments that were not excessive.

Smaller size firms show greater receipts per dollar of assets--both total and current assets--than do the larger firms (Table 5). They also tend to hold a higher portion of total assets in the form of current assets, suggesting that larger firms have gone further in mechanization and replacing labor with equipment.

In the eleven size groups there were only two significant exceptions to the positive association between size of firms and the percentage reporting net incomes. All firms in the three largest asset groups reported net income. Net income as a percent of total receipts increased as firm size increased.

Because of their position in regards to total assets, current assets, total receipts, and net incomes, the larger plants should not have too much difficulty in obtaining investment capital for pollution control facilities if the increased cost can be recovered through higher prices for their products.

The three largest size groups were the only ones with net incomes averaging three percent or more of total receipts. These same three groups were the only ones whose income subject to tax was two percent or more of total receipts. No group with assets below $1 million had incomes subject to tax over one percent of their total receipts.

Census of Manufactures data for 1967 illustrate some of the similarities and differences of the dairy industry as compared with other manufacturing industries. These data also reveal marked differences existing between the sub-industries within the dairy industry.

One measure of total volume is the value of shipments made by an industry. It does not differentiate between total value and value added by the industry; to that extent this measure is an overstatement of the industry contribution. The measures as shown in Table A4 should be used in connection with the more descriptive measures shown in Tables A5, A6, and A7.

Value added by manufacture is a more meaningful measure of manufacturing activity by an industry. The average dairy products company adds about two-thirds as much value by manufacturing as does the average food processing company. The same relationship holds on a per establishment basis (Table A5).

The condensed products industry is characterized by high value added per company, per establishment, per employee, per production worker, per dollar labor cost, and even per unit of capital expenditures for machinery and equipment. On the other hand, the cheese industry tends to be low in these respects.

Cheese plants have the highest proportion of production workers to total employees of any of the dairy products industries. Fluid milk is at the other extreme, with only one-third of the employees represented by production workers.

Capital expenditures are required to replace buildings and equipment and to adopt new technology. Individual establishments face peak periods of heavy investment such as expansion, rebuilding, etc., but the industry as a whole tends to invest in a more or less regular flow pattern.

Cheese and butter, the two small-type dairy industries, spent considerably less on new capital expenditures per establishment than did the other dairy industries (Table A6). Both were also low in capital expenditures per production worker and per dollar of depreciable assets. However, they held high values of depreciable assets per production worker and per dollar added by manufacture. The replacement rate of machinery, equipment and buildings was low. Perhaps this low rate is due to a slower rate of depreciation of butter and cheese making equipment, and to a slower rate of adoption of new technology. Low returns were no doubt a major consideration.

We recognize the variations in net income, cash flow, and other characteristics of plants in the same volume and product groups, and certainly between product groups. Despite these variations we believe it meaningful to make the transition from IRS Dollar Asset categories for SIC 2020 to the Census size categories based upon number of employees and to extend this transition to the SIC breakdown into 2021, 2022, 2023, 2024, and 2026.

To make the comparisons, small plants are considered those employing fewer than 20 employees. Medium size plants are those employing 20-99, and plants were considered large if employing more than 100 employees.

Using the IRS data, small firms were considered to be those with assets below $250,000, medium firms those with $250,000-$5,000,000, and large firms those above $5 million in total assets. Since the small firms are predominantly single plant, this group compares with the "small" category employing fewer than 20 employees. In each case, just over one-half the plant-firms are groups that will be hardest hit by any additional cost.

The medium-size groups are not so similar. Some firms in this range are multi-plant firms. However, the major difference is that large firms own several plants that are in the medium size category. We were unable to separate these plants, but feel that the comparisons between the two groups are valid and meaningful.

Investment Capital

Additional capital will be required to implement pollution control measures. Both private industry and municipalities will be requiring investment capital and operating funds as new treatment facilities are built and operated.

Municipalities probably will be able to obtain some grant monies from the Federal government. The remainder will need to come from bond issues and from charges to industry. Some municipalities are planning to issue bonds adequate to finance the non-grant portion, recovering the industry portion through increased charges. Others plan to require industry to immediately put up their proportionate share of the investment. The latter method will have a more pronounced effort upon the firms, and will decrease their ability to obtain credit for other needs.

Although pollution control will be a very major investment for the dairy industry, dairy's portion of the total will be rather small. Simultaneous demand for funds will be forthcoming and competing with regular demand for capital funds.

With Federal grants to municipalities and with municipal bond issues, adequate capital funds should be available for most dairy plant pollution control. However, small municipalities and small plants will both experience difficulty. Subsidized loans may alleviate the situation. But even then, most small dairy plants will not be able to adequately finance pollution control facilities. They do not have the financial structure to justify credit of this amount. If pollution control costs were passed on in higher prices these plants could continue for a time if they could pay the increased costs as operating expenses rather than as capital investment.

Pollution Control Requirements

This section of the report discusses the procedure, analysis and results of implementing standards to reduce the BOD and suspended solids content of dairy processing waste effluents. Under the proposed guidelines, achievement of the minimum acceptable effluent levels (schedule B) will require a removal of 88.6 percent in BOD. 1/ Achievement of the "highest" level of control technology now considered "practicable" and "available" to the industry will require a BOD reduction on the order of 97 percent or more.

Procedure for Costing

The reduction of dairy processing plant waste loads and costs can be accomplished by the exclusive use of in-plant modifications or waste treatment systems or some combination of the two. In-plant modifications offer the advantage of cost savings in water and sewage fees and reductions in product loss that will offset partially or completely the cost of modifications. Waste treatment does not offer any possible savings. Costs are increased without any offsetting benefits in terms of increased efficiency.

For dairy processing plants, one alternative can substitute for the other. The most economical technological system is probably some combination of the two alternatives. However, a lack of information on the types of in-plant modifications and costs for reducing waste loads by varying amounts prevented an analysis of this alternative and the combination of in-plant and waste treatment systems.

1/ Effluent Limitations Guidance for the Refuse Act Permit Program, the Dairy Products Industry", Aug. 4, 1972.

Table 6. [illegible] processing plant sizes [illegible] by [illegible] dairy product

SIC	Product	Size	Size (milk equivalent processed per day) Lbs.	BOD (per 1000 lb. M.E.) Lbs.	Water (per 1000 lbs. M.E.) Gals.	Total per day BOD Lbs.	Total per day Water Gals.
2021	Butter	(sm.)	40,000	1.5	400	60	16,000
		(med.)	425,000	1.5	400	638	170,000
		(lg.)	670,000	1.5	400	1,005	268,000
2022	Cheese	(sm.)	35,000	2.0	400	70	14,000
		(med.)	175,000	2.0	400	350	70,000
		(lg.)	1,400,000	2.0	400	2,800	560,000
2023	Condensed and evaporated	(sm.)	25,000	1.0	400	25	10,000
		(med.)	250,000	1.0	400	250	100,000
		(lg.)	1,150,000	1.0	400	1,150	460,000
2024	Ice Cream	(sm.)	10,000	4.0	400	40	4,000
		(med.)	85,000	4.0	400	340	34,000
		(lg.)	325,000	4.0	400	1,300	130,000
2026	Fluid milk	(sm.)	14,000	1.5	400	21	5,600
		(med.)	88,000	1.5	400	132	35,200
		(lg.)	408,000	1.5	400	612	163,200
	Fluid milk and Cottage cheese 1/	(sm.)	14,000	2.12 2/	454 2/	30	6,356
		(med.)	88,000	2.12	454	187	39,952
		(lg.)	408,000	2.12	454	869	185,200
	Fluid milk and cottage cheese 1/ 3/	(sm.)	14,000	4.83 4/	465 4/	68	6,500
		(med.)	88,000	4.83	465	424	40,940
		(lg.)	408,000	4.83	465	1,970	189,800

1/ Milk equivalent utilized as 91 percent in fluid products and 9 percent in cottage cheese.

2/ Cottage cheese processing requires 1,000 gallons of water per 1,000 lbs. M.E. and effluent has a BOD of 8.5 per 1,000 lbs. M.E. used in cottage cheese.

3/ Cottage cheese whey discharged with other processing wastes.

4/ Hydraulic load is 1,125 gallons per 1,000 lbs. M.E. used in cottage cheese and cottage cheese processing effluent with whey has a BOD of [illegible]8.5 lbs per 1,000 lbs M.E. used in cottage cheese.

information was available on waste treatment systems and the investments and costs. Consequently, the impact analysis is based on the exclusive use of the treatment alternative.

The analytical procedure used was the development of investment and costs for three different size plants in each of the five industries utilizing four alternative waste treatment systems. Table 6 gives the size of plants, effluent characteristics, and principle product for each of the five industry groups. Specifications were developed from census data and published information on effluent wastes of plants in the dairy industry. For fluid milk processing, specifications were developed for three situations: (1) processing of fluid milk only, (2) processing 91 percent of the milk equivalent into fluid products and 9 percent into cottage cheese with the whey collected and shipped, and (3) the same as (2) but the whey is discharged with the plant effluent from processing fluid milk products.

The four treatment systems analyzed are: (1) ridge and furrow, (2) municipal, (3) plant pretreatment followed by municipal treatment and (4) exclusive plant treatment. Ridge and furrow is a land disposal system suitable for small plants in rural areas in particular. Properly managed and operated, the system will reduce the BOD and suspended solids in effluent by 96 to 100 percent. The system is less desirable for large plants because of extensive land requirements. 1/

Municipal systems are assumed to have the capability to reduce pollutant levels of dairy processing wastes to those proposed (Schedule A). However, it is recognized that dairy processing plants may be the primary contributor to municipal systems, and the existing systems cannot achieve

1/ Existing or future local, state or Federal regulations will tend to severely limit the use of land for disposing of waste products.

desired levels. This problem will be prevalent in rural areas of the Lakes Region where numerous butter, cheese, and condensing plants are located.

Pretreatment followed by municipal treatment is a method to reduce loadings discharged to municipal systems. For this analysis, pretreatment is activated sludge with an expected reduction in BOD of 80 to 85 percent. It is assumed the municipal system can achieve for further reductions in BOD and suspended solids to desired levels.

The fourth system is the privately owned system. This is an activated sludge process followed by a filtration system to reduce BOD by 96 to 98 percent before effluent discharge into a stream. Such systems would be constructed, owned, and operated by the processing plants. Private treatment systems would be necessary for plants located in communities without a municipal system, or too great a distance from municipal sewer lines to justify extension.

While other treatment systems exist and are in use such as spray irrigation, lagoons, reverse osmosis, etc., the four systems considered here cover the expected range in costs of all treatment alternatives currently available to firms in the industry.

Investment and costs were determined by each plant size for each system. Costs are divided into two categories: Fixed costs or those that do not vary with volume of effluent treated and variable costs or those costs that do vary with effluent volume. Municipal charges are based on the hydraulic load and a surcharge for BOD is added when the concentration exceeds 200 PPM. It is not assumed that the charges are sufficient to cover the costs incurred. In many cases, plants may pay additional amounts for annual assessments covering appurtenances installed by the municipality in addition to a hook-up charge. In all probability, the municipal charges used in this analysis are well below those that would cover the full cost burden to the community.

Costs are determined on the basis of 1,000 lbs. of milk equivalent input. The costs are transformed into the cost for treatment on a per unit of finished product. In all cases but the fluid milk-cottage cheese process case, it is assumed the cost is added to the cost of the primary product of the plant. In actuality, firms may attempt to assign some of the cost to by-products and recover it on increases in by-product prices.

Results

Preliminary results on investments and costs are presented in tables 7-13 . The ridge and furrow and municipal alternatives are the least cost solutions. Harper has indicated that plants processing 90 percent of the milk equivalent are connected to municipal systems. 1/ While this would support a conclusion of a minimum impact on the industry in total, it is not likely that all existing municipal systems are achieving a reduction in BOD and suspended solids equal to those in the proposed standards. Therefore plants connected to systems that require upgrading face the prospects of higher rates and assessments or investment in treatment

1/ See pages 62 and 66.

facilities at some future date.

The pretreat-municipal and private treatment systems are the most expensive alternatives. Either will create a heavy demand for capital, possibly beyond the borrowing capacity of many small and medium size plants. In addition, additional investment for in-plant process changes will be necessary to achieve consistent reductions in effluent BOD and suspended solids by the treatment systems.

The investment and cost figures presented below should be interpreted as only estimates for a set of unique conditions:

(1) Capacity is defined as 260 days of operation at the daily volumes indicated. In actuality, processing is seasonal for many commodities and plants can vary the hours of operation per day or days per week.

(2) Plants are assumed to have a consistent product mix, but many vary the mix and this alters the processing plant effluent characteristics from day to day.

(3) Treatment investment figures do not incorporate the concept of economies of size. Such economies do exist and the figures presented here underestimate investment for smaller plants and may overestimate for larger size plants.

(4) Uniform rates for hydraulic and BOD loadings per 1,000 lbs. M.E. are, used. Information to date indicates some plants have superior levels while others are substantially inferior.

(5) Investment figures do not include capital requirements for in plant modifications. Plants with outmoded technology may require large investments.

Table 7: Investment and costs of four waste treatment systems for three butter plant sizes.

Item	Plant size (M.E. in lbs. per day)		
	40,000	425,000	670,000
	dollars		
Ridge and furrow			
Investment1/	6,400	68,000	107,000
Annual cost2/	1,280	13,600	21,440
Cost per 1,000 lbs. M.E.3/	0.12	0.12	0.12
Municipal			
Investment4/	--	--	--
Annual cost5/	1,300	13,813	21,775
Cost per 1,000 lbs. M.E.3/	0.125	0.125	0.125
Pretreat plus municipal			
Investment6/	23,000	242,000	381,000
Annual cost5/7/	6,560	64,290	101,240
Cost per 1,000 lbs. M.E.3/	0.63	0.58	0.58
Private treatment			
Investment8/	37,000	392,600	619,000
Annual cost9/	8,880	86,372	136,180
Cost per 1,000 lbs. M.E.3/	0.85	0.78	0.78

1/ Investment based on $3,200 per acre, acreage requirement based on application rate of 8,000 gallons of water per acre per day.

2/ Annual cost is 20 percent of investment.

3/ Based on annual operation of 260 days with annual M.E. input of 10,400,000 lbs., 110,500,000 lbs., and 174,200,000 lbs., respectively.

4/ No investment assumed but firms may have additional charges assessed for trunk and lateral sewer lines.

5/ Cost is based on 25 cents per 1,000 gallons of waste water and an extra strength charge of 3 cents per pound BOD for concentrations exceeding 200 PPM.

6/ Investment is determined from the equation: $\left[(\$300 \times \text{waste water coefficient}) + (\$275 \times \text{BOD coefficient})\right] \times \frac{\text{gallons of water per day}}{1,000}$. The waste water coefficient is 3.34 and the BOD coefficient is 1.5 for butter plants.

7/ Annual cost is sum of the fixed cost, 12 percent of investment; the variable cost, 12 percent of investment for investments less than $100,000, 10 percent for investments ranging from $100,000 to $1,000,000, and 8 percent for investments over one million; and municipal charges (see 5/).

8/ Investment is estimated from equation 6/ plus $\left[(\$250 \times \text{waste water coefficient}) + (\$200 \times \text{BOD coefficient})\right] \times \frac{\text{gallons of water per day}}{1,000}$. The coefficients are 3.34 and 0.3, respectively.

9/ Annual cost is the same as in 7/ excluding municipal charges.

Table 9: Investments and costs of four different treatment systems for three different size cheese plants.

Item	Plant size (M.E. in lbs. per day) 35,000	175,000	1,400,000
	------ dollars	------	------
Ridge and furrow			
Investment1/	5,600	28,000	224,000
Annual cost2/	1,120	5,600	44,800
Cost per 1,000 lbs. M.E.3/	0.12	0.12	0.12
Municipal			
Investment4/	--	--	--
Annual cost5/	1,274	6,370	50,960
Cost per 1,000 lbs. M.E.3/	0.14	0.14	0.14
Pretreat plus municipal			
Investment6/	21,700	108,600	869,100
Annual cost7/	6,118	28,442	227,600
Cost per 1,000 lbs. M.E.3/	0.67	0.625	0.625
Private treatment			
Investment8/	34,500	172,700	1,381,500
Annual cost9/	8,280	37,994	276,300
Cost per 1,000 lbs. M.E.3/	0.91	0.835	0.76

1/ Investment based on $3,200 per acre, acreage requirement based on application rate of 8,000 gallons of waste per acre per day.

2/ Annual cost is 20 percent of investment.

3/ Based on annual operation of 260 days with annual M.E. input of 9,100,000 lbs., 45,500,000 lbs., and 364,000,000 lbs., respectively.

4/ No investment assumed but firms may have additional charges assessed for trunk and lateral sewer lines.

5/ Cost is based on 25 cents per 1,000 gallons of waste water and an extra strength charge of 3 cents per pound BOD for concentrations exceeding 200 PPM.

6/ Investment is determined from the equation [($300 x waste water coefficient) + ($275 x BOD coefficient)] x $\frac{\text{gallons of water per day}}{1,000}$. The coefficients are 3.34 and 2.0 respectively for cheese plants.

7/ Annual cost is sum of the fixed cost, 12 percent of investment; the variable cost, 12 percent of investment less than $100,000, 10 percent for values between $100,000 and $1,000,000, and 8 percent for values over one million dollars; and the municipal charge (see 5/).

8/ Investment is estimated from equation in 6/ plus estimate for the following equation: [($250 x waste water coefficient) + ($200 x BOD coefficient)] x $\frac{\text{gallons of waste water}}{1,000}$.with coefficients 3.34 and 0.4 respectively.

9/ Annual cost determined as in 7/ excluding municipal charges.

(6) The municipal rate used is based on a constant charge for hydraulic volume and surcharge for excessive BOD loading. Rates are known to vary widely between communities.

Butter: Treatment system investment by butter plants ranges from zero for municipal to slightly over $900 per 1,000 lbs. M.E. input capacity per day. Investment for the ridge and furrow system is $160 for 1,000 lbs. M.E. per day, and pretreat investment is $575 per 1,000 lbs. M.E. per day.

Operating costs (fixed and variable) range from 12 cents to 85 cents per 1,000 lbs. M.E. processed. Both ridge and furrow and municipal have essentially the same cost, 12 and 12.5 cents per 1,000 lbs. M.E. respectively. The cost estimate per 1,000 lbs. M.E. for pretreat-municipal ranges from 6[illegible] cents for the small plant to 58 cents for the medium and large plants. The cost for private treatment range from 85 cents to 78 cents per 1,000 lbs. M.E. with the medium and larger size plants having the cost advantage.

Natural Cheese: Investment in treatment systems range from zero for municipal treatment to almost $1,000 per 1,000 lbs. of M.E. capacity per day for private treatment. Investment in the ridge and furrow system is estimated at $160 per 1,000 lbs. M.E. capacity per day to slightly in excess of $600 for a pretreat-municipal combination.

Operating costs per 1,000 lbs. M.E. input are 12 cents for ridge and furrow, 14 cents for municipal, 62.5 to 67 cents for pretreat-municipal, and 76 to 91 cents for private treatment. For the latter two systems, unit cost (variable) decreases with plant size.

Condensed and evaporated products: Investment for treatment systems per 1,000 lbs. of daily M.E. capacity for condensed and evaporating plants are zero for municipal, $160 for ridge and furrow, $511 for pretreat-municipal, and $860 for private treatment.

Table 9. Investment and costs of four different treatment systems for three different size condensed and evaporated plants.

Item	Plant size (M.E. in lbs. per day) 25,000	250,000	1,150,000
	------------- dollars -------------		
Ridge and furrow			
Investment1/	4,000	40,000	184,000
Annual cost2/	800	8,000	36,800
Cost per 1,000 lbs. M.E.3/	0.12	0.12	0.12
Municipal			
Investment4/	--	--	--
Annual cost5/	715	7,150	32,890
Cost per 1,000 lbs. M.E.3/	0.11	0.11	0.11
Pretreat plus municipal			
Investment6/	12,770	127,700	587,400
Annual cost7/	3,715	34,594	159,128
Cost per 1,000 lbs. M.E.3/	0.57	0.53	0.53
Private treatment			
Investment8/	21,500	215,000	989,900
Annual cost9/	5,160	47,300	217,800
Cost per 1,000 lbs. M.E.3/	0.80	0.73	0.73

1/ Investment based on $3,200 per acre, acreage requirement based on an application rate of 8,000 gallons of waste per acre per day.

2/ Annual cost is 20 percent of investment.

3/ Based on annual operation of 260 days with annual M.E. input of 6,500,000 lbs., 65,000,000 lbs., and 299,000,000 lbs., respectively.

4/ No investment assumed but firms may be subject to additional assessments for trunk and lateral sewer lines.

5/ Cost is based on 25 cents per 1,000 gallons of waste water and an extra strength charge of 3 cents per pound BOD for concentrations exceeding 300 PPM.

6/ Investment is estimated from the equation $\left[(\$300 \times \text{waste water coefficient}) + (\$275 \times \text{BOD coefficient})\right] \times \frac{\text{gallons of water per day}}{1,000}$ with coefficients of 3.34 and 1.0 respectively.

7/ Annual cost is the sum of the fixed cost, 12 percent of investment; the variable cost, 12 percent of investment less than $100,000, 10 percent of investment between $100,000 and $1,000,000 and 8 percent of investment over $1,000,000; and municipal charges.

8/ Investment is estimated from equation 6/ above plus estimate from the following equation: $\left[(\$250 \times \text{waste water coefficient}) + (\$200 \times \text{BOD coefficient})\right] \times \frac{\text{gallons of water per day}}{1,000}$ with coefficients of 3.34 and 0.2 respectively.

9/ Annual cost determined as in 7/ above excluding municipal charges.

Table 10: Investment and costs of four waste treatment systems for three ice cream plant sizes.

Item	Plant size (M.E. in lbs. per day)		
	10,000	85,000	325,000
	dollars		
Ridge and furrow			
Investment 1/	2,560	21,760	89,600
Annual cost 2/	512	4,352	17,920
Cost per 1,000 lbs. M.E. 3/	0.20	0.20	0.20
Municipal			
Investment 4/	--	--	--
Annual cost 5/	520	4,417	18,195
Cost per 1,000 lbs. M.E. 3/	0.20	0.20	0.20
Pretreatment plus municipal			
Investment 6/	8,400	71,500	273,300
Annual cost 7/	2,291	19,464	69,000
Cost per 1,000 lbs. M.E. 3/	0.88	0.88	0.82
Private treatment			
Investment 8/	12,390	105,300	402,6[illegible]
Annual cost 9/	2,974	23,166	48,3[illegible]
Cost per 1,000 lbs. M.E. 3/	1.14	1.05	1.[illegible]

1/ Investment based on $3,200 per acre, acreage requirement based on an application rate of 50 pounds BOD per acre per day.

2/ Annual cost is 20 percent of investment.

3/ Based on annual operation of 260 days with annual M.E. input of 2,600,000 lbs., 22,100,000 lbs., and 84,500,000 lbs.

4/ No investment assumed, but firms may be subject to additional assessments for trunk and lateral sewer lines.

5/ Cost is based on 25 cents per 1,000 gallons of waste water and an extra strength charge of 3 cents per pound BOD for concentrations exceeding 200 PPM.

6/ Investment is estimated from the equation $[(\$300 \times \text{waste water coefficient}) + (\$275 \times \text{BOD coefficient})] \times \frac{\text{gallons of water per day}}{1,000}$ with coefficients of 3.34 and 4.0 respectively.

7/ Annual cost is the sum of the fixed cost, 12 percent of investment; the variable cost, 12 percent of investment less than $100,000, 10 percent of investment from $100,000 to $1,000,000 and 8 percent over $1,000,000; and municipal charges.

8/ Investment is estimated from equation in 6/ above plus estimate from the following equation $[(\$250 \times \text{waste water coefficient}) + (\$200 \times \text{BOD coefficient})] \times \frac{\text{gallons of water per day}}{1,000}$ with coefficients of 3.34 and 0.8 respectively.

9/ Annual cost is the same as in 7/ above excluding municipal charges.

Operating costs per 1,000 lbs. M.E. input per day are in ascending order: 11 cents for municipal, 12 cents for ridge and furrow, 53 to 57 cents for pretreat-municipal, and 73 to 80 cents for private treatment. In the case of the latter two systems, unit cost decreases with increasing plant size reflecting operating economies in variable cost items.

Ice cream: Treatment system investment by ice cream plants range from zero for municipal systems to $1,239 per 1,000 lbs. of M.E. input capacity per day for private treatment. Investment for ridge and furrow is $256 and pretreat-municipal $840 per 1,000 lbs. of M.E. input capacity per day.

Operating costs are 20 cents per 1,000 lbs. M.E. processed for both the ridge and furrow and municipal treatment systems. Pretreat-municipal operating costs decrease with plant size from 88 cents to 82 cents for a large plant on a 1,000 lbs. of M.E. basis. Private treatment costs also decrease with plant size from $1.14 to $1.05 per 1,000 lbs. M.E. processed.

