ABSTRACT

MICHAEL WAYNE WEIMAR for the degree of MASTER OF SCIENCE in AGRICULTURAL ECONOMICS presented on May 26, 1976

Title: SANITATION PROCEDURES, COSTS AND MANAGEMENT PRACTICES OF FOUR OREGON RETAIL FOOD STORES

Abstract approved by: Harvey A. Meier

The main objective of this study was to provide more information on the costs, procedures and management practices of sanitation programs in retail food stores. The specific objectives were to: (1) identify and evaluate current procedures and problems associated with cleaning and sanitizing all areas of retail food stores; (2) develop comparative labor, service, equipment, and supply cost data for existing sanitation procedures in retail food stores; (3) identify and analyze current retail food store sanitation management practices; and (4) develop recommendations for improving sanitation procedures and management practices, and for controlling sanitation program costs in retail food stores.

Four Oregon retail food stores were surveyed in this research. Interviews with departmental managers were utilized to identify existing sanitation procedures. Personal observations were made of

sanitation management practices executed in each of the four surveyed stores. Sanitation cost data were developed using several methods. The work sampling technique provided a basis for determining the proportion of total weekly departmental man-hours devoted to sanitation activities. Data on costs of sanitation services were obtained from store accounting records. Store management provided estimates of both the weekly usage of sanitation supplies and the useful life of sanitation equipment. Supply and equipment prices were obtained from suppliers or from the prices marked on those items obtained from the stores' display shelves.

Sanitation procedures were rated on a comparative basis with recommendations established by Project Consumer Concern, a joint venture of the United States Department of Agriculture and the National Association of Retail Grocers of the United States. Sanitation management practices were evaluated for each department on the basis of Project Consumer Concern recommendations, other research studies, and state sanitation regulations.

Cross-classification tables were constructed to permit analysis by department of relationships between employee position and sanitation man-hours, sanitation time as a percent of total man-hours, and sanitation wage costs. Additional cross-classification tables were constructed to analyze sanitation equipment, supply, labor, and service cost differences among and between departments of each store surveyed.

Sanitation management practices were being followed by all four surveyed stores. However, problems did exist with the four classified areas; product management, temperature control, pest control, and employee hygiene. Of these four areas, temperature control problems were most prevalent such as refrigerated display cases observed filled beyond their load lines.

Overall, Store B was assigned the highest weighted average rating for total store sanitation procedures among the four stores surveyed. This could be attributed to its formal store-wide sanitation program. Store D's meat department also followed a formal sanitation program and its rating was the highest among all four meat departments. This suggests that formal sanitation programs are more apt to result in the establishment, implementation and follow through with sanitation procedures designed to meet recommended sanitation procedures compared to informal sanitation programs.

The proportion of total departmental man-hours devoted to sanitation activities ranged from 3.33% in Store D to 8.18% in Store B. In general, a larger proportion of departmental man-hours was spent on sanitation activities in meat and bakery departments compared to the grocery and produce departments.

The estimated weekly total store sanitation costs ranged from

$452.83 in Store A to $1,219.76 in Store C. Most of the sanitation costs among the four surveyed stores were accounted for by departmental labor exclusive of Store D, whose in-store janitorial service accounted for the largest portion. Two major implications surfaced from this finding: (1) Store D's in-store janitorial service staff constituted part of the overall merchandising strategy in terms of enhancing the appearance of the store in addition to performing sanitation activities performed by the departmental employees of the other three surveyed stores; and (2) meat and produce department employees of Store D used specialized equipment which appeared to reduce sanitation man-hours compared to the other three surveyed stores.

Total store sanitation costs as percentages of total store sales for all four stores averaged 1.14%. It appeared that higher total store sanitation costs accompanied higher total store sales volumes. This relationship also appeared to be dependent upon total employee man-hours.

Sanitation Procedures, Costs and Management Practices of Four Oregon Retail Food Stores

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SANITATION PROCEDURES, COSTS AND MANAGEMENT PRACTICES OF FOUR OREGON RETAIL FOOD STORES

I. INTRODUCTION

Delineation of the Problem

In recent years, regulatory agencies at the federal, state, and local community levels concerned with food sanitation have increased their emphasis on protecting the quality and safety of foods available to consumers. As a result, the entire food industry has become subject to compliance with more stringent regulatory sanitation standards.

Retail food stores constitute an important segment of the food industry. These establishments merchandise many lines of dry groceries such as breakfast cereals, flour, and sugar which are subject to rodent infestation. In addition, they also sell highly perishable foods such as meat, produce, bakery, frozen food, and dairy products. In order to maintain the quality and safety of food products offered for sale, retail food stores are required by law to maintain sanitary conditions throughout their establishments.[1] To a large extent, these conditions can be achieved when store employees follow proper

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[1] The Federal Food, Drug, and Cosmetic Act of 1938 serves as the basis for regulatory control of the wholesomeness and safety of food to American consumers. This act has served as a precedent for regulatory action which is now being applied to a wide range of food businesses such as food retailers, wholesalers, and manufacturers.

preparation, storage, handling, and sanitation procedures.

Research reveals that most Americans believe food purchased in retail food stores is wholesome to the extent of being in sound condition, clean and free from adulteration; and therefore, fit for human consumption. For example, a 1972 consumer opinion survey conducted by the Food and Drug Administration (FDA) revealed that 78 percent of the respondents were definitely or reasonably sure that food they purchased from establishments such as retail food stores was wholesome and safe for their families to eat (Simon and Kuehl, 1973).

However, recent studies and observations made by enforcement agencies and researchers have revealed that some food while at the retail food store becomes unwholesome or is stored under insanitary conditions. For example, a charge of holding food under insanitary conditions was prompted by an FDA inspection of a Nashville, Tennessee supermarket in January 1974. Rodent contamination of candy bars and sugar was discovered, which resulted in the seizure of these products (FDA Consumer, April 1974). Similar enforcement actions have been executed by the Dairy and Consumer Services Division of the Oregon Department of Agriculture (Oregon Department of

Agriculture, Consumer Protection, monthly publication).[2]

Much of the concern for the safety of food in retail food stores has focused on fresh meat products. Several reasons account for this concern. First, unlike many food products such as dry groceries which are delivered to a store prepackaged in retail form, fresh meat often is delivered in wholesale form such as a carcass or as boxed primal and sub-primal cuts. The meat then is usually processed at store level. Today's fresh meat processing techniques require store employees to handle the product several times before it is packaged. Typical handling practices are cutting, cubing, grinding, trimming, and wrapping. The more frequently fresh meat is handled, the greater is its potential for becoming contaminated with microorganisms. Moreover, microorganisms are capable of rapid growth rates on fresh meat products.

Second, research investigating the extent of microbial contamination in meat departments of retail food stores has measured the level of microorganisms on such items as walls and equipment, and

[2] A sanitation inspection program for Oregon retail food stores is conducted by the Dairy and Consumer Services Division of the Oregon Department of Agriculture. Sanitarians of this Division serve as the law enforcement officers. They conduct regular inspections of retail food stores and investigate consumer complaints of contaminated food products purchased at retail food stores. These complaints are received by the consumer officer of the department. Laboratory technicians of the department analyze food samples that inspectors purchase from retail food stores. Meat products are especially sampled and analyzed for bacterial levels.

in air and sawdust (Nauman et al., 1965). The findings of this research revealed that meat processing equipment often is contaminated with microorganisms. Therefore, microbial contamination of meat tends to exist whenever it comes in contact with processing equipment surfaces. While this study did not reveal the type of microorganisms analyzed, other studies have proven the presence of pathogenic bacteria in meat purchased at retail food stores.[3]

For example, a study was conducted to analyze the bacteriological quality of raw refrigerated ground beef purchased in retail food stores (Duitschaever, 1973). This analysis revealed that 98% of the samples had an average plate count of 1000 per gram staphylococci and 95% of the samples had a coliform count greater than 100 per gram. In addition, 37% of the samples contained coaglase-positive staphylococci. However, no salmonellae were detected. The study concluded that "Generally, the quality (of raw refrigerated ground beef) was similar to that reported in previous investigations dating as far back as 1914. This may indicate a need for a thorough examination of the practices used in handling of meat from the abattoir [slaughterhouse] to the consumer" (Duitschaever, 1973, p. 377). Other studies revealed the presence of salmonella in meat and poultry

[3] Pathogenic bacteria are bacteria which cause human illness and disease. Salmonella, staphylococcus, and clostridium perfrigens are food-borne pathogens.

products obtained at retail food stores (Ladiges, 1974; Messer, 1970; Morris, Dunn, 1970; Weisman, Carpenter, 1969).[4]

The state of Oregon has been a leader in establishing more stringent sanitation regulations and standards as applied to retail food stores. A revision of the Meat Inspection Act in 1973 established new bacterial standards for fresh, frozen, and processed meat (Oregon Administrative Rules Compilation, 1974). These standards became effective in May, 1973. This revision resulted from recommendations made by a microbiological survey committee which had evaluated the analytical results of luncheon meat and fresh meat samples purchased from selected retail food stores. The newly established meat bacterial standards were developed to: (1) enhance consumer health protection practices; (2) improve the quality of meat made available for purchase by Oregon consumers; and (3) improve and/or maintain existing meat handling practices.

Other regulatory legislation included Oregon's Open Dating Law which became effective in July 1974 (Oregon Administrative Rules Compilation, 1975). This law requires that an uncoded pull or packaging date be marked on all perishable products with a projected shelf life of 30 days or less. The purposes of this law were to provide

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[4] Salmonella are bacteria which can multiply in the gastrointestinal tract and cause the food-borne illness, salmonellosis that is characterized by nausea, vomiting and diarrhea. An FDA estimate attributes 100 human deaths in the United States to salmonellosis in 1970.

consumers with improved information on product freshness and to enable retail food stores to more effectively control their inventory of products offered for sale (Carl, 1975).

At the national level, the FDA has developed a model sanitation ordinance for retail food stores (Bower, 1975). This model ordinance has several purposes. One is to provide uniform sanitation standards for retail food stores between states so that chain operations with stores in more than one geographic location would have only one set of sanitation standards to follow for all of their stores. Second, many states do not have laws specifically dealing with retail food store sanitation.

Cognizant of these observations, the increasing emphasis being placed on food stores to provide consumers with a more wholesome, sanitary, and safe food supply, a joint committee of the United States Department of Agriculture (USDA) and the National Association of Retail Grocers of the United States (NARGUS) was established in 1972. This joint venture, known as "Project Consumer Concern," was initiated to study retail food store sanitation practices and to develop a supermarket sanitation program. Project Consumer Concern resulted in the development of sanitation guidelines and checklists for instituting a voluntary store-wide sanitation program (USDA-NARGUS, 1973). Moreover, the purpose of Project Consumer Concern was to enable retail food stores to meet wholesome food requirements and regulatory sanitation standards, and to assure their customers that the food products they purchased have been carefully handled and maintained in the best possible condition by store employees.

Those involved with various aspects of food sanitation have argued that proper and/or improved sanitation practices in retail food stores will contribute to reducing incidences of food-borne illnesses and will benefit consumers with a more wholesome and safe food supply. Concomitantly, regulatory agency emphasis on the prevention of food-borne illnesses via proper sanitation practices in retail food stores can be expected to continue to increase. For many store operators, this implies potential changes in their current policies and procedures relating to total store sanitation. Moreover, increased operating costs may result as more comprehensive sanitation programs are implemented to meet the demands of more stringent regulatory sanitation standards.

Presently, there is a lack of information on the costs and problems of existing sanitation procedures and practices in retail food stores. While several retail food stores in the United States have initiated formal total store sanitation programs in response to increased regulatory enforcement action, detailed information concerning the costs and problems associated therewith have not been established. In order for regulatory agencies to assess the economic impact of new and more stringent regulatory sanitation standards and for retail food store management to evaluate the costs of implementing more comprehensive sanitation programs, it is necessary to determine and analyze the costs and problems of existing sanitation procedures and practices. This constitutes the primary focus of the present research.

Once existing costs have been identified it then becomes possible to determine the additional costs associated with implementing more comprehensive sanitation programs and/or regulatory standards. The findings of this study should provide both retail food store senior executive management and store managers with information useful for managing existing and improved store-wide sanitation programs.[5] Implementation of sanitation procedures and management practices recommended by this study and by Project Consumer Concern should benefit the consuming public with a more wholesome and safe food supply. Furthermore, this study should provide regulatory agencies with information on sanitation costs incurred by retail food stores to comply with new sanitation regulations and standards such as those now in effect in Oregon. For example, the information developed on

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[5] In this study senior executive management refers to persons such as company presidents down to regional managers. A store manager is the person responsible for the operation of a particular store. Store management would include the store manager as well as those persons responsible for managing departments within a store.

meat department sanitation costs for the four surveyed stores in this study should give federal and state regulatory agencies an indication of the magnitude of sanitation costs associated with operating a meat department within the new legal limits of microbial standards in Oregon.

Objectives of the Study

The major objective of this study was to develop more information on the procedures, costs, and management practices of sanitation programs in retail food stores. The specific objectives were to: (1) identify and evaluate current procedures and problems associated with cleaning and sanitizing all areas of retail food stores; (2) develop comparative labor, supply, equipment, and service cost data for existing procedures in retail food stores; (3) identify and analyze current retail food store sanitation management practices; (4) develop recommendations for improving sanitation procedures and management practices, and for controlling sanitation program costs in retail food stores.

General Procedures

Four Oregon retail food stores were surveyed in this research. Two stores were chain operations and two were independently owned. Two of the stores had weekly sales volumes ranging between $40,000 and $60,000 while the other two had weekly sales volumes ranging from $90,000 to $110,000.

Store management and departmental employees were personally interviewed to identify the current sanitation procedures used in cleaning and sanitizing all areas of each store. Each store's sanitation management practices were observed independently over a seven-day period. Several methods were utilized to collect cleaning and sanitizing cost data for each store. Data on the costs of sanitation services such as laundry, janitorial, and waste disposal were obtained from accounting records. Store management provided estimates of the weekly usage of sanitation supplies such as detergents, sanitizers, and meat case soaker pads. Estimates on the longevity of sanitation equipment such as mops, mop buckets, and brooms also were obtained from store management. Labor cost data were developed using hourly wage rate schedules, weekly labor schedules and by means of a commonly used industrial engineering estimation technique known as work sampling.[6] The work sampling technique

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[6] Work sampling is a technique used to estimate the proportion of an individual's or group's time spent on separate and defined work activities.

In order to define the activities for the work sampling process in this study, flow process analysis was used. Flow process analysis, another industrial engineering technique, is a schematic diagram of the flow of people or materials from one designated point to another (Barnes, 1968).

provided a basis for determining the proportion of total weekly departmental man-hours devoted to sanitation activities in each store. Work sampling data were collected over a continuous seven-day period in each of three stores and for two separate weeks in the fourth store.

Microbial examinations of in-store food processing equipment, selected food products, and storage facilities were not conducted as part of this study. This was deemed beyond the scope of this study because of the complexity involved in this research with first determining existing sanitation costs, procedures, management practices, and problems associated with store-wide sanitation programs.

The procedures used to clean and sanitize equipment and surfaces in all areas of each store by department were ranked on the basis of being the same, above, or below those recommended by Project Consumer Concern. Sanitation management practices were evaluated by department following the recommendations of Project Consumer Concern, other research studies, and state sanitation regulations. When possible, deviations relating to each store's procedures and management practices were identified. These problems were analyzed to identify possible causal factors.

Cross-classification tables were constructed to permit analysis by department of relationships between employee position and sanitation man-hours, sanitation labor time as a percent of total labor time, and sanitation wage costs. These tables were prepared by department for each store surveyed. Additional cross-classification tables were constructed to analyze sanitation equipment, supply, labor, and service cost differences among and between each department of each store surveyed.

Finally, statistical tests of the average proportion of man-hours devoted to sanitation were made to identify the presence of any significant differences among the stores surveyed and between each week in the one store for which two separate weeks of work sampling data were collected.

Review of Literature

Several studies have investigated the display life of fresh meat and the benefits of implementing improved sanitation procedures and practices. One study reported that a retail meat department could double the display life of prepackaged fresh meat products by instituting improved sanitation practices (Nauman et al., 1965). It also reported that rewraps of discolored prepackaged meat could be reduced at least 50 percent. However, data on the costs and returns of instituting the study's recommended sanitation practices were not developed.

In a New Mexico study, data on the costs and returns of a previously established and an improved sanitation program in a retail meat department were developed for a specific meat product, cube steak (Sneed et al., 1967). While the findings revealed that costs and net value increased as the improved program was implemented, the increase in net value reportedly was higher than the increase in costs. The net value of cube steaks was defined as the value of sales minus the value of discarded product. Costs were identified only for detergents and sanitizers. Consequently, this study was limited in scope to the extent that it did not evaluate the costs of sanitation labor, equipment and services.

While several studies have investigated the display life of fresh meat and the benefits of implementing improved sanitation procedures and practices in retail food stores, studies which have analyzed the economics of a store-wide sanitation program were not identified through a literature review. Therefore this study concentrates on determining and analyzing the costs and problems associated with executing existing sanitation procedures and management practices in retail food stores.

II. CONCEPTS AND METHODOLOGY

Selection of Survey Stores

Types of Retail Food Stores

In this study a retail food store was defined as an establishment which is primarily in business to sell food products to consumers. There are several types of retail food stores: specialty stores, convenience stores, superettes, and supermarkets. Specialty and convenience stores include only one department compared to superettes and supermarkets which consist of several departments. Meat markets, delicatessens, bakeries, and produce stands usually are classified as specialty stores. Convenience stores are self-service stores which are open long hours and stock a limited number of brands and sizes of selected food products. Superettes and supermarkets usually sell large lines of food products ranging from dry groceries to fresh meat products. These stores maintain separate departments for selected food products such as dry groceries, meat, and produce.