Fluid milk: Investment for treatment systems by fluid milk plants ranges from zero for municipal systems to approximately $920 per 1,000 lbs. of M.E. capacity per day for private treatment. The investment for ridge and furrow and pretreat-municipal systems is $160 and $565 per 1,000 lbs. of M.E. capacity per day respectively.

Operating costs are 12 and 12.5 cents per 1,000 lbs. M.E. for ridge and furrow and municipal treatment. Pretreat-municipal operating costs are 62 cents per 1,000 lbs. M.E. for small and medium plants and 58 cents per 1,000 lbs. M.E. for large plants. Private treatment costs are 85 cents per 1,000 lbs. of M.E. for small and medium size plants and 78 cents per 1,000 lbs. M.E. for large plants.

Fluid milk-cottage cheese: The addition of a cottage cheese processing operation even at a small proportion of total milk equivalent processed has a significant impact on fluid plant investment and treatment costs. 1/ In this situation, the whey is collected and shipped out for disposal. Treatment system investment ranges from zero for municipal to almost $1,500 per 1,000 lbs. of plant M.E. capacity per day for private treatment. But investment per 1,000 lbs. M.E. per day of capacity for fluid ranges from zero to $924 while the investment for cottage cheese waste treatment ranges from zero to $7,270 per 1,000 lbs. of M.E. capacity per day. Ridge and furrow system investment is $183 per 1,000 lbs. M.E. of plant processing capacity and pretreat-municipal requires an investment of $950 per 1,000 lbs. M.E. of capacity per day.

Operating costs for plants with either ridge and furrow or municipal systems are 14 and 15 cents per 1,000 lbs. M.E. respectively. Costs for the fluid product waste treatment are 12 and 13 cents per 1,000 lbs. M.E. for the two systems, but 31 and 46 cents per 1,000 lbs. M.E. processed into cottage cheese for ridge and furrow and municipal treatment.

Average plant waste treatment cost by pretreat-municipal decreases from 99 to 92 cents per 1,000 lbs. M.E. and from $1.38 to $1.27 for private treatment. On a product basis per 1,000 lbs. of M.E., the cost decreases with increasing plant size from 62 to 58 cents for fluid product wastes and from $4.72 to $4.35 for cottage cheese waste by pretreat-municipal. With private treatment, the cost likewise decreases with increasing plant size, from 85 to 78 cents for fluid and $6.71 to $6.15 for cottage cheese on a per 1,000 lbs. of M.E. input.

Fluid milk-cottage cheese (whey discharged): 2/ This situation differs from

1/Milk equivalent input is allocated 91 percent to fluid operations and 9 percent to cottage cheese processing.

Table 11: Investment and costs of four treatment systems for three fluid milk plant sizes.

Item	Plant size (M.E. in lbs. per day) 14,000	88,000	408,000
	------------- dollars	-------------	-------------
Ridge and furrow			
Investment1/	2,240	14,100	65,300
Annual cost2/	448	2,820	13,060
Cost per 1,000 lbs. M.E.3/	0.12	0.12	0.12
Municipal			
Investment4/	--	--	--
Annual cost5/	455	2,860	10,608
Cost per 1,000 lbs. M.E.3/	0.125	0.125	0.125
Pretreatment plus municipal			
Investment6/	7,920	49,800	230,900
Annual cost7/	2,266	14,238	61,395
Cost per 1,000 lbs. M.E.3/	0.62	0.62	0.58
Private treatment			
Investment8/	12,930	81,300	376,900
Annual cost9/	3,104	19,512	82,916
Cost per 1,000 lbs. M.E.3/	0.85	0.85	0.78

1/ Investment based on $3,200 per acre, acreage requirement based on an application rate of 8,000 gallons of waste water per acre per day.

2/ Annual cost is 20 percent of investment.

3/ Based on an annual operation of 260 days with annual M.E. input of 3,640,000 lbs., 22,880,000 lbs., and 106,080,000 lbs., respectively.

4/ No investment assumed but firms may be subject to additional assessments for trunk and lateral sewer lines.

5/ Cost is based on 25 cents per 1,000 gallons of waste water and an extra strength charge of 3 cents per pound BOD for concentrations exceeding 300 PPM.

6/ Investment is estimated from the equation $\left[(\$300 \times \text{waste water coefficient}) + (\$275 \times \text{BOD coefficient})\right] \times \frac{\text{gallons of water per day}}{1,000}$ with coefficients of 3.34 and 1.5 respectively.

7/ Annual cost is the sum of the fixed cost, 12 percent of investment; the variable cost, 12 percent of investment under $100,000, 10 percent of investment from $100,000 to $1,000,000 and 8 percent over $1,000,000; plus municipal charges.

8/ Investment is estimated from equation in 6/ above plus estimate from the following equation $\left[(\$250 \times \text{waste water coefficient}) + (\$200 \times \text{BOD coefficient})\right] \times \frac{\text{gallons of water per day}}{1,000}$ with coefficients of 3.34 and 0.3 respectively.

9/ Annual cost is estimated the same as in 7/ above excluding municipal charges.

Table 12: [illegible] costs [illegible] treatment systems [illegible] fluid milk-co[illegible]

Item	Fluid	Cottage Cheese	Total	Fluid	Cottage Cheese	Total	Fluid	Cottage Cheese	Total
	Plant size (M.E. in lbs. per day)								
	12,740	1,260	14,000	80,080	7,920	88,000	371,300	36,700	[illegible]
	dollars								
Ridge and furrow									
Investment1/	2,048	512	2,560	12,816	3,184	16,000	59,466	14,774	74,[illegible]
Annual cost2/	410	102	512	2,563	637	3,200	11,893	2,955	14,[illegible]
Cost per 1,000 lbs. M.E.3/	0.12	0.31	0.14	0.12	0.31	0.14	0.12	0.31	[illegible]
Municipal									
Investment4/	--	--	--	--	--	--	--	--	--
Annual cost5/	414	149	563	2,603	937	3,540	12,069	4,341	16,41[illegible]
Cost per 1,000 lbs. M.E.3/	0.13	0.46	0.15	0.13	0.45	0.15	0.13	0.46	[illegible]
Pretreat - Municipal									
Investment6/	7,208	6,102	13,310	45,309	38,353	83,662	210,082	177,720	387,[illegible]
Annual cost7/	2,060	1,546	3,606	12,957	9,719	22,676	55,872	41,484	97,[illegible]
Cost per 1,000 lbs. M.E.3/	0.62	4.72	0.99	0.62	4.72	0.99	0.58	4.35	0.9[illegible]
Private treatment									
Investment8/	11,769	9,160	20,929	73,978	57,578	131,556	343,000	266,800	609,[illegible]
Annual cost9/	2,824	2,198	5,022	16,275	12,667	28,942	75,460	58,696	[illegible]
Cost per 1,000 lbs. M.E.3/	0.85	6.71	1.38	0.78	6.15	1.27	0.78	6.15	1.2[illegible]

1/ Investment based on $3,200 per acre, acreage requirement based on an application rate of 8,000 gallons of waste water per acre per day.

2/ Annual cost is 20 percent of investment.

3/ Based on an annual operation of 260 days with annual M.E. input of 3,640,000 lbs., 22,880,000 lbs., and 106,080,000 lbs.

4/ No investment assumed but firms may be subject to additional assessments for trunk and lateral sewer lines.

5/ Cost is based on 25 cents per 1,000 gallons of waste water and an extra strength charge of 3 cents per pound BOD for concentrations exceeding 200 PPM.

6/ Investment estimated from the equation [($300 x waste water coefficient) + ($275 x BOD coefficient)] x $\frac{\text{gallons of water per day}}{1,000}$ with fluid coefficients of 3.34 and 1.5 and cottage cheese coefficients of 8.35 and 8.5 respectively.

7/ Annual cost is the sum of the fixed cost, 12 percent of investment; the variable cost, 12 percent of investment under $100,000, 10 percent of investment from $100,000 to $1,000,000, and 8 percent over $1,000,000, plus municipal charges.

8/ Investment estimated from 6/ above plus estimate from following [($250 x waste water coefficient) + ($200 x BOD coefficient)] x $\frac{\text{gallons of water per day}}{1,000}$, with fluid coefficients of 3.34 and 0.3 and cottage cheese coefficients of 8.35 and 1.7 respectively.

9/ Annual cost estimated the same as in 7/ less municipal charges.

Table [illegible]: [illegible] and cost of [illegible] systems for [illegible] cottage cheese plant sizes (whey [illegible] in waste).

Item	Fluid	Cottage Cheese	Total	Fluid	Cottage Cheese	Total	Fluid	Cottage Cheese	Total
	Plant size (M.E. in lbs. per day)								
	12,740	1,260	14,000	80,080	7,920	88,000	371,300	36,700	[illegible]
	dollars								
Ridge and furrow									
Investment1/	2,048	2,272	4,320	12,816	14,320	27,136	59,[illegible]	[illegible]	[illegible]
Annual cost2/	410	454	864	2,563	2,864	5,427	11,[illegible]	13,[illegible]	[illegible]
Cost per 1,000 lbs. M.E.3/	0.12	1.39	0.24	0.12	1.39	0.24	0.12	1.39	[illegible]
Municipal									
Investment4/	--	--	--	--	--	--	--	--	--
Annual cost5/	414	447	861	2,603	2,811	5,414	12,069	13,026	25,095
Cost per 1,000 lbs. M.E.3/	0.13	1.37	0.24	0.13	1.37	0.24	0.13	1.37	[illegible]
Pretreat - municipal									
Investment6/	7,208	19,012	26,220	45,309	119,461	164,770	210,082	553,569	763,65[illegible]
Annual cost7/	2,060	4,761	6,821	12,051	26,993	39,044	55,872	125,082	180,95[illegible]
Cost per 1,000 lbs. M.E.3/	0.62	14.53	1.87	0.58	13.11	1.71	0.58	13.11	[illegible]
Private treatment									
Investment8/	11,769	24,528	36,297	73,978	154,121	228,099	343,000	714,214	[illegible]
Annual cost9/	2,824	5,886	8,710	16,275	33,907	50,182	68,600	142,843	[illegible]
Cost per 1,000 lbs. M.E.3/	0.85	17.97	2.39	0.78	16.47	2.19	0.71	14.97	[illegible]

1/ Investment based on \$3,200 per acre, acreage requirement based on an application rate of 50 pounds BOD per acre per day.

2/ Annual cost is 20 percent of investment.

3/ Based on an annual operation of 260 days with annual M.E. input of 3,640,000 lbs., 22,880,000 lbs., and 106,080,000 lbs.

4/ No investment assumed but firms may be subject to additional assessments for trunk and lateral sewer lines.

5/ Cost is based on 25 cents per 1,000 gallons of waste water and an extra strength charge of 3 cents per pound BOD for concentrations exceeding 200 PPM.

6/ Investment estimated from the equation [(\$300 x waste water coefficient) + (\$275 x BOD coefficient)] x $\frac{\text{gallons of water per day}}{1,000}$ with fluid coefficients of 3.34 and 1.5 and cottage cheese coefficients of 9.40 and 38.5 respectively.

7/ Annual cost is the sum of the fixed cost, 12 percent of investment; the variable cost, 12 percent of investment under \$100,000, 10 percent of investment from \$100,000 to \$1,000,000, and 8 percent over \$1,000,000 plus municipal charges.

8/ Investment estimated from 6/ above plus estimate from following [(\$250 x waste water coefficient) + (\$200 x BOD coefficient)] x $\frac{\text{gallons of water per day}}{1,000}$ with fluid coefficients of 3.34 and 0.3 and cottage cheese coefficients of 9.40 and 7.7 respectively.

9/ Annual cost estimated the same as in 7/ less municipal charges.

the above only in the method of disposing of the acid whey. In this situation, the whey is discharged with the rest of the plant processing wastes. The BOD loading is increased substantially with only a small increase in hydraulic volume.

Plant investment ranges from zero for the municipal alternative to $2,593 per 1,000 lbs. of M.E. capacity per day for private treatment. The investment for ridge and furrow is $309 and $1,873 for pretreat-municipal for each 1,000 lbs. of M.E. capacity per day. From 50 to 73 percent of the investment is for treatment facilities for the cottage cheese processing wastes and whey.

Operating costs for plants by systems are: 24 cents per 1,000 lbs. M.E. processed for ridge and furrow and municipal, $1.71 to $1.87 per 1,000 lbs. M.E. processed for pretreat-municipal, and $1.99 to $2.39 per 1,000 lbs. of M.E. processing capacity for private treatment. By system, the cost per 1,000 lbs. of M.E. processed into fluid products is: 12 cents for ridge and furrow, 13 cents for municipal, 58 to 62 cents for pretreat-municipal, and 71 to 85 cents for private. For each 1,000 lbs. M.E. processed into cottage cheese, the treatment cost is: $1,39 for ridge and furrow, $1.37 for municipal, $13.11 to $14.53 for pretreat-municipal, and $14.97 to $17.97 for private. 1/

1/ A reportedly far less expensive method to dispose of whey is to dry and mix the condensed whey with fuel oil and burn the mixture in the plant's boilers. No pollutant problems were reported with stack eases or ash disposal.

Dairy Processing Industry Waste Disposal Situation

Several sources of data on waste disposal practices of dairy processing plants were analyzed to obtain additional information on the magnitude of the problem of eliminating stream pollution. Data sources and areas considered are (1) the 1967 Census of Manufactures, Water Use in Manufacturing for the U.S., (2) several sources on practices in Wisconsin a major dairy State, and (3) survey information from Vermont.

United States

In 1967, 518 dairy processing establishments each reported the use of 20 million or more gallons of water a year. Fluid plants comprised by far the largest single group, 303 or 58 percent. In order of importance, the next largest group was condensed and evaporated milk, 71 plants; butter, 61 plants; cheese, 43 plants and ice cream, 40 plants. These plants reported an intake of 55.9 billion gallons and a discharge of 53.1 billion gallons (table 14). Discharge of water by these plants is principally into municipal sewers, 58.4 percent or 31.0 billion gallons. But there is considerable difference between the several industry groups. Fluid and ice cream plants discharged 76 and 72 percent of their waste volumes respectively into municipal systems. Plants in the other three groups have a less impressive record, with only 44 percent of the waste water from butter plants, 49 percent from cheese, and 30 percent from condenseries being discharged into municipal systems. Because of the predominately rural orientation of these plants, in terms of location, municipal systems are not as readily available as for fluid and ice cream plants.

Approximately 38 percent of the waste water discharge of the industry is disposed in surface and tidal water with the small balance 3.4 percent discharged

Table 14 : Water intake and discharge by the U.S. dairy industry, 1967 __/

Industry group	Establishments	Employment	Water (billion gallons) Intake	%	Discharge	%
Butter	61	2,900	6.6	11.8	6.2	11.7
Cheese	43	4.400	3.8	6.8	3.5	6.6
Condensed and Evaporated Milk	71	5,400	13.5	24.2	13.1	24.7
Ice Cream	40	4,400	3.2	5.7	2.9	5.5
Fluid Milk	303	51,500	28.8	51.5	27.4	51.5
Dairy Industry	518	68,600	55.9	100.0	53.1	100.0

into the ground or transferred to other uses. Cheese, butter, and condensing industries discharged 50 percent or more of their waste waters into surface bodies while the fluid milk and ice cream industry establishments discharged 20 percent or less of their waste volume into surface waters.

Wisconsin

A survey of the plants of the dairy processing industry in Wisconsin revealed additional information on waste disposal practices and location characteristics. In 1972, 739 plants had an average monthly input volume of 1.92 billion pounds. A total of 171 plants with an aggregate input flow of 0.75 billion pounds milk were connected to municipal treatment systems. These plants account for 23 percent of the total number and 39 percent of the input volume, and average 4.4 million pounds of input per month, well above the statewide plant average of 2.6 million pounds (table 15).

Another 42 plants, 6 percent of the total, with a monthly flow of 0.12 billion pounds, 6 percent of the total volume, utilized lagoon systems. These plants average 2.8 million pounds of input a month, slightly greater than the statewide plant average.

Twelve plants had private treatment systems and a monthly input flow of 35 million pounds. These plants represent about 1.5 percent of the total plants and 2 percent of the volume. The plants averaged 2.9 million pounds of input a month.

The remaining 514 plants, 70 percent of the total, had a total monthly input of 1.02 billion pounds of whole, skim, or buttermilk, cream, or condensed products, equivalent to 53 percent of the state total. These plants reported the use of a wide variety of waste disposal practices or none at all. The practices reported were primarily land disposal methods and a few others of questionable value. In general, it appears these plants are utilizing unacceptable or questionable methods that will have to be changed before obtaining permits.

The reasons for the large number of plants utilizing questionable practices are two: (1) location and (2) economics. Analysis of plant location indicated that 54 percent, 399 plants, are located in communities with a population (1970) of less than 2,000. A total of 303 of these plants did not have municipal, private, or lagoon waste treatment, and they had a total input volume of .59 billion pounds a month.

In the communities with 2,000 to 5,000 population, there are 118 plants with 81 not utilizing municipal, private, or lagoon systems. These plants had a total input volume of 0.17 billion pounds.

The 384 plants in the two population catagories generate 75 percent of the wastes receiving what appears to be inadequate disposal. But these plants are in general smaller than the state average. Consequently they cannot be expected to have adequate reserves, earning capacity, or borrowing capacity

	Rural Non Community	Community Size (population) -999	1,000-1,999	2,000-2,999	3,000-4,999	5,000-9,999	10,000-24,999	25,000 -	Total
All plants	43	233	123	70	48	91	64	67	739
Percent of plants	5.8	31.5	16.6	9.5	6.5	12.3	8.7	9.1	100
Vol./mo. (million lbs.)	9.053	476.136	347.893	184.058	137.962	198.244	181.504	300.495	1917.345
Percent of volume	4.7	24.8	18.1	9.6	7.2	10.3	9.5	15.8	100.0
Cum. percent of volume		29.5	47.6	57.2	64.4	74.7	84.2	100.0	
Ave. vol./mo./plant (mil. lbs.)	2.1175	2.0435	2.8284	2.6294	2.8742	2.1785	2.836	4.485	2.5945
Municipal treatment plants									
Number	1	24	25	17	7	29	16	52	171
Percent of plants							25	78	
Vol./mo. (million pounds)	.840	87.994	129.580	60.262	60.223	84.149	94.568	228.495	746.111
Percent of volume									38.9
Lagoon Treatment (plants)	1	19	9	3	6	2	2	0	42
Vol./mo. (million lbs.)	1.950	68.239	23.861	6.870	10.314	2,509	3.916	0	117.659
Other treatment plants	1	4	2	2	2	1	0	0	12
Vol./mo./million lbs.	1.500	6.364	6.713	14.222	3.834	2.179			34.812
Non acceptable treatment and other plants	40	186	87	48	33	59	46	15	514
Volume/month (million lbs.)	86.763	313.539	187.739	102.704	63.591	109.407	83.020	72.000	1,018.763
Ave. vol./plant/mo.	2.169	1.686	2.140	2.140	1.927	1.854	1.805	4.800	1.982
% of plants w/o acceptable trt.	93.0	79.8	70.7	68.6	68.8	64.8	71.9	22.4	69.6
% of volume w/o acceptable trt.	95.3	65.9	54.0	55.8	46.1	55.2	45.7	24.0	53.1

to build treatment facilities. Furthermore, it is unlikely the small communities with the same type financial problems can provide joint treatment facilities without outside aid.

The majority of these plants are cheese processors followed by a smaller number of butter, condensing, and collection or transfer facilities. Since there is a major structural change in terms of size and numbers of plants in the cheese, butter, and transfer industries underway, there is even less incentive to improve the waste treatment practices of the small plants in small communities.

Oregon: The state has been involved in the regulation and control of water pollution for over 30 years. Regulations adopted early in 1968 emphasize prevention and require removal of 85 percent of the BOD and suspended solids before waste discharge. Other requirements pertain to pH, temperature, color, and other characteristics. These standards are at least equal to those proposed in schedule B by EPA.

The impact upon Oregon's dairy industry has been slight. Production trends of the fluid and manufactured products are positive and appear no different than those in contiguous states during the 1967-71 period. There has been a gradual reduction in plant numbers for all products except natural cheese. Cheese plants decreased from 19 to 6 through consolidation into larger facilities, and production increased 10 percent in the four year period. The number of plants producing cottage cheese decreased by two, from 19 to 17, and production increased 50 percent in the four year period.

Vermont

The State of Vermont has moved rapidly to improve environmental quality. As of May 1, 1972, whey and waste from dairy plants can no longer be dumped into waterways or on land such that the effluent will drain into the State's rivers.

This firm regulation has effected a marked change by dairy plants, most of which had followed the practice of dumping the liquid effluent into waterways. Cheese plants, especially, have been affected because of the volume and high BOD loadings of their effluent.

The larger size fluid milk processors are located in the larger population centers and are utilizing the municipal treatment system. Only two cheese plants have this alternative, and that is for waste water only.

All the other cheese plants are handling their effluent problem themselves. The communities do not have adequate facilities to treat such large volumes. These are small communities, several of which are confronted with inadequate municipal systems for handling residential sewage.

Faced with the stringent State regulation on pollution control, Vermont cheese makers, the State of Vermont, University of Vermont, local and Federal governments, have cooperated in an effort to solve the problem. In an unique joint-venture, these participants have contracted to build and operate a central whey drying plant which would dry almost all the sweet and acid whey produced in the State.

The central drying plant is a long-term solution for whey disposal. However, until the plant can be built and successfully operated--and for water disposal--the plants must make other arrangements. Most of the cheese makers have built large lagoons; some are also spraying on land, some hauling for land disposal, and some hauling to livestock feeders. They plan to continue to use the lagoons for waste water disposal after the drying plant is operational. Cheese makers are paying 5¢-6¢ per hundredweight of whey to get it hauled.

Impact Analysis

Price Effects

The financial situation of the industry and the cost estimates for pollution control indicate many product manufacturers will require higher prices to cover the increase in costs. In this section, the costs for the several treatment alternatives are converted into unit costs for the primary product of each of the several industry groups.

Butter:

The increase in manufacturing costs for butter by treatment system is 0.26 cents per lb. for ridge and furrow, 0.27 cents per lb. for municipal, 1.26 cents to 1.37 cents per lb. for pretreat-municipal, and 1.69 to 1.84 cents a lb. for private. These increases are based on capacity operations.

Output of butter plants is subject to seasonality of milk supplies, and consequently plants will not achieve capacity operation levels over time. The effect is an increase in unit treatment costs as fixed costs are spread over fewer units of output.

The maximum impact on butter prices is an increase of one to two cents a pound. With butter retailing between 79 and 89 cents a pound, the additional cost for treatment could increase retail prices between one and 2.5 percent.

Cheese

Waste treatment costs for natural cheese with manufacturing operations at capacity are: 0.11 cent a lb. of cheese for ridge and furrow, 0.12 cent a lb. for municipal, 0.54-0.58 cent a lb. for pretreat-municipal, and 0.66 to 0.79 cent a lb. for private waste treatment. The costs are based on shipment of all sweet whey to condensing and drying plants, a practice that is not conducted by all firms in the industry. Large quantities of sweet whey are surplus to existing market needs and disposal will add considerably to the above treatment costs.

The maximum effect on prices at retail is an increase of one cent a pound. At an average price of $1.20 a lb., the cent represents 0.8 percent rise in retail prices.

Cheese manufacturers are also subject to seasonality of milk supplies. This effect will tend to increase waste treatment costs.

Of more serious concern is the problem of whey disposal. There is little potential to expand the demand for condensed or dried whey at existing prices. If manufacturers have to subsidize part of the cost of production of whey products or treat whey in the plant effluents, costs will increase considerably and have a far greater impact on retail cheese prices.

Condensed and evaporated products

The price effect from increased costs for waste treatment in this industry is expected to be minimal. On a per can basis (14.5 ounces of product) the potential increases are: 0.03 cents for ridge and furrow, 0.02 cents for municipal, 0.11 to 0.12 cents for pretreat-municipal and 0.16 to 0.17 cents for private treatment. On a per case basis (48 cans), the increases range from 1 to 7 cents. These products retail for 17-19 cents per 14.5 oz. can. Possible impact on retail prices may be a fraction of a cent a can, but processors, wholesalers and retailers may absorb the increase.

Ice Cream

The price effect per gallon of ice cream from processing waste treatment costs ranges from 0.25 cent a gallon for ridge and furrow and municipal treatment to 1.4 cent a gallon for private treatment. Pretreat-municipal would add 1.0¢ to the cost of a gallon of ice cream. At retail, ice cream sells for $1.50 to $3.00 per gallon depending on quality. Treatment costs passed through the market could add a maximum of one to two cents to the retail price.

Fluid milk

Treatment costs of fluid processing wastes are negligible, ranging from 0.025 cents to 0.183 cents a quart. By treatment system, the costs per quart are 0.025 cents for ridge and furrow, 0.027 cents for municipal, 0.125 to 0.134 cents for pretreat-municipal, and 0.168 to 0.183 cents for private treatment.

At retail, milk is priced at 30-35 cents a quart and from $1.00 to $1.25 a gallon. Potential price impact is a fraction of cent a quart and a cent a gallon.

Fluid milk-cottage cheese (sit 1.)

The effects on milk prices are the same as those reported above. For cottage cheese, the impact is much greater. Costs per lb. of product range from 0.20 cents for ridge and furrow to 4.22 cents for private. Municipal costs are 0.29 cents a lb. and pretreat-municipal are 2.75-3.0 cents a pound.

Cottage cheese retails for 33-37 cents a pound. The possible increase in prices could range between one and three cents a pound at retail for most firms.

Fluid milk-cottage cheese (sit 2.)

Under this situation, the cheese whey is discharged with other wastes. No additional effects on cost are assumed for fluid milk with all additional costs allocated to cottage cheese processing. Costs per lb. of product by system are: 0.88 cents for ridge and furrow, 0.86 cents for municipal, 8.3 to 9.2 cents for pretreat-municipal and 9.4 to 11.3 cents for private treatment. The effect on retail prices under this situation is a minimum of a one cent increase and a maximum of 8 to 10 cents a pound increase. Increases of this magnitude would reduce consumption, output, and number of firms manufacturing cottage cheese.

Financial Effects

New investment for pollution control would range from negligible amounts up to approximately $1 per pound of milk handled per day. Those plants already being adequately serviced by municipal systems may not have any additional investment. Plants that will be required to build and operate their own treatment facilities will have the high investment and operating cost. Increased annual costs would range from about 12¢ up to 91¢ per 1,000 pounds of milk handled.

Can dairy processing firms financially afford the costs of the pollution control facilities without price relief? The income characteristics and cash flow information presented in the tables A1, A2, and A3 provide some answers to the question.

For the small firms with assets of less than $250,000 and average revenues of $405,000 in 1967 that comprise half the firms in the industry, the situation appears critical for many. Nearly two-thirds of these firms, particularly firms involved in the processing of butter, cheese, and cottage cheese have inadequate cash flows and resources to finance pretreat or private treatment facilities. Some of these firms would experience difficulty in covering municipal treatment costs without considering the added burden of hook-up or assessment fees. Neither ice cream nor specialized fluid processors would encounter as serious financial problems, especially since many already are connected to municipal systems.

The medium size category consisting of 1,325 firms or 45 percent with total assets of $250,000 to $5,000,000 and average revenues of $2.7 million would not be expected to encounter as serious a financial problem. Two-thirds to 75 percent could afford the necessary investments and added operating costs, although total returns on investment would be reduced.

The remainder of these firms would encounter financial difficulties in attempting to construct or operate the pretreat or private treatment systems. Some of these firms could not afford substantially increased municipal fees.

The 59 firms in the large group comprise the large single plant and multi-plant firms that accounted for two-thirds of the revenue to the industry in 1967. Nine of these firms reported deficits, but had positive cash flows. Although these firms have adequate returns, the multi-plant firms will probably not make large investments in marginal plants.

The IRS data indicated that incomes reported by dairy firms in the medium-size category tended toward a normal distribution, with a rather flat curve (Table 16). This tendency appears to be strong enough to permit the assumption of a normal distribution of incomes for this group.

Distribution of income among the small firms was somewhat skewed to the left, with more firms reporting incomes below the group mean than above the mean. Examination of the data indicates that the mean income for these small firms would be at approximately the 62 percentile rather than at the median.

The large firms are multi-plant firms, so are not comparable with the small or medium size firms, nor with other data which are on a plant basis. Neither are the data adequate for estimating how nearly the income distribution approached normal. The array is presented in Table 16 for comparison. although no estimates are made in this section as to the increased vulnerability of large firms.

Table 16: Distribution of Incomes of Dairy Firms as Computed From Data in the Internal Revenue Service 1968 Source Book of Statistics of Income Assuming a Normal Distribution Within Size Grouping 1/

Size of dairy firms by assets	Small	Medium	Large
Total number	1,487	1,325	59
Number with net income	847	1,054	50
Number with deficits	640	271	9
Average net income, $100	54	548	66,68[illegible]
Average deficit, $100	-47	-114	-940
Average net income less deficit, $100	8	433	65,742
Average net income, those with net, $100	95	688	78,685
Average deficit, those with deficit, $100	-108	-560	-6,164
Percent within 1 standard deviation (1 side)	34	34	34
Percent below zero (with deficit)	43	20	15
Percent of plants from mean to zero net income	19*	30	35
Derived standard deviations from mean to zero net income	0.50*	0.85	1.04
Derived standard deviation (implicit $100)	108	645	64,117
Derived percent below net income 0.5 standard deviation below mean	43*	31	31
Derived net income level at 0.5 standard deviation below mean, $100	0*	229	24,624
Derived percent below net income 0.5 standard deviation above mean	77*	69	69
Derived net income level at 0.5 standard deviation above mean, $100	108*	871	93 [illegible]

1/ See appendix tables A1, A2, A3.

* Adjusted to compensate for skew to left. Set mean at 62% of group rather than 50%.

With these exceptions, the assumption of normal distribution appears to be reasonably valid for approximating the relative income position of dairy firms. These data for previous years, and for 1969 which just became available, substantiate these assumptions.

With a normally distributed population, about 34 percent of the population would have incomes between the mean income and one standard deviation below the mean. Thirty percent of the medium-size firms reported incomes between the mean and zero. This was 0.85 percent of 34, so that one standard deviation would be $\left(\frac{\text{mean} - 0}{0.85}\right)$ = $645 (Table 16).

By applying these assumptions to the size groupings and their reported incomes, the relative income positions of the firms were estimated. These distributions were then compared with plant investment required for pollution control facilities so as to estimate the vulnerability of plants.

Reported net income by small dairy firms averaged $5,400 (Table 16). The average deficit was -$4,700 for the group and -$10,800 for those 640 with no net income. Those with net income averaged $9,500.

Medium-size firms averaged $54,800, with an average deficit of -$11,400. Those with deficits averaged -$56,000, and those with a net income averaged $68,800.

The situation confronting dairy manufacturing plants is very similar, especially for cheese plants and butter plants. Manufacturing is characterized by a large number of small and medium size plants, with only a few large plants.

The great majority of these manufacturing plants are located in rural areas and small towns in or adjacent to heavy milk production areas. Relatively few have access to municipal treatment plants which would be adequate for economically handling the plant effluent. For most of these plants, effluent treatment is a plant problem. Costs for providing treatment facilities are very similar for these plants.

Considering these similarities, for this discussion the plants were grouped into two groups: (1) manufacturing plants and (2) fluid plants.

Small manufacturing plants:

These are the plants which have been experiencing the highest rate of attrition. They are having difficulty remaining competitively viable. Most of the plants have been depreciating their capital investment and accepting a low return on capital and labor. They have not been making new capital expenditures sufficient to maintain themselves in the industry (Table A13).

Financially, physically, and competitively, the small manufacturing plants are in a most disadvantageous position. Many do not have equity capital for further investments; they do not have adequate incomes to make investments from current revenue; and current revenues certainly do not justify loans for investment purposes.

Less than one in four small manufacturing plants have access to suitable treatment facilities, and fewer than 10 percent are on municipal systems (Table A23). Most all of the others would be faced with the necessity to provide their own treatment facilities.

A small plant earning less than $10,000 per year could not be expected to successfully install effluent treatment facilities. Such a plant would be able to make only limited, low-cost adjustments. Three out of four small plants fall in this category.

Allowing for those plants with municipal systems available and those that could use other methods satisfactorily, approximately 65 percent of the small plants would be seriously vulnerable if pollution control requirements were imposed upon them (Table 17). Extending the trend of the past few years would indicate nearly 30 percent would close even if they were not confronted with such an investment.

Medium size manufacturing plants:

Following the same procedure indicates a more favorable situation for medium size plants. Besides being in better financial condition, about one-half these plants are using some sort of effluent treatment, with about one-fifth on municipal systems.

Medium size plants cannot expect to meet effluent standards without treatment. Most of those with municipal systems available are already using them. The remaining plants have very limited alternatives.

If pollution control were required, an estimated 30 percent of these plants would be in a vulnerable position. These would be those with net incomes below $23,000, of which two-thirds (20 percent of total group) reported deficits.

Large manufacturing plants:

The IRS income data for large firms are not applicable in this instance. There are a few single-plant large firms, but multi-plant firms predominate in this group. Also, large plants tend to be part of multi-plant firms. However, 85 percent of the large firms reported net incomes.

Large plants should not experience undue difficulty meeting pollution control requirements as discussed in this report. Their earnings, financial situation, being a part of a multi-plant firm, location in regards to municipal treatment facilities, economies to scale, and physical facilities all give large plants a greater ability than small plants to meet pollution control standards.

Multi-plant firms also have the potential to use plant specialization yet offer a full line of products. Large firms can close one plant and transfer those operations to another plant. The large firm has a great deal more flexibility to meet changing conditions than does the small one-plant firm.

For these reasons, explicit estimates are not made for large plants. Such an estimate would be purely guesswork and probably misleading.

Industry adjustment:

Plants and companies in the condensed and dry products industry (SIC 2023) tend to be larger than the industry (SIC 202) average. Increased specialization of plants has increased the demand for intermediate dairy products to be used as ingredients by other dairy plants, i.e. condensed for ice cream, powder for ice cream, cottage cheese, and fortification. More whey is also being condensed and dried thereby increasing the demand for condensing services. Both these factors are expected to continue and to moderate the impact of pollution control upon condenseries and driers as compared with the other dairy manufacturers.

The cheese industry has a large number of small-volume plants located in small towns and rural areas. Relating the increased investment and operating costs to this industry shows that a considerable adjustment could be expected.

Increased annual costs would not be the major reason for cheese plants closing down. These costs could be passed on. The major factor is the high investment required.

Small cheese plants are already in financial trouble. Their rural location means they will have to provide treatment facilities--either for themselves or to bear a major portion of new municipal systems for small towns. Most small plants cannot finance an investment of this magnitude. Large plants should be able to finance and make the investment. Medium-size plants are the dividing line.

Small cheese plants, 598 out of 846 total, produced about 15 percent of the cheese in 1970. The IRS data reveals that about 45 percent of these plants realized no net income. Most of these would be going out of business whether or not they were required to invest so as to control pollution.

Cheese plants averaged only 40 percent of the average per plant for the dairy industry in dollar value added by manufacture in 1967 (Table A5). The average value of shipments per cheese plant was about 80 percent that of the average for the dairy industry. Average dollar depreciable assets was 55 percent of the industry average.

Applying these measures to the 1968 IRS data would indicate an average asset value of approximately $25,000-$30,000 for these small cheese plants and annual receipts about $320,000. The average small cheese plant with net returns would have earned considerably less than the $10,000 dairy industry average for small plants.

For these plants, the necessary investment for pollution control would be almost equal to their present total assets. Only a small part of these small plants could justify this type investment. In this group, the plant successfully making the investment would be the exception.

The salvage value of most dairy plants is extremely low. This is especially true for small manufacturing plants. There is a surplus of used equipment and it is very specialized.

Fluid milk products:

Fluid milk plants tend to be located in larger population centers. Most of the effluent is discharged into municipal systems. Therefore, these plants do not face as much of a disposal problem as do many milk manufacturing plants. Even in those instances where new or expanded treatment facilities are required, the cost is lower, for both plant and community, than if the plant had to provide its own treatment facilities.

Average dollar value of shipments per fluid milk establishment (Table A4) were about 10 percent greater than the overall average for the dairy industry.

Small fluid firms:

Small fluid processors have been experiencing strong competitive pressures which have resulted in a high attrition rate. These pressures are expected to continue during the next 5 years, and add to the impact of pollution control requirements.

Approximately 62 percent would have earned less than the mean income and most of these could not be expected to survive the necessity to make additional investment. However, increased municipal sewage charges that could be treated as operating costs and mostly passed on through higher product prices would simply put a little more stress upon small plants. About 60 percent of the small fluid plants could be expected to be very vulnerable to closing during the next 5 years. Most of them would be vulnerable even without being faced with pollution control requirements. Pollution control requirements would probably be a significant reason for increasing such vulnerability for 20 percent of this group (Table 17).

Medium size fluid:

A normal distribution would indicate about 31 percent of these plants would have earned less than $22,500 and 69 percent would have been below $87,000.

Large fluid firms:

Most large fluid plants are operated by regional and national firms. Food retailers and producer's cooperatives also operate some large fluid plants.

The comparison between data sources is not so evident, nor as valid, for large plants as is the case for small and medium size plants. However, applying the percentage figures for large firms to large plants (for they do operate primarily large plants), only 15 percent failed to earn net incomes (Table 16).

Large plants will close during the next 5 years, but these will tend to be selective closings, and there will be some replacements. The data are not adequate to make meaningful estimates for these plant closings due to pollution control.

Table 17:--Estimated Increase in Vulnerability of Dairy Plants in Light of Water Pollution Control Requirements

	Manufacturing plants				Fluid plants			
	Total plants	Small plants	Medium size plants	Large plants	Total plants	Small plants	Medium size plants	Large plants
Estimated number of plants 1970:								
Butter (SIC 2021)	408	308	91	9				
Cheese (SIC 2022)	846	598	209	39				
Condensed and dry products (SIC 2023)	257	114	121	22				
Total of 3 subindustries	1,511	1,020	421	70				
Fluid (SIC 2026)					2,824	1,326	1,090	408
	Percent							
Estimated percentages of plants expected to be vulnerable during next 5 years in view of pollution control requirements		65	30	no estimate		60	30	no estimate
Estimated percentages of plants which would be vulnerable during next 5 years with no significant change in pollution control requirements		28	16	no estimate		42	20	no estimate
Estimated impact of pollution control requirements in significantly increasing vulnerability of plants:								
Percent of plants with vulnerability significantly affected		36	14	no estimate		18	10	
Percent of total present volume	14				6			

Production Effects

The decision to invest or to shut-down is a separate decision to be made by each plant. There are both profitable and unprofitable plants in all size categories of each industry. However, despite the many variations, the problems--financial and physical--tend to be of like magnitude for certain groups of plants.

Basically plants that will face the greatest problems are:

Small plants,

Cottage cheese plants,

Cheese plants,

Butter plants,

Plants without access to municipal systems,

Plants in communities with small population base,

Northern plants (frozen ground for land disposal).

This certainly implies that small cheese plants located in small Northern communities without access to municipal sewage systems will be facing the most difficult problems. In fact, very few of these plants can be expected to survive pollution control requirements if left to their own resources.

Some larger plants will be shut down. Primarily, the reasons will be to consolidate operations, to close obsolete plants, to change location, or for some reason that would cause pollution control costs to be unusually great. Shut-downs because of pollution control will tend to be a selective process for larger plants. The opposite is true for small plants as only a select few can be expected to remain competitively viable.

Plant closings would cause considerable problems because of a shortage of facilities for handling milk during the spring flush production of May and June. These shortages would be in the manufacturing industry, cheese, butter and powder. Extra capacity would need to be provided at new or existing plants. Local communities would still be hard pressed for short periods. Fluid plants, except for isolated instances, would not be expected to have a capacity problem because of closings due to pollution control requirements.

Production of dairy products will be affected by water pollution control requirements in the dairy processing industry. In general the major effects will be higher processing costs, slightly higher prices, reduced number of plants, larger and more specialized plants, and some relocation of processing plants.

Pollution control requirements will have the greatest impact upon small manufacturing plants and will cause them to be more vulnerable. These requirements could be expected to significantly increase the vulnerability of about third of the small manufacturing plants and about one-seventh of the medium size plants. This would seriously threaten about 14 percent of the total volume of manufactured dairy products (Table 17). The expected impact upon fluid industry would be about one-half as great as that upon the manufacturing industries.

Employment Effects

Although the dairy industry is undergoing major structural changes in terms of reductions in plant numbers and employment, the adoption of more stringent pollution control regulations is expected to accelerate the rate of exits from the industry. Two types of communities are expected to be most impacted: (1) rural communities primarily in the western half of the Lakes Region where dairy product manufacturing activity is concentrated and (2) urban communities throughout the country where fluid and ice cream processing facilities are located. In the first case, a high proportion of the product manufacturing plants; butter, cheese and condensing; are located in lightly populated communities, less than 2,000 in the majority of cases. These communities probably will not be financially able to construct and operate treatment facilities to service local industry without major assistance in the form of grants or aids from outside sources.

There are 1,463 plants in the butter, cheese, and condensing industries in the U.S. employing 38,068 persons during 1971. While plant numbers are decreasing at the rate of 3 to 5 percent a year, employment has decreased at a lower rate of 2 percent a year. Decreases in employment in the butter and condensing industries is being partially offset by increases in cheese manufacturing.

It is anticipated that the current practice of consolidating small plants, employing generally less than 20 persons, into fewer large scale, more efficient plants, with satisfactory in-plant pollution control equipment or with joint treatment facilities will continue. These plants will be located in the larger rural centers not far removed from the source of milk supplies. The employment problem is one of dislocation as well as loss of employment opportunities.

Some minor secondary effects are likely, both favorable and unfavorable. The small communities losing plants will experience reduced economic activity and a lower property tax base. But the communities gaining the new plants will benefit from the losers. Regionally, the losses may be largely offset by the benefits. However, the full economic impact will depend on how pollution control regulations affect all economic activity in a particular region.

The number of communities impacted will number less than a thousand and most will be located in the Lakes Region. Since firms in the three industries are already in the process of restructuring, the number of communities impacted primarily by adoption of the pollution control standards may number only several hundred.

The fluid and ice cream processing industries presents a different situation in several respects. The two account for 70 percent of the plants, 3,316, and 80 percent of the employment, 153,953, in the dairy industry. While plant numbers are decreasing at about 6 percent a year, employment is decreasing at an increasing rate. Over 9,100 jobs, almost 7 percent, were lost between 1970 and 1971.

These plants are located primarily in population centers and will not experience the impact from pollution control regulations as is expected in the rest of the industry. Most of the plants are connected to municipal systems but may have to make in-plant modifications or construct pretreatment facilities to reduce waste loads. Some plants manufacturing cottage cheese may be forced to cease this activity.

It is expected that some plants will be forced to cease operations or relocate as a result of pollution controls. Relocation will not likely involve more than a move of a few miles except for cottage cheese operations. These operations will probably be consolidated into large units outside metropolitan areas.

Community impact from adjustments by fluid and ice cream plants will be negligible since these operations represent a very small part of the economic activity of the community. Employees that may lose their jobs should be able to obtain new employment in the large and diverse job markets of urban areas. Employment outside the dairy industry is the best prospect since there is no indication of a reversal in the employment trend in the fluid and ice cream industries.

Wisconsin and Vermont were used to illustrate employment effects. Basically, Wisconsin is a rural State. Much of the State's income is realized from agriculture and related industries. Any decrease in job opportunities in these industries would be felt throughout the State's economy.

According to the Bureau of the Census' County Business Patterns, 1970, there were 15,673 employees working in dairy products plants in Wisconsin. More than one-half of these, 7,901 were employed in cheese plants. Fluid milk plants employed 4,133; condensed and dry milk plants 2,108; butter plants 1,012; and ice cream plants employed 519.

According to data provided by the Wisconsin State Department of Agriculture, more than one-half the cheese plants employed 7 or fewer workers. The majority of Wisconsin cheese plants are located in or near small towns. They have a marked impact upon the labor market in these small communities. In fact, 121 of the cheese plants are in communities with fewer than 500 population, and 214 are in communities under 1,000 population. There are 150 in towns with populations of 1,000-5,000, so that over 80 percent of the State's cheese plants are in communities below 5,000 population.

Fluid milk plants in Wisconsin tend to be in the larger towns and cities. This is especially true of the larger plants. Fifty-nine fluid plants (of 121) are in counties with more than 20,000 employed workers. These 59 plants employed over 3,200 people, or 78 percent of the employees of fluid plants in the State. These larger plants packaged most of the fluid milk.

Ice cream plants also are located in the larger population centers. Only 7 of the 70 were in communities with fewer than 1,000 population, and 10 more in towns up to 5,000. About 60 percent, 42 of 70 plants, were in cities with more than 10,000 population. These were the larger plants and produced most of the State's ice cream.

Cottage cheese is produced in Wisconsin primarily by fluid milk processors. The plants are located in the larger population centers, with 80 percent of them in cities over 10,000. Only small amounts are produced by those plants in smaller communities.

Wisconsin dairy product plants employed 15,673 workers, which was 1.3 percent of total employees 1/ in the State. More than 1 percent of total employees were employed by dairy product plants in 34 counties. In 10 of these counties dairy plants employed more than 5 percent, and in one of these they employed more than 10 percent of all employees in the county.

The ratio of dairy plant employees to total employees tends higher in the lesspopulous Wisconsin counties. Due to nondisclosure requirements, the breakdowns shown in the county business patterns are limited for those counties with few firms. Therefore, the impact of dairy plants in the local labor market is greater than these data reveal.

Receiving stations and transfer stations are located in the milk production area rather than in the consuming center. In either case, the station itself uses but little labor. To a great extent, these

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1/ As defined by Census Bureau in County Business Patterns, 1970.

stations are combined with, or at least operated in connection with, manufacturing plants. In this manner, the milk can be assembled and routinely forwarded to fluid plants when needed or simply used for manufacturing when not needed for fluid. Often-times, the milk is received and transferred for manufacturing in large plants so as to realize economies of scale. Central manufacturing also evens out the milk flow, reducing variation in receipts, manufacturing, and also in the effluent.

The Vermont dairy industry differs from that of Wisconsin in several ways. Nearly 90 percent of farm income in the State comes from dairying. Basically, Vermont is geared toward supplying fluid milk to the Boston metropolitan area, manufacturing that which is excess to fluid needs. Due to the distance from Boston, Vermont absorbs much of the variation in supply and demand so about 30 percent of the milk is used in manufacturing. Cheese is the primary product made from this milk.

The 40 dairy plants employ 1,905 people, 15.3 percent of total employment in the State. Thirty of these plants in Vermont are fluid milk plants, while only 7 are classed as cheese plants. These fluid plants employ more than 82 percent of total dairy plant employees in the State. As in Wisconsin, these fluid plants, and especially the larger ones, are located in the larger population centers.

Vermont's cheese plants are small to medium size. They are located in small towns and have an important role in the community.

The cheese plant is the only manufacturing industry in some instances. In such cases, percentage comparisons fail to portray the full impact which would result from a change in employment and associated economic opportunities.

Community Impact--Overview

Wisconsin and Vermont were selected to illustrate the probable impact that pollution control requirements would have upon the dairy industry and the community. It is recognized that each production-processing area has a different set of circumstances, but the similarities are significant and provide useful guidelines for evaluating change.

Both States are basically rural. Milk production is concentrated in rural areas. Vermont has no manufacturing grade milk production. The emphasis is upon servicing the metropolitan Boston fluid milk market. Due to location, Vermont plants handle much of the fluctuation in this surplus by manufacturing it into cheese. These manufacturing plants are located in small communities within the milk producing areas.

Wisconsin services a large proportion of the Chicago fluid milk market. Other fluid markets, some quite distant, use Wisconsin as the ultimate source of reserve supply. About 16 percent of the State's milk production is shipped out of State for processing. However, the Wisconsin dairy industry is primarily manufacturing oriented, and it is by far the leading State in manufactured dairy products.

The Northeastern States' dairy industry would realize an impact similar to that in Vermont. This area is primarily a fluid milk market, with the surplus being manufactured in rural areas. The fluid plants, and associated ice cream and cottage cheese plants, are located in or near larger metropolitan areas. These urban plants and communities will be least affected by pollution control on the dairy plants. For them, it is more a community effluent treatment problem. The Northeast milk manufacturing industry is very much a sub-industry of the fluid industry. Therefore, the impact upon these plants will also be tempered.

The heavy milk producing North Central States are similar to Wisconsin. This area produces a large portion of the nation's manufactured milk products. These manufacturing plants are mostly located in smaller towns and communities. Effluent treatment for them will be more of a plant problem insofar as the milk plant will be producing more effluent than that produced by the remainder of the community. Even if the milk plant uses the municipal sewage treatment plant, it will be bearing a large share of the sewage treatment responsibility--a much different situation than when wash water, whey, and similar effluent were discharged into waterways or onto the land.

Even where the manufacturing in these areas is in connection with the fluid market, the overall ratio of fluid to manufacturing is much lower than in the East. Therefore, the Midwest manufacturing industry will necessarily bear more of the pollution control costs than in those markets where fluid milk dominates the market. Unless this changing cost relationship is recognized, shifting production patterns could be fostered through pricing and regulatory procedures whereby the fluid sector unduly and unevenly subsidized some part of the manufacturing industry. If such were to occur, without offsetting considerations, the Midwest manufacturing industry would be disadvantaged in comparison with the fluid markets of the Northeast, Southeast, South, Southwest, and Far West.

Pollution control costs will be lower for those plants that can pay a prorata share and utilize municipal systems than those which must provide their own treatment facilities. This economy will increase the rate at which smaller plants have been closing. The greatest impact resulting from pollution control measures will fall upon plants in small communities and upon those smaller communities.

Bulk handling of raw milk has resulted in many receiving stations being closed down. Although much of the adjustment to bulk handling has already been made, more will be closed as the additional pressure and cost of pollution control is felt. Over one-half the receiving and transfer stations in Wisconsin are in communities of less than 2,000, with 60 percent of these in small communities smaller than 1,000.