While superettes and supermarkets are departmentalized retail food stores, they usually are distinguished from one another by the magnitude of their weekly sales volume (Super Market Institute, Facts, 1973). The minimum weekly sales volume of supermarkets as defined by Super Market Institute (SMI) is $20,000. The sales volume of superettes usually is less than the volume achieved by supermarkets. However, Progressive Grocer, a leading trade publication, distinguishes supermarkets from superettes by using weekly sales volume of $10,000 as the break point compared to $20,000 in sales per week as established by SMI (Progressive Grocer, April 1974).

When using the $20,000 sales per week classification, the total sales volume of all United States supermarkets in 1973 constituted 70 percent of total sales volume for all retail food stores (Progressive Grocer, April 1974). This percentage increases to 79 percent when the $10,000 minimum sales per week classification is used. In addition, supermarkets also account for 20 percent of the total number of retail food stores using the $10,000 classification (Progressive Grocer, 1974).[7]

There are three types of supermarkets: conventional super, combination super, and food department (Super Market Institute, 1973). A conventional super has most of its selling area devoted to food products. A combination super has approximately 50 percent of its selling area allocated to food products and the remainder to non-food products or general merchandise such as drugs, clothes, and hardware. A food department is a supermarket in a general merchandise store and is distinctively separated from other areas of the store.

[7]In this study a supermarket was defined as a departmentalized retail food store with a minimum sales volume of $10,000 per week.

The basic departments of any type of supermarket are grocery, meat, and produce. Some supermarkets also include allied departments such as in-store bakeries, restaurants, and delicatessens (prepared food).

Grocery departments can be classified as either integrated or nonintegrated. An integrated department would stock both food and nonfood products in the same display area. A nonintegrated grocery department would stock food and nonfood products in separate display areas of the department.

Meat departments can be classified in several ways. They can be either closed or open. In the closed type the preparation area is a refrigerated room separated from the remainder of the store. The open type preparation area is not enclosed and separated from other departments in the store. Meat departments also can be distinguished by the form in which they receive their wholesale cuts. Today, carcass and boxed meat are typical forms being used by many meat departments.

Produce departments generally do not exhibit characteristics which can be used for classification purposes like the grocery and meat departments.

Delicatessen departments can be distinguished as service and self-service. In the service type, food is packaged as the customer purchases it according to his specific order. Food is prepackaged in the self-service delicatessen and the customer selects his purchase from assorted package sizes of various food products.

In-store restaurants are another allied department which can be found in supermarkets. Different types include coffee shops, short order, and buffet style.

There are two basic types of in-store bakeries, bake-off and scratch. Scratch type bakery operations involve fabricating raw products (mixing ingredients and shaping), baking, decorating, and packaging. The bake-off type receives prefabricated products and employees perform operations from baking to packaging.

Some departments can be divided into subdepartments. For example, a supermarket without a delicatessen department could have a meat department with a self-service delicatessen subdepartment. A grocery department can be divided into subdepartments such as dairy, frozen foods, and dry goods. Moreover, in those stores without in-store bakeries, bakery goods often are considered a subdepartment of the grocery department.

Selection Criteria

Four Oregon retail food stores were selected to obtain data on sanitation procedures, costs, and management practices. The following criteria were developed for selecting these four survey stores.

In order that this study may be useful to a large number of retail food stores, one criterion was that all four stores should be supermarkets. This criteria was established because supermarkets tend to: (1) capture the largest share of all retail food store sales.

A second criterion was that two supermarkets should be owned by chain operations and two should be independently owned. This even split between chain and independents is representative of the proportions of stores owned by each group in the retail food industry (Progressive Grocer, 1974). A chain operation consists of eleven or more store units while an independent operation consists of one to ten store units (Progressive Grocer, 1967).

A third criterion for selecting the study's survey stores was that two or three of the supermarkets should have typical sales volumes and at least one or two should have high sales volumes. The typical range of sales volumes for supermarkets is $20,000 to $80,000 sales per week (Progressive Grocer, 1974). High sales volumes for supermarkets could be considered above $90,000 sales per week because less than four percent of the supermarkets in the United States achieve sales volumes exceeding $90,000 per week.

A fourth criterion was to select supermarkets according to their age: old, ten years or more; intermediate, three to ten years; and new, up to three years. At least one store was to be selected in the three age groups.

A fifth criterion was to select supermarkets with floor areas consistent with their sales volumes and age. New stores opened in 1973 averaged 32,000 square feet of floor area compared to 22,000 square feet in 1970 (Progressive Grocer, 1974). Sales volumes also tend to be larger with larger floor area. Thus it was deemed appropriate for this study to select two or three stores having typical sales volumes along with floor areas ranging between 15,000 and 20,000 square feet. The one or two stores selected having high sales volumes and who were newer in age were to have floor areas ranging between 20,000 and 30,000 square feet.

A sixth criterion was to select supermarkets without in-store restaurants. This type of supermarket was avoided because restaurants were subject to a different set of state sanitation regulations.

The presence of allied departments such as bakeries and delicatessens in supermarkets also was considered when selecting stores. In-store delicatessen departments and bake-off bakery departments were uncommon in Oregon supermarkets while the scratch type bakeries tended to be more common. Therefore, a seventh criterion was to select two supermarkets with in-store scratch type bakery departments.

Sanitation in Retail Food Stores[8]

Sanitation in Oregon retail food stores is defined as maintaining food fit for human consumption. This includes keeping food free of foreign material and limiting the growth of microorganisms to harmless levels.[9]

Sanitation Procedures

Concept. Sanitation procedures to be followed by store employees in retail food stores often include step-by-step processes of cleaning and sanitizing equipment and surfaces in all departments and areas of the store. Cleaning denotes such activities as sweeping, scraping, mopping, washing, soaking, rinsing, brushing, and wiping to remove dirt and adulterated food as well as by-products from a store's wall, floors, surfaces, and equipment. Cardboard, meat scraps, and produce trim are common forms of by-products.

Sanitizing is the destruction of microorganisms including pathogens, which cause human illnesses. Equipment and surfaces may be sanitized in two ways. One way involves applying a sanitizing agent

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[8] The terms retail food stores and supermarkets will be used interchangeably throughout the remainder of this thesis.

[9] This definition is consistent with the Oregon Retail Food Establishment Sanitation Standards (Oregon Administrative Rules Compilation, 1969).

such as chlorine, quaternary ammonium, or iodine to equipment and surfaces. A second way involves maintaining equipment at extremely hot temperatures for an extended period of time long enough to destroy microorganisms. In most stores the sanitizing agent method is used more often than the hot temperature method.

In addition to cleaning and sanitizing activities, sanitation procedures involve such activities as disassembling and reassembling equipment.

An example of a sanitation procedure which could be followed when cleaning and sanitizing a power meat saw is presented below.

1. Disassemble the saw.
2. Soak the saw parts in a solution of hot water (170° F.) and "Janitor In A Drum" for five minutes.[10]
3. Brush parts to remove any food particles still remaining.
4. Rinse with water.
5. Rinse the saw parts with a solution of 200 parts per million available chlorine.
6. Lay the saw parts to drain and air dry on a sink counter.
7. Reassemble the saw.

In the above illustration, step one is a preliminary step which must be completed prior to cleaning and sanitizing the saw. Steps

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[10] Mention of trade products by firm name does not imply that they are endorsed or recommended by Oregon State University over other firms or similar products not mentioned.

two, three and four constitute cleaning activities while steps five and six represent sanitizing activities. Finally, step seven denotes post-cleaning and sanitizing activities which facilitate operating the saw after it has been cleaned and sanitized.

The above sanitation procedure also is an illustration of the standard or two-step cleaning and sanitizing procedure which is recommended for use in Oregon by the Oregon Department of Agriculture. In this procedure, a cleaning agent is applied in a separate step compared to the application of a sanitizer agent. A rinsing step occurs between cleaning and sanitizing steps to remove the cleaning agent which could otherwise cause the sanitizing agent to become ineffective (Super Market Institute, 1973).

Another commonly used sanitation procedure is the one-step cleaner-sanitizer procedure (Quad Corporation, 1975). In this procedure, cleaning and sanitizing procedures are performed simultaneously in the same step by using a germicidal detergent.

The frequency with which sanitation procedures are executed by store employees often ranges from "as needed" to annually. "As needed" defines an irregular frequency determined on the basis of subjective judgment by store management. For example, the walls of a display area would be cleaned when visibly dirty (as needed), rather than cleaned at a regularly scheduled interval.

Data Collection. In this research, the following method was developed to collect data on sanitation procedures executed in the four surveyed stores. Items which usually required cleaning and sanitizing were classified accordingly. Individual departments such as grocery, meat, and produce served as a basis for developing the classification scheme. Functional areas within each department of a supermarket were identified using floor plans to further develop the scheme.

The following are functional areas identified for each department of a supermarket. Bakery departments typically consist of four areas: preparation room, freezer storage, dry ingredient storage, and display area. Similar areas in both the produce and meat departments are display, preparation, and storage cooler. The delicatessen department usually includes display, processing, refrigerator box, freezer box, and dry storage areas. Grocery department areas often are designated as display, dairy and beverage cooler, frozen food storage box, dry storage, and check out.

In addition to the departmental organization of a store, there also is a miscellaneous group of nondepartmental areas. These include the store's office, rest rooms, sanitation station, and employee lounge. Sanitary conditions must be maintained in these areas even though they usually do not involve the preparation and handling of food. For example, employees often contact surfaces in these areas and the potential exists for transmitting microorganisms to food handled in preparation areas.

Two groups of physical structures which typically exist within each area of the store were identified. These were equipment and building surfaces. Meat grinders, mixing bowls, and display cases constitute equipment (Table 1). Walls, ceilings, and floors are illustrative of building surfaces (Table 1).

In addition to sanitation procedures for equipment and building surfaces, store employees usually are required to follow prescribed sanitation procedures to maintain personal hygiene. These procedures include washing hands, wearing hair coverings, and wearing clean uniforms.

After developing the classification scheme for equipment, building surfaces, and employees, personal interviews with department managers were conducted to collect data on the sanitation procedures executed by each of the surveyed stores. The following information was collected in these interviews for each building surface and piece of equipment cleaned and sanitized: (1) the sanitation procedure executed, (2) the employee performing the sanitation activity, (3) the frequency of repetition, (4) the sanitation equipment and supplies used, (5) problems involved with cleaning and sanitizing the surface or equipment, and (6) possible alternative solutions to these problems.

Table 1. Typical equipment and building surfaces which are subject to cleaning and sanitizing procedures classified according to departmental areas in supermarkets

Area	Equipment and Building Surfaces		
Meat Department			
Display	Display Cases		Table Scales
	Fresh meat	Delicatessen	Floor
	Frozen meat	Warming oven	Walls
	Fish, Poultry		Ceiling
Preparation	Grinder	Trees	Cutting tables
	Mixer	Hooks	Roll coll (or
	Patty maker	Holding trays	Chicken trough)
	Cuber	Tubs	Barbecue
	Slicer	Scrap barrel	Cabinets
	Tenderizer	Carts	Shelves
	Netter	Knives	Sinks
	Power saw	Scrapers	Floor
	Wrapping station	Bone duster	Walls
	Weighing station		Ceiling
Cooler	Blower	Carts	Floor
	Rails	Grinder	Walls
	Trees	Mixer	Ceiling
	Hooks	Patty maker	
	Tubs	Scrap barrel	
Grocery Department			
Display	Dairy Case	Bottle carts	Floor
	Gondolas	Grocery carts	Walls
	Frozen food case	Check stands	Ceiling
	Drinking fountain	Trash cans	Windows
	Ash tray cans		
Storage	Ice machine	Racks	Hand trucks
	Dairy and beverage cooler	Shelves	Conveyor
	Floor	Drains	Floor
	Walls	Freezer box	Walls
	Ceiling	Racks	Ceiling
	Blower	Pallets	Stairs
		Carts	

Table 1 (cont.)

Area	Equipment and Building Surfaces		
Produce Department			
Display	Display Cases	Mirrors	Walls
	Wet rack	Scale pans	Ceiling
	Dry rack	Floor	
Preparation	Knives	Racks	Floor
	Trim barrels	Carts	Walls
	Garbage grinder	Work benches	Ceiling
	Sinks	Ice machine	
Storage	Cooler		Dry storage
	Floor	Ceiling	Floor
	Walls	Blower	Walls
			Ceiling
Bakery Department			
Display	Display cases	Floor	Walls
	Ceiling		
Preparation	Bread slicer	Carts	Bins
	Wrapping station	Dollies	Icing warmer
	Work benches	Sinks	Oven
	Utensils	Mixing	Retard
	Mixing bowls	machines	Proof box
	Scales	Deep fat fryer	Floor
	Bread molder	Hood	Walls
	Bun former	Fry racks	Ceiling
	Bun divider	Glazer pot	Pans
Storage	Shelves	Transient	Floor
	Frozen food box	trays	Ceiling
	Walls	(Frozen)	

Sanitation Management Practices

Compliance with State of Oregon sanitation standards often requires store personnel to follow prescribed sanitation management practices. These practices include activities such as monitoring and maintaining proper temperature levels of perishable food products and minimizing pest infestation. Temperature levels and rodent infestation are examples of factors which influence the wholesomeness, quality, and safety of food offered for sale.[11]

In this research sanitation management practices were identified through a review of state sanitation standards, Project Consumer Concern (PCC), and other research studies. These practices were classified into four categories: product management, temperature control, pest control, and employee hygiene.

Product Management. Product management involves the physical handling and display of products. Sanitation is an element of product management because food may be contained in defective or damaged packages and containers. Typical examples are dented, unsealed, or swollen cans and broken, unsealed, or leaking packages.

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[11] An Oregon Department of Agriculture sanitation inspector was accompanied on a routine inspection of several retail food stores. This inspection revealed several sanitation management practices which stores are required to follow in order to comply with State of Oregon sanitation standards.

In addition, food products may be decayed and/or displayed beyond their pull date.[12]

Inspection of food products in display areas for the above conditions, and identification and subsequent removal of such food products from display areas constitutes sanitation management practices (Oregon Administrative Rules Compilation, 1969 and 1975).

In some instances sanitation management practices occur in conjunction with other management practices. For instance, the removal from display and rewrap of a leaking package of meat, a "leaker," constitutes a sanitation management practice. However, this practice often occurs together with rearranging products in the meat display case, which constitutes part of a store's meat merchandising strategy.

Disposition of food which has contacted a contaminated surface is defined as a sanitation management practice (USDA-NARGUS, 1973). An unpackaged cut of fresh meat dropped on the floor creates an insanitary condition and should be disposed of by employees. Under no circumstances should it be mixed with uncontaminated meat.

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[12] According to State of Oregon sanitation standards, food products with a shelf life of 30 days or less must be marked with an uncoded pull date or packaging date. The packaging date must be marked on a product such as fresh chicken. Food products with expired pull dates may be offered for sale if they are fit for human consumption. However, such products must be segregated from products with unexpired pull dates and labeled that the pull dates have expired (Oregon Administrative Rules Compilation, March 1974).

In supermarkets, handling "hazardous substances" such as insecticides, rodenticides, cleaning agents, and sanitizing agents creates a need for following proper sanitation management practices.[13] Hazardous substances must be separated from food products (Oregon Administrative Rules Compilation, 1969). This sanitation management practice should be followed by store employees in storage, preparation, display, and check stand areas.

Temperature Control. Temperature control of perishable products is another type of sanitation management practice. In order to comply with state sanitation standards, air temperatures in display and storage areas for perishable products must be maintained at proper levels: refrigerated products, 45° F. or less; frozen products, 0° F. or less; and heated products, 140° F. or higher (Oregon Administrative Rules Compilation, 1969).

Temperature controlled display cases which are filled beyond "load or fill lines" designated by manufacturers constitutes an

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[13] "'Hazardous substances' is a substance or mixture of a substance which is toxic, corrosive, an irritant, flammable, or which generates pressure through heat, decomposition or other means; or which has been designated by the United States Food and Drug Administration as a strong sensitizer, or a radioactive material or which 'may cause substantial personal injury as substantial illness during or as a proximate result of any reasonably foreseeable handling or use, including reasonably foreseeable ingestion by children.'" (Oregon Administrative Rules Compilation, 1969, p. 129b)

improper temperature control practice (USDA-NARGUS, 1973).[14] Food placed over the load line usually will not be maintained at proper temperatures. This occurs because the air curtain, a flow of air across the opening of a refrigerated or frozen food display case, is broken. Products stored in a case near the broken air curtain tend not to be kept as cold as they would be with an unbroken air curtain.

Temperature control of food cooked in a store and sold hot is another sanitation management practice. While such food is subject to a wide range of temperatures, it is maintained fit for human consumption by storing it at 45° F. or lower prior to the cooking process. After such food is cooked and placed in a display warming oven it should be maintained at a temperature of 140° F. or above (Oregon Administrative Rules Compilation, 1969). The transitional time between these temperatures (45° F. to 140° F. or vice versa) should be minimized to retard growth of microorganisms.

Pest Control. Pest control is another sanitation management practice which contributes to maintaining sanitary conditions in a supermarket. This practice prevents contamination of food from vermin such as rodents, birds, and arthropods. Vermin can be

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[14] A "load or fill line" is a marking on a display case usually designated by the statement "Do not fill beyond this line." The load line indicates the level to which a case was designed to be filled with food products.

vectors of communicable diseases and can also adulterate food with fecal droppings.[15]

Pest control practices in supermarkets often are handled through contractual agreements with exterminator service firms. The exterminator's responsibility usually is to destroy pests which enter a store. In some instances, he may become involved with educating store management on practices to reduce pest activity. Nevertheless, store management inspections to identify the presence of pest activity can be classified as an in-store sanitation management practice.