Unless the receiving station can use the municipal system, effluent treatment would be too costly. Once loaded, the transport could move the milk directly to the processing plant rather than using a receiving station. The exception would be those receiving and transfer stations operating as part of a manufacturing plant complex.

Probably about one-third of the receiving and transfer stations would be subject to closing rather than implementing measures to adequately control pollution.

Forty percent of Wisconsin licensed fluid plants are in communities with fewer than 2,000 population. However, these tend to be smaller plants and process not much more than 10 percent of the packaged milk. At least one-half these plants could be expected to discontinue packaging fluid milk as pollution control would be too costly for these already competitively disadvantaged plants.

International Trade

International trade is not a particularly important factor to the economic activity of the U. S. Dairy Industry. Exports over the past 13 years have averaged 1.5 percent of total milk production and ranged between a low of 0.3 percent in 1967 to a high of 5.4 percent in 1964. Imports have been more stable in volume averaging 1.1 percent of U. S. production. One distinct difference is the growth in imports and contraction in exports.

A substantial proportion of the dairy products export trade is made under government sponsored programs, in particular P.L. 480. Stocks of dairy products acquired by the CCC (Commodity Credit Corporation) in their activities to support dairy prices are distributed under P.L. 480 as donations, and for soft or hard currencies, to foreign countries for welfare feeding programs. The volume depends on the level of activity of the CCC, inventory of stocks in excess of domestic program needs, and available funds. In recent years, supplies of dairy products have come more closely in balance with demand and stocks available for distribution have shrunk. Currently, supplies have been reduced to a level that has almost ended distribution under P.L. 480.

Under P.L. 480, the major products exported have been dried milk, canned milk, butter and some cheese. These products were exported primarily to Asiatic and South American countries. During the early period of the program, 1954-60, over 60 percent of total exports were under P.L. 480. In more recent years, commercial exports have comprised a majority of shipments.

The commercial export shipments have consisted of dried milk, canned milk, butter, small amounts of cheese, and infant and dietetic foods and mixes. Shipments tend to fluctuate widely on a year to year basis. The

U. S. is encountering increasingly severe competition in commercial foreign markets from western European countries, Australia and New Zealand. The U. S. is not likely to increase sales abroad in the near future.

Dairy product imports by the U. S. have consisted of a variety of cheeses and casein. Cheese and casein are imported from western Europe, Australia and New Zealand. During the past two fiscal years, cheese and casein imports have accounted for 92 and 95 percent of the dollar value of dairy product imports. Cheese imports substitute for cheese produced in the U. S., but the U. S. relies on imports for its entire supply of casein. World supplies of casein have been short of market requirements.

Two programs are used to regulate the quantity of dairy products imported into the U. S. Tariffs are applied to all dairy products but have been imposed under section 22 of the Agricultural Adjustment Act of 1933 as amended in 1953. Quotas have been established for all dairy products except some special cheeses, casein, and lactose. The quotas have been effective in almost every year in restricting imports of products that would substitute for products produced domestically.

Table 18 is a comparison of the imports and exports of dairy products on a milk equivalent basis. During the early sixties exports exceeded imports, but this situation has changed with increased imports and diminishing P.L. 480 export shipments. Imports are expected to exceed exports during the years in the near future. 1/ Beginning with 1966, imports have exceeded exports on an average of slightly more than one billion pounds M.E. a year.

1/ During 1971 large commercial sales of butter were made to the United Kingdom because of a lack of supplies by traditional exporting countries to the U. K.

Table 18: Dairy product imports and exports, U. S., 1960-1971 1/

Year	Imports million lbs.	Imports % of production	Exports million lbs.	Exports % of production
1960	604	0.5	776	0.6
1961	760	0.6	655	0.5
1962	795	0.6	1,287	1.0
1963	915	0.7	5,036	4.0
1964	830	0.7	6,872	5.4
1965	923	0.7	1,836	1.5
1966	2,791	2.3	778	0.6
1967	2,908	2.4	363	0.3
1968	1,780	1.5	1,185	1.0
1969	1,600	1.4	921	0.8
1970	1,874	1.6	438	0.4
1971	1,342	1.1	2,480	2.1

1/ Milk equivalent, fat solids basis

Table 19 compares the dollar value of imports and exports of dairy products on a fiscal year basis from 1960 through 1972. In every year but two, 1967 and 1970, the value of exports has exceeded imports. On the average the difference has been $54.4 million in favor of exports. However, some of the exports under P.L. 480 have been donations or for soft currencies. Currently, P.L. 480 shipments are for hard currencies.

In terms of balance of payments, the U. S. has maintained a very small favorable balance of payments. However, with the value of imports increasing and expectations of a decreasing dollar value for exports, the balance of payments is expected to become unfavorable by several million dollars a year.

Table 19: Value of dairy product imports and exports, U. S., 1960-1972 1/

Year	Imports	Exports	Difference
	(millions of dollars)		
1960	49.2	114.4	+ 65.2
1961	52.7	117.3	+ 64.6
1962	54.1	114.9	+ 60.8
1963	54.8	143.1	+ 88.3
1964	57.2	191.5	+ 134.3
1965	67.6	204.6	+ 137.0
1966	94.1	160.8	+ 66.7
1967	133.2	110.6	- 22.6
1968	85.8	103.6	+ 17.8
1969	101.1	138.7	+ 37.6
1970	112.1	109.1	- 3.0
1971	125.6	131.2	+ 5.6
1972	140.2	195.1	+ 54.9

1/ Fiscal year

The impact of implementation of environmental control programs on the dairy, production and processing industries is expected to aggravate the balance of payments situation. However, during the adjustment period, the U. S. can maintain or even change import quotas to minimize the payments problem. This would further reduce dairy product supply availability from all sources and increase product prices to consumers.

Effects Upon the Industry's Suppliers and Consumers

Suppliers

Only minor effects are expected upon milk producers. As plants are closed producers may have to find new buyers for their milk in some instances.

Another possible effect is the relocation of processing facilities from one milk market order area to a different area. This could result in a change in the utilization ratio of fluid to manufactured and alter the blend price received by producers. This is not expected to become a serious problem.

An additional potential problem is the supply of equipment for in-plant modifications and waste pretreatment facilities to either reduce or treat hydrological and BOD loadings. Recognizing that a number of industries will be in the market for this type of equipment at the same time, suppliers may not be able to furnish the equipment without considerable delay.

Businesses servicing the dairy industry can expect dairy plants to decrease in number but increase in size. Small manufacturing plants located in rural areas will be most affected, as will those businesses which are dependent upon this segment.

Consumers

Table 20 presents three possible price effect levels upon consumers expenditures. These are: low, expected, and high. The low is based on extensive use of plant-community joint treatment, the expected level is a mix of joint treatment and plant pretreat while the high is based on a mix of joint, pretreat, and private treatment. The figures have been adjusted to reflect the high proportion of dairy product wastes already being treated by municipal systems. The expenditure effects are based on 1971 per capita consumption data. No adjustments have been made for possible margin increases by wholesalers or retailers.

The expected impact is 20 cents per capita or $41.4 million a year. The major item is cottage cheese followed by fluid products and natural cheese. The increases on a per unit of product basis are not large, and consumers are not expected to react by reducing consumption of these products.

Table 20: Potential impact of water pollution control standards upon annual consumer expenditures1/

Product	Per capita consumption2/	Low	Effect expected	High
		(cents)		
Butter	5.1 lbs.	1.1	2.4	4.2
Cheese	12.1 lbs.	1.2	2.5	4.4
Cond. & evap.	11.8 lbs.	.3	.8	1.5
Ice cream & frozen products	6.3 gals.	1.1	1.7	2.6
Fluid products	30.1 gals.	2.3	3.9	6.1
Cottage cheese	5.2 lbs.	3.2	8.7	16.1
Total per capita		9.2	20.0	34.9
Total per family of four		36.8	80.0	139.6
Total U.S. (million dollars)		19.0	41.4	72.2

1/ Considers only the extra cost of pollution control associated with manufacture of these products. Does not consider increased ingredient cost or marketing margins.

2/ 1971 consumption.

Critical Assumptions

Several assumptions were used in order to estimate the impact which might be expected as a result of imposing pollution control requirements upon the dairy processing industry. Some of the more critical include:

1. The data as presented in the 1967 and previous editions of Census of Manufactures is representative of the sub-industries (SIC 2021, 2022, 2023, 2024, 2026) and that past trends will continue.

2. The data as presented by Internal Revenue Service in the 1968 Corporation Source Book of Statistics of Income are representative of firms in the dairy industry; that these can be projected through the next 5 years; that the incomes within each size grouping approximated the normal distribution (in fact, it is somewhat skewed to left in small and medium size groupings).

3. Cost estimates for treatment facilities were supplied by EPA. These estimates, made upon limited data, were applied to different size plants and to the wide range of conditions as found in the industry. Economies to scale were treated as minor.

4. It was assumed that facilities would be available and that effluent treatment methods and facilities would perform satisfactorily. Allowances for failures were not made, although some new facilities are reporting operational troubles. Allowances were not made for geographical differences in cost estimates.

5. In-plant modifications were not considered. Neither was the cost of whey disposal from cheese plants, except as noted in the discussion. Product mix was not considered as influenceing treatment costs except as noted. Subsidization (firm, product, government) was not considered.

6. Increased cost from pollution control was considered only as it applies to the dairy processing industry. Cost changes in other activities were not considered. Such changes would affect the net result as these changes are cumulative.

Limitations due to assumptions: Detailed data are not available to array plants by size and income in the product groups. The assumptions were made and the available data used for comparisons, but it is recognized that such data do not adequately reflect industry conditions, especially the variety of circumstances and the changing competitive situations.

The comparisons have not been reviewed by the dairy industry nor technical engineers. This should be done.

Pollution control will cost. How the cost will be distributed and what will be the differential impacts are the main considerations.

If one incorporates economies of scale in controlling pollution the larger plants naturally will fare better than under the assumption of linear costs. However, in general, neither assumption would permit small dairy plants to survive.

Were all increased costs to be passed on to consumers in the form of higher product prices, small plants still could not invest the sums required to provide their own treatment facilities. These small plants could continue to operate, but at an increasing disadvantage, if pollution control could be effected solely through increased operating costs. They would continue the process of "living off depreciation", but at an accelerated rate.

Plants using municipal treatment systems will probably realize an advantage over those who must provide their own treatment facilities. This would be true for investment and for operating costs. Even though the community must expand or even build new facilities, this would be the least cost method of handling effluent from most dairy plants.

Processing plants located in communities where the plant generates a large proportion of the total effluent will be somewhat handicapped. If such plants are charged proportionately to their contribution to total effluent, they will have higher costs,investment and operating, than similar plants using larger municipal systems.

Industry reports significant economies to scale in treating waste discharges. Dairy plants, discharging a waste that is compatible with municipal systems, can benefit themselves and the community by using the municipal system. The broader base will then permit lower investment and operating unit costs for treatment of residential and plant effluent. (Perhaps this fact could be used by plants in public relations. Many communities are "blaming" dairy plants for increasing their sewage treatment costs.)

Compliance dates must be set in order to secure compliance. However, more drastic adjustments should be expected when the conversion period is relatively short.

Cheese plants in one area, under time pressure to adjust, were offered various solutions to their whey disposal problem by firms who proposed to dry the whey. Generally, the proposals assured the dryer operater that his expenses would be covered and some profit realized for a designated period of time ranging up to 30 years. Under long-term contracts, the cheese manufacturers would have been responsible for providing the whey at a price stipulated under present market conditions, which amounts to almost giving the whey to the dryer in order to "get rid of the problem".

While market conditions may remain unfavorable for raw whey for some time, the change in demand for skim milk (which formerly was considered waste) should not be dismissed. If in 1960 butter plants had contracted to sell skim milk to dryers for 30 years, at 1960 prices, they would already be defunct. In 1960, butter represented 70.6 percent of the value of butter + nonfat dry milk and 85 percent of the price paid to farmers for milk. In 1971, the value of butter in whole milk was only 54.5 percent of the value of butter + nonfat dry milk, and equal to 63.3 percent of the price received by farmers.

Were a similar shift in value to occur for whey, no cheese plant could survive under the contracts as had once been agreed to by Vermont cheese makers.

This action, taken under pressure to meet a time deadline, then would have changed that State's cheese industry completely. Either the present cheese plants would have been forced out of business or would have come under complete control of the dryer as he subsidized their operation.

With the breakdown of negotiations, and a cooperative approach by the State, community, EPA and the Cheese makers, Vermont now is in the process of making new arrangements which appear to be much more workable and advantageous to the industry.

Timing, standards, and realistic alternatives are all important considerations in improving the effectiveness of pollution abatement. At best there will be some cost, but disruptions to the industry may be minimized. Otherwise, cost may be considerably higher and the disruptive effect much greater.

This analysis has considered the economic impact of water pollution control in the dairy processing industry. Other pollution control requirements also will have an impact. Whereas any single control program may in itself indicate only minor impact, the cumulative result of the various control measures and adjustments within each subindustry may cause the aggregate to be quite different from the individual parts.

Limitations of the Analysis

This analysis has incorporated the additional costs of pollution control into the dairy processing industry. Any change which would change the cost would change the results of the analysis. Perhaps the most significant variable is the level of pollution abatement required. Limitations upon effluent treatment or disposal methods can greatly alter costs and feasibility of making adjustments.

The time schedule for meeting requirements will also influence plant adjustments. Excessive delay would encourage noncompliance; too rapid a time-table would make it impossible for many plants to make necessary adjustments. Perhaps it would be advisable to approve some methods on an interim basis, while long-term solutions are being effected.

With the limitations of this analysis we cannot assign specific statistical measures of reliability. However, in light of the data and consultation with industry personnel, we feel the unit cost results are reliable within 20 percent (plus or minus).

Estimated plant and volume adjustment are discussed. These estimates do not claim that pollution control requirements would close the plant, there is no feasible way to make a meaningful estimate of that adjustment. The discussion is intended to indicate where pollution control would be a significant consideration in the decision to close. These estimates provide indicators for change in dairy plant numbers. Actual closings will be greater, but that would be true for most of the dairy industry even without increasing costs or investment due to pollution control.

In-plant modifications are not analyzed in this report. The potential for reduction of hydraulic and BOD loadings are not well enough known. Neither are the costs of in-plant changes adequately known.

Statistical measures have been applied to describe certain perimeters although the data did not meet all necessary qualifications for statistical reliability.

Impact Areas for Additional Consideration

We strongly recommend that the potential and cost for reducing effluent by in-plant modifications be the subject of further research. Such research could be accomplished without undue cost or use of time. It should be done in different size plants, making different products under different levels of technology.

The most critical assumption implicit in this report is that plants would be able to successfully and continuously meet pollution abatement requirements by providing the facilities. This is not necessarily true. New plants with new treatment facilities are reporting operational problems. These reports are from large firms with considerable expertise and experience, as well as financing.

Changes are inter-related to such an extent that even problems in physical treatment cannot all be foreseen and provided for. This economic analysis does not inquire into the technological aspects of handling and treating plant effluent.

Economies of scale for treating waste are probably greater than recognized in these cost computations. To that extent, smaller plants will be more seriously affected and large plants less seriously affected than shown.

There is no existent market for the volume of dried whey which will be forthcoming because plants are no longer permitted to dump their whey as they have in the past. New uses will be developed and present uses expanded. However, the impact of this additional volume is open to question. At least in the short-run, nonfat dry milk prices can be expected to be forced to the support price. There is no support for whey, so dry whey would be expected to remain at a very low-level price.

Certain circumstances could alter the conclusions of this report significantly. If firms could not pass the increased costs along to their customers the impact would be much more drastic than indicated.

A control policy which would permit some form of land disposal--or other less costly method--by small plants in uncongested areas would reduce the impact upon small manufacturing plants located in such areas. Total effluent from such a plant may be less polluting than the treated effluent from a large plant in a congested area.

Time allowed for meeting standards is critical. The quicker plants are required to meet standards, the greater the impact upon the industry.

Technological developments, in plant or in effluent treatment, could have a real influence. This is especially true if it were to alter the economies to scale relationships. Changes in national demand and supply conditions for milk and milk products would have a marked influence upon the impact expected in the industry.

Structural changes in the industry could alter the expected impact of pollution control.

Impact of pollution control will be greatly influenced by the proportion of dairy products produced by plants using municipal treatment facilities, as this is the most economical way. Harper estimated that plants with 90 percent of the volume were using municipal facilities. This estimate appears to be valid for fluid milk plants. However, survey data from Wisconsin and Vermont show a much lower proportion of the manufacturing industry using municipal systems. Many of the manufacturing plants do not have access to such systems (Tables A19, A20, A21, A22, A23). About three-fourths of a billion pounds of milk a month is handled by Wisconsin plants not on municipal systems (Table A25).

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Table A1. Income Characteristics of Corporations Classified in the Dairy Products Industry (SIC 2020). Percent of total for each Characteristic Represented by Firms in each Size Grouping According to Total Assets, Computed from Data as Shown in Internal Revenue Service 1968 Corporation Source Book of Statistics of Income. (TOTAL ASSETS $1,000)

	Total 1/	Over Zero Under 50	50 Under 100	100 Under 250	250 Under 500	500 Under 1,000	1,000 Under 5,000	5,000 Under 10,000	10,000 Under 25,000	25,000 Under 50,000	50,000 Under 100,000	100,000 or More
				Size Group as Percent of Total								
1. Number Returns 2/	2,875	15.72	8.80	27.20	19.41	15.23	11.41	1.18	.45	.10	.10	.21
2. Returns With Net Income 2/	1,733	16.10	4.33	25.27	21.87	15.18	14.20	1.79	.40	.17	.17	.35
5. Total Assets	4,867,691	.24	.31	2.43	3.65	4.63	13.29	4.38	3.24	2.40	4.96	60.46
Current Assets	2,498,736	.25	.39	2.16	4.60	4.35	14.63	4.77	3.15	2.11	4.66	58.93
Current Liabilities	1,335,556	.47	.30	3.18	5.43	5.23	15.67	5.23	5.11	2.41	6.61	50.36
36. Total Receipts	12,288,990	.66	.52	3.72	5.80	6.33	16.77	5.96	3.45	2.34	4.14	50.05
49. Total Deductions	11,851,518	.69	.54	3.84	5.99	6.41	17.08	6.09	3.56	2.36	4.13	49.05
50. Cost of Sales & Operation	9,645,508	.71	.54	3.99	6.45	6.66	17.08	6.57	3.65	2.36	3.80	47.90
51. Compensation of Officers	72,310	3.03	3.16	14.47	18.48	14.28	27.67	6.41	1.93	.67	1.29	8.62
52. Repairs	113,923	.17	.48	2.81	3.99	4.97	13.48	2.69	3.97	2.34	5.89	58.93
53. Bad Depts	22,800	3.77	.02	7.84	3.38	3.53	28.85	3.95	3.15	4.78	2.75	37.98
54. Rent Paid on Bus. Prop.	108,474	.75	.50	2.02	3.76	6.55	14.18	3.05	6.17	2.97	4.95	54.76
55. Taxes Paid	163,323	.52	.41	3.76	3.63	5.07	16.64	4.23	3.71	2.07	5.52	54.31
56. Interest Paid	57,290	.27	.17	2.55	5.11	5.27	14.07	3.93	5.58	2.61	5.82	54.13
57. Contribution or Gifts	6,138	(5)	(5)	.67	1.04	2.80	13.57	3.29	.99	1.81	4.12	71.68
58. Amortization	1,870	0	(5)	.75	6.31	81.76	1.82	.75	.48	0	4.60	3.53
59. Depreciation	222,843	.30	.46	3.19	4.05	6.67	15.92	4.67	3.21	2.14	4.97	54.37
60. Depletion	1,943	0	0	(5)	0	8.70	0	0	.05	(5)	0	91.25
61. Advertising	200,438	.06	.71	.64	.63	2.72	6.23	1.46	1.21	1.37	3.16	81.81
62 Pension Profit Sharing	55,251	.06	0	.49	3.78	1.42	13.51	3.80	1.92	1.48	4.95	68.58
63. Other Employee Plan	16,733	.12	.24	1.66	2.71	1.38	17.50	5.60	4.58	2.29	5.78	57.88
65. Other Deductions	1,151,042	.60	.47	3.05	3.71	5.09	19.36	4.33	3.08	2.60	6.52	51.04
69. Net Income	475,036	.12	.11	1.47	1.90	4.63	8 75	2.86	.97	1.82	3.92	73.26
77. Income Subject to Tax Total	440,392	.07	.13	.92	1.56	1.62	8.65	2.79	1.04	1.90	2.38	78.72
79. Income Tax Before Credits	224,942	.02	.15	.51	.91	1.25	8.28	2.82	1.03	1.94	2.42	80.43
83. Investment Credit	14,951	(5)	.28	.74	3.79	3.58	10.51	2.62	2.01	2.33	5.31	68.80
90. Cost of Property Used for Credit	269,019	.02	.08	2.38	4.23	5.67	13.17	4.51	2.99	2.19	5.28	59.47
70. Deficit	27,642	6.05	2.25	16.75	22.80	11.71	20.36	12.35	7.72	0	0	0

1/ Actual numbers and $1,000; not percentages

2/ There were 2,599 regular corporate returns plus 276 reporting on Form 1120S, a total of 2,875 returns. There were 1,733 regular returns with net income and 866 without net income. All computations are on the basis of the 2,875 total returns.

A

Table A2. Comparison of Income Characteristics of Corporations Classified as in the Dairy Product Industry (SIC 2020). Computed from Data as Shown in the Internal Revenue Service 1968 Source Book of Statistics of Income, by Size of Total Assets

(TOTAL ASSETS $1,000)

	Total (Overall)	Over zero Under 50	50 Under 100	100 Under 250	250 Under 500	500 Under 1,000	1,000 Under 5,000	5,000 Under 10,000	10,000 Under 25,000	25,000 Under 50,000	50,000 Under 100,000	100,000 or More
E. (2-4) Number Returns	2,875	452	253	782	559	438	328	34	13	3	3	6
Average Per Income Tax Return, $1,000												
5. Total Assets	1,693.1	26.3	59.8	151.2	318.1	514.4	1,972.1	6,277.3	12,130.4	38,922.3	80,433.7	490,540.3
E. (6-12) Current Assets	869.1	13.6	38.6	69.2	205.6	248.0	1,114.5	3,505.3	6,057.3	17,595.0	38,786.3	245,421.7
E. (25-27) Current Liabilities	464.5	13.8	15.9	54.4	129.7	159.3	638.0	2,056.8	5,250.5	10,728.7	29,427.3	112,095.2
36. Total Receipts	4,274.4	178.7	254.6	584.2	1,274.6	1,777.2	6,281.9	21,525.6	32,652.5	95,992.0	169,403.7	1,025,147.7
49. Total Deductions	4,122.3	181.1	255.1	581.2	1,269.7	1,734.4	6,171.9	21,226.7	32,455.6	93,109.7	163,174.3	968,855.5
50. Cost of Sales & Operation	3,355.0	152.1	207.2	491.6	1,112.8	1,466.6	5,023.6	18,633.9	27,071.3	75,981.7	122,125.3	769,965.7
51. Compensation of officers	25.2	4.8	9.0	13.4	23.9	23.6	61.0	136.4	107.5	162.7	310.7	1,038.5
52. Repairs	39.6	.4	2.2	4.1	8.1	12.9	46.8	90.1	348.0	889.0	2,235.0	11,188.7
53. Bad Debts	7.9	1.9	.02	2.3	1.4	1.8	20.1	26.5	55.2	363.0	209.3	1,443.3
54. Rent paid on Business Prop.	37.7	1.8	2.2	2.8	7.3	16.2	46.9	97.3	515.0	1,074.0	1,791.3	9,900.8
55. Taxes paid	56.8	1.9	2.6	7.9	10.6	18.9	82.9	203.1	466.2	1,128.7	3,007.3	14,784.3
56. Interest paid	19.9	.3	.4	1.9	5.2	6.9	24.6	66.2	245.8	499.3	1,111.3	5,168.7
57. Contributions or Gifts	2.1	(5)	(5)	.1	.1	.4	2.5	5.9	4.7	37.0	84.3	733.3
59. Depreciation	77.5	1.5	4.0	9.1	16.1	33.9	108.1	306.4	550.2	1,589.3	3,690.3	20,192.0
61. Advertising	69.7	.2	5.7	1.6	2.3	12.5	38.1	85.8	186.7	914.7	2,112.0	27,328.2
62. Pension Profit Sharing Annuity	19.2	.1	0	.3	3.7	1.8	22.8	61.7	81.7	272.7	911.3	6,315.0
63. Other Employees Benifit Plan	9.3	.1	.3	.6	1.3	.8	14.3	44.0	94.2	203.7	515.3	2,579.0
64. Net Loss Noncapital Assets	.6	.6	(5)	.8	.2	.4	.7	3.1	.9	.7	13.7	0
65. Other Deductions	400.4	15.2	21.5	44.9	76.3	133.7	679.5	1,466.0	2,727.5	9,993.3	25,028.3	97,911.5
69. Net Income	165.2	1.3	2.0	8.9	16.1	50.2	126.7	398.9	354.2	2,882.0	6,199.7	58,001.8
70. Deficit	9.6	3.7	2.5	5.9	11.3	7.4	17.2	100.4	164.2	0	0	0
77. Income Subject to Tax	153.2	.6	2.2	5.2	12.3	16.3	116.1	361.8	351.2	2,895.0	3,494.0	57,779.2
79. Income Tax (Before Credit)	78.2	.1	1.3	1.5	3.7	6.4	56.8	186.8	178.2	1,451.3	1,814.7	30,154.0
83. Investment Credit	5.2	(5)	.2	.1	1.0	1.2	4.8	11.5	23.1	116.3	264.7	1,714.3
90. Cost of Property Assets for Inventory Credit	93.6	.1	.8	8.2	20.3	34.8	108.0	357.2	618.5	1,961.0	4,733.3	26,664.8
68. Net Income Less Deficit	155.6	-2.4	-.5	3.0	4.8	42.8	109.5	298.5	190.0	2,882.0	6,199.7	58,001.8

(5) Less than $500 per return.