To the extent possible, store management should establish and maintain a store environment conducive to retarding pest inhabitation (Oregon Administrative Rules Compilation, 1969). This entails keeping all areas of a store well illuminated and eliminating harbors and entry ways for rodents. Removing food residue from food preparation areas and maintaining properly designed storage areas for food residue provides a less conducive environment for pests in supermarkets as well. Moreover, storage of food in covered containers located in coolers helps to control pest infestation. This practice prevents access to food and a cold environment is an unattractive habitat for pests. Cold temperatures retard the decaying process

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[15] Vectors are organisms which transmit a pathogen (FDA Publication No. 16, 1969).

and minimize omissions of odors which attract pests. Finally, covering trim containers when not in use has been identified as an effective pest control practice (USDA-NARGUS, 1973).

Some aspects of pest control also are related to product arrangement. Food products should be covered whenever possible and whenever they are unattended to prevent pest infestation. For example, raw ingredients in the bakery area should be covered when not being utilized. Also bakery products in the display area should be covered or wrapped to prevent pests from contacting them. Finally, food products in cloth or paper containers should be stored away from walls and not stored directly on floors (Oregon Administrative Rules Compilation, 1969 and 1972).

Employee Hygiene. Personal habits, hygiene, health, sanitation education, and uniforms are areas to which sanitation management practices can be applied. Personal habits which contribute to improper sanitation include such practices as coughing, eating, and using tobacco in food preparation areas (Super Market Institute, 1973). Employees following proper hygienic practices will be less apt to contaminate food preparation areas compared to employees following improper hygienic practices. Employees with communicable diseases are not allowed to work in food preparation areas according to Oregon sanitation standards.

Another employee sanitation management practice involves wearing uniforms that conform to state sanitation standards. Hair covering is a required part of the uniform of an employee in food preparation areas (Oregon Administration Rules Compilation, 1969).

An essential element of any sanitation program, if it is to be successful, includes educating employees about the requirements necessary to maintain sanitary conditions throughout a retail food store (USDA-NARGUS, 1973).

Data Collection. In this study preliminary observations were made of sanitation management practices in several supermarkets to provide some guidelines for developing the data collection technique. These observations revealed that some practices could be more easily observed than others. Employees continuously wearing hair covering were easily observable whereas the inspection by employees of temperatures in refrigerated display cases occurred only infrequently and thus was less observable.

A checklist data collection form was designed for sanitation management practices (Figure 1). This form was to be completed by trained observers every two to four hours during a surveyed store's work day. Those practices believed to be most readily observable were included on the checklist form. Other practices observed but not included specifically on the checklist were noted by observers as additional comments on the form.

Figure 1. Sanitation management practices data collection form

Yes or No ($\checkmark$) (x)	
	Product Management
________	1. Removal of damaged, leaking, and decayed food products from display cases.
________	2. Separation of hazardous substances such as cleaning agents and insecticides from food products.
________	3. Trim containers covered.
________	4. Bakery products packaged or enclosed in display area.
________	5. Clean up of empty beverage bottle spillage.
	Temperature Control
________	6. Products stored in display cases above fill lines.
________	7. Perishable products left in unrefrigerated areas for extended lengths of time (milk, meat, eggs, butter).
________	8. Cooler or freezer doors left open.
________	9. Temperature levels within legal limits for perishable products (140° F., fully cooked hot; 45° F., fresh meat, produce, and dairy; 0° F., frozen) as measured by installed thermometers on all temperature controlled units.
	Pest Control
________	10. Premises free of pest infestation and droppings.
________	11. Control of flies (use of screens, spraying, or other methods of control).
________	12. Control of rodents (use of traps, and/or bait boxes, and entry ways sealed).
	Employee Hygiene
________	13. Wearing hair covering in food preparation areas.
________	14. Not smoking in food preparation areas.
________	15. Not eating in food preparation areas.
________	16. Good health; no signs of infected wounds, open sores, or acute respiratory infections.

Comments:

Costs of Sanitation

Expenses in retail food stores are typically classified as controllable and noncontrollable (Oesterle, 1965). Sanitation costs can be categorized in like manner. Controllable expenses are those expenses which have not yet been incurred or which will be incurred when a retail food store is operating.

In this study, controllable sanitation expenses in retail food stores were classified into four groups: labor, equipment, supply, and service. Labor expenses included the proportion of payroll, payroll taxes, and employee fringe benefits of a store allocated according to the proportion of total store labor time devoted to cleaning and sanitizing activities. Equipment expenses consisted of the cost for items such as brooms, mops, mop buckets, and scrapers. Supply expenses were comprised of the costs incurred for soaker pads, cleaning agents, sanitizing agents, and paper towels. Service expenses were composed of janitorial, laundry, garbage disposal, and exterminator costs.

Noncontrollable expenses are those expenses which already have been incurred or those expenses which will be incurred even if a store fails to continue to operate as a viable entity. Noncontrollable sanitation expenses would include the costs of installing sinks and constructing drain systems. They also consist of costs incurred for repairs and maintenance of facilities such as sinks and drain systems. In addition, noncontrollable expenses include property taxes and insurance premiums prorated according to the value of facilities such as sinks and drain systems.

Preliminary surveys of several retail food stores revealed that the majority of costs associated with a store-wide sanitation program were of the controllable type. Consequently, this research focuses upon determining and analyzing those sanitation costs associated with service, equipment, supply, and labor. Moreover, these costs were determined on a departmental cost per week basis.

Services

Store and department managers of each of the four stores surveyed were personally interviewed to identify the sanitation services utilized by their stores. Sanitation services purchased from other businesses were classified as outside services such as janitorial, laundry, garbage disposal, and exterminator compared to in-store services such as a janitorial staff employed by a store.

Cost data for these sanitation services were developed using the following three methods: (1) each store's receipts and accounting records were examined; (2) personal interviews were conducted with each store's manager; and (3) personal interviews were conducted with the management of outside sanitation service firms.

Sanitation service costs were allocated to each department of each store surveyed. In some instances the costs for services such as laundry were allocated in the store's accounting records to specific departments, while in other instances the costs for services such as janitorial were accounted for in store overhead expense. In this study those sanitation service costs accounted for as store overhead expense were allocated to each department in proportion to the percent of total store sales volume accounted for by each department.

Equipment and Supplies

The following procedures were used to determine the costs of sanitation equipment and supplies utilized by the stores surveyed. First, personal observations and interviews were made to identify the types of sanitation equipment and supplies used by each store. Sanitation equipment included brushes, brooms, mops, buckets, hoses, and scrapers. Sanitation supplies included materials that were used in the processes of cleaning and sanitizing. Sanitizing agents, cleaning agents, paper towels, and glass cleaner are examples of sanitation supplies. Supply materials which became contaminated were discarded.

Second, after compiling an inventory of equipment, store management was interviewed to estimate the expected useful life of equipment and the amount of supplies used in each store surveyed. For example, a store manager may have estimated that mop buckets are replaced annually and a gallon of cleaning agent is dispensed weekly.

Finally, sanitation equipment and supply prices were obtained directly from suppliers, or from prices marked on these goods if they were obtained from a store's display shelf.

To determine the average weekly cost of a piece of equipment, the purchase price of the equipment was divided by its estimated useful life given in weeks. The expenses incurred for purchased sanitation equipment identified in this study were fully accounted for in each store's accounting records during the accounting period in which the equipment was purchased. Repair and maintenance costs of most equipment were not determined because these costs were negligible or included as part of supply costs. For example, mop buckets were not repaired when they began leaking but were discarded. In addition, in this study mop head replacements were included as part of supply costs rather than equipment maintenance costs.

To determine the cost of sanitation supplies, the estimated quantity used of a supply per week was multiplied by its price per unit. The average weekly costs of all supplies were then summed together to give an average weekly total cost of sanitation supplies.[16]

Departmental Labor

The fourth group of sanitation costs determined in this study was associated with departmental employee labor. From preliminary observations in supermarkets, an assumption was made that most departmental employees perform some sanitation activities. However, payroll records of the four surveyed stores did not include labor distribution reports allocating the dollars and man-hours of each employee by various activities they performed. Therefore, the following framework was developed to measure the costs of sanitation labor.

First, a method was developed to measure the amount of time spent by departmental employees on sanitation activities. Second, data was collected from each store's accounting records on the total labor cost of departmental employees. Then, total departmental

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[16] Examples of computing sanitation equipment and supply costs for individual items:

a.

Item	Price/Unit	Useful Life in a Store
Mop bucket (equipment)	$60.00	1 yr.

average weekly cost of mop bucket = $\frac{\$60}{52 \text{ wk}}$ = $1.15

b.

Item	Price/Unit	Quantity Used/Week
Sanitizer (supply)	$5.40/gal.	.75 gal.

average weekly cost of sanitizer = $5.40 x .75 = $4.05

sanitation labor cost was determined by multiplying total departmental labor cost by the proportion of departmental time devoted to sanitation activities.

Time Measurement Methods. Three techniques, personal interview, time study, and work sampling could be employed to measure the amount of sanitation labor time departmental employees spent performing cleaning and sanitizing activities at different frequencies such as daily, monthly, and quarterly.

Personal interviews were practical for collecting labor time data on sanitation activities performed monthly, quarterly, and annually. Sanitation tasks that occurred at these intervals were executed separately from other store activities and the man-hours spent on these tasks usually were significantly large enough so that store management could estimate them with accuracy. Therefore, these labor time data were collected through interviews with departmental managers.

Work sampling or time study techniques could be applied to daily and weekly sanitation labor activities because of their more frequent occurrence and intermix with other activities compared to sanitation activities of longer intervals.

Time study is a work measurement technique designed to determine the amount of time required to perform a specific activity by use of a stop watch or other time measuring device. The direct result when studying an employee working at a normal pace is a "normal time" in units such as minutes to perform a specific task. Time study requires highly trained observers to collect the data and usually works best with repetitive tasks (Barnes, 1968).

In this study work sampling is used to measure the proportion of time devoted to sanitation work, other work, and idle time activities. These three groups of activities must be defined so that 100 percent of the employees' time is spent performing activities of the three defined groups. Then using instantaneous observations, a sample is drawn from the total activity time available to the employees. Instantaneous observations are similar to images captured in photographs. The results of this sample are then expressed as normal time in units such as man-hours or minutes by multiplying the proportion of total observations devoted to a specific activity by the total amount of employee time from which the sample is drawn.[17]

Work sampling is based on the probability that a sample taken at random from a large population will tend to have the same frequency distribution as the large population. In work sampling, the

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[17] Example: One employee observed during 60 minutes. 20 total instantaneous observations. Four instantaneous observations of a specific activity, cleaning. Thus 4/20 or 20% of the employee's time was spent cleaning. 60 minutes x .2 = 12 minutes of employee's time spent cleaning.

population is time. The sample is the group of observations taken from the population. "At random" is the equal chance that any member of the population will be drawn in the sample. Members of a random sample usually are chosen by the use of a random numbers table. Consecutive numbers in the table can represent random members of a population. Therefore, numbers selected consecutively from the table then will represent members of a random sample to be drawn from the population.

In this study, the work sampling technique rather than the time study technique was selected to measure the amount of time store employees spent on daily and weekly sanitation activities for the following reasons (Barnes, 1968):

1. There were a large number of employees to be observed because in most instances all departmental employees had some responsibility for sanitation in the supermarkets surveyed. The work sampling technique permitted observation of several employees by a single observer. Therefore, this technique would tend to use fewer observer man-hours for observation compared to time study. Thus, work sampling would be a less costly method of obtaining reliable time use information compared to time study.

2. Sanitation man-hours represented a small proportion of total departmental employee man-hours and tended to occur

irregularly and nonrepetitively.[18] This type of activity has been found more suited to work sampling than time study.

3. Employees being studied prefer work sampling to time study because the observation pattern is not continuous. Consequently, work sampling tends not to disrupt normal work habits to the extent time study might.

4. This study required that labor time be defined within a limited number of activities, in which case, work sampling serves as a suitable measurement technique. Studies which require a finer breakdown of activities are more suited to time study.

Performance rating is often combined with time study or work sampling to establish a normal time (Barnes, 1968). Performance rating is a matter of subjective judgment on the part of the observer in determining whether or not a worker's pace is normal.[19] Extensive training of the observer is necessary for him to be skilled at rating a worker's tempo. Performance rating of employees in supermarkets has merit because their activities often are not paced by a machine.

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[18] Managers of supermarkets who were consulted in developing the methodology for this study estimated that sanitation man-hours represented a small proportion of total man-hours.

[19] An observation of tempo is taken simultaneous to the work sampling observation. It is recorded as a percent of the normal pace. For example, the normal pace is 100% and a slower tempo might be observed as 75% of the normal pace.

However, in this study performance rating was not utilized for several reasons. First, the assumption was made that different employees perform sanitation activities at various tempos but observation of a large number of employees would tend to produce a normal pace. Second, the purpose of the study was not to measure the proficiency of employees to perform sanitation activities. Rather, it was to measure time that employees spent while executing existing sanitation procedures. Finally, comparative data on sanitation time percentages in this study were a comparison of sanitation time among surveyed stores was limited to the performance of store employees in one small area of the United States; hence, variation of worker output between regions was avoided.

Flow Process Analysis. To facilitate defining employee work activities for the work sampling technique used in this study, flow process analysis was utilized to identify the direct production activities of store employees. These activities involve handling specific products such as price marking and meat cutting.

Flow process analysis, an industrial engineering technique, is a schematic diagram or chart of the flow of man or materials from one designated point to another (Barnes, 1968). A diagram consists of standard symbols established by the American Society of Mechanical Engineers, combined with abbreviated explanations of the processes that occur.

The following is a presentation of the symbols and their definitions used for product flow process analysis in this study (Barnes, 1968).

O <u>Operation</u>--An activity that changes a product and constitutes a major step in the flow process such as using a machine or activity at a designated work station such as cutting, wrapping, or pricing.

⇨ <u>Transportation</u>--An activity that moves a product from a station or storage area to another location such as carting full beverage containers from the back room to the display shelf.

□ <u>Inspection</u>--An activity that occurs when a worker identifies or examines a product for quality, quantity or compares it to a standard such as weighing a meat carcass.

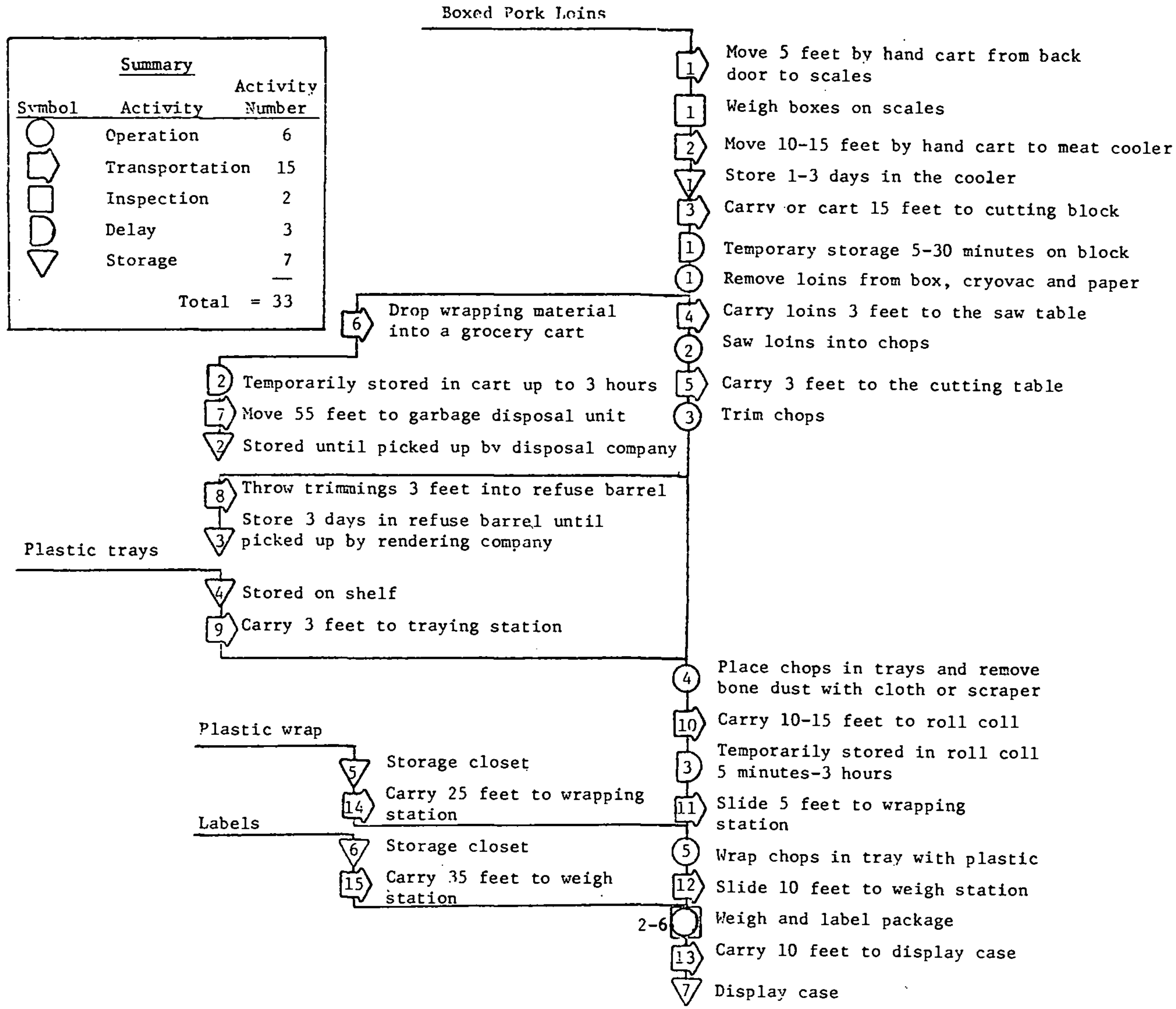
D <u>Delay</u>--An occurrence when a product is temporarily withheld from the next major process such as beef steak waiting ten minutes to be weighed after being wrapped because only one person is wrapping and weighing.