Table A3. Income Characteristics of Corporations Classified as in the Dairy Products Industry (SIC 2020). Computed from Data as shown in 1968 Corporation Source Book of Statistics of Income, by Size of Total Assets. Average Per Income Tax Returns Expressed as Percentage Relationship Within each Size Group.

(TOTAL ASSETS $1,000)

	Total	Over zero Under 50	50 Under 100	100 Under 250	250 Under 500	500 Under 1,000	1,000 Under 5,000	5,000 Under 10,000	10,000 Under 25,000	25,000 Under 50,000	50,000 Under 100,000	100,000 or More
						Percent						
Number Returns 1/	2,875	452	253	782	559	438	328	34	13	3	3	6
Percent of Returns with Net Inc.	66.68	61.73	37.69	60.25	75.05	79.46	76.40	91.18	53.85	100.00	100.00	100.00
Current as Percent of Total Assets	51.33	51.70	64.59	45.73	64.64	48.22	56.51	55.84	49.94	45.21	48.22	50.03
Current as Percent of Total Liabilities	27.44	52.62	26.54	35.95	40.77	30.97	32.35	32.77	43.28	27.56	36.59	22.85
Receipts as Percent of Assets	252.46	679.40	425.63	386.36	400.64	345.49	318.54	342.91	269.18	246.62	210.61	208.98
Total Receipts, 1/ $1,000	12,288,990	80,751	64.424	456,861	712,485	778,403	2,060,447	731,872	424,483	287,976	508,211	6,051,669
						Items as Percent of Receipts						
49. Total Deductions	96.44	101.35	100.16	99.49	99.62	97.59	98.25	98.61	99.40	97.00	96.32	94.51
50. Cost of Sales & Operations	78.49	85.15	81.39	84.15	87.31	82.53	79.97	86.57	82.91	79.15	72.09	75.11
51. Compensation of Officers	.59	2.71	3.55	2.29	1.88	1.33	.97	.63	.33	.17	.18	.10
52. Repairs	.93	.24	.85	.70	.64	.73	.75	.42	1.07	.93	1.32	1.09
53. Bad Debts	.19	1.07	.01	.39	.11	.10	.32	.12	.17	.38	.12	.14
54. Rent Paid on Business Prop.	.88	1.01	.85	.48	.57	.91	.75	.45	1.58	1.12	1.06	.97
55. Taxes Paid	1.33	1.05	1.03	1.34	.83	1.06	1.32	.94	1.43	1.18	1.78	1.44
56. Interest Paid	.47	.19	.15	.32	.41	.39	.39	.31	.75	.52	.66	.50
57. Contribution or Gifts	.05	(5)	(5)	.01	.01	.02	.04	.03	.01	.04	.05	.07
58. Amortization	.02	0	(5)		.02	.20				0	.02	
59. Depreciation	1.81	.84	1.58	1.56	1.27	1.91	1.72	1.42	1.68	1.66	2.18	1.97
60. Depletion	.02	0	0	(5)	0	.02	0	0		(5)	0	.03
61. Advertising	1.63	.14	2.22	.28	.18	.70	.61	.40	.57	.95	1.25	2.67
62. Pension Profit Sharing Annuity	.45	.04	0	.06	.29	.10	.36	.29	.25	.28	.54	.62
63. Other Employees Benefit Plan	.22	.04	.10	.10	.10	.05	.23	.20	.29	.21	.30	.25
64. Net Loss Noncapital Assets	.01	.36	(5)	.14	.02	.03	.01	.01			.01	0
65. Other Deductions	9.37	8.51	8.45	7.68	5.99	7.52	10.82	6.81	8.35	10.41	14.77	9.55
69. Net Income	3.87	.72	.80	1.52	1.27	2.82	2.02	1.85	1.08	3.00	3.66	5.66
77. Income Subject to Tax Total	3.58	.36	.87	.89	.96	.92	1.85	1.68	1.08	2.91	2.06	5.64
79. Income Tax (before credit)	1.83	.06	.52	.25	.29	.36	.90	.87	.55	1.51	1.07	2.94
83. Investment Credit	.01	(5)	.07	.02	.08	.07	.08	.05	.01	.12	.16	.17

1/ Absolute number, not a percentage.

(5) Less than $500 per return.

Table A4. Value of Shipments by selected industries in relation to selected variables, shown as averages for industry as computed from 1967 Census of Manufactures data.

Industry by SIC Code	Company	Estab-lishment	Employee	Pro-duction worker	Man hour by production worker	Dollar labor-cost	Dollar value added by manufacture	Dollar capital expenditure	Dollar capital expenditure for structures	Dol. capital expenditure for machinery & equipment	Dollar depreciable assets
	- Average dollar value of shipments per -										
All manufacturing	2,068,489	1,791,469	28,846	39,942	20	4.02	2.13	26	98	35	3
Food & Kindred Products---- 20	3,139,377	2,582,422	50,906	74,864	37	7.46	3.15	49	180	66	4
Dairy Products--- 202	2,492,725	2,070,960	55,309	119,432	58	7.95	3.70	66	249	90	5
Butter-------2021	1,880,000	1,775,556	110,207	149,812	69	19.37	8.47	101	479	130	6
Cheese-------2022	1,916,723	1,664,522	85,390	102,880	50	14.99	7.54	99	328	141	7
Condensed----2023	7,055,865	4,340,206	95,682	126,300	61	13.48	3.39	61	154	100	5
Ice Cream----2024	1,485,835	1,246,353	43,065	76,768	39	6.08	2.63	40	186	51	3
Fluid Milk---2026	2,619,143	2,248,205	47,373	129,355	62	6.63	3.33	65	259	87	5

Table A5. Value added by manufacture by selected industries in relation to selected variables, shown as averages for industry as computed from 1967 Census of Manufactures data.

Industry by SIC Code	Company	Estab-lishment	Employee	Pro-duction worker	Man hour by production worker	Dollar labor-cost	Dollar value of shipments	Dollar capital expenditure	Dollar capital expenditure for structures	Dol. capital expenditure for machinery & equipment	Dollar depreciable assets
	- Average dollar value added by manufacture per-										
All manufacturing	972,215	842,013	13,558	18,773	9	1.89	.47	12	46	17	1.20
Food & Kindred Products--- 20	995,211	818,651	16,138	23,733	12	2.37	.32	15	57	21	1.29
Dairy Products--- 202	674,266	560,181	14,607	32,306	16	2.15	.27	18	67	24	1.27
Butter-------2021	221,961	209,230	13,011	17,688	8	2.29	.12	12	57	15	.67
Cheese-------2022	254,209	220,760	11,325	13,645	7	1.99	.13	13	44	19	.91
Condensed----2023	2,084,358	1,282,131	28,265	37,310	18	5.06	.30	18	46	30	1.51
Ice Cream----2024	565,217	474,118	16,382	29,203	15	2.31	.38	15	71	19	1.07
Fluid Milk---2026	786,714	675,294	14,229	38,855	19	1.99	.30	20	78	26	1.38

Table A6. Capital expenditure by selected industries in relation to selected variables shown as averages for industries as computed from 1967 Census of Manufactures data.

Industry by SIC Code	- Average dollars of new capital expenditures per - Company	Establishment	Employee	Production worker	Man hour by production worker	Dollar labor-cost	Dollar value added by manufacture	Dollar value of shipments	Dollar value capital expenditures for structures	Dol. capital expenditure for machinery & equipment	Dollar depreciable assets
All manufacturing	79,797	69,110	1,113	1,541	.902	.155	.082	.039	3.76	1.36	.099
Food & Kindred Products--- 20	72,849	53,204	1,049	1,542	.766	.154	.065	.021	3.71	1.37	.084
Dairy Products--- 202	37,814	31,416	839	1,812	.875	.121	.056	.015	3.78	1.36	.071
Butter-------2021	18,627	17,593	1,092	1,484	.683	.192	.084	.010	4.75	1.28	.057
Cheese-------2022	19,416	16,862	865	1,042	.510	.152	.076	.010	3.33	1.43	.069
Condensed----2023	116,201	71,478	1,576	2,080	1.005	.282	.056	.016	2.54	1.65	.084
Ice Cream----2024	37,307	31,294	1,081	1,928	.978	.153	.066	.025	4.67	1.27	.071
Fluid Milk---2026	40,261	34,559	728	1,988	.952	.102	.051	.015	3.98	1.34	.071

Table A7. Depreciable assets held by selected industries in relation to selected financial variables, average per industry as computed from 1967 Census of Manufactures data.

Industry by SIC Code	- Average dollar depreciable assets per - Company	Establishment	Employee	Production worker	Man hour by production worker	Dollar labor-cost	Dollar value added by manufacture	Dollar value of shipments	Dollar value capital expenditures for structures	Dol. capital expenditure for machinery & equipment	Dollar capital expenditures
All manufacturing	809,283	700,901	11,286	15,627	7,833	1,574	.832	.391	38.16	13.81	10,142
Food & Kindred Products--- 20	771,494	634,624	12,510	18,398	9,134	1,834	.775	.246	44.28	16.33	11,928
Dairy Products--- 202	532,640	442,518	11,818	25,520	12,329	1,698	.790	.214	53.27	19.15	14,086
Butter-------2021	329,412	311,111	19,310	26,250	12,086	3,394	1.484	.175	84.00	22.70	17,684
Cheese-------2022	280,135	243,275	28,690	39,000	17,957	2,191	2.205	.260	124.80	33.73	26,274
Condensed----2023	1,381,006	849,485	12,360	14,892	7,292	3,354	1.091	.145	47.54	20.43	14,289
Ice Cream----2024	527,209	442,235	15,280	27,239	13,820	2,157	.933	.355	65.95	17.99	14,132
Fluid Milk---2026	568,139	487,676	10,276	28,060	13,430	1,437	.722	.217	56.21	18.86	14,111

Structural Aspects of the Dairy Industry 1/

Two recent structural changes have altered the traditional relationships among sectors of the dairy industry. Producer cooperatives have grown from local to regional organizations. Concurrently, retail food chains have developed central procurement programs to obtain their packaged fluid milk products.

Producer Cooperatives

Cooperatives have effected a dramatic change in their relationships with producers and processors, and, perhaps most importantly, among themselves. The local producers' cooperative has become regional and national in its milk marketing principles.

New production, processing, and transportation technologies, economies of size, and the breakdown of intermarket barriers all have increased the mobility of milk supplies. Distributors service large marketing areas from a central plant.

Bargaining and functional effectiveness were both limited for local producer organizations. Producers' cooperatives found that they had to grow to properly service their members and the processors.

A number of Midwestern cooperatives formed two large bargaining federations in the early 1960's, and these initial federations have been followed by extensive mergers among cooperatives. Thus, truly regional cooperatives have developed throughout the Central and Southeastern United States. These mergers have probably set the pattern for continuing merger activity among cooperatives in the dairy industry.

Cooperatives have developed full-supply arrangements with many processors. Under full supply, the cooperative exercises complete responsibility for providing the processor with a flow of milk as needed. Procuring the fluctuating supply and coordinating it with a variable demand has been a high-cost operation. Variability of fluctuations, the risk factor and degree of uncertainty, and cost have been reduced by this cooperative action.

Farm quality control, intermarket transfer, and surplus management are being more effectively performed by these large cooperatives. Their size and method of coordinating these activities give flexibility of operation, while providing necessary stability for efficient milk production and marketing, especially in maintaining price relationships among markets. Approximately 72 percent of the Nation's milk supply is marketed through cooperatives. Both the number of cooperatives and producer membership have dropped to one-half the level 20 years ago. Though some of this attrition occurred because cooperatives went out of business, recent merger activity also has reduced their number.

These large cooperatives have consolidated much of their bargaining activity into big regional cooperatives and federations. Increased bargaining activities and shifting a major part of the responsibility for supply coordination from processors to cooperatives will continue to influence number, size, and competitive activities of processors of fluid and manufactured milk products.

1/Excerpted from "Market Structure of the Food Industries" MRR 971, ERS, USDA, Sept., 1972.

Number of Plants

The most consistent structural change in the dairy industry has been the decline in plant numbers. A major influence has been the continuing shift in the economies of size curve. Small plants find themselves at an increasing cost disadvantage in processing milk compared with larger plants. As processing becomes more complex and equipment more costly, unit cost of processing small volumes becomes prohibitive.

In the 1900's and 1910's, introduction of many city ordinances requiring milk pasteurization resulted in relatively higher costs for small distributors compared with large ones, and many small distributors could no longer compete. In the 1920's and 1930's, introduction of classified pricing plans providing for uniform prices to producers by all handlers, both large and small, forced numerous small handlers to pay the same prices as their large competitors. Many of these small handlers found it impossible to do so and they, too, went out of business. In the late 1930's and 1940's, cost levels of smaller distributors were raised further by introduction of the paper carton. Since World War II, several technological and economic developments--none of them outstanding--have tilted the cost curves further.

Economies of size in plant operations are well demonstrated by the following tabulation:

Plant size (quarts per day)	Cost per quart
	Cents
6,000	6.7
20,000	4.5
50,000	3.7
100,000	3.4
200,000	2.8
400,000	2.6
800,000	2.4

Obviously, the smallest plants are severely disadvantaged and cannot compete unless they obtain access to specialized markets at higher than average prices or unless their owners are willing to accept substantially reduced returns for both investment and management. Middle-sized plants operate at some disadvantage.

Number of plants operated by local firms has declined most sharply. However, the trend has been downward for milk bottling plants under all types of ownership (table A8).

Fluid milk bottling plants in the United States fell 53 percent between 1948 and 1964. This decrease in 17 years was equaled by a 54-percent decline during the next 7 years--through 1971 (table A-9).

Table A8.--Fluid milk bottling plants operated by various types of firms, December 1964 and December 1970

Type of firm	December 1964	December 1970	Change, 1964-70
	Number	Number	Percent
National	280	205	-37
Regional	90	66	-27
Local:			
Multiunit	231	110	-52
Single-unit	3,209	1,658	-48
Cooperatives:			
Multiunit	115	95	-17
Single-unit	152	81	-47
Total	4,077	2,215	-46

Table A9.--Fluid milk bottling plants operated by commercial processors, 1948, and December 1964-71

Period	Regulated by Federal orders	Other	Total
	Number		
1948			8,484
1964	1,936	2,141	4,077
1965	1,782	1,939	3,721
1966	1,530	1,828	3,358
1967	1,456	1,503	2,959
1968	1,485	1,155	2,640
1969	1,478	980	2,458
1970	1,349	866	2,215
1971	1,136	728	1,864

While many small plants have gone out of business, remaining plants have grown larger. Fluid milk plants packaged an average of slightly more than 20 million pounds per plant in 1970, compared with less than 13 million pounds in 1963 and about 5.6 million in 1948.

From 1965 to 1970, number of plants selling less than 4 million pounds per month of packaged fluid milk decreased sharply. In contrast, a marked gain took place in plants packaging more than 4 million pounds (table A10).

Table A10.--Size distribution of fluid milk plants, comparable Federal orders and States, 1965 and 1970

Monthly sales volume of packaged fluid milk products (1,000 pounds)	1965	1970	Change, 1965-70
	Plants		Percent
Less than 100	495	220	-56
100-499	855	444	-48
500-999	300	183	-39
1,000-1,999	266	205	-23
2,000-2,999	128	108	-16
3,000-3,999	102	82	-20
4,000-4,999	48	65	+35
5,000-9,999	120	138	+15
10,000-14,999	33	38	+15
15,000-19,999	12	18	+50
20,000-29,999	7	12	+71
Total	2,366	1,513	-36

Manufacturing plants increased the average volume of milk (milk equivalent basis) which they made into manufactured dairy products from 5.6 million pounds per plant in 1948 to 10 million in 1963 and about 17 million in 1970.

Though most of the impetus for larger plants undoubtedly comes from economies of size in processing, institutional factors also exert a strong influence. Under full-supply arrangements, cooperatives pick up milk from farmers, deliver it to plants according to a specified time and volume schedule, and have complete responsibility for filling shortages or processing surplus into manufactured products. This shift in procurement practices has enabled fluid milk processors to close many small country plants which they had maintained as a source of fluid milk and a means of handling their surplus. This change has contributed to overall efficiency in supplying the fluid milk market and in manufacturing dairy products

Number of plants manufacturing dairy products also has been declining, but at a slower rate than that of fluid milk plants. Manufacturing plants dropped 37 percent between 1944 and 1961 and 42 percent from 1961 to 1970 (table A11).

Smaller volume plants have accounted for most of the decline in numbers, both in fluid milk plants and manufacturing plants (table A12 and fig. 1). The decline has been dramatic for plants with fewer than 20 employees, while the number of plants with more than 100 employees has remained almost steady.

Larger plants naturally have a greater than proportionate share of employees, value added, and value of shipments in the industry (fig. 2 and table A13). However, considering economies of size, their proportion of new capital expenditures appears more than adequate to maintain the greater share. Thus, the shift toward larger plants should continue or accelerate.

Distribution

The fluid milk market, which began as a home-delivery operation, has now moved to the supermarket (fig. 3). Increasing delivery costs, especially for servicing small accounts, combined with economies of mass merchandising and new shopping habits by consumers to bring about this shift.

The switch from home delivery to large-volume wholesale deliveries has put the small processing plant at a great disadvantage. Processors outside the immediate area can service large supermarket accounts, whereas they would not find it practical to service home-delivery accounts. Many of these smaller plants have discontinued processing and become distributors for other fluid milk processors. In some cases, a number of small distributors have joined together to establish a jointly held bottling plant, while maintaining their separate identities as distributors.

Supermarkets have not been the only outlets to gain a part of the volume formerly delivered to homes. Dairy stores, delicatessens, convenience stores, and other types of foodstores account for about a fifth of sales; restaurants, hotels, institutions, schools, military establishments, and vending machines, another fifth (table A14).

Integration by Supermarkets

In the 1930's, two large national grocery chains built their own milk bottling plants to serve some of their stores. After World War II, they added more plants in other areas. In the last few years, they have been supplying a high proportion of their stores with milk from their own plants. In the postwar period--primarily in the late 1950's and the 1960's--other chains and a few cooperative and voluntary groups built or purchased milk plants.

Table A11 .--Plants manufacturing selected dairy products, selected years, 1940-55 and 1960-70

Year	Butter	Natural cheese 1/	Creamed cottage cheese	Evaporated milk 2/	Nonfat dry milk 3/	Ice cream 4/	All dairy manufacturing plants
	Number						
1940	4,692	N.A.	1,783	142	273	4,191	N.A.
1944	4,022	2,856	1,652	144	498	3,656	9,739
1945	3,763	2,565	1,603	145	498	3,699	N.A.
1950	3,060	2,158	1,571	N.A.	459	3,269	N.A.
1955	2,343	1,789	1,748	N.A.	461	3,010	N.A.
1960	1,659	1,419	1,370	72	442	1,950	N.A.
1961	1,516	1,410	1,263	72	432	1,905	6,134
1962	1,427	1,355	1,193	66	425	1,805	N.A.
1963	1,320	1,283	1,094	63	407	1,729	N.A.
1964	1,227	1,252	1,021	59	394	1,640	N.A.
1965	1,152	1,209	910	59	372	1,560	N.A.
1966	1,048	1,160	836	51	326	1,456	N.A.
1967	919	1,121	758	50	303	1,369	N.A.
1968	818	1,051	679	49	272	1,291	N.A.
1969	727	995	621	44	245	N.A.	N.A.
1970	619	963	583	42	219	N.A.	3,546
1971	524	920	539	39	190	N.A.	3,496

1/ All "hard" cheeses, cream, Neufchatel, and blue mold; excludes full-skim American-type and cottage cheese.
2/ Whole unsweetened, unskimmed case goods (canned).
3/ For human food.
4/ Excludes counter freezers (plants producing less than 20,000 gallons per year) 1,518 plants produced hard ice cream in 1971.
Note: N.A.= not available.
Source: Statis. Rptg. Serv. Production of Manufactured Dairy Products, U.S. Dept. Agr., annual issues.

Table A12.--Dairy product establishments, by number of employees, census years 1954-67

Industry and year	Total establishments	Proportion of total establishments with-- 1-19 employees	20-99 employees	100 or more employees
	Number	Percent		
Creamery butter:				
1954	1,262	80.4	17.1	2.5
1958	1,058	78.4	19.2	2.4
1963	766	76.7	21.7	1.6
1967	540	74.4	23.9	1.7
Natural and processed cheese:				
1954	1,419	87.2	12.4	.4
1958	1,203	86.7	12.4	.9
1963	1,138	81.9	15.6	2.5
1967	1,026	76.8	20.1	3.1
Condensed and evaporated milk:				
1954	359	46.5	45.4	8.1
1958	313	35.5	54.6	9.9
1963	281	40.9	48.1	11.0
1967	291	41.9	47.4	10.7
Ice cream and frozen desserts:				
1954	1,587	70.0	26.3	3.7
1958	1,382	67.2	28.5	4.3
1963	1,081	64.2	29.6	6.2
1967	850	61.8	30.7	7.5
Subtotal, sum of four industries:				
1954	4,627	76.3	21.0	2.7
1958	3,956	73.6	23.2	3.2
1963	3,266	71.3	24.5	4.2
1967	2,707	67.9	27.1	5.0
Fluid milk:				
1958	5,817	61.6	29.6	8.8
1963	4,619	57.8	31.4	10.8
1967	3,481	53.0	32.9	14.1

Source: Bur. of the Census, Census of Manufactures, U.S. Dept. Commerce.