▽ <u>Storage</u>--An occurrence when a product is held in inactive status such as eggs being stored in the dairy cooler for one to three days.

Product flow charts were developed for one supermarket. These were constructed from observations made of products moving through the store and from interviews with the store's departmental managers. Process charts were developed for products in the grocery, meat, produce, and bakery departments. Specific products diagrammed individually included pork loins, hamburger, bread, cakes, and lettuce. Products such as lines of dry groceries which had similar flow processes were grouped together and diagrammed in one generalized flow chart. One of the flow process charts developed is shown in Figure 2. The flow of products was diagrammed from their entry points in the store to their display areas. By-products such as meat scraps and produce trim not sold in display areas were diagrammed to their exit point from the supermarket.

Some products encountered situations that did not distinctly fall into one of the five general processes such as operation and transportation. An example of this situation involved the display of products in the sales area. This process could be considered either an operation or a storage function. In the sense of an operation, the products were being displayed for sale, sales being a main purpose of the supermarket. In the sense of a storage process, the products were relatively stationary and were not undergoing intentional changes of characteristics as an operation was defined. An example of an intentional change of a meat product would be cutting it into retail cuts, while an unintentional change would be deterioration of the meat product. In this supermarket most of the products were placed in the

FIGURE 2. PRODUCT FLOW CHART FOR PROCESSING BOXED FRESH PORK LOINS IN A MEAT DEPARTMENT



display area rather than stored in the back room. Therefore, all displays of products were diagrammed as storage functions on all process charts developed for this supermarket.

Flow process charts were developed only for one supermarket. While differences in flow processes between the four stores might occur in store layout, products, and sequence of processes, the assumption was made that individual activities such as facing, stocking, and cutting identified by the flow process charts for one supermarket should occur in the other surveyed supermarkets as well.

Personnel flow charts were not developed for supermarket employees because most activities of the employees were identified on the product flow process charts.

Defining Activities. For purposes of using the work sampling technique in this study the activities of supermarket employees were defined into three groups: sanitation, other work, and idle time.

"Sanitation" activities were defined as those associated with executing sanitation procedures. These activities included cleaning activities: scraping, brushing, sweeping, mopping, washing, rinsing, and wiping to remove dust, foreign material, nonsalable food particles from surfaces, equipment, and hands. Sanitizing activities also were classified as part of the "sanitation" activities. Sanitizing involved the application of a sanitizing solution to surfaces, equipment, and hands to destroy microorganisms. Sanitation activities also included such activities as transporting a mop and bucket to and from the area to be cleaned and sanitized. Assembling and disassembling equipment to be cleaned and sanitized also were classified as sanitation activities.

"Other work" activities were defined as direct and indirect productive activities exclusive of sanitation activities. Direct productive activities involved movement of the product from the receiving points in the stores to the display areas. These included such activities as stocking, checking, customer communications, receiving, pricing, facing, mixing, cutting, trimming, traying, wrapping, weighing, and decorating bakery products.

Indirect productive activities were classified as part of a store's operations which did not directly involve selling specific products. These activities included general administration; employee supervision; and communications between management, departmental employees, customers, and employees of firms engaged in business with the store.

Even though sanitation activities can be classified as indirect activities, they were observed as a separate group in this research.

"Idle time" was denoted as time spent in nonproductive activities such as personal delays, scheduled rest breaks, and unforeseen delays in planned work schedules. Personal delays included use of rest rooms and conversations unrelated to store business between employees. An example of an unforeseen delay in a planned work schedule could be the late arrival of merchandise which could create idle time for the unloading crew.

Idle time and work activities could be difficult to differentiate at times; however, the following guidelines were established to clarify the distinction. For example, when an employee was talking with a customer, such activity was defined as customer communication, and classified as "other work" activity. If direct productive activity was being performed by an employee simultaneous to a conversation unrelated to store business, then the employee was considered performing "other work" activity rather than idle time. If the conversation was between two or more employees performing no direct productive activities, it was considered either "sanitation" or "other work" activity depending upon the nature of the conversation, unless the conversation clearly did not pertain to store business in which case it was considered idle time. If the conversation clearly pertained to sanitation and the employees were not performing direct productive activities, then it was defined as a sanitation activity.

Personal hygienic activity that occurred in the rest rooms was included as part of idle time due to the impracticality of observing this sanitation activity.

Pretest. The work sampling technique was further developed by observing employees' work activities in one supermarket. A trial test of a conventional route plan was conducted. This consisted of starting at a point in the store and proceeding throughout the store following a predetermined route until all employees had been observed. An instantaneous observation was taken by the observer at the first instant he viewed an employee's activity. The observation was then recorded as a tally mark in the appropriate activity square (clean and sanitize, other work, idle time) on a data collection form (Figure 3).

The trial test of the conventional route technique revealed the necessity of redesigning the sampling technique to be utilized in this study. One problem encountered was that an observer became fatigued after walking and observing for one hour. A second problem with this technique was that an observation of an employee could be missed if he moved to a new location in the store. This problem was identified by the low amount of idle time observed compared to the findings of other studies (Barnes, 1968; Case, 1972; Marion, 1966).

To remedy these problems, the following technique was developed. An observer was required to watch two groups of employees on an alternating basis. A group usually consisted of employees of one department or five to eight employees working in the same area. The observer would take observations of one group over a ten-minute time interval, and would be required to observe the second group over

Figure 3. Work sampling process data collection form for the trial test of conventional route method.

Store__________ Dept__________ Date__________ Observer__________

Activity	Tally	Total
Clean and Sanitize		
Other Work		
Idle Time		

Time: Stop__________ Total__________

Start__________

Elapsed__________

a similar time interval. This sequence was repeated continuously during store operating hours. Ten observations of each employee in a group were made during a ten-minute time interval. Observations in a time interval of an employee were spaced approximately one minute apart. The sample of employees' time became groups or clusters of observations rather than a simple random sample which is normally used in work sampling studies.

Binomial formulas usually are used to estimate the mean proportion of time and variances of mean proportions for work sampling data. However, the binomial formula for estimating the variance tends to underestimate the true value because the formula requires the assumption that observations are independent (Cochran, 1963). In the case of clustered observations there may be a stronger positive correlation between observations within a cluster than between clusters.

Formulas for estimating the mean and variance of the mean have been developed for cluster sampling (Cochran, 1963). These formulas for cluster sampling were adapted to measure proportions of man-hours devoted to sanitation. The sample mean proportion of man-hours devoted to sanitation can be designated as p where

$$p = \frac{\overset{n}{\Sigma}\, a_i}{n\, m} = \frac{1}{m} \sum_{1}^{n} p_i .$$

The variance of the sample means is

$$v(p) = \frac{\sum^{n} (p_i - p)^2}{n - 1} .$$

n = number of sampling units. A sampling unit is a specific number of observations of an employee made during a time interval at a rate of one observation per minute.

m = the number of elements called observations in a sampling unit.

a_i = the number of observations of sanitation in the ith sampling unit ($i = 1, 2, 3 \ldots n$).

$p_i = a_i/m_i$ = the proportion of observations in the ith sampling unit that is sanitation ($i = 1, 2, 3 \ldots n$).

The sample mean proportion of time spent on sanitation activities by employees observed multiplied by their total labor cost enabled computation of the sanitation labor cost associated with these employees. The estimated variance of the sample mean was used to determine the acceptability of the mean proportion of time devoted to sanitation activities.

This acceptability can be set in terms of the coefficient of variation, a relative measurement of the variation compared to the sample mean (Petersen, 1972). The coefficient of variation is determined as X where

$$X = \frac{\sqrt{v(p)}}{p} (100).$$

p = sample mean proportion of time devoted to sanitation activities.

$v(p)$ = estimated variance of the sample mean proportion.

$\sqrt{v(\bar{p})}$ = standard deviation of the sample mean proportion.

For example, when $v(p) = 0.0725$ and $p = 0.50$, the coefficient of variation is 50%. In other words, the true mean proportion of time should be between 0.25 and 0.75 with one standard deviation, $\{P \pm 0.50(P)\}$. In this study the maximum acceptable level for the coefficient of variation was set at 15%.

A test trial of the cluster sampling technique was conducted. The sampling intervals consisted of ten-minute clusters with ten observations per cluster. From the trial sample, estimates of the mean proportion of time spent on sanitation activities ranged from zero to twelve percent among employees. The coefficient of variation among clusters was 100%.

Additional data was collected and a larger sample was analyzed. This resulted in a variability among clusters of 33%. It was assumed that the acceptable degree of variability (15%) could be achieved by reducing the number of observations per cluster by 50 percent and doubling the number of clusters.

At this point in the study the proportion of time for sanitation activities was calculated for employees of the store as a whole. However, stratifying the population by employees may reduce the sampling error for several reasons (Snedecor, 1967). First, employees had different responsibilities which may have required one employee to spend more or less time performing sanitation activities compared to other employees. In other words, the activities of one employee may be more homogenous than between employees. Secondly, store employees did not work equal numbers of hours. Therefore, the sample of time was stratified using time of each employee as a subpopulation or stratum.

The sampling within strata was systematic.[20] Each hour of an employee's time was divided into three equally spaced cluster sampling periods. This sampling scheme can be termed stratified systematic sampling and "is suitable . . . if unequal sampling fractions are used" (Cochran, 1963, p. 227). It was suitable because store employees often worked unequal numbers of hours. The advantage of this systematic sampling scheme was that only one random number was used to determine the starting time for collecting observations in each hour compared to a simple random sampling process which would have required using three random numbers per hour.

The use of systematic sampling was also examined for disadvantages. Periodic sanitation activities such as sweeping the floor at eight o'clock each morning could bias the sample. This type of bias was removed by observers beginning observations at various hourly times such as 8:00, 8:05, and 8;10. Another disadvantage of systematic sampling is that a reliable method for estimating the standard

[20] Marion used a systematic work sampling technique in a labor productivity study of meat departments in supermarkets (Marion, 1964).

error of the sample mean is not available unless systematic sampling is part of a more complex sampling scheme (Snedecor, 1967). In this study the above problem was overcome because systematic sampling had been combined with cluster and stratified sampling.

In the formulas for cluster sampling the mean proportion of time devoted to sanitation was designated as P. Combining the cluster sampling and stratified systematic sampling procedures, p can be redesignated as $\overline{P}_{syh}$, the mean proportion of time for the hth employee. Then the estimate of the mean proportion of labor time was $\overline{P}_{stsy}$ for a stratified systematic sample where

$$\overline{P}_{stsy} = \Sigma W_h \overline{P}_{syh}.$$

The estimate of the variance of the sample mean was

$$v(\overline{P}_{stsy}) = \Sigma W_h^2 V(\overline{P}_{syh}).$$

where $W_h = \frac{n_h}{n}$ = the stratum weight.

n_h = number of sampling units of the hth employee (h = 1, 2 . . . m).

n = total number of sampling units for all employees. (Cochran, 1963)

The sample mean and its variance were used in the same way as the mean and the variance described earlier for simple cluster sampling.

Work Sampling Data Collection. To collect data for the systematic stratified sample of each departmental employee's time, an hourly schedule for an observer was developed which consisted of six sampling periods and a random rest break. A sampling period consisted of approximately eight minutes of which five minutes were used for the observation interval. The other three minutes were used to move from one group of departmental employees to another and to set up data collection forms. During the five-minute observation interval the observer made five instantaneous observations of each employee in the group. The observation interval for each employee constituted a cluster of observations. Five minutes were necessary because in some situations employees did not occupy one station or work area continuously; therefore, the observer had to move about the store to observe the entire group of employees and observations of an employee were spaced approximately one minute apart. In other situations when all the employees of a group were stationary in a close area, such as the meat department preparation area, observations on an employee were spaced one minute apart using a stop watch.

Furthermore, each employee was observed for three intervals during an observation hour with five observations made per interval. This occurred because observation intervals of one group of employees were alternated with observation intervals of a second group of employees for a total of six sampling periods per hour. Thus, an employee working an eight-hour day would be observed during 24 intervals.

The random rest break period was used for two purposes. First, the break period was random to force the six sampling periods of each hour to have a random starting time for observation. This randomness removed bias from the sample induced by systematic sampling of periodic activities. Thus, each instant of an employee's time had an equal chance of being observed. Second, the break period provided a rest break for the observer.

The random rest break period was determined by a random rest break schedule posted on a clipboard that each observer carried (Table 2). The numbers in the schedule were taken from a random numbers table. Each number on the schedule represented a ten minute break. For example, the third number, 50, on the schedule was for a ten minute break at 50 minutes after the hour. After a number was used it was scratched from the list by an observer and the next number below it indicated the random rest break period for the next observation hour.

Therefore, 48 minutes of an hourly schedule for an observer was used for data collection in the six sampling periods and ten minutes was allowed for an observer break period. An additional two minutes in each hour were available as needed to set up data

Table 2. Data collection work sampling random rest break schedule for observers: Minute after the hour to begin rest break period

10	30	00	40	10
20	30	30	00	00
50	00	30	40	00
40	00	50	40	30
40	30	50	00	50
40	50	30	50	40
20	30	20	30	40
50	40	30	50	30
20	30	40	00	40
40	20	00	20	20
10	50	30	00	50
40	50	30	50	00
30	40	40	00	00
10	40	00	10	10
00	40	20	00	20
50	20	50	00	20
30	20	00	00	00
00	00	20	20	40
40	20	10	40	50
20	20	20	30	00
30	30	20	30	20
20	20	50	20	10
10	50	50	20	50
30	00	50	30	30
40	40	40	10	00
00	10	00	20	40
10	00	50	00	20

collection forms and make observations of groups of employees spread widely apart. If this time was not used among the six sampling periods, it was used as additional rest break time.

A coding system was developed for recording the work sampling data to identify each cluster of observations. The system included a numerical code for observers, employees and the store being surveyed. In addition, the code system included types of departments, employee positions, weeks, days, hours, and intervals of the hour (Table 3). This system was developed in numerical form for ease of adaptation for computer use. The coding also was designed so that cross checks could be made to identify miscoded observations and to check the sample for missing observations. The code was placed on the observer's clipboard along with the random rest break schedule. Also the clipboard included a list of employee names and their name code numbers.

The work sampling data were recorded on a data collection form (Figure 4).

An example of a properly recorded cluster of observations for meat manager Jim Hack, name code 19, of Store 4 is illustrated in Figure 5. The cluster was collected by observer 2 in the first interval between 7 a.m. and 8 a.m. Thursday, of the first week of observation. The observer recorded five observations of "other work" activities.

Table 3. Work sampling data coding system for departments, employee positions, weeks, days, hours, and intervals of the hour

Department

1 = Grocery
2 = Meat
3 = Produce
4 = Bakery

Position

1 = Dept. Manager
2 = Cutter
3 = Wrapper
4 = Baker
5 = Decorator
6 = Clerk
7 = Box Boy
8 = Clean-up Boy

Day

1 = Sunday
2 = Monday
3 = Tuesday
4 = Wednesday
5 = Thursday
6 = Friday
7 = Saturday

Interval

1 = First interval
2 = Second interval
3 = Third interval

Week

1 = First week in store
2 = Second week in store

Hour

1 = 1 a.m.	13 = 1 p.m.
2 = 2 a.m.	14 = 2 p.m.
3 = 3 a.m.	15 = 3 p.m.
4 = 4 a.m.	16 = 4 p.m.
5 = 5 a.m.	17 = 5 p.m.
6 = 6 a.m.	18 = 6 p.m.
7 = 7 a.m.	19 = 7 p.m.
8 = 8 a.m.	20 = 8 p.m.
9 = 9 a.m.	21 = 9 p.m.
10 = 10 a.m.	22 = 10 p.m.
11 = 11 a.m.	23 = 11 p.m.
12 = 12 a.m. (noon)	24 = 12 p.m. (midnight)

Figure 4. Work sampling data collection form used for clustered observations of departmental employees.