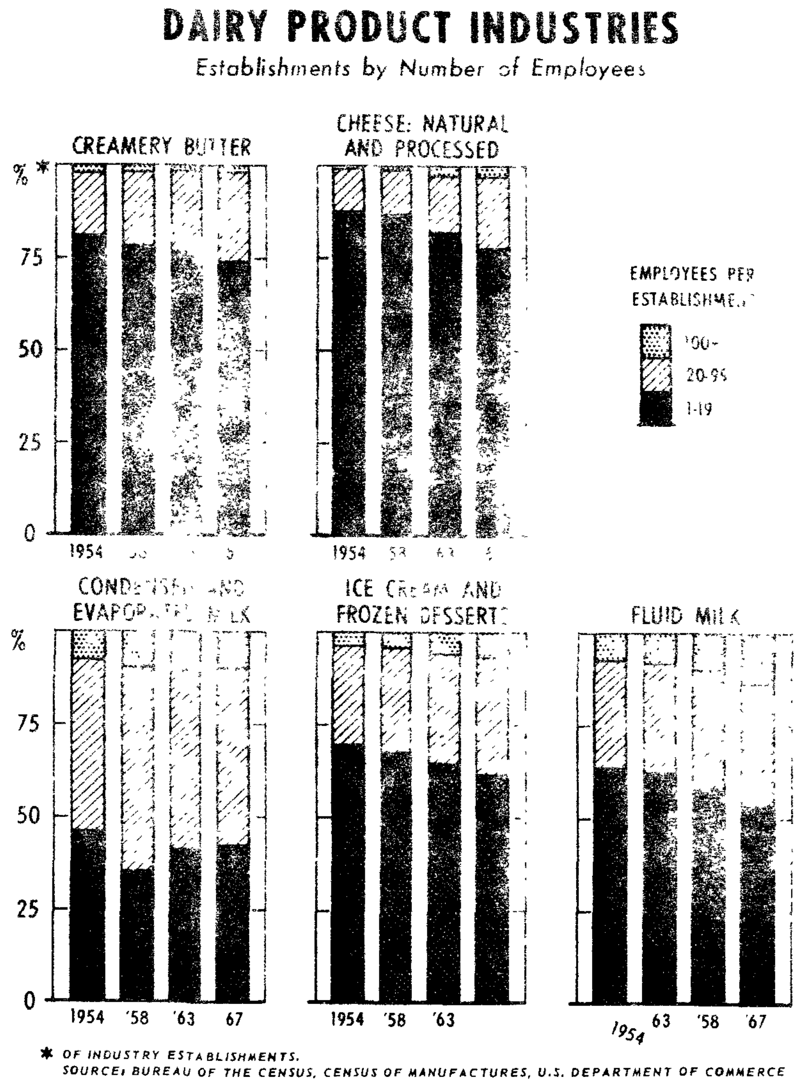


Figure 1

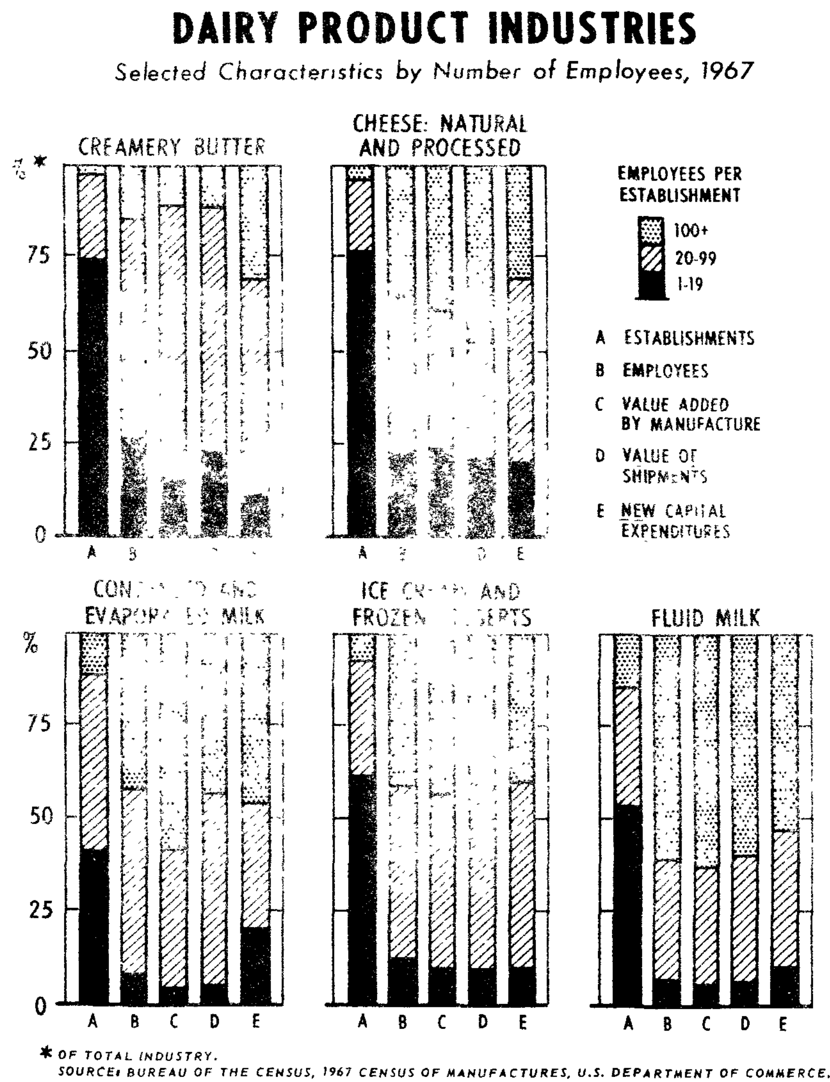


Figure 2

Table A13 .--Dairy product industries: Establishments, employees, value added by manufacture, value of shipments, and new capital expenditures, by employee size of establishment, 1967

Industry and size of establishment	Establishments	Employees		Value added by manufacture 1/		Value of shipments 1/		New capital expenditures 1/	
	Number	1,000	Percent	Mil. dol.	Percent	Mil. dol.	Percent	Mil. dol.	Percent
Creamery butter:									
Total establishments ...	540	8.7	100.0	113.2	100.0	958.8	100.0	9.5	100.0
1-19 employees	402	2.3	26.4	24.2	21.4	212.1	22.1	1.1	11.6
20-99 employees	129	5.2	59.8	77.8	68.7	646.0	67.4	5.4	56.8
100 or more employees ..	9	1.2	13.8	11.2	9.9	100.6	10.5	3.0	31.6
Cheese, natural and processed:									
Total establishments ...	1,026	20.0	100.0	226.5	100.0	1,707.8	100.0	17.3	100.0
1-19 employees	788	4.5	22.4	52.9	23.3	326.8	19.1	3.4	19.7
20-99 employees	206	8.4	41.8	84.5	37.3	560.5	32.8	8.5	49.1
100 or more employees ..	32	7.2	35.8	89.2	39.4	820.7	48.1	5.4	31.2
Condensed and evaporated milk:									
Total establishments ...	291	13.2	100.0	373.1	100.0	1,263.0	100.0	20.8	100.0
1-19 employees	122	1.0	7.6	15.6	4.2	60.2	4.7	2/4.1	2/19.8
20-99 employees	138	6.6	50.4	143.0	38.3	652.5	51.7	7.1	34.3
100 or more employees ..	31	5.5	42.0	214.5	57.5	550.3	43.6	9.5	45.9
Ice cream and frozen desserts:									
Total establishments ...	850	24.6	100.0	403.0	100.0	1,059.4	100.0	26.6	100.0
1-19 employees	525	3.1	12.6	40.2	10.0	105.5	10.0	2.8	10.5
20-99 employees	261	11.4	46.3	188.1	46.7	532.2	50.2	13.2	49.6
100 or more employees ..	64	10.1	41.1	174.6	43.3	421.8	39.8	10.6	39.9
Fluid milk:									
Total establishments ...	3,481	165.2	100.0	2,350.7	100.0	7,826.0	100.0	120.3	100.0
1-19 employees	1,845	11.3	6.8	141.0	6.0	525.8	6.7	2/14.3	2/11.9
20-99 employees	1,146	53.2	32.2	743.7	31.6	2,673.0	34.2	42.5	35.3
100 or more employees ..	490	100.9	61.0	1,466.1	62.4	4,627.2	59.1	63.5	52.8

1/ Sums may not equal totals because of rounding.
2/ Includes unspecified amount for plants under construction but not in operation.
Source: Bureau of the Census, 1967 Census of Manufactures, U.S. Dept. Commerce.

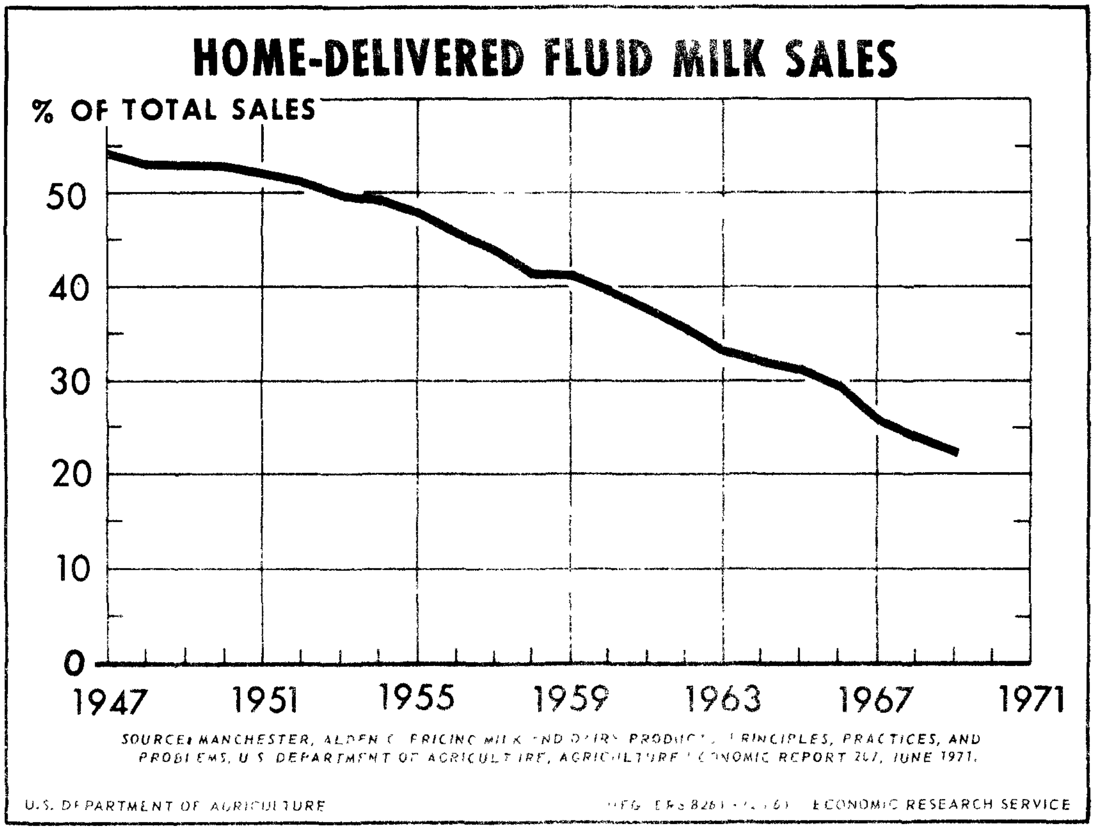


Figure 3

In 1965, 20 companies in the United States operated 36 plants which processed 3 percent of total volume (table A15). By 1967, this figure had increased to 5.1 percent and, by 1969, 23 companies operated 41 plants and accounted for 6.8 percent of total volume.

Some incentive for vertical integration by supermarket chains is provided by the existence of relatively high fixed margins under resale price control. Under such control, there has been considerable reluctance to permit quantity discounts and limited service delivery. In these circumstances, supermarket organizations have an incentive to build or acquire their own milk plants to capture available profits. In parts of the country where resale price control does not provide guaranteed margins, incentives are less clear cut. The argument has been given that a retail organization deals with a different labor organization than do processors and might be able to achieve economies of distribution which conventional milk processors could not. Generally, however, this argument does not seem to have held. Another possible incentive is that a retail organization operating its own milk plant can be fully assured of capturing all economies possible in a large-volume, limited service operation. Such economies might be prevented if price negotiation with processors were used, because of trade practice regulation activities of Federal and State agencies.

A broad range of forces can affect a food chain's decision to integrate backward in the marketing channel. These forces include: (1) relative cost of performing a set of functions under a vertically integrated system compared with cost under an open market price system; (2) forces that may influence

Table A14.--Fluid milk products, by type of outlet and distributor, 1969

Outlet	Volume accounted for by --			
	Commercial processor	Subdealer 1/	Producer-distributor 2/	Total
	Percent			
Home delivered	15.4	7.4	0.4	23.2
Plant and farm sales to consumers	3.0	--	.9	3.9
Stores:				
Supermarkets:				
Integrated	7.1	--	--	7.1
Other	21.6	.1	--	21.7
Dairy and convenience stores:				
Integrated	3.4	--	1.1	4.5
Other	5.2	.2	--	5.4
Other grocery stores and delicatessens	5.5	5.6	.3	11.4
Commissary stores	1.0	--	--	1.0
Nonfood stores	.7	3/	3/	.7
All stores	44.5	5.9	1.4	51.8
Institutional outlets:				
Military	2.3	--	--	2.3
Schools	5.4	1.4	.3	7.1
Restaurants, hotels, and institutions	8.3	.9	.1	9.3
All institutional	16.0	2.3	.4	18.7
Vending machines	1.8	.6	3/	2.4
Total	80.7	16.2	3.1	100.0

1/ Distributors who operate no milk processing facility but purchase their total supply as packaged milk.
2/ Obtain their primary supply of raw milk for processing from their own herds.
3/ Less than 0.05 percent.

Table A15 .--Milk bottling plants operated by supermarket groups under Federal orders and other regulations, December 1965, 1967, and 1969 1/

Item	December		
	1965	1967	1969
	Number		
Plants:			
Federal orders	21	24	28
Other	15	16	13
Total	36	40	41
Companies	20	22	23
	Million pounds		
Volume:			
Federal orders	88.0	130.7	209.7
Other (estimated)	48.6	80.6	96.0
Total	136.6	211.3	305.7
	Percent		
Proportion of sales of commercial processors	3.0	5.1	6.8

1/ Most sales go through supermarket's stores. At least 5 other supermarket companies operate milk plants which supply other outlets beside their own stores; their volume is not included here but in table 19.

Source: Manchester, Alden C. Pricing Milk and Dairy Products, Principles, Practices, and Problems, Econ. Res. Serv. U.S. Dept. Agr., Rpt. 207, June 1971.

survival or growth of a firm; (3) forces that may have market power connotations; and (4) the legal and institutional evironment--various laws, regulatory agencies, and bargaining groups.

The extent to which food chains have adopted centralized milk programs which represent various degrees of vertical coordination has been increasing. Developments that undoubtedly have resulted because of the forces encouraging backward vertical integration in fluid milk marketing channels by food chains are: (1) a general trend toward centralized buying and merchandising of fluid milk; (2) adoption of limited service delivery and performance of services in the marketing channel that traditionally were performed by fluid milk processors; (3) more emphasis on price competition at the fluid milk processor-food chain level of negotiations; (4) more attention to separating out the cost of fluid milk from the associated bundle of services at various stages in the channel; (5) initiation of private-label brands; and (6) full integration into fluid milk processing.

A somewhat different form of integration--or coordination--which supermarkets are practicing may have a greater impact on distribution. Food chains increasingly are negotiating terms of trade at their division or regional offices rather than at local stores. A study of the North Central Region found that about 80 percent of the supermarkets and 60 percent of the smaller stores served by 183 food distributors without their own milk plants were supplied milk on a centralized basis

Supermarkets are limiting the brands of milk handled--often to their private label and the brand of the processor supplying the private label. The processor thus has an all-or-nothing bargaining situation. This result, together with the size of the account, has greatly increased the risk associated with servicing store accounts. To compete for supermarket accounts, the processor must be large enough to handle the total volume of business of a retail store division, which may involve several market centers. Since retail store divisions are often dispersed over large areas, other fairly large processors in the same vicinity could consequently lose their accounts. Even if such processors continue to compete, the advantage lies with multiunit processors who have plants covering the entire area served by retail store divisions.

From one point of view, a processor is not large enough to compete for supermarket chain or group accounts if he would be unable to withstand the financial shock of losing the account later. In general, medium-sized processors can exist primarily by serving the home-delivery market and non-supermarket portions of the wholesale market. These outlets are significant, however, and account for about 68 percent of all milk distributed.

Industry Concentration

Eight large dairy companies are important in the market for all types of dairy products. Several date back into the 19th century, but major growth of all eight has occurred since the turn of the century and of all but one, since the mid-1920's. Much of the growth of these companies--like that of other industrial firms throughout the economy--occurred during two of the three merger movements in the United States.

The first wave of mergers around 1900 did not include significant activities in the dairy industry. The second merger movement--during the latter half of the 1920's--saw one dairy company with sales of over $100 million in 1919 more than double its sales volume, primarily because of mergers within the industry. Another company was organized in 1923 and immediately began a period of rapid growth, primarily through mergers. By 1930, this dairy company had become the largest in the industry.

The 1950's brought the third major merger movement. As in many other industries, several companies in the dairy industry grew very rapidly, primarily by merger with other firms in the industry. By 1956, each of the eight national dairy companies had sales of over $100 million, although not entirely of dairy products.

In 1934, the three largest dairy companies accounted for 22.8 percent of sales of packaged fluid milk and cream made by all commercial handlers (excluding producer-dealers). By 1950, their share had declined to 16.4 percent. Between 1950 and 1957, the share of these three companies increased modestly--from 16.4 to 18.8 percent. During the same period, the share of the fourth to eighth largest companies went from 4.3 to 8.3 percent.

Horizontal acquisitions made by dairy companies have slowed substantially since 1957, primarily because the FTC has challenged acquisition efforts of a number of the large companies under section 7 of the Clayton Act. The four largest fluid milk companies dropped from a 23-percent share in 1958 to 21 percent in 1967. This change was offset with an equal gain by the fifth to eighth largest; thus, the eight largest maintained their 29-percent share of the national market. The ninth through 20th largest companies also increased their share so that the top 20 companies moved from 37 percent in 1958 up to 40 percent in 1967 (table A16).

These large dairy companies, prevented from expanding their activities in the dairy industry, have been diversifying into a wider variety of product lines. Largely through mergers, they have moved into new lines inside and outside the food industry.

Despite the rapid decline in plant numbers, concentration in manufactured products has changed little at the manufacturing level in the past quarter century. Concentration of production in the butter industry dropped from 1947 to 1963, but rose during 1963-67. The percentage of total natural cheese production held by the four and eight largest companies fell between 1947 and 1954 but this share has risen since 1954. In 1958, the census classification was changed to include processed cheese with natural cheese. Volume of the four largest firms increased from 35 percent of industry shipments in 1958 to 45 percent in 1967. The fifth to eighth largest firms raised their share from 7 to 8 percent in the same time period; thus, the eight largest had 53 percent of industry shipments in 1967.

Table A16.--Concentration in dairy manufacturing and fluid milk industries, census years 1947-67

Industry and year	Value of shipments accounted for by-- 4 largest companies	8 largest companies	20 largest companies
	Percent		
Butter:			
1947	18	24	32
1954	14	19	28
1958	11	15	24
1963	8	14	25
1967	14	20	33
Cheese, natural and processed:			
1963	45	50	59
1967	45	53	62
Condensed and evaporated milk:			
1958	38	48	58
1963	33	42	55
1967	35	47	61
Ice cream and ices:			
1954	33	41	52
1958	35	44	54
1963	34	43	57
1967	32	42	57
Fluid milk and related products:			
1958	23	29	37
1963	22	29	38
1967	21	29	40

Source: Bur. of the Census, Census of Manufactures, 1967 Special Report Series: Concentration Ratios in Manufacturing, Part 2: Product Class Concentration Ratios, U.S. Dept. Commerce, 1971.

Table A17.--Production of milk and milk products in the United States selected years, 1950-1971

	Total milk	Fluid milk (consumption)	Cheese	Creamery butter	Nonfat dry milk (human food)	Cottage cheese	Ice Cream and ice milk
	Million pounds						Mil. Gal.
1950	116,602	37,280	1,191	1,386	881	352	591
1955	122,945	43,710	1,367	1,383	1,366	569	719
1960	123,109	47,360	1,478	1,373	1,819	799	845
1965	124,173	49,750	1,755	1,325	1,989	864	988
1970	117,149	45,885	2,201	1,137	1,444	1,038	1,049
1971	118,640	45,200	2,373	1,144	1,418	1,084	1,055
	Per Capita Pounds						Gallons
1950	766	273	7.8	9.1	5.8	2.3	3.8
1955	745	290	8.3	8.4	8.3	3.4	4.4
1960	681	276	8.2	7.6	10.1	4.4	4.7
1965	642	264	9.1	6.8	10.3	4.5	5.1
1970	572	229	10.7	5.6	7.1	5.1	5.1
1971	575	223	11.5	5.5	6.9	5.3	5.1

Table A18.--Milk and dairy product prices, selected years 1950-1971

	Wholesale						Retail
	All milk	Manufacturing grade	Bottling milk	Butter, Grade A Chicago	Cheese, American Cheddar Wisconsin assembling points	Nonfat dry milk human food, manuf. ave. selling price	Milk, fresh groc. in leading cities
	dol./ 100 lb.	dol./ 100 lb.	dol./ 100 lb.	cents/ lb.	cents/lb.	cents/lb.	cents per ½ gal.
1950	3.81	3.16	4.86	61.7	31.9	11.9	
1955	4.01	3.15	5.18	57.4	33.1	15.4	
1960	4.21	3.25	5.48	59.1	34.6	13.7	24.7(qt)
1965	4.23	3.34	5.39	60.2	35.8	14.7	47.3
1970	5.71	4.70	6.94	6.94	55.0	26.3	57.4
1971	5.86	4.85	7.12	68.4	56.5	30.7	58.9

Table A19.--Number of [illegible] Plants by Community Population Size
(pop. size 100)

Volume class 1000 #	No organized Town	1-9	10-19	20-29	30-49	50-99	100-249	250 +	Total
Incomplete volume data	11	33	34	17	19	44	30	60	248
1-499	5	34	19	9	3	12	8	2	92
500-1,499	10	55	16	17	12	15	12	0	137
1,000-1,999	2	30	12	10	3	4	4	0	65
1,500-1,999	7	25	12	4	4	7	0	1	60
2,000-2,999	4	23	8	5	2	2	1	0	45
3,000-4,999	1	17	11	3	2	3	1	1	39
5,000-6,999	0	6	4	0	0	0	3	1	14
7,000-9,999	2	5	2	1	0	2	2	1	15
10,000-19,999	1	4	3	3	2	1	3	1	18
20,000 +	0	1	2	1	1	1	0	0	6
Total	43	233	123	70	48	91	64	67	739

Table A20.--Volume of Wisconsin Dairy Plants by Community Population Size
(pop. size 100)

Volume class 1000 #	No organized Town	1-9	10-19	20-29	30-49	50-99	100-249	250 +	Total
Incomplete volume data	-	-	-	-	-	-	-	-	-
1-499	1,515	10,860	6,674	2,610	1,221	3,648	2,111	540	29,179
500-999	8,300	38,619	11,760	12,600	9,350	10,365	8,760	0	99,754
1,000-1,499	2,340	35,715	14,274	12,429	3,600	5,040	4,500	0	77,898
1,500-1,999	11,610	41,850	20,910	6,195	6,360	11,880	0	1,800	100,605
2,000-2,999	10,070	55,191	19,530	11,910	4,920	4,815	2,220	0	108,656
3,000-4,999	4,800	62,925	40,359	13,230	6,600	12,765	4,800	3,000	148,479
5,000-6,999	0	36,090	23,160	0	0	0	19,110	6,540	84,900
7,000-9,999	17,010	42,990	17,640	7,630	0	17,460	16,980	9,000	128,710
10,000-19,999	10,000	57,450	43,417	45,752	27,300	13,920	37,950	15,000	250,789
20,000 +	0	27,000	54,000	27,000	24,000	22,500	0	0	154,500
Total	65,645	408,690	251,724	139,356	83,351	102,393	96,431	35,880	1,183,470

Table A21.--Wisconsin Dairy Plants Grouped by Volume and by Volume Per Population Base[1/]

Volume 1,000 lb. per month	No organized town	1,000 lb. milk equivalent received by a plant per 100 community population											
		-4.9	5-9.9	10.0-19.9	20.0-29.9	30.0-49.9	50-99	100-199	200-299	300-499	500-999	1000 +	Total
						Number Plants							
Incomplete volume data:	11	0	0	0	0	0	0	0	0	0	0	0	248*
1-499	5	18	9	13	9	14	12	8	2	1	1	0	92
500-999	10	9	11	14	10	16	24	23	12	6	2	0	137
1000-1499	2	0	2	4	4	7	11	18	6	7	2	2	65
1500-1999	7	0	1	1	4	5	6	13	10	6	7	0	60
2000-2999	4	0	0	1	0	2	6	6	6	7	6	7	45
3000-4999	1	1	0	1	0	1	3	4	7	9	5	7	39
5000-6999	0	0	0	1	1	1	1	0	0	1	4	5	14
7000-9999	2	0	1	0	0	0	5	0	0	1	3	3	15
10000-19999	1	0	0	0	0	2	2	0	2	1	4	6	18
20000 & over	0	0	0	0	0	0	0	0	0	1	1	4	6
Total	43	28	24	35	28	48	70	72	45	40	35	34	739
						Volume 1,000 lb. per Month							
Incomplete volume data	0	0	0	0	0	0	0	0	0	0	0	0	0
1-499	1,515	4,559	2,946	3,819	3,095	4,815	3,945	2,985	720	315	465	0	29,179
500-999	8,300	6,480	7,155	10,490	7,350	12,180	16,590	15,399	9,270	5,070	1,470	0	99,754
1000-1499	2,340	0	2,100	4,950	4,650	8,559	13,404	21,495	7,170	8,700	2,460	2,070	77,898
1500-1999	11,610	0	1,800	1,560	6,720	8,310	9,345	22,560	17,220	9,660	11,820	0	100,605
2000-2999	10,070	0	0	2,220	0	4,815	14,430	14,610	14,640	16,320	15,120	16,431	108,656
3000-4999	4,800	3,000	0	4,800	0	3,600	12,165	16,830	23,904	33,795	17,745	27,840	148,479
5000-6999	0	0	0	6,540	6,150	6,000	6,960	0	0	5,700	24,150	29,400	84,900
7000-9999	17,010	0	9,000	0	0	0	41,940	0	0	7,630	25,860	27,270	128,710
10000-19999	10,000	0	0	0	0	28,350	24,600	0	24,420	16,800	58,652	87,967	250,789
20000 & over	0	0	0	0	0	0	0	0	0	22,500	24,000	108,000	154,500
Total	65,645	14,039	23,001	34,379	27,965	76,629	143,379	93,879	97,344	126,490	181,742	298,978	1,183,470

* Data did not permit volume-population comparison.

1/ A milk plant handling 225,000 pounds per month of milk per 100 community population would be responsible for approximately 50 percent of the total municipal treatment costs if using a joint plant-municipal system.

Table A22. Wisconsin Dairy Plants by Type and Volume 1/

Volume Group 1,000 pounds per month	Butter	Cheese	Cottage Cheese	Powder	Condensery	Concentrated Whey	Ice Cream	Fluid	Receiving or Transfer Station	Total All Plants 2/
	Number of Plants									
Incomplete Volume Data	12	23	15	25	12	13	65	103	35	248
1-499	7	82	0	2	1	0	0	3	5	92
500-999	8	130	0	0	0	0	0	5	5	137
1,000-1,999	11	112	0	4	0	1	0	11	14	125
2,000-2,999	4	40	0	1	2	1	1	10	8	45
3,000-4,999	11	30	1	6	3	1	1	17	10	39
5,000-6,999	1	9	0	5	4	3	1	9	8	14
7,000-9,999	5	5	0	5	3	3	1	10	7	15
10,000-19,999	6	9	0	8	1	5	1	7	9	16
20,000 & over	1	1	0	1	0	4	0	2	2	6
Total	66	441	16	57	26	31	70	177	103	739
	Volume, Milk Equivalent 1,000 Pounds Per Month									
1-499	2,280	26,014	0	780	360	0	0	1,140	1,578	29,179
500-999	5,930	94,244	0	0	0	0	0	3,990	3,870	99,754
1,000-1,999	16,530	158,949	0	6,000	0	1,560	0	17,805	21,534	[illegible]
2,000-2,999	9,840	96,591	0	2,400	5,400	2,841	2,700	24,261	18,[illegible]65	106,656
3,000-4,999	42,720	112,914	4,200	24,480	12,855	4,470	4,500	68,610	39,870	146,479
5,000-6,999	6,900	53,100	0	33,540	25,250	16,860	6,540	54,540	51,570	84,[illegible]
7,000-9,999	41,350	42,750	0	40,390	24,270	25,6[illegible]	8,760	85,810	61,920	[illegible]
10,000-19,999	94,839	123,409	0	124,297	14,100	67,920	12,000	106,239	132,339	[illegible]
20,000 & over	24,000	22,500	0	24,000	0	106,500	0	46,000	46,500	154,[illegible]
Total	244,389	730,471	4,200	256,187	82,275	225,801	34,500	410,395	377,846	1,183,470

1/ As licensed by Wisconsin State Department of Agriculture, 1972.
2/ In the total, each plant and its volume are counted only once, although there is duplication under type listings due to multi-product plants. Volume accounts for [illegible] percent of total State production.

Table [illegible]. [illegible] Disposal Methods Employed by Wisconsin Dairy Plants[1]

Volume group 1,000 milk equivalent per month	Ditch	Land	Hauled	Lagoon	Septic	Private plant	Municipal plant	Miscel-laneous	Total all plants[2]
	Number Plants								
Incomplete Volume Data	12	14	5	6	4	5	24	6	248
1-499	17	23	7	9	14	0	8	11	92
500-999	30	51	11	5	18	2	13	15	137
1,000-1,999	28	54	6	9	15	2	18	7	125
2,000-2,999	10	21	1	4	5	2	8	1	45
3,000-4,999	7	12	0	6	1	1	11	6	39
5,000-6,999	2	1	0	0	1	0	10	2	14
7,000-9,999	4	4	1	1	1	0	8	1	15
10,000-19,999	5	3	0	1	1	1	11	2	18
20,000 plus	0	1	0	2	0	0	3	1	6
Total	115	184	31	43	60	13	114	52	739
	Volume, 1,000 Pounds Milk Equivalent Per Month								
1-499	5,739	6,987	1,923	2,715	4,455	0	2,850	3,619	29,179
500-999	22,310	37,055	7,425	3,390	12,204	1,680	9,855	11,490	93,754
1,000-1,999	39,300	76,500	9,045	12,630	21,240	2,700	27,174	10,134	178,505
2,000-2,999	24,396	50,271	2,100	9,900	11,670	4,500	19,845	2,300	108,656
3,000-4,999	25,275	45,195	0	22,884	3,150	3,885	42,000	24,420	148,479
5,000-6,999	12,900	5,940	0	0	5,310	0	60,000	12,690	[illegible]
7,000-9,999	31,180	35,230	9,000	9,450	9,000	0	68,450	7,050	120,710
10,000-19,999	77,587	47,034	0	14,100	11,100	12,122	152,550	38,017	250,789
20,000 plus	0	27,000	0	57,000	0	0	78,000	22,500	154,500
Total	238,687	331,212	29,493	132,069	78,129	24,887	460,704	132,220	1,183,470

1/ Data from Wisconsin Department of Agriculture, 1972. Does not represent a complete listing of disposal methods.

2/ Total counts each plant licensed by Wisconsin Department of Agriculture only once. There is some duplication and some ommissions under type disposal.

Table A24 Comparison of Dairy Product Plants, and Production of Manufactured Dairy Products in Wisconsin, Vermont, and Oregon with the Total United States, 1965, 1970, 1971. Source, Production of Manufactured Dairy Products, Statistical Reporting Service U.S. Department of Agriculture.

	1971				1970				1965			
	U.S.	Wisc.	Vt.	Ore.	U.S.	Wisc.	Vt.	Ore.	U.S.	Wisc.	Vt.	Ore.
Manufacturing Plants												
Number of Plants Manufacturing dairy products	3,496	631	28	38	3,749	667	27	38				
Whole Milk Used In Manufactured Dairy Products												
Production 1,000 lbs.	61,489,861	13,395,216	597,225	612,637	59,124,176	12,919,244	503,254	561,013	61,726,832	13,940,081	366,477	430,760
% of U.S. Products	100.00	21.78	.97	1.00	100.00	21.85	.85	.95	100.00	22.58	.59	.70
Skim Milk Equivalents Calculated Quantities Used in Manufacturing Specified Dairy Products From Skim Milk												
Production 1,000 lbs.	24,186,080	3,036,006	461,362	231,920	24,349,837	3,058,533	475,084	208,300	30,142,840	5,560,976	405,382	135,871
% of U.S. Products	100.00	12.55	1.91	.99	100.00	12.56	1.95	.86	100.00	18.45	1.34	.45
Butter												
Number Plants	524	61	5	16	622	74	5	16	1,152	130	6	23
Production 1,000 lbs.	1,143,557	202,320	11,627	14,198	1,373,020	198,832	9,337	12,505	1,322,825	290,188	7,406	8,883
Av. Prod. 1,000 lbs.	2,182	3,317	2,325	887	2,207	2,627	1,867	782	1,148	2,232	1,234	386
% of U.S. Products	100.00	17.69	1.02	1.24	100.00	14.48	.68	.91	100.00	21.94	.56	.67
Cheese Total												
Number Plants	920	458	14	6	963	481	16	6	1,207	633	12	20
Production 1,000 lbs.	2,372,504	986,369	35,143	18,820	2,201.428	947,591	32,730	16,428	1,755.528	770,398	21,301	18,099
Av. Prod. 1,000 lbs.	2,579	2,154	2,510	3,137	2,286	1,970	2,046	2,738	1,454	1,217	1,775	905
% of U.S. Products	100.00	41.48	1.48	.79	100.00	43.04	1.49	.75	100.00	43.88	1.21	1.03

Table A24 Cont'd — Comparison of Dairy Product Plants, and Production of Manufactured Dairy Products in Wisconsin, Vermont, and Oregon with the Total United States, 1965, 1970, 1971. Source, Production of Manufactured Dairy Products, Statistical Reporting Service U.S. Department of Agriculture.

	1971				1970				1965			
	U.S.	Wisc.	Vt.	Ore.	U.S.	Wisc.	Vt.	Ore.	U.S.	Wisc.	Vt.	Ore.
Cheese, American												
Number Plants	636	350	8	6	669	368	8	6	865	481	5	20
Production 1,000 lbs.	1,510,622	671,417	15,057	18,579	1,423,399	652,340	12,203	16,120	1,158,380	519,921	9,013	17,942
Av. Prod. 1,000 lbs.	2,375	1,918	1,882	3,096	2,128	1,773	1,525	2,687	1,339	1,081	1,803	897
% of U.S. Products	100.00	44.45	1.00	1.23	100.00	45.83	.86	1.13	100.00	44.88	.78	1.55
Cheese, Cheddar												
Number Plants	553	312	6	6	587	330	6	6	806	464	4	20
Production 1,000 lbs.	1,224,884	579,722	14,697	18,110	1,182,386	569,850	11,574	15,720	1,006,658	482,011	8,382	16,928
Av. Prod. 1,000 lbs.	2,215	1,858	2,450	3,018	2,014	1,727	1,929	2,620	1,249	1,039	2,096	846
% of U.S. Products	100.00	47.33	1.20	1.48	100.00	48.20	.98	1.33	100.00	47.88	.83	1.68
Cheese, Italian												
Number Plants	194	60	7	0	197	66	9	0	179	60	6	0
Production 1,000 lbs.	453,021	165,566	19,022	0	393,668	154,343	18,169	0	244,480	118,615	10,820	0
Av. Prod. 1,000 lbs.	2,335	2,759	2,717	0	1,998	2,339	2,019	0	1,366	1,977	1,804	0
% of U.S. Products	100.00	36.55	4.20	0	100.00	39.21	4.62	0	100.00	48.52	4.43	0
Cheese, Other Specified Types												
Number Plants	215	97	3	3	219	101	3	3				
Production 1,000 lbs.	285,738	91,695	360	469	241,013	82,490	629	400				
Av. Prod. 1,000 lbs.	1,329	945	120	156	1,101	817	210	133				
% of U.S. Products	100.00	32.09	.13	.16	100.00	34.23	.26	.17				

Table A24 (cont'd) Comparison of Dairy Product Plants, and Production of Manufactured Dairy Products in Wisconsin, Vermont, and Oregon With the Total United States, 1965, 1970, 1971. Source, Production of Manufactured Dairy Products, Statistical Reporting Service U.S. Department of Agriculture.

	1971				1970				1965			
	U.S.	Wisc.	Vt.	Ore.	U.S.	Wisc.	Vt.	Ore.	U.S.	Wisc.	Vt.	Ore.
Cottage Cheese, Curd.												
Number Plants	548	20	5	15	593	19	6	15	914	33	7	18
Production 1,000 lbs.	742,444	39,971	18,539	12,167	726,338	39,437	20,324	11,738	627,061	42,154	16,267	8,390
Av. Prod. 1,000 lbs.	1,355	1,999	3,708	811	1,225	2,076	3,387	786	686	1,277	2,324	466
% of U.S. Products	100.00	5.38	2.50	1.64	100.00	5.43	2.80	1.62	100.00	6.72	2.59	1.34
Cottage Cheese, Creamed.												
Number Plants	539	16	4	17	583	17	5	16	912	28	6	19
Production 1,000 lbs.	1,003,422	54,236	15,946	18,339	978,452	54,020	19,522	17,368	837,133	48,216	14,481	12,494
Av. Prod. 1,000 lbs.	1,862	3,390	3,986	1,079	1,678	3,178	3,904	1,086	918	1,722	2,414	658
% of U.S. Products	100.00	5.40	1.59	1.83	100.00	5.52	2.00	1.78	100.00	5.76	1.73	1.49
Condensed Milk, Bulk Foods, Unsweetened, Skinned												
Number Plants	153	16	4	0	162	20	4	0	238	18	4	0
Production 1,000 lbs.	953,028	184,122	25,287	0	921,108	153,766	20,712	0	899,858	113,499	4,112	0
Av. Prod. 1,000 lbs.	6,229	11,508	6,322	0	5,686	7,688	5,178	0	3,781	6,306	1,028	0
% of U.S. Products	100.00	19.32	2.65	0	100.00	16.69	2.25	0	100.00	12.61	.46	0
Evaporated and Condensed, Case Goods, Whole.												
Number Plants	39				46				59	6		
Production 1,000 lbs.	1,268,086				1,268,325				1,692,974	100,694		
Av. Prod. 1,000 lbs.	32,515				27,572				28,694	16,782		
% of U.S. Products	100.00				100.00				100.00	5.95		

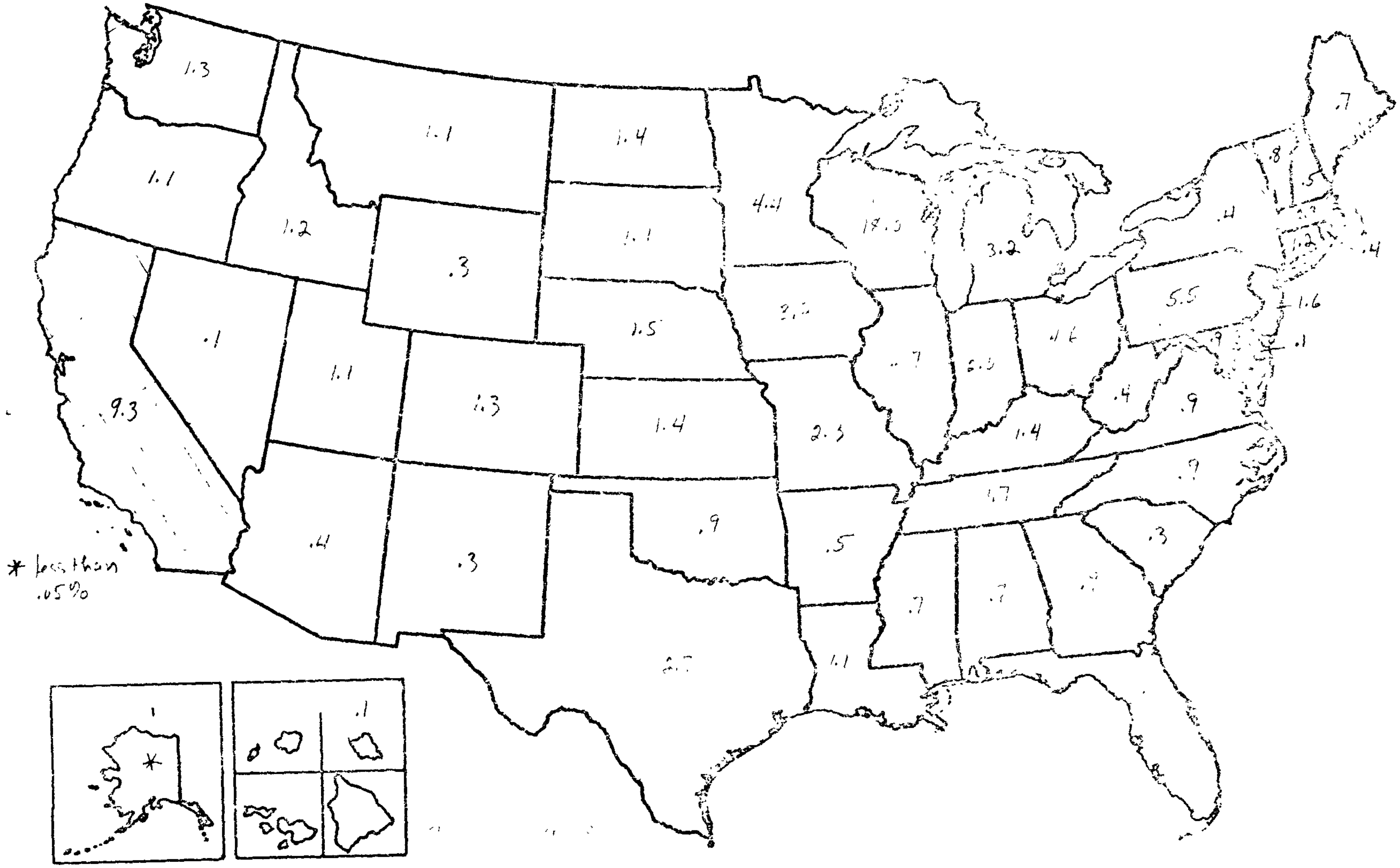
Table A24 Cont'd Comparison of Dairy Product Plants, and Production of Manufactured Dairy Products in Wisconsin, Vermont, and Oregon with the Total United States, 1965, 1970, 1971. Source, *Production of Manufactured Dairy Products, Statistical* Reporting Service U.S. Department of Agriculture.

	1971				1970				1965			
	U.S.	Wisc.	Vt.	Ore.	U.S.	Wisc.	Vt.	Ore.	U.S.	Wisc.	Vt.	Ore.
Non-Fat Dry Milk for Human Food, Spray and Roller												
Number Plants	190	22	4	1/	219	28	3	3	307	51	3	0
Production 1,000 lbs.	1,417,648	181,100	23,786		1,444,360	186,677	25,275	9,036	1,916,686	414,247	24,352	0
Av. Prod. 1,000 lbs.	7,461	8,232	5,946		6,595	6,667	8,425	3,012	6,243	8,122	8,117	0
% of U.S. Products	100.00	12.78	1.68		100.00	12.92	1.75	.63	100.00	21.61	1.27	0
Non-Fat Dry Milk for Animal Feed.												
Number Plants	126	13	3	1/	141	16	3	3				
Production 1,000 lbs.	11,396	842	108		11,674	860	241	483				
Av. Prod. 1,000 lbs.	90	65	36		83	54	80	161				
% of U.S. Products	100.00	7.39	.95		100.00	7.37	2.06	4.14				
Dry Whey, Total												
Number Plants	120	32	0	0	117	33	0	0				
Production 1,000 lbs.	679,447	332,884			621,031	292,981						
Av. Prod. 1,000 lbs.	5,662	10,403			5,308	8,878						
% of U.S. Products	100.00	48.99			100.00	47.18						
Condensed Whey												
Number Plants	35	18			36	18						
Production 1,000 lbs.	286,922	190,873			225,102	151,553						
Av. Prod. 1,000 lbs.	8,198	10,604			6,253	8,420						
% of U.S. Products	100.00	66.52			100.00	67.33						

Table A24 Cont'd Comparison of Dairy Product Plants, and Production of Manufactured Dairy Products in Wisconsin, Vermont, and Oregon with the Total United States, 1965, 1970, 1971. Source, Production of Manufactured Dairy Products, Statistical Reporting Service U.S. Department of Agriculture.

	1971				1970				1965			
	U.S.	Wisc.	Vt.	Ore.	U.S.	Wisc.	Vt.	Ore.	U.S.	Wisc.	Vt.	Ore.
Ice Cream - Total												
Number Plants									12,595	318	41	249
Production 1,000 lbs.	767,530	20,010	174	6,826	761,732	21,411	128	6,617	757,047	25,103	393	6,243
Av. Prod. 1,000 lbs.									60	79	10	25
% of U.S. Products	100.00	2.61	.02	.89	100.00	2.81	.02	.87	100.00	3.32	.05	.82
Ice Cream Mix												
Number Plants	1,178	41	6	25	1,258	41	4	24				
Production 1,000 lbs.	395,441	10,049	239	3,537	388,656	10,945	204	3,421				
Av. Prod. 1,000 lbs.	336	245	40	141	309	267	51	143				
% of U.S. Products	100.00	2.54	.06	.89	100.00	2.82	.05	.88				

Figure 4 Number of Dairy Plants Manufacturing One or More Dairy Products, as Percent of U.S. Total, 1971



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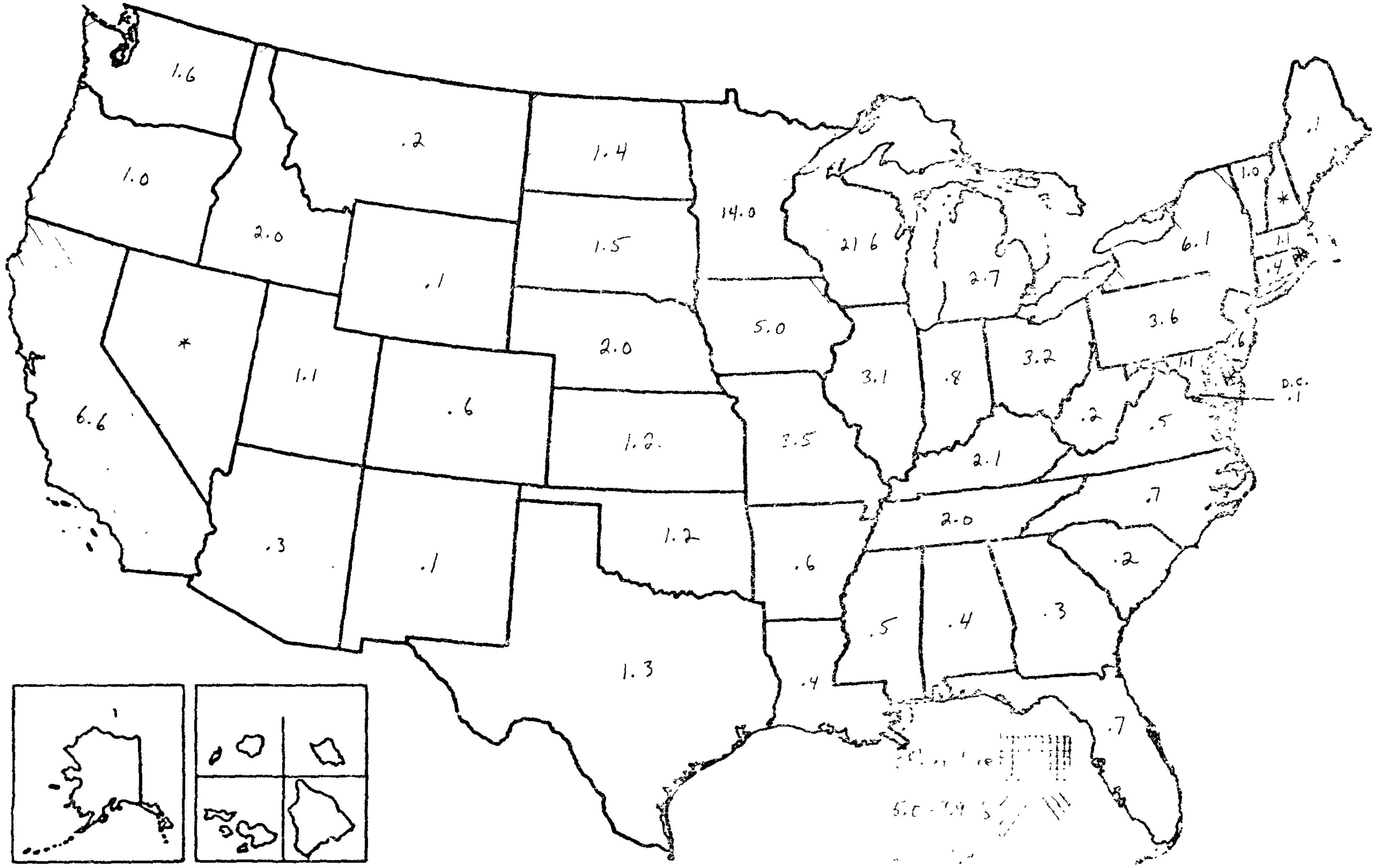
"2-62"

Figure 5   Whole Milk Used in Manufactured Dairy Products, as Percent of U.S. Total, in Milk Equivalents, 1971



AD-401.1

"2-62"