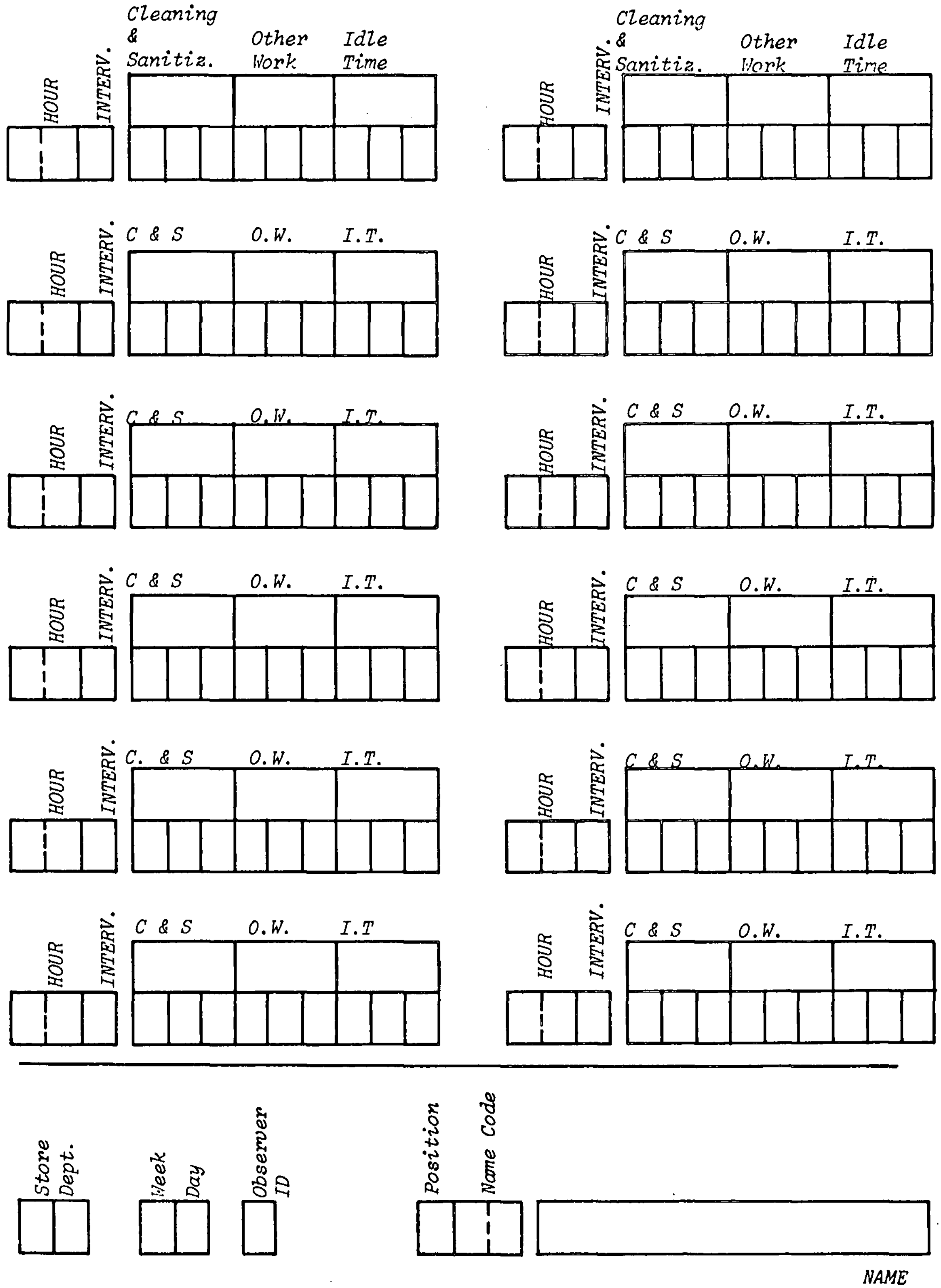
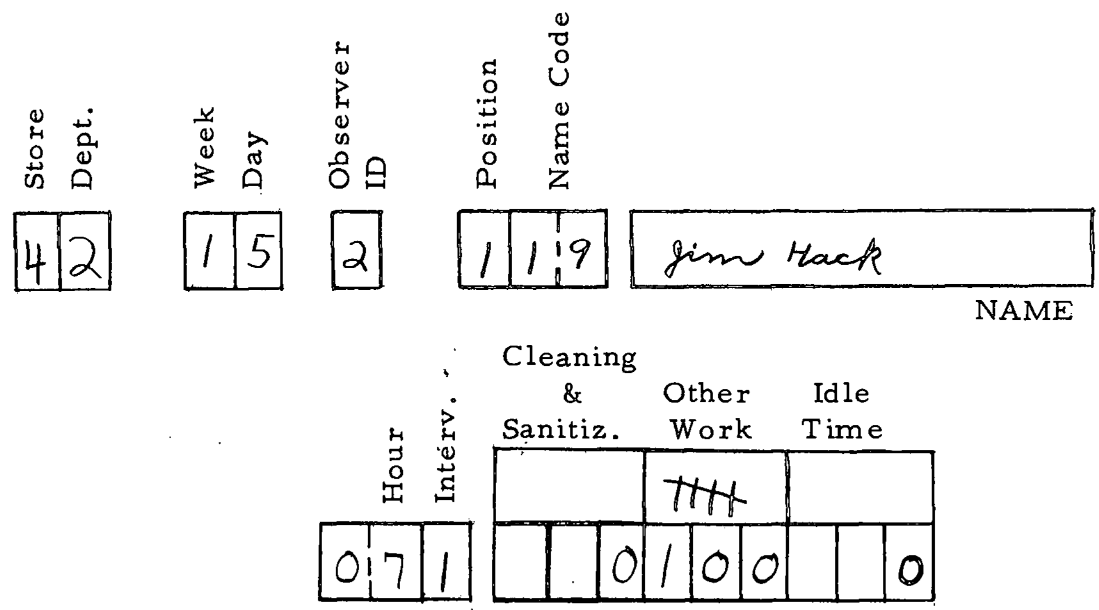


Figure 5. Illustration of a properly recorded cluster of observations for the work sampling data collection process



The work sampling data in this study consisted of observations made of four Oregon retail food stores employees. In three of the stores the data were collected in one sampling period. In the fourth store, data were collected in two sampling periods spaced two months apart. A sampling period consisted of seven consecutive days. The sampling days for a store were consecutive to facilitate observer scheduling.

The sampling period each day included all of each store's operating hours exclusive of hours utilized by night stocking crews. Only one store had a night crew that worked every night of the week. A second store had a regular night crew that worked two days a week. These employees were not observed because personal interviews with the managers of these two stores revealed that sanitation activities were not performed by these employees.

The work sampling data collection process was conducted during the fall of 1974. Work sampling was not conducted during the two weeks preceding Thanksgiving, since it was assumed that this holiday might tend to increase store sales activity and disrupt normal work loads.

The data collection technique for the work sampling process was designed with flexibility to accommodate variations, such as employee grouping patterns, encountered among surveyed stores. For example, more observers were used at the beginning of the sampling period in a store to observe small groups of employees until employee grouping patterns were identified. Then larger groups of employees working closer together were selected for each observer. However, eight employees tended to be the maximum number an observer could accurately observe in one group.

An estimate was made for the number of people required for an observation team to collect the work sampling data. The observation team consisted of eight people: one full-time coordinator, one full-time assistant, and six graduate students in the Department of Agricultural and Resource Economics at Oregon State University who served as part-time observers. All members of the team were required to make observations. Observers were trained in a workshop which included a session on supermarket flow processes and layouts; and definitions of employee activities to be observed. In a second session, observation procedures were presented and demonstrated to the trainees. In the final session, observers practiced collecting work sampling data and an observer schedule was developed for the first store to be surveyed.

Idle Time Allocation. From the labor data collected, a standard time for carrying out existing sanitation procedures in the surveyed stores was computed. A standard time for an activity includes the normal time plus an allowance for idle time because employees are not expected to work 100 percent of the time (Barnes, 1968). In this study which concentrates on sanitation activities, idle time was allocated proportionally between sanitation and other work activities.

The proportion of time observed as idle time is computed the same way as sanitation time. The proportion of time observed as other work activities also can be computed by subtracting the proportion for sanitation and idle time from 1.00 which represents the total man-hours. It is possible to use this method since sanitation, other work, and idle time constitute the proportion of total man-hours.

The equation used to determine the standard sanitation time was:[21]

$$(A/A + B)\ (C) + A = A'.$$

A = proportion of time for sanitation activities.

B = proportion of time for other work activities.

C = proportion of time for idle time activities.

A' = proportion of standard time for sanitation activities.

The expression $(A/A + B)$ modifies sanitation time from a proportion of total man-hours $(A + B + C)$ to a proportion of productive time (sanitation (A) and other work (B) activities). This modification is necessary in order to fully allocate idle time to productive activities. Next the modified value for sanitation time is multiplied by the proportion of total man-hours observed as idle time, $(A/A + B)\ (C)$. This determines the portion of idle time to allocate to sanitation activities. Adding this value to the proportion of total man-hours devoted

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[21] Example: A meat department spends 10% of its time on sanitation activities, 85% on other work activities and 5% on idle time activities. Substituting values into above, $A' = 11\%$, the standard time for sanitation activities for that meat department. Conversely, the standard time for other work activities, B', also can be computed by changing the equation to

$$(B/A + B)\ (C) + B = B'$$

Substituting the values into this equation, $B' = 89\%$, the standard time for other work activities. Thus, idle time is fully allocated to productive activities because $89\% + 11\% = 100\%$.

to sanitation, $(A/A + B)(C) + A$, results in A', the standard proportion of total man-hours devoted to sanitation activities.

Cost Computation. The sanitation labor cost of employees observed with the work sampling technique was determined using the standard proportion of total man-hours for sanitation, weekly labor schedules, and payroll accounting data. The labor cost data were determined on a departmental basis for purposes of analysis.

The weekly sanitation labor cost for a department was calculated as G, where

$$\sum_{i=1}^{n} \frac{W_i H_i}{\sum_{i=1}^{n} H} = D, \text{ the weighted average hourly departmental wage}$$

$$\frac{Q + R}{Q} = E, \text{ payroll wages and overhead labor cost as a proportion of total payroll wages.}$$

$$D \times E = F, \text{ weighted average hourly departmental labor cost.}$$

$$A'\left(\sum_{i=1}^{n} H_i\right) F = G, \text{ sanitation labor cost for a department.}$$

where A' = standard proportion of total man-hours for sanitation in a department.

H_i = weekly man-hours of ith departmental employee ($i = 1, 2 \ldots n$).

Q = payroll wages of entire store for a quarter.

R = overhead labor cost of the store for a quarter including social security, unemployment insurance, health insurance and other employee benefits.

W_i = hourly wage of ith employee.[22]

While the weekly sanitation labor cost was determined for sanitation activities that occurred weekly or more often, a prorated labor cost was determined for sanitation activities that occurred less often than weekly. For example, prorated labor cost was computed for cleaning and sanitizing a frozen food display case quarterly. The

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[22] Example of computing weekly sanitation labor cost for a department with three employees:

Employees	Hourly Wage, W_i	Weekly Man-Hours, H_i	Weighted Average Hourly Departmental Wage
1	\$6.00	44	264/122
2	5.25	40	210/122
3	4.50	38	171/122
		$\Sigma H = 122$ hr.	D = \$5.29

\$10,000 = Q, payroll wages for a quarter
\$ 1,000 = R, overhead labor cost for a quarter

$$\frac{\$10,000 + \$1,000}{\$10,000} = \$1.10 = E,$$ wages and overhead labor cost as a proportion of wages.

$$\underset{(D)}{\$5.29} \times \underset{(E)}{1.10} = \$5.82 = F,$$ weighted average hourly departmental labor cost.

Assume $A' = 0.11$, the standard proportion of man-hours for sanitation,

then $\underset{(A')}{0.11} \times \underset{(H)}{122} \times \underset{(F)}{\$5.82} = \$78.10 = G$, the weekly sanitation labor cost for a department.

man-hours for these sanitation activities was estimated by departmental managers.

The prorated sanitation labor cost was computed as L, where

$\frac{T_j}{U} = K_j$, the prorated labor time for jth sanitation activity ($j = 1, 2 \ldots m$).

$\sum_{j=1}^{m} K_j \times F = L$, the prorated sanitation labor cost per week.

F = weighted average hourly departmental labor cost (the same as determined for weekly sanitation labor cost).

T_j = man-hours required for cleaning and sanitizing the jth equipment or building surface ($j = 1, 2 \ldots m$).

U = interval of time given in weeks between repetition of sanitation activities for the jth equipment or building surface.[23]

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[23] The following is an illustration of the computation of prorated departmental employee sanitation labor cost:

Equipment or Surface	Sanitation Man-Hours, T_j	Repetition in Weeks, U	Prorated Man-Hours Per Week, K_j
Frozen food display case	10	13	0.77
Frozen food storage box	12	26	0.47
			$\Sigma K = 1.24$ hr.

Assume \$5.82 = F, weighted average departmental labor cost

(ΣK_j) (F)
1.24 x \$5.82 = \$7.22 = L, the prorated weekly sanitation labor cost.

The total sanitation labor cost for a department (S') was, ($G + L$), the sum of the weekly sanitation labor cost (G) and the pro-rated sanitation labor cost (L).[24]

Methods of Analysis

Sanitation Procedures

The procedures used to clean and sanitize each equipment and building surface in all areas of each department of the four surveyed stores were rated on a comparative basis with sanitation procedures recommended by Project Consumer Concern (PCC). PCC was a joint committee of the United States Department of Agriculture (USDA) and the National Association of Retail Grocers of the United States (NARGUS). It was established for the purposes of studying retail food store sanitation practices and developing a supermarket sanitation program. As a result, sanitation guidelines and checklists were developed for instituting a voluntary store-wide sanitation program (USDA-NARGUS, 1973). A literature review of sanitation procedures did not reveal any other single source which covered all departments

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[24] From the results of the preceding two footnotes, the total sanitation labor cost for the department is:

$$\overset{G}{\$78.10} + \overset{L}{\$7.22} = \overset{S'}{\$85.32}$$

of a retail food store.[25] PCC's recommended procedures were stated in terms of clean, sanitize, and/or vacuum. Also, PCC's recommended execution frequencies for sanitation procedures were stated as daily, weekly, or quarterly.

A rating system with a five-point scale (low to high) was developed to compare surveyed store sanitation procedures with those recommended by PCC. A sanitation procedure with a rating of 5 indicated that an observed procedure exceeded PCC's recommendation and minimized potential public health hazards. A public health hazard in this instance refers to potential food-borne illnesses caused by pathogenic microorganisms such as staphylococci. A sanitation procedure with a rating of 4 exceeded the PCC recommendation. A rating of 3 meant that the store sanitation procedure was the same as recommended by PCC while a rating of 2 meant that it was below PCC's recommendation. A rating of 1 for a store sanitation procedure was below PCC's recommendation and constituted a potential public health hazard. While this rating system is somewhat subjective in nature, it was developed to provide a basis for

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[25] Literature reviewed included SMI Sanitation System Guidelines and Standards, Supermarket Institute, Inc., 1973; Orts and Vastine, Meat Sanitation Pays, 1973; Nauman et al., Handling Prepackaged Meat, 1968; NARGUS, Produce Packaging Information, 1967; Learning Systems Development Corporation, Grocery Stocking, 1971.

differentiating among sanitation procedures executed by the four surveyed stores.[26]

The following is an example of an assigned rating for a given sanitation procedure. PCC's recommended procedure for a cuber in an unrefrigerated meat department preparation area was to clean and sanitize it twice daily. Failure to fulfill this recommendation by cleaning and sanitizing only once daily could allow growth of potential food-borne pathogens and therefore would be rated a 1. Practices such as a display floor cleaning frequency below PCC's recommendation would not normally constitute a potential public health hazard and would therefore only be rated a 2.

Sanitation procedures ratings in each area of a department of the four surveyed stores were averaged to provide an indication of the overall relative level of sanitation procedures of a departmental area compared to the procedures recommended by PCC. This relative level of sanitation also was compared among stores. Deviations from an average rating of 3 for a departmental area which seemed significant were explained. For example, one store rated significantly low in the bakery department preparation area because sanitizing procedures were not executed as recommended by PCC, while the

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[26] William D. Davidson, a food technologist specialist at Oregon State University, was consulted in establishing this rating system for sanitation procedures.

cleaning procedures for the preparation area were generally carried out as recommended.

Project Consumer Concern did not recommend sanitation procedures for all the equipment and building surfaces found in the four surveyed stores. In such cases these procedures for each store were listed and explained rather than compared and rated with PCC's recommendations.

Sanitation Management Practices

Sanitation management practices were evaluated by type of department following the recommendations of Project Consumer Concern, other research studies, and state sanitation regulations. While a rating system was used to analyze sanitation procedures in each store, sanitation management practices were analyzed without using a rating system. Individual stores were not identified for most practices in order to maintain confidentiality among stores. Thus, practices were evaluated for the stores as a group.

The analysis of sanitation management practices involved evaluating data recorded by the observation team on the sanitation management practices data collection forms. These data were compiled by departments for each store to analyze the number of observations of each practice. The compilations of observations were evaluated for tendencies indicating strengths and weaknesses in sanitation management practices. For example, a frequent observation in the meat department display areas of three of the four surveyed stores revealed a condition of overfilled frozen meat cases. However, the fourth store did not exhibit this practice. The practice of overfilling frozen display cases was explicitly in violation of both state sanitation standards and recommendations established by Project Consumer Concern.

Sanitation Costs

Cross-classification tables were constructed to permit analysis by department of relationships between employee position and sanitation labor. The sanitation labor was presented in man-hours, as a percent of total man-hours, and in terms of wage costs per man-hour. Total man-hours and hourly base wage rates for each position were presented as references.

Sanitation man-hours and their percentage of total man-hours by position did not include an allocation for idle time. Thus, sanitation man-hours could be analyzed without being distorted by the idle time factor. However, in the departmental summary both standard sanitation man-hours (which included idle time) and sanitation man-hours without idle time were presented to show the affect of idle time upon sanitation labor cost. The sanitation man-hours by position were summed to give weekly totals in the departmental summary.

Hourly wage rates in the cross-classification tables for each position represented weighted averages in proportion to the man-hours worked by employees in the same position who received different hourly wages. Hourly wage rates by position did not include overhead labor costs such as payroll taxes. However, the average hourly wage rates reported in the departmental summaries were computed both with and without overhead labor costs, for comparison purposes. The average hourly wage rates including overhead labor cost were used to compute the total sanitation labor costs per week by department for each surveyed store.

Besides comparisons of sanitation time percentages, man-hours, and wage costs within departments of the four stores, the tables were constructed to provide for comparisons among stores. Differences between sanitation time percentages among stores by employee position sometimes were accounted for by differences in sanitation procedures or differences in store operations.

Additional cross-classification tables were constructed to analyze cost differences associated with sanitation equipment, supplies, labor and services among and between each department of each store surveyed. The weekly sanitation labor cost already had been analyzed as a wage cost, but not as a total cost. These data were presented as average total costs per week.

Finally, statistical tests of the mean proportion of departmental employee man-hours devoted to sanitation activities were made to determine significant differences among stores surveyed. The statistical test for significant differences in the proportion of total man-hours devoted to sanitation between two stores is the null hypothesis, H_o: $\bar{p}_1 = \bar{p}_2$, and the alternative hypothesis, H_a: $\bar{p}_1 \neq \bar{p}_2$. A statistical t-value,

$$t = \frac{\bar{d}}{\sqrt{S_{\bar{d}}^2}},$$

was computed to test the hypothesis where $\bar{d} = \bar{p}_1 - \bar{p}_2$ is the difference of the sample means. To determine $S_{\bar{d}}^2$ (the sample variance of the difference), first a pooled difference was determined, S_p^2.

$$S_p^2 = \frac{[(n_1)(n_1 - 1)(V\bar{p}_1)] + [(n_2)(n_2 - 1)(V\bar{p}_2)]}{n_1 + n_2 - 2}.$$

The sample variance of the mean difference is

$$S_{\bar{d}}^2 = S_p^2 \left[\frac{n_1 + n_2}{n_1 n_2}\right].$$ [27]

n_1 = number of observation clusters in Store 1.

n_2 = number of observation clusters in Store 2.

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[27] When n is large, the sample variance of the mean difference is

$$S_{\bar{d}}^2 = \frac{(n_1^2 \cdot V\bar{p}_1) + (n_2^2 \cdot V\bar{p}_2)}{n_1 n_2}.$$

$\bar{p}_1$ = sample mean proportion of sanitation time in Store 1.

$\bar{p}_2$ = sample mean proportion of sanitation time in Store 2.

$V\bar{p}_1$ = estimated variance of sample mean proportion in Store 1.

$V\bar{p}_2$ = estimated variance of sample mean proportion in Store 2.

(Peterson, 1972)

The estimated statistical t-value is then compared to the t-value from a Students' t-table with a predetermined probability. When the tabular t-value is greater than the estimated statistical t-value, the null hypothesis is not rejected or in this case it is concluded that no statistically significant difference exists between two stores.

The combined average sanitation time percentages of the meat, grocery, and produce departments were tested between stores. The bakery departments' sanitation time percentages were not included in the average sanitation time percentages for the two stores with in-store bakeries in order to test the four surveyed stores on a departmental equivalent basis. However, the two bakery departments were tested for statistical differences in sanitation time percentage. A statistical test of differences between weeks also was made for the one store which had two observation weeks.

III. FINDINGS AND ANALYSIS

General Store

Store Profile

Stores A and C were classified as independent stores while Stores B and D were chain stores (Table 4). Three of the stores, Stores A, B, and C, were conventional supermarkets, while Store D was a food department in a general merchandise store. Of the four stores, Stores A and D included three basic departments: grocery, meat, and produce, while Stores B and C also had in-store scratch bakeries. Average weekly sales volumes for Stores A and B ranged between $40,000 and $60,000. Both stores employed between 35 and 40 people.

Weekly sales of Stores C and D averaged over $90,000. Store C employed over 70 people while Store D employed over 50. Two factors accounted for the larger number of employees in Store C compared to Store D. First, more part-time employees were used in Store C than Store D, especially in the grocery department. Second, Store C had an in-store scratch bakery department which

Table 4. General profiles of four surveyed Oregon retail food stores, Fall 1974

Category	Store A	Store B	Store C	Store D
Ownership[a]	Independent	Chain	Independent	Chain
Weekly Sales	\$40,000-\$60,000	\$40,000-\$60,000	\$90,000-\$110,000	\$90,000-\$110,000
Store Area (sq. ft.)	18,000	18,000	25,000	25,000
Age (years)	13	12	2	6
Type of Supermarket[b]	Conventional	Conventional	Conventional	Food Dept.
Departments[c]	G(I), M, P	G(I), M, P, SB	G(I), M, P, SB	G(NI), M, P
Check Stands	8	6	10	9
Employees	35	36	73	51

[a] A chain operation consists of eleven or more store units while an independent operation consists of one to ten store units (Progressive Grocer, 1967).

[b] A conventional supermarket has most of its selling area devoted to food products. A food department is a supermarket in a general merchandise store and is distinctively separated from other areas of the store (Super Market Institute, 1973).

[c]

G	Grocery	NI	Nonintegrated	P	Produce
I	Integrated	M	Meat	SB	Scratch bakery

An integrated grocery department has food and nonfood products stocked in the same display area. A nonintegrated grocery department has food and nonfood products displayed in separate areas of the department.

required more man-hours compared to the self-service bakery sub-department (of the grocery department) in Store D.

Sanitation Program Profile

Table 5 illustrates the total store sanitation programs of the four surveyed supermarkets. Of the four surveyed stores, only Store B had a formal sanitation program for all departments.[28] Store B had the sanitation procedures posted on the walls of the meat, produce, and bakery departments, but not in the grocery department. Also, more detailed instructions were contained in Store B's sanitation manual for all departments. Only one other store, Store D, followed some kind of formal sanitation program. It applied to the meat department and consisted of a sanitation schedule posted on the wall.

Sanitation procedures involving both cleaning and sanitizing were executed in all four stores using the one-step cleaning-sanitizing chemicals in the same wash solution compared to the two-step method which involves applying the two chemical agents separately.

Each store used a variety of cleaning and sanitizing agents of which some were commercial products and some were household

[28] A formal store-wide sanitation program was implemented in Store B two weeks prior to the work sampling and sanitation management practices data collection period.

Table 5. Sanitation program profiles of four surveyed Oregon retail food stores, Fall 1974

<table>
<tr><th rowspan="2">Category</th><th colspan="4">Store</th></tr>
<tr><th>A</th><th>B</th><th>C</th><th>D</th></tr>
<tr><td>Formal Program</td><td>No</td><td>Yes</td><td>No</td><td>Yes</td></tr>
<tr><td>Sanitation Center</td><td>No</td><td>Yes</td><td>No</td><td>Yes</td></tr>
<tr><td>In-Store Janitor</td><td>No</td><td>Yes</td><td>No</td><td>Yes</td></tr>
<tr><td>General Sanitation Procedure[a]</td><td colspan="4">← One-Step Cleaner-Sanitizer →</td></tr>
<tr><td>Cleaning Methods[b]</td><td colspan="3">← Manual →</td><td>Mechanical</td></tr>
<tr><td></td><td colspan="4">← Water Pressure →</td></tr>
<tr><td>Sanitation Equipment</td><td>Vacuum</td><td colspan="2">← Wet Mop
Bucket
Scraper
Hose with Nozzle
Dust Mop
Broom
Squeegee →</td><td>Mobile Floor Scrubber, Portable High Pressure Washer
Floor buffer</td></tr>
<tr><td>Cleaning and Sanitizing Agents[c]</td><td>409-C
Ajax-C
Janitor in A Drum-C
Pinesol-CS
Windex-C
Bleach-S
*Septisol-CS
Hand Soap-C</td><td>*Westosan-CS
*Westpower-C
*Scrub-CS
Windex-C</td><td>*Amway-CS
Bleach-S
409-C
Dish Detergent-C
Windex-C
Lysol-CS
Hand Soap-C</td><td>*Westosan-CS
*Westpower-C
*Luron-C
409-C
SOS Pads-C
Ammonia-CS
*Ten and Forty-C
Bleach-S
Dish Detergent-C</td></tr>
<tr><td>Outside Sanitation Services</td><td colspan="4">← Laundry
Garbage Disposal
Steam Cleaning
Exterminator →</td></tr>
<tr><td></td><td colspan="3">← Janitorial →</td><td></td></tr>
<tr><td></td><td></td><td>Rest Room Sanitation Service</td><td></td><td></td></tr>
</table>

[a] In executing the one-step cleaning and sanitizing procedure, a germicidal detergent is used in the same step to clean and sanitize simultaneously.

[b] Cleaning Methods: Manual methods include such activities as scraping, wiping, and mopping, while mechanical methods refer to vacuuming, using a mobile floor scrubber, and a floor buffing machine. The water pressure method involves either spraying equipment and building surfaces using water pressure from in-store water lines or spraying with a portable high pressure washer which develops more pressure than the pressure from in-store water lines.

[c] C = Cleaner S = Sanitizer CS = Cleaner-Sanitizer

*These products are commercial cleaning and sanitizing agents which are also listed by manufacturer in Appendix I. Mention of trade products by firm name does not imply that they are endorsed or recommended by Oregon State University over other firms or similar products not mentioned.

products.[29] Westosan, Westpower, and Scrub were three commercial products used in Store B and manufactured by West Chemical Company. Westosan was a general cleaner-sanitizer used throughout the store. Westpower was a degreasing agent mainly used in the meat and bakery departments to remove heavy grease buildups on equipment and surfaces such as ovenhoods and barbecue units. Scrub was a hand cleaner-sanitizer that was dispensed at all hand sinks in Store B. Westosan and Westpower also were used on similar equipment and surfaces in the meat department of Store D similar to their use in Store B. These two chemical agents were dispensed by a high pressure portable washer in Store D.

Luron, a hand cleaner manufactured by U. S. Borax Company, was dispensed at hand sinks in all departments and rest rooms of Store D. Septisol, a hand cleaner-sanitizer produced by Vestal Laboratories, was used in the meat department of Store A.

Another commercial cleaner-sanitizer, Amway Corporation's Liquid Organic Concentrate (L.O.C.), was used in the meat department of Store C for cleaning and sanitizing most of the equipment, building surfaces, and meat department employee hands. Also, Ten

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[29] Commercial cleaning and sanitizing agents used by the four surveyed stores are also listed by manufacturers in Appendix I. Mention of trade products by firm name does not imply that they are endorsed or recommended by Oregon State University over other firms or similar products not mentioned.

and Forty Cleaner and Finisher, a commercial product produced by Paulsen and Roles Laboratory was a cleaning-waxing agent applied to the display floors of Store D.

Household brands of cleaning and sanitizing agents were used by all the stores. Laundry bleaches, window cleaners, and general purpose cleaners such as 409 and Fantastic were among the most common products used.

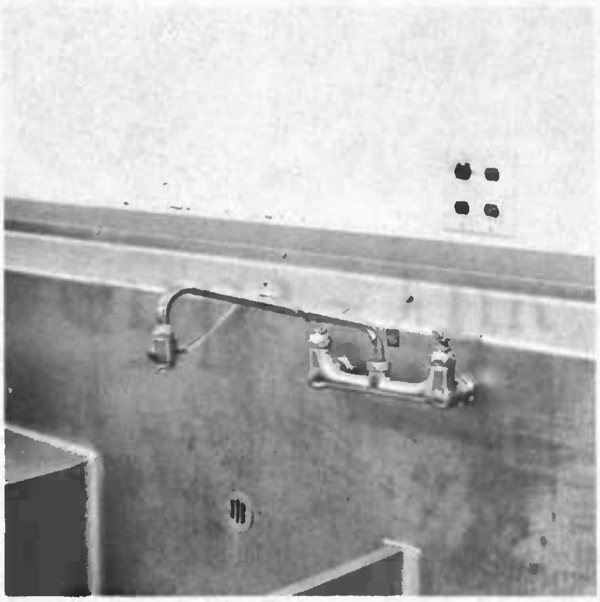
Laundry bleach was used as a sanitizer in the meat departments of Stores A, C, and D. In Store C, bleach was used as a sanitizer for all equipment and surfaces which were sanitized and was mixed with L.O.C. in the meat department even though L.O.C. contained a sanitizing agent. In Store D, bleach was added to mopping solutions to sanitize its floors. It also was added to water in a spray bottle used in the meat department to sanitize all meat contact surfaces of equipment between each batch of meat processed. In Store A, bleach was used in mop solutions for floors in all departments. In the meat department of Store A, bleach was combined with Janitor In The Drum, a cleaner agent and was used to clean and sanitize most of the department's equipment and surfaces.

Another characteristic of the sanitation programs of the four surveyed stores was the method used to clean equipment and building surfaces. Three basic types of methods were employed: manual, mechanical, and water pressure. Manual methods included such activities as scraping, wiping, and mopping. Mechanical methods entailed vacuuming, use of a mobile floor scrubber, and use of a floor buffing machine. The water pressure method involved either spraying equipment and surfaces using water pressure from in-store water lines or spraying with a portable high pressure washer which developed more pressure than the pressure from in-store water lines. In addition to manual cleaning, the next common method used was water pressure in Stores A, B, and C. In Store D, the mechanical method was used on floors daily. A portable high pressure washer also was used extensively in the meat department of Store D.

Sanitation equipment commonly found in all four stores included brooms, dust mops, wet mops, mop buckets with wringers, hoses with nozzles, scrapers, and squeegees. In Store A, a rake was used in the meat cooler to remove sawdust. Store A also used a vacuum for cleaning its carpet.

Metering devices were used on water lines in the bakery, meat, and produce departments of Store B and in the meat department of Store D (Figure 6). These devices were connected to a container of cleaner-sanitizer agent to regulate the correct amount of chemical agent siphoned into the water lines. As a result, the flow of chemical agent could be started or stopped for cleaning-sanitizing and rinsing operations respectively. The metering device usually was set at a mixing level according to the manufacturer's recommendations.

Figure 6. Metering device attached to a faucet's nozzle in one meat department of the four surveyed Oregon retail food stores, Fall 1974



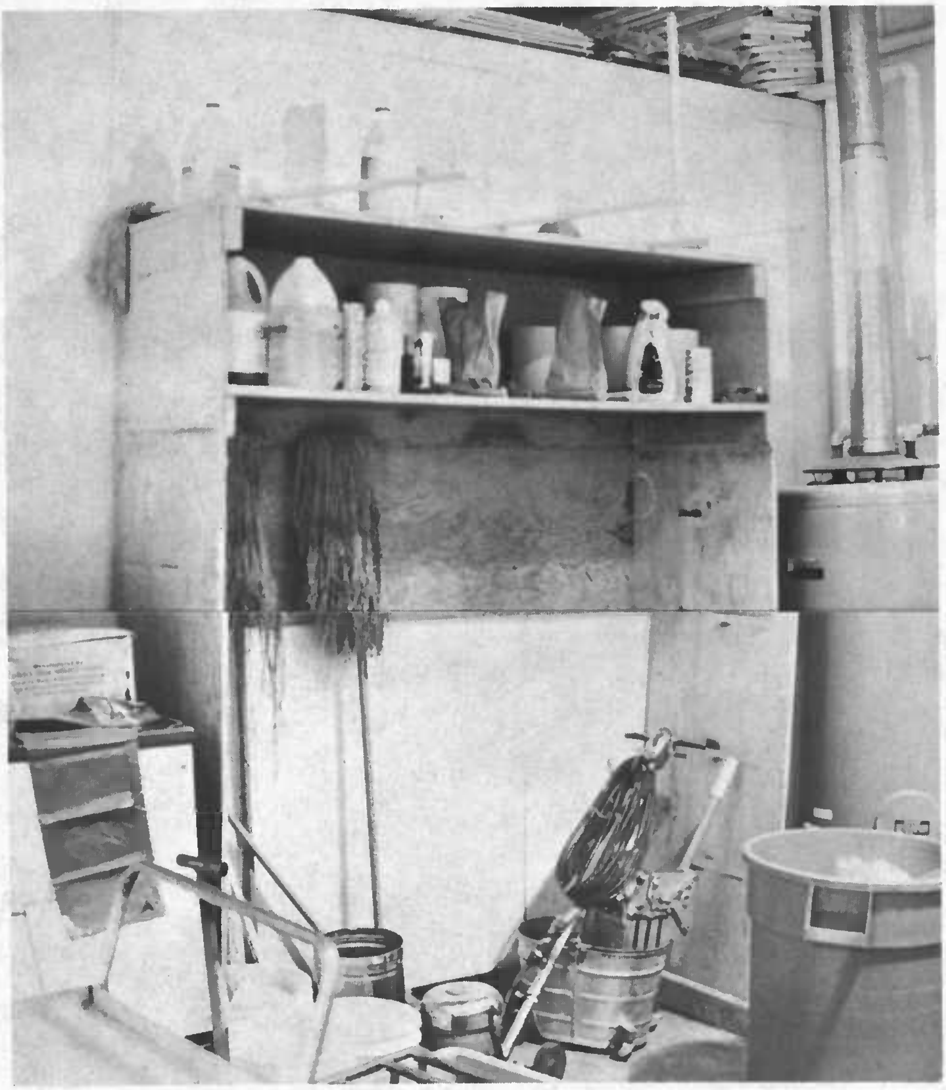
All four stores used outside sanitation services: laundry, garbage disposal, steam cleaning, and pest control. In addition, Stores A, B, and C maintained contractual agreements with janitorial service firms to clean display area floors and windows. Store B maintained a contractual agreement with a rest room sanitation service firm. This firm cleaned and sanitized rest room toilets every two weeks using wire brushes and other materials not normally used by store employees who cleaned and sanitized the rest rooms every other day.