Figure 6 Butter Production, as Percent of U.S. Total, 1971

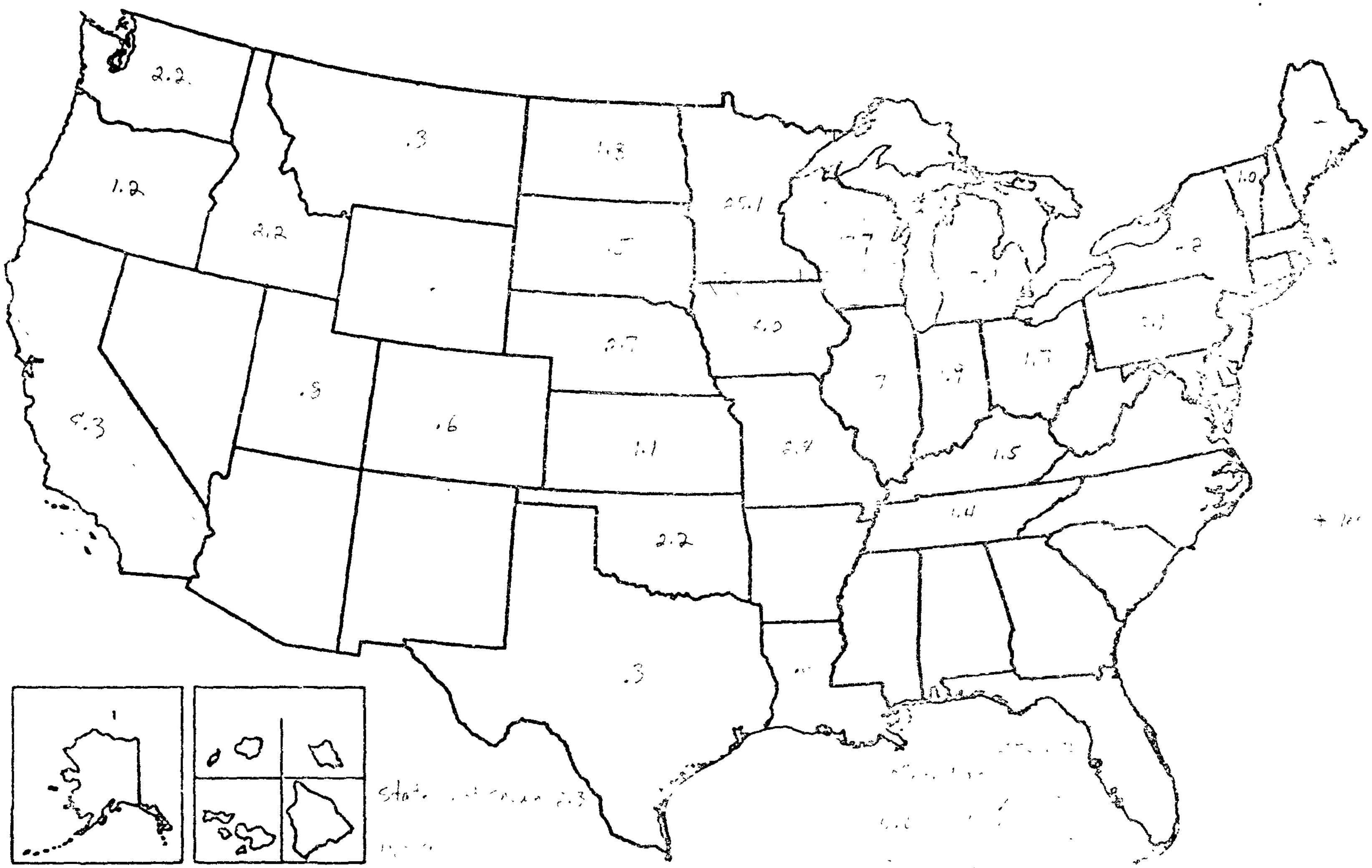
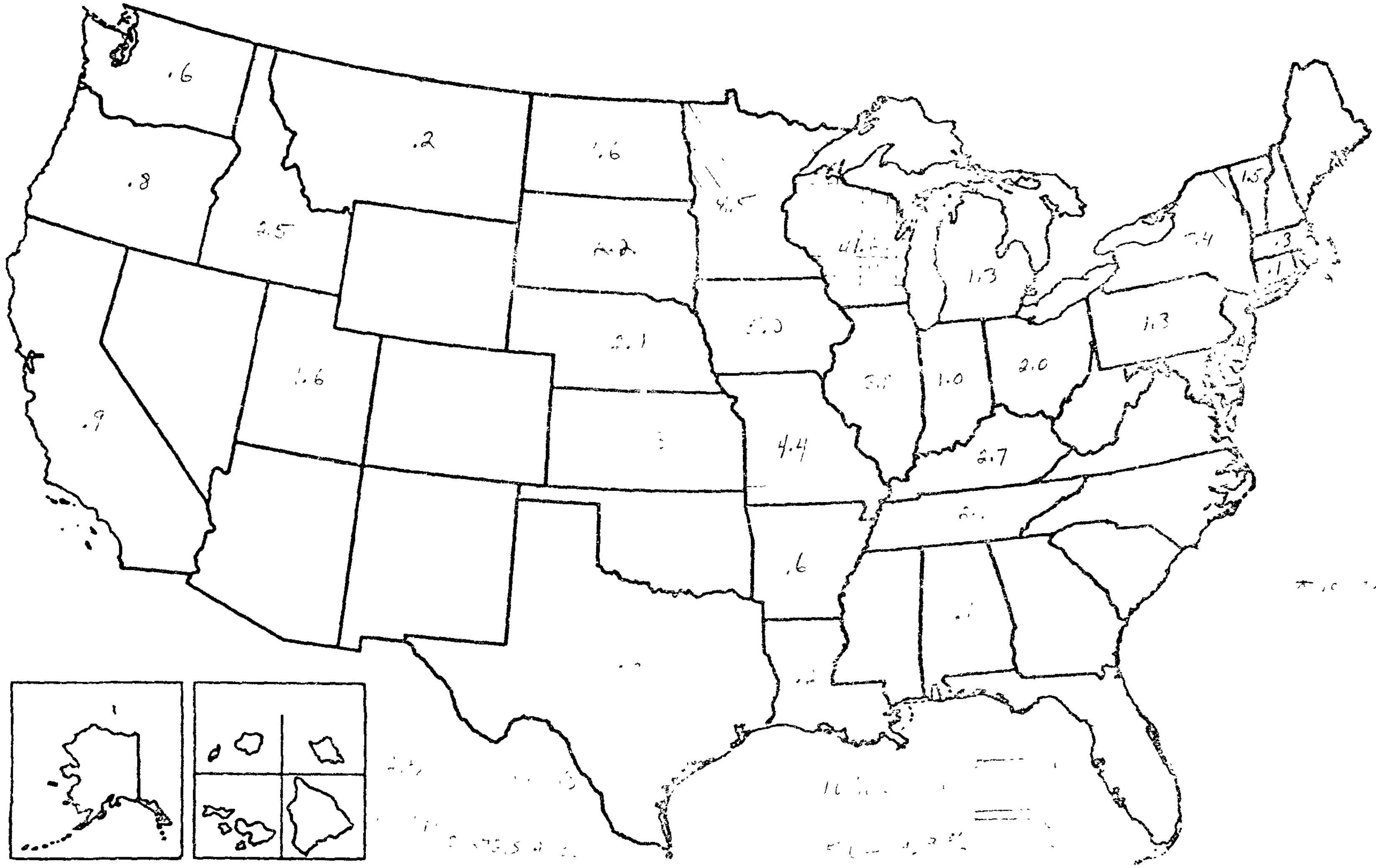


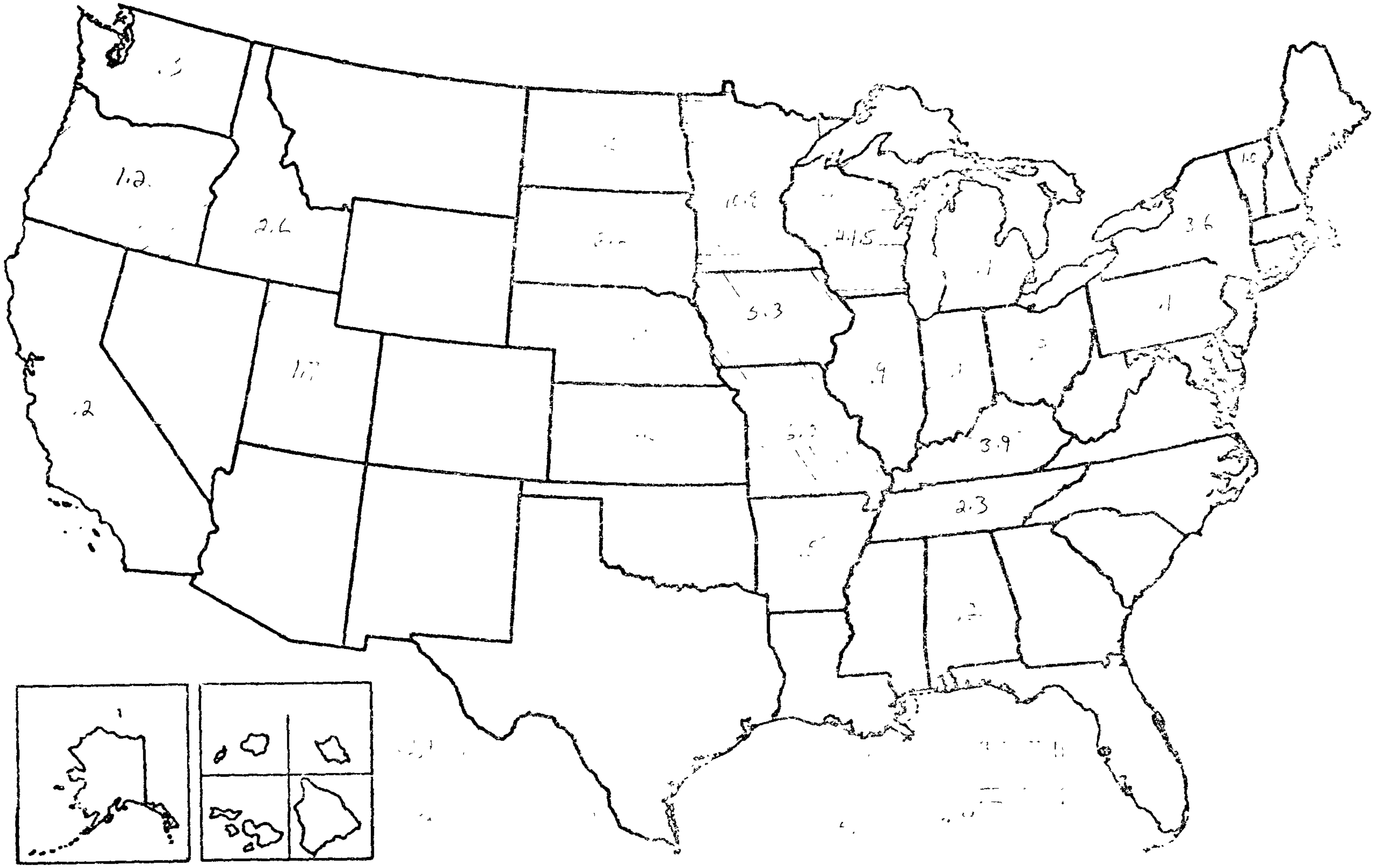
Figure 7 Total Cheese, Excluding Full-skim American and Cottage, as Percent of U.S. Total, 1971



AD-401.1

"2-62"

Figure 8 American Cheese Made From Whole Milk as Percent of U.S. Total, 1971



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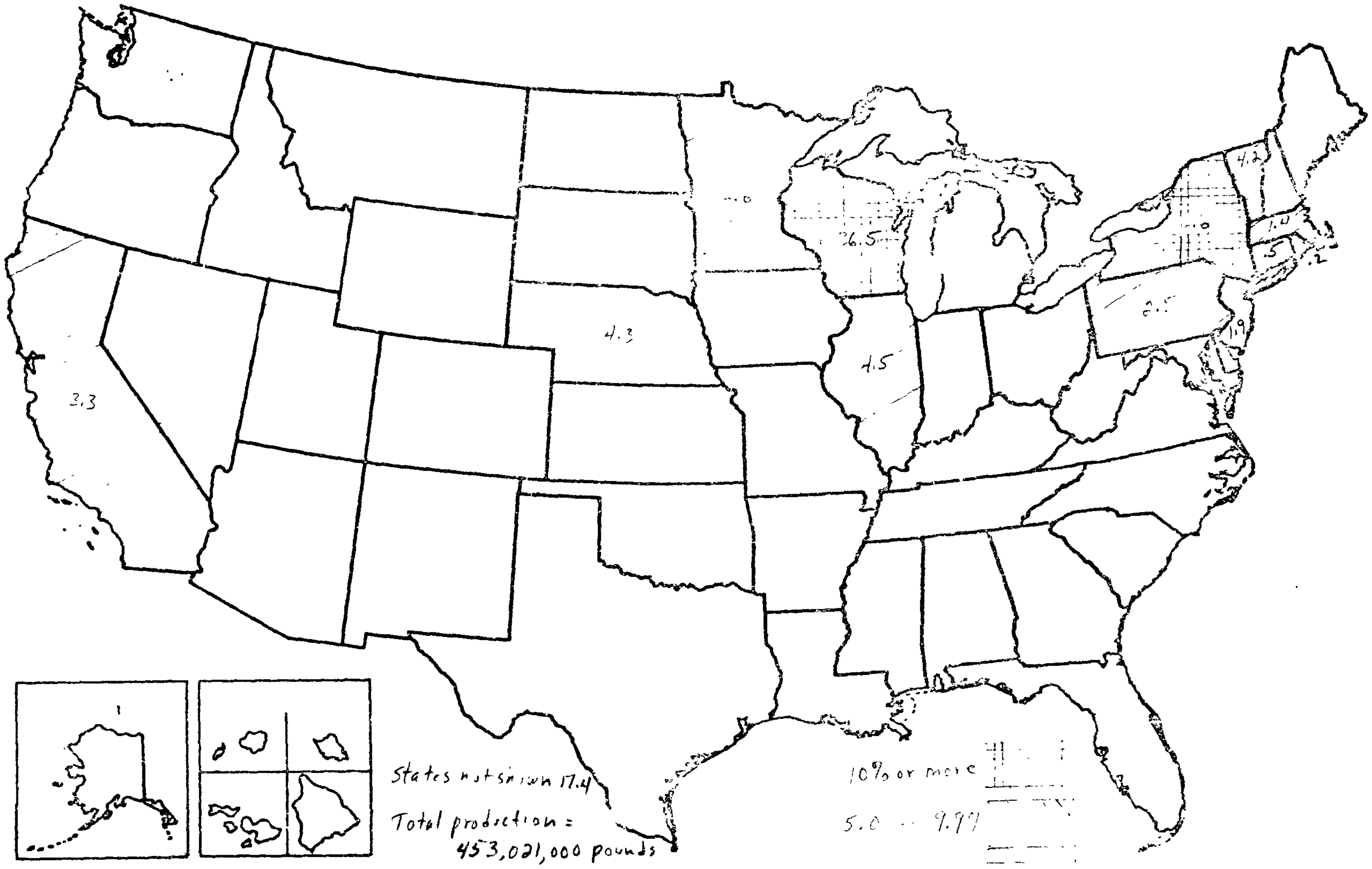
U.S. Total, 1971



10% or more

5.0 - 9.9%

3.0 - 4.9%

1.0 - 2.9%

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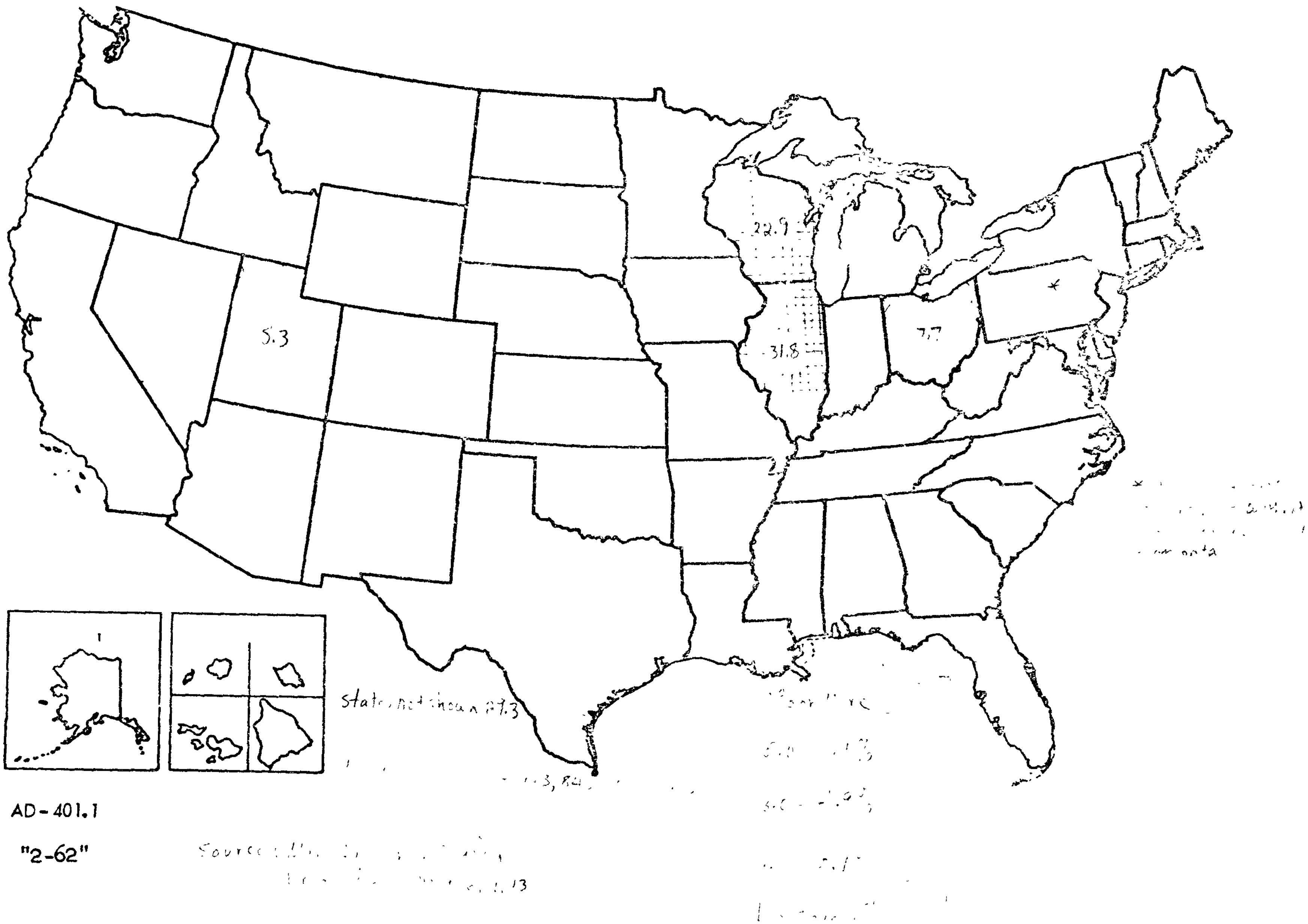
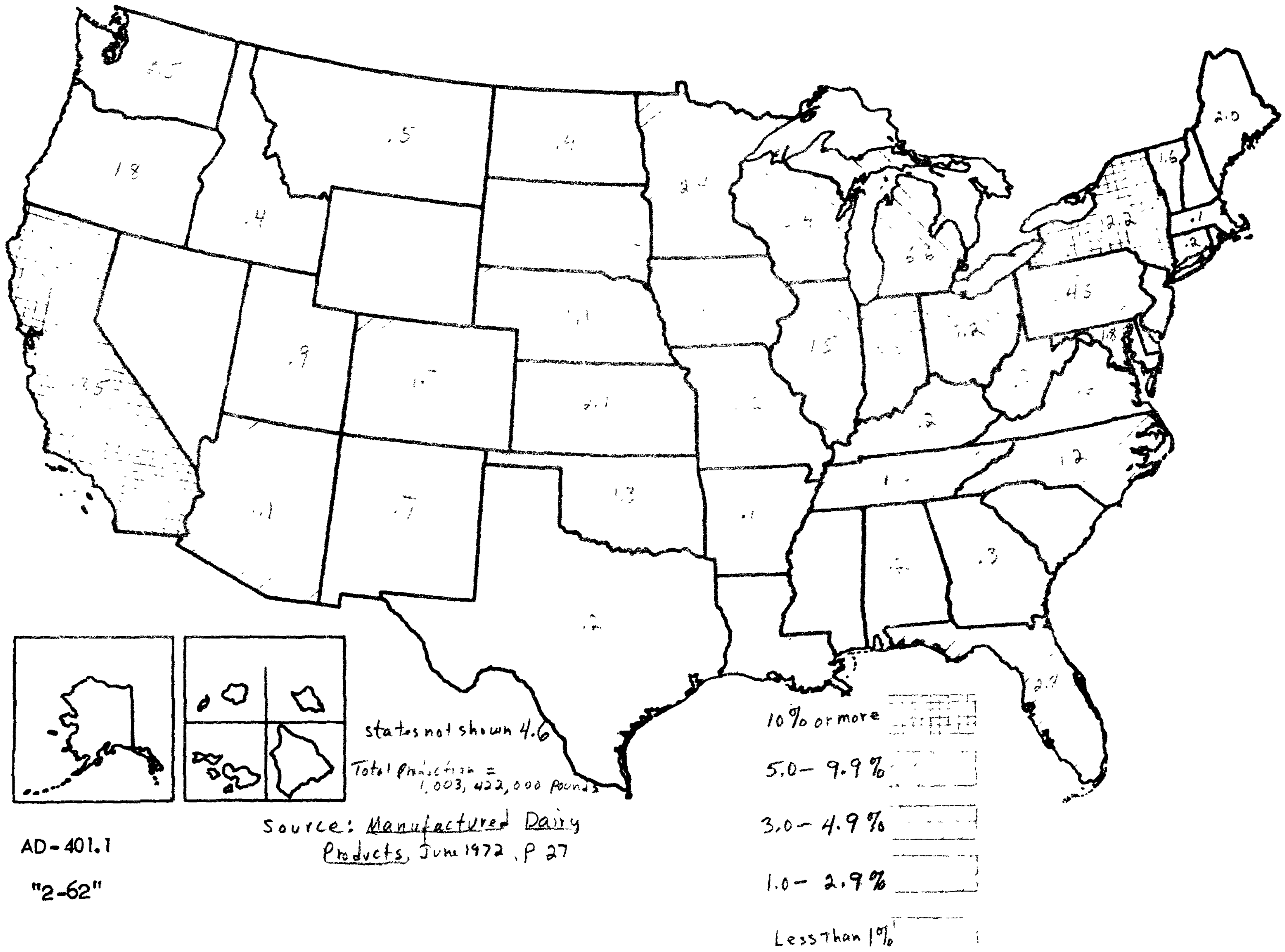
"2-62"

Source: Manufactured Dairy Products, June 1972, p. 21

U.S. Total, 1971

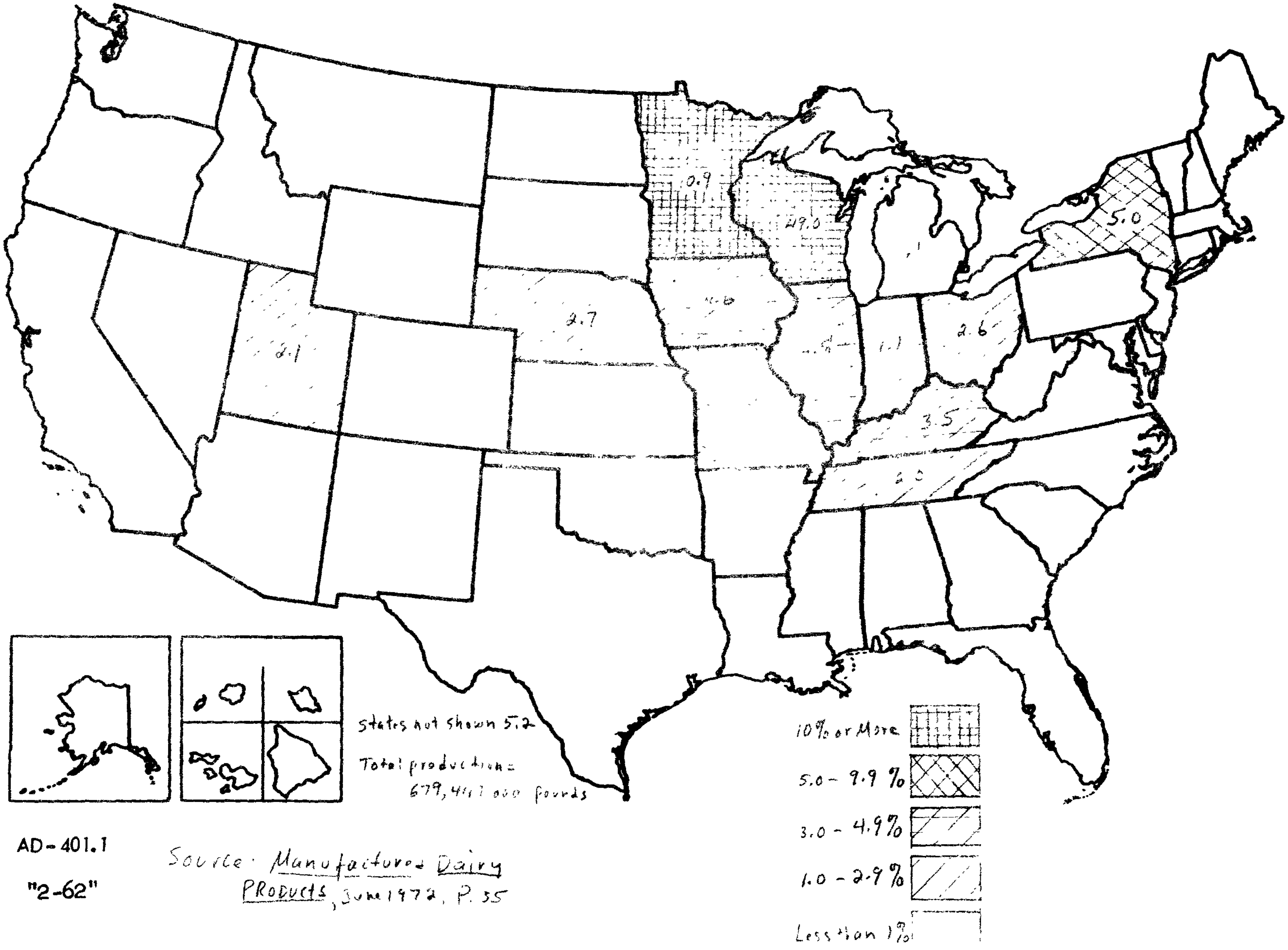



states not shown 4.6
Total production = 1,003, 422,000 pounds
Source: Manufactured Dairy Products, June 1972, P 27
10% or more
5.0– 9.9%
3.0– 4.9%
1.0– 2.9%
Less than 1%

AD-401.1

"2-62"

Figure 12 Total Dry Whey, as Percent of U.S. Total, 1971



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"2-62"

Source: Manufactured Dairy PRODUCTS, June 1972, P. 35

[illegible]
Region [illegible]
230 S [illegible]
C[illegible]