Store B employed a part-time janitor whose responsibilities included cleaning and sanitizing rest rooms, and replenishing supplies in rest rooms with supplies obtained from the sanitation center. In addition, Store B's janitor cleaned and sanitized ash and garbage cans in the display areas. He also helped to clean and sanitize meat, dairy, and produce display cases.

Store D employed approximately three full-time janitors to meet its janitorial service needs. Store D's janitorial staff cleaned floors, cleaned and supplied rest rooms, cleaned ash and garbage cans in display areas, and baled cardboard and garbage.

Stores B and D had sanitation centers where equipment and supplies were stored (Figure 7). The sanitation center in Store D mainly was used by its in-store janitorial staff and was locked during store operating hours. A problem appeared to exist in Store D as to

Figure 7. Sanitation center in one (Store B) of the four surveyed Oregon retail food stores, Fall 1974



which store employees should have access to the sanitation center. The in-store janitorial staff locked the center because they argued that some departmental employees failed to properly care for sanitation equipment, and furthermore often had failed to return the equipment to the center after using it. On the other hand, departmental employees complained of not having access to enough sanitation equipment to adequately perform their sanitation duties during the day.

The principle purpose of a sanitation center often is to provide a central location for employees to obtain sanitation equipment and to return it after use. This purpose tended to be defeated in Store D where access was limited only to the janitorial staff while departmental employees also were held responsible for cleaning and sanitizing the store. As observed in Store D, which had a locked sanitation center, and in Stores A and C, which did not have centers, equipment was scattered throughout the stores and employees had to spend extra time locating equipment each time it was used.

Another situation which occurred in Stores A and C which did not have sanitation centers was that five or more partially used containers of the same cleaner and sanitizer agents could be found throughout the store. This situation would be less apt to exist if a sanitation center was established and properly used. Moreover, an inventory of supplies and equipment can be taken faster and more accurately when sanitation materials are located in one area rather than being scattered throughout a store.

Sanitation Procedures in Nondepartmental Areas

Personal interviews with store employees enabled identification of the sanitation procedures used in nondepartmental areas such as rest rooms, offices, and lounges (Table 6). Box boys were responsible for cleaning and sanitizing these areas in Stores A and C. Instore janitors were responsible in Stores B and D.

Rest Rooms. Of the nondepartmental areas in the four surveyed supermarkets, rest rooms tended to require the most frequent and thorough execution of sanitation procedures. Most surfaces in the rest rooms were cleaned and sanitized every other day except for the ceilings. Mirrors were cleaned but not sanitized. Floors were cleaned and sanitized daily in all stores exclusive of Store B where the floor was mopped with a cleaner-sanitizer every two days. The sinks were cleaned every day in Stores A, C, and D and cleaned and sanitized in Store B every two days. The toilet bowls were cleaned and sanitized daily in Stores C and D, every two days in Store B and weekly in Store A. An outside sanitation service firm also was hired by Store B to clean and sanitize the toilet bowls and surface areas around them every two weeks. The walls of the rest rooms were

Table 6. Nondepartmental area sanitation procedures of four surveyed Oregon retail food stores, Fall 1974

Category	Store A	Store B	Store C	Store D
Rest Rooms				
Floor	CS-DY	CS-2DY	CS-DY	CS-DY
Walls	CS-MT	CS-MT	CS-DY	CS-M
Ceiling	← No-CS →			
Sink	C-DY	CS-2DY	C-DY	C-DY
Toilet Bowl	CS-WK	CS-2DY CS-2WK	CS-DY	CS-DY
Mirror	C-WK	C-2DY	C-WK	C-DY
Wastebasket	C-DY	CS-2DY	C-DY	C-DY
Soap and Towel Dispensers	DY	2DY	DY	DY
Office and Lounge				
Floors	C-DY	C-DY	C-DY	C-DY
Walls, Ceilings	← No-CS →			
Wastebaskets	← Empty-DY →			

C	Clean	DY	Daily or Days
S	Sanitize	WK	Weekly
CS	Clean and Sanitize	MT	Monthly

cleaned and sanitized monthly, except in Store B, where this activity occurred every two days.

Wastebaskets were emptied daily in Stores A, C, and D while in Store B they were emptied every two days with the outside surface of the wastebasket being wiped with a cleaner-sanitizer solution. The supply of soap, towels, and toilet paper was inspected daily and replenished "as needed."[30] However, Store B had a frequency of inspecting its rest rooms for supply requirements every two days instead of daily.

Office and Lounge. Three stores had employee lounges and offices. Store A did not have a lounge and Store D did not have an office. Litter was removed and the floors were swept and mopped daily in the offices and/or lounges of Stores A, C, and D, but only every two days in Store B. Store A had a second office which was vacuumed weekly instead of being swept and mopped. The walls and ceilings of the offices and lounges of all four stores were not cleaned and sanitized.

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[30] "As needed" defines an irregular frequency determined on the basis of subjective judgment by store management. For example, the walls of a display area are cleaned and sanitized when they are visibly dirty (as needed).

Meat Department

Profile

Weekly sales of the meat departments in Stores A and B ranged from \$11,000 to \$16,000 and in Stores C and D from \$23,000 to \$27,000 (Table 7). Stores A, B, and C had approximately the same total area devoted to the meat department which included a self-service delicatessen subdepartment. In Store D, however, the meat department which also included a self-service delicatessen subdepartment, had approximately 1,000 square feet more area compared to the other three stores. The larger area was accounted for mainly by larger receiving and storage areas.

The preparation areas for the meat departments in Stores A and D were refrigerated and enclosed from other areas of the store. In Stores B and C the meat department preparation areas were unrefrigerated and open to other areas of the store.

Stores A and D received most of their fresh wholesale beef in hanging form while in Store C most beef was received in boxed form. Store B received a combination of boxed and hanging fresh beef.

Stores A and B each employed four people in the meat department, Store C employed nine people, and Store D employed seven people. Each meat department employed a manager who also cut meat besides managing the department. In Store D, a second person

Table 7. Meat department profiles of four surveyed Oregon retail food stores, Fall 1974

Category	Store			
	A	B	C	D
(Total Store Sales)	$40,000-60,000	$40,000-60,000	$90,000-110,000	$90,000-110,000
Weekly Departmental Sales	$13,000-16,000	$11,000-14,000	$23,000-26,000	$24,000-27,000
Area (sq. ft.)	1885	1725	1900	3250
Preparation Area[a]	Enclosed	Open	Open	Enclosed
Wholesale Beef Form	Hanging	Boxed Hanging	Boxed	Hanging
Employee Profile				
Total Number	4	4	9	7
Manager	1	1	1	2
Cutter	1	2	5	2
Wrapper/Clerk	2	1	2	3
Cleanup Boy	0	0	1	0

[a]The preparation areas in the meat departments were either refrigerated and enclosed from other areas of the store or unrefrigerated and open to other areas of the store.

managed the self-service delicatessen subdepartment of the meat department. Another person also worked primarily with delicatessen products in Store D. Store C was the only store which employed a regular part-time cleanup boy in the meat department. Store B used box boys from the grocery department as cleanup boys in its meat department during the first week of observation. This occurred because a meat cutter was on vacation part of the week and the store was having a beef sale. Regular meat department employees were required to work overtime as a result of the vacationing cutter and to provide extra manpower for the beef sale. During the second week of observation, the meat department was fully staffed by regular meat department employees and grocery department box boys were not utilized for cleanup.

The sales volume in the meat departments of Stores C and D were similar but Store C employed one more full-time meat department employee. This occurred because Store C had a higher ratio of fresh meat sales to delicatessen sales compared to Store D and fresh meat products tended to require more in-store labor than prepackaged delicatessen products.

In addition to the typical equipment found in the meat department of the four surveyed stores such as power saws, cutting tables, and grinders, Store D had a needle tenderizer, a conveyer to move meat from the cutting station to the wrapping station, and a freezer box to store meat separate from the grocery department freezer box. Store B had a poultry cooler separate from the red meat cooler. Both Stores B and C had barbecue units and warming ovens. Finally, Store A had a fresh seafood display case which was enclosed and separated from the fresh meat case.

Sanitation Management Practices

In this study sanitation management practices were classified into four areas: product management, temperature control, pest control, and employee hygiene. Product management involves the physical handling and display of products such as removal of leaking meat packages from display cases. Temperature control entails monitoring and maintaining proper temperature levels of perishable food products such as fresh meat. Pest control involves minimizing the amount of vermin in the store such as houseflies and rats. Finally, employee hygiene encompasses personal habits, health, hygiene, uniforms, and sanitation education.

Product Management. A practice observed in the meat department of all four stores was the removal of old products from display cases. This practice occurred daily when cases were restocked. However, decaying products such as cheese were still observed in the display cases of all stores during the survey weeks. Ground meat not sold within 48 hours of processing was removed from the fresh meat display case by meat department employees in all stores. The ground meat was not observed after it was removed from the case; however, it should have been discarded or cooked. Products with expired pull dates were not found in the fresh meat and delicatessen sections of the meat department display cases of any of the stores. Products in meat departments of all surveyed stores were sold on the basis of products received first, or in other words, on a first in, first out cycle (FIFO). When products began to deteriorate in quality they were placed in separate sections of meat and delicatessen display cases at reduced prices for quick sale. Moreover, molded cheese products were trimmed, rewrapped, and also displayed in this area. Other types of products placed in this section included discolored lunchmeats and fresh meats exclusive of ground meat.

In one store a customer was observed detecting a spoiled odor associated with fresh oysters (in the shell) in the seafood display cases. This odor was reported to a meat cutter who immediately removed all oyster packages from the display case. The oysters were placed in the morgue, a container for decayed and/or discarded products. While the above problem occurred even though products were sold on a FIFO basis, employees generally attempted to detect and remove old products from the display case. Furthermore, a strong odor of decaying meat was detected in two other stores surveyed. While the specific cause was not determined by the observers, possible explanations could be that the odor was being emitted by boxed fresh meat or the floor.

Prevention of cross contamination is another aspect of product management in terms of maintaining sanitary conditions.[31] The meat department preparation area is a potential place for cross contamination because different types of meat products are handled on the same contact surfaces. Observations of both proper and improper practices were made in this study. One example of a proper practice observed was cutting beef, then cleaning and sanitizing the equipment before cutting pork. An improper practice observed was cutting a turkey on a power saw immediately after cutting fresh pork. The saw was not cleaned and sanitized before or after cutting the turkey.

One of the meat departments was designed with two coolers, one for poultry and fish and one for red meat. This design helped to reduce the possibility of cross contamination between red meat and other meat products. One store tended to induce potential recontamination of unwrapped fully cooked meat by placing it in a cooler with fresh meat (Figure 8). It was not feasible to determine the existence

[31] Cross contamination in retail food stores refers to the transfer of microorganisms from one food product to another. All fresh meat is contaminated with microorganisms. However, the level of contamination by harmful microorganisms usually is low when products are properly handled and consumed within a reasonable length of time. Fully cooking fresh meat products destroys the most pathogenic microorganisms associated with it. Nevertheless, the fully cooked product can be recontaminated when not protected from cross contamination.

Figure 8. Unwrapped fully cooked meat stored with raw meat products in one of the four surveyed Oregon retail food stores, Fall 1974

Figure 9. A frozen meat case filled with turkeys above the load line in one of the four surveyed Oregon retail food stores, Fall 1974

of this problem (if it was prevalent) in the other store which sold hot delicatessen meat products because of departmental management's restriction on observer entry to the cooler. This policy could be supported on the basis of possible contamination of meat products in the cooler by observers. Stores A and B had table scales used for special orders. The employees in these stores placed waxed paper on scale platforms for each cut of meat weighed to prevent cross contamination.

Meat scrap barrels in all four stores were left uncovered when stored in meat coolers. These trim barrels usually contained meat which probably had high microbial counts since these barrels usually served as the morgue for old and discarded products. Consequently, uncovered scrap barrels constituted a potential source of spreading odor from decaying meat to uncut meat carcasses.

All four stores had plastic protective tubes around fluorescent lights in the meat processing areas. These tubes were used to prevent adulteration of meat should a light shatter. Another way in which meat could be adulterated by foreign material is from paint peeling off the ceiling. This situation was observed in one meat department preparation area.

"Leaker" meat packages were frequently removed from display cases by meat department employees in all stores during the display case restocking cycle. The leakers were then rewrapped and redisplayed. Packages of fresh chickens were observed leaking more than other meat products and usually these products were not rewrapped. The leaking was caused by sharp bones breaking the plastic bag. More leakage from fresh chicken packages compared to other fresh meat packages probably accounted for more frequent cleaning and sanitizing of poultry display sections as compared to other meat display sections. Because it was not feasible for employees to remove all leakers from the display case prior to customers placing them in their shopping carts, occasional trails of blood drippings were observed throughout each store's total display area. Usually these drippings were removed when cleaning the total display area floor.

Another sanitation practice observed in the meat departments of all four stores involved handling hazardous substances such as insecticides, and cleaning and sanitizing agents. All four supermarkets stored these substances safely away and/or below cutting and wrapping areas, usually under sinks or in cabinets.

Temperature Control. Proper temperature control practices were not being executed by all the stores. The most frequently observed problem was to overfill display cases beyond their load lines or to allow meat and delicatessen products to cover air ducts on display cases (Figure 9). Cheese products in the delicatessen display cases were the most common product observed covering air ducts of refrigerated display cases (Figure 10).

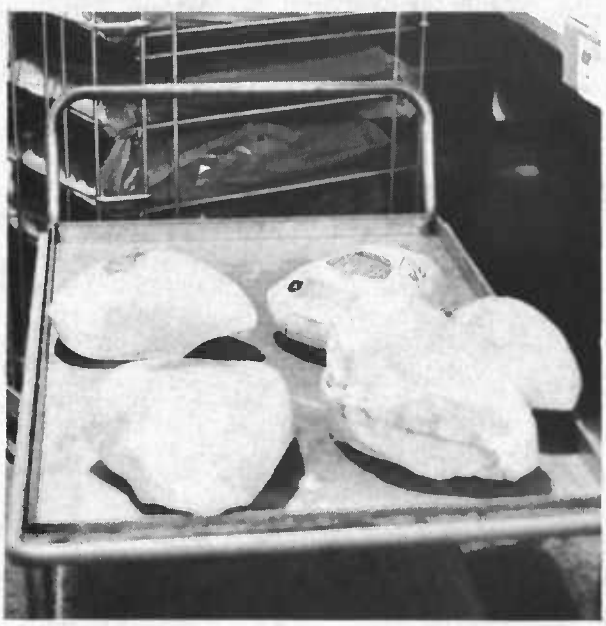
In only one store was frozen meat on display maintained in a completely frozen state. The other stores were observed keeping partially thawed poultry in the frozen display case. One incident observed involved the placement of a partially thawed frozen turkey in a fresh meat display case for twenty-four hours, and then transferring it to a frozen meat display case.

Another temperature control problem involved maintaining perishable products in unrefrigerated or unfrozen areas. A common practice observed in all stores involved removing meat from the freezer and placing it in a receiving area to thaw overnight (Figure 11). This could allow the outer surfaces of the products to remain above the temperature level set by Oregon's sanitation code (45^{o} F.) for several hours. In some instances, hot delicatessen products in two stores tended to be delayed in wrapping station areas which could allow product temperatures to fall below the prescribed temperature (140^{o} F.).

Written records of temperature levels in meat coolers of the four surveyed stores were not maintained as recommended by Project Consumer Concern. The temperature levels of coolers, freezers, and display cases reportedly were inspected daily, or more often by employees in all four stores. This practice was not observed because employees could inspect temperature levels of thermometers installed

Figure 10. Cheese products covering air ducts of a refrigerated delicatessen display case in one of four surveyed Oregon retail food stores, Fall 1974

Figure 11. Frozen turkeys left in an unrefrigerated area to thaw in one of the four surveyed Oregon retail food stores, Fall 1974



in the refrigeration units while performing other activities. Temperature levels of these thermometers were within recommended limits as observed in this study. However, confidence in the accuracy of these thermometers has been weak among State of Oregon sanitarians and other researchers.[32]

For purposes of sanitation and air circulation to maintain proper temperatures, hanging meat was kept away from cooler walls and off cooler floors. There was a tendency to place boxed meat against walls which could reduce air circulation around all sides of the boxes. However, the boxes of meat were kept off the floor.

While temperature control practices were violated by all four stores, there were no perishable food products observed which outwardly appeared unfit for human consumption due to improper temperature control practices.

Pest Control. Meat department employees of the two stores were observed at least once in each store spraying with "Raid" in preparation areas to control the presence of houseflies. The active

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[32] Davidson's and Bodyfelt's research in 24 Oregon retail food stores including the four stores surveyed in this study, revealed that only two-thirds of the display thermometers were within ± 5° F. (when working or when present). Davidson's research reported that temperatures of meat products in the display cases of the 24 stores were on the average 11.2° F. higher than the air temperature at the blower where thermometers usually are installed (Davidson, Temperature Control Monitoring: . . . , 1975).

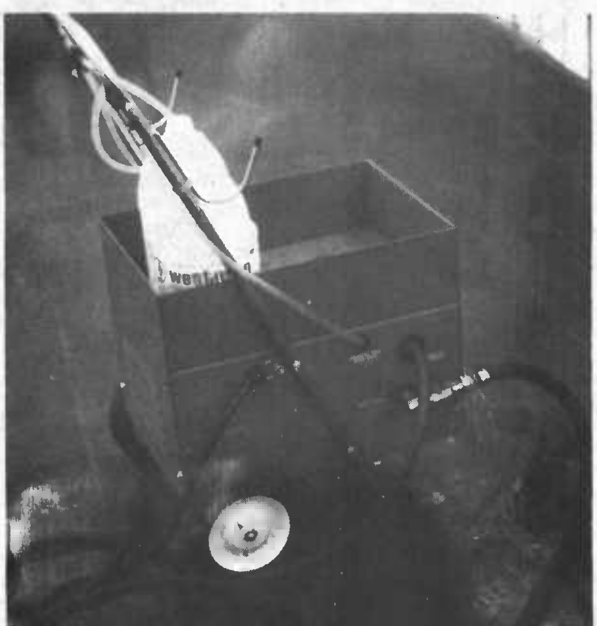
ingredient in "Raid" is pyrethrins, an Oregon Department of Agriculture acceptable chemical which can be used in food preparation areas providing all food and equipment is covered. The preparation areas in these two meat departments were sprayed after daily production was finished; however, employees failed to cover equipment before spraying the area. The fly problem was more prevalent because the processing areas were not enclosed. This allowed warmer temperatures and increased access to the meat preparation area by flying insects.

Employee Hygiene. Employees of three stores failed to wear hair coverings in processing areas during the entire production period as prescribed by the Oregon sanitation code (Figure 12). Employees in two meat departments were observed eating in the preparation areas which also was in violation of the Oregon sanitation code.

In addition, employees were observed smoking in the meat department areas of two stores, another violation of Oregon sanitation standards. This was observed during early morning hours prior to the onset of full production and during cleanup after daily production was completed. The general health of meat department employees appeared to be satisfactory with no signs of infected wounds, open sores, or acute respiratory infections.

Figure 12. Meat department employees failing to wear hair covering in the preparation area in one of the four surveyed Oregon retail food stores, Fall 1974

Figure 13. Portable high pressure washer utilized in the meat department of one (Store D) of the four surveyed Oregon retail food stores, Fall 1974



Sanitation Procedures

The sanitation procedures for all building surfaces and equipment in the meat department areas of the four surveyed stores were executed by departmental employees except for the floors, walls, and ceilings in the meat display areas. The meat display floors of all stores were cleaned along with the entire display area floors of the stores. In Stores A, B, and C, grocery department box boys and outside janitorial service firms maintained display floors. In Store D, its in-store janitorial staff maintained the meat display floor. Cleaning walls and ceilings of the meat display area was the responsibility of grocery department employees in all four stores. Sanitation procedures of the meat departments in the four surveyed stores were rated on a comparative basis with the procedures recommended by Project Consumer Concern (PCC) (Table 8).[33]

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[33] A joint committee of the United States Department of Agriculture and the National Association of Retail Grocers of the United States established Project Consumer Concern (PCC). It was established for the purposes of studying retail food store sanitation practices and developing a supermarket sanitation program. As a result, sanitation guidelines and checklists were developed for instituting a voluntary store-wide sanitation program (USDA-NARGUS, 1973).

In this study, Project Consumer Concern recommendations were selected for comparison with procedures executed by the four surveyed stores because PCC had developed recommendations for sanitation procedures in all departments of a retail food store. Other literature reviewed did not cover all departments.

Table 8. Meat department sanitation procedures of four surveyed Oregon retail food stores, Fall 1974 compared to procedures recommended by Project Consumer Concern[a]

Item	Recommended by PCC	Store A	Store B	Store C	Store D
Display Area					
Table Scales	CS-DY	3[b]	3	NA	NA
Warming Oven	CS-DY	NA	2	2	NA
Poultry, Fish Cases	CS-WK	3	3	3	3
Fresh Meat Case	CS-WK	2	2	3	3
Delicatessen Case	CS-WK	2	2	2	2
Frozen Meat Case	CS-QT	2	2	2	2
Floors	CS-DY	2	2	2	2
Walls	CS-MT	2	2	2	2
Ceilings	C-QT	2	2	2	2
	Average	2.3	2.2	2.3	2.3
Preparation Area		Food Contact Equipment			
Grinder	CS-DY below 55° F. CS-Twice DY above 55° F.	3	3	3	2
Mixer		4	3	3	4
Patty Maker		3	3	NA	4
Cuber	CS-DY below 55° F. CS-Twice DY above 55° F.	3	1	1	3
Slicer		3	1	1	3
Power Saw		3	1	1	3
Netter		NA	2	NA	3
Cutting Table		3	2	2	5
Knives, scrapers, steels		3	2	2	4
Tubs		2	4	4	4
Trays		2	4	4	4
Sink		2	2	2	3
Trees, Hooks	CS-After each use	1	3	3	4
	Average	2.7	2.4	2.4	3.5

Table 8 (cont.)

Item	Recommended by PCC	Store A	Store B	Store C	Store D
Preparation Area (cont)		Equipment and Building Surfaces Which Do Not Usually Contact Food			
Barbecuer	No Recommendation	NA	CS-DY	CS-DY	NA
Carts	No Recommendation	Steam C-SA	CS-BWK Steam C-SA	Steam C-3MT	Steam C-4MT
Roll Coll (Chicken Trough)	No Recommendation	NA	CS-BWK	CS-"as needed"C	C-WK CS-SA
Wrapping Station	CS-DY	3	3	3	3
Weighing Station	CS-DY	3	3	3	3
Scrap barrel	CS-After each empty W/ liner-CS-WK	2	2	2	2
Floors	CS-DY	2	3	3	2
Walls	CS-WK	2	4	4	3
Ceiling	C-QT	2	2	2	2
	Average	2.3	2.8	2.8	2.5
Cooler Area					
Floors	CS-WK	2	3	2	2
Walls, shelves	CS-WK	2	2	2	2
Ceiling, blower	CS-QT	2	3	3	2
Rails	C-MT	2	2	3	2
	Average	2.0	2.5	2.5	2.0

Table 8 (cont.)

Item	Recommended by PCC	Store A	Store B	Store C	Store D
Employees					
Hands	C	4	4	4	3
Uniforms	C	4	4	3	4
	Average	4.0	4.0	3.5	3.5
Departmental Average[d]		2.5	2.5	2.5	2.9

[a]A United States Department of Agriculture (USDA) and National Association of Retail Grocers of the United States (NARGUS) committee established Project Consumer Concern (PCC) which developed sanitation procedures for all departmental areas of a retail food store (USDA-NARGUS, 1973).

C	Clean	DY	Daily	QT	Quarterly
S	Sanitize	WK	Weekly	SA	Semiannually
CS	Clean and Sanitize	BWK	Biweekly	NA	Not Applicable

[b]Rating System:

5 Above procedures recommended by PCC and also minimizes public health hazard.
4 Above PCC's recommendation.
3 Same as recommended by PCC.
2 Below PCC's recommendation.
1 Below procedures recommended by PCC and could be a potential public health hazard.

[c]"As needed" defines an irregular frequency determined on the basis of subjective judgment by store or departmental managers. For example, walls of the display area are cleaned and sanitized only when visibly dirty or "as needed."

[d]The departmental average is the average rating of all items rated in comparison to PCC or the average rating of all areas weighted by the number of items in each area rated with PCC.

Display Area. Table scales were used only in Stores A and B and were cleaned and sanitized daily as recommended by PCC. According to PCC recommendations, warming ovens should be cleaned and sanitized daily; however, Stores B and C cleaned and sanitized them only on a weekly basis. In all four stores, poultry and fish cases were cleaned and sanitized weekly which corresponded to PCC's recommended procedures.

Project Consumer Concern's recommended procedure for the fresh meat case was to clean and sanitize it weekly. Only Stores C and D were in accord with this recommendation. In Store A part of the rack top was cleaned and sanitized daily, while the entire case was cleaned and sanitized only at monthly intervals. In Store B, a monthly cycle of cleaning and sanitizing one section per week was followed. The portable high pressure washer used by the meat manager in Store D permitted cleaning and sanitizing the fresh meat case without having to disassemble it (Figure 13). This probably reduced the number of sanitation man-hours required to clean and sanitize this case compared to the other surveyed stores because it was not disassembled and reassembled. Stores B and C used soaker pads beneath case racks to absorb leakage from meat packages. The pads facilitated the cleaning operation by not allowing the liquid to dry on the bottom panel of the case. Stores B, C, and D also used plastic netting on the racks of the meat display case to prevent foreign objects such as price labels from falling to its bottom, thus plugging its drain.

The frequencies recommended by PCC for cleaning and/or sanitizing the delicatessen and frozen meat cases, floors, walls, and ceilings in the display areas of the meat departments were not consistent with those practiced by any of the four surveyed stores. The recommended procedure for the delicatessen case was to clean and sanitize it weekly. The delicatessen case in Store B was cleaned and sanitized "as needed" during restocking.[34] The other three stores cleaned but did not sanitize this case "as needed" during stock rotation. In Store D, aluminum foil was used in the bottom of its delicatessen cases to facilitate the cleaning process. The frozen meat cases were cleaned semiannually in all four stores. Only in Stores B and D were the frozen meat cases sanitized semiannually. PCC recommended cleaning and sanitizing the frozen meat cases quarterly.

PCC's recommended procedure for display floors was to clean and sanitize them daily. The floors were cleaned but not sanitized daily by box boys in Stores A, B, and C. Store D's in-store janitorial staff cleaned the meat display floor daily. An outside janitorial service firm was contracted by Stores A, B, and C to clean and wax the

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[34] "As needed" defines an irregular frequency determined on the basis of subjective judgment by store management. For example, the walls of a display area are cleaned only when visibly dirty or "as needed."

meat department display floors. This service was performed weekly in Stores A and B and every two weeks in Store C.

PCC recommended that display walls be cleaned and sanitized monthly and that ceilings be vacuumed quarterly. The walls in all four stores were only cleaned if dirt was visible, and then box boys cleaned them. The ceilings were not cleaned in all four stores surveyed.

Most sanitation procedures in the meat department display areas of all four surveyed stores were below the recommendations established by PCC. The procedures in Stores A and B for a table scale, a piece of equipment where unpackaged meat could contact its surface, were in accord with PCC's recommendations. However, most sanitation procedures in the stores' display areas were applied to equipment and building surfaces which did not contact unpackaged food products. These procedures were executed mainly for merchandising purposes. Very little difference occurred between the average ratings assigned to sanitation procedures for the meat department display areas of the four surveyed stores.

Preparation Area. In PCC two alternative sanitation procedure frequencies were recommended for most equipment in the preparation area of a meat department. For food contact equipment, which included meat grinders, mixers, patty makers, power saws, steak cubers, slicers, netters, sinks, and cutting tables, the recommendation was to clean and sanitize them daily if the preparation area temperature was below 55° F., but twice daily if the temperature was above 55° F. The sanitation procedures executed in Stores A, B, and C for the meat grinders rated the same as recommended by PCC, while in Store D it was below PCC's recommendation. Store D's procedure for the grinder rated below PCC's because it was not sanitized daily although it was cleaned daily and kept in the cooler. The sanitation procedures executed for the ground meat mixer in Stores A and D were above PCC's recommended procedure because the mixer was cleaned and sanitized after each use and placed in the cooler. The procedure for the mixers in Stores B and C were the same as recommended by PCC. The sanitation procedures for the patty maker in Stores A and B were the same as recommended by PCC, while in Store D they were above because the patty maker was cleaned and sanitized after each use and stored in the cooler. Store C did not use a patty maker.

The sanitation procedures for slicers, cubers, and power saws for Stores A and D were the same as recommended by PCC. In Store A, a vegetable oil was sprayed on the power saw after it was sanitized to facilitate cleaning it the following day. The procedures for cubers, slicers, and power saws in Stores B and C were below PCC's recommendation because this equipment was cleaned and sanitized only daily while being utilized in unrefrigerated preparation areas. Furthermore, there could be a potential public health hazard because the equipment was used intermittently throughout the day which could allow growth of potential food-borne pathogens on this equipment. The netters used in Stores B and D were cleaned and sanitized daily; however, Store D's preparation area was refrigerated whereas Store B's was unrefrigerated. Hence, Store D's procedure was the same as recommended by PCC while Store B's was considered below.

Store A's sanitation procedure for cutting tables was the same as recommended, which entailed cleaning and sanitizing daily. The cutting table sanitation procedure for Stores B and C were executed daily, which was below PCC's recommended frequency of twice daily for unrefrigerated areas. Store D's sanitation procedure of cleaning and sanitizing after each batch of meat was processed was considered above PCC's daily frequency recommendation. Furthermore, this procedure minimizes any potential public health hazard by minimizing cross contamination and growth of pathogenic microorganisms. The sanitation procedure for knives in Store A was rated the same as PCC's while Stores B and C were below because of lower frequencies than recommended. In Store D the knives were cleaned and sanitized several times daily which was above the daily frequency recommendation. The tubs and trays in Store A were cleaned after each use, but were not sanitized, which was below the procedure recommended by PCC, while Stores B, C, and D exceeded this recommendation because they cleaned and sanitized their tubs and trays after each use. The procedures for the sinks in Stores A, B, and C were rated below PCC's recommendation of cleaning and sanitizing daily in refrigerated areas and twice daily in unrefrigerated areas because the sink was not sanitized in Store A and the procedures were executed only daily in Stores B and C. Store D's procedure for the sink rated the same as PCC's. Trees and hooks as recommended were to be cleaned and sanitized after each use. Store A's sanitation procedure rated below this recommendation and would be a potential public health hazard because hooks and trees reportedly were not cleaned and sanitized. The procedures in Stores B and C for hooks and trees corresponded to PCC's recommendation. In Store D the procedure was rated above PCC's recommendation because in addition to being cleaned and sanitized after each use, the trees and hooks were stored in the meat cooler under refrigeration.

One general sanitation procedure followed in Store B was to spray a chlorine sanitizer solution on all food contact surfaces of the meat equipment in the preparation area one half hour prior to the onset of daily production. Although the residual effectiveness of this solution is eliminated once production begins, this practice should have improved the level of sanitation at the onset of production.

The variation in average ratings for sanitation procedures of food contact equipment revealed that Store D had an average rating above (3.5) that recommended by PCC. Store A, which also had a refrigerated preparation area similar to Store D, ranked second among the four stores but with an average rating slightly below (2.7) PCC's recommendations. Finally, the sanitation procedures for food contact equipment of Stores B and C which had unrefrigerated preparation areas rated below (2.4) PCC's recommended procedures.

Sanitation procedure data also were collected for equipment and building surfaces which did not contact meat products such as carts, floors, and ceilings. However, PCC did not develop recommended sanitation procedures and execution frequencies for barbecues, carts, and roll colls.[35] A roll coll was not used in Store A because its preparation room was refrigerated. However, the roll coll was cleaned and sanitized twice weekly in Store B and "as needed" in Store C. In Store D, the roll coll was cleaned but not sanitized weekly and then cleaned and sanitized semiannually. The carts used in all the surveyed meat departments were steam cleaned by an outside service firm on a quarter to semiannual frequency. The carts also were cleaned and sanitized irregularly between formal steam

[35]A roll coll is a refrigerated unit with an open top or side next to the wrapping and weighing stations where meat is placed after it has been trayed. Another name for roll coll is chicken trough.

cleanings. The barbecue units in Stores B and C were cleaned and sanitized daily, while Stores A and D did not utilize this equipment.

The sanitation procedures in all the stores were the same as PCC's recommended frequency for cleaning and sanitizing the wrapping and weighing stations on a daily basis. The recommended sanitation procedure by PCC for meat scrap barrels was to clean and sanitize them weekly if a plastic liner was used. This was not practiced by any of the four stores. The rendering companies who picked up meat scraps rinsed the barrels with hot water twice weekly, but did not sanitize them prior to installing a new plastic liner.

The recommended sanitation procedure for the preparation area floors was to clean and sanitize them daily. This was practiced by Stores B and C. A problem expressed by store personnel in Store B was the lack of a floor drain to facilitate cleanup, especially when cleaning and sanitizing the floors. In Store A, the floors were cleaned daily and sanitized only twice monthly which was considered below the frequency recommended by PCC. In Store D, the floor was cleaned daily and sanitized twice weekly, which also rated below PCC's recommendation.

The recommended sanitation procedure by PCC for walls was to clean and sanitize them weekly. This recommended frequency was exceeded by Stores B and C in which this procedure was executed daily. The walls in Stores A and D were cleaned and sanitized "as needed" up to a semiannual frequency. The recommended sanitation procedure for ceilings was to vacuum them quarterly. This was not practiced by any of the stores. In Stores A, B, and C, the ceilings were not cleaned at all, while in Store D they were cleaned and sanitized semiannually.

The average ratings for sanitation procedures of equipment and building surfaces in the preparation areas which did not contact food of Stores B and C were slightly below (2.8) the procedures recommended by Project Consumer Concern, while Stores A and D were even lower (2.3 and 2.5 respectively).

Cooler Area. The recommended procedure for walls and floors in meat coolers was to clean and sanitize them weekly. Stores A, C, and D were not in accord with this recommendation. Store B's procedure for the cooler floor was the same as recommended but the frequency of cleaning and sanitizing cooler walls was less often than recommended. Store A was the only supermarket using sawdust on the cooler floor as an absorbant and the floor was cleaned monthly, which rated below the recommended procedure. The cooler floors in Stores C and D were cleaned and sanitized every two weeks. A mobile floor scrubber was used on the cooler floor of Store D.

Project Consumer Concern recommended that the ceilings and blowers in the coolers be cleaned and sanitized quarterly. Stores B and C were in accord with this recommendation. The blower and ceiling were not cleaned in Store A but were cleaned and sanitized semiannually in Store D. The rails in the cooler were to be cleaned monthly according to PCC. However, these were cleaned by Stores B, C, and D at the same time the ceilings were cleaned and sanitized. The rails in Store C only were used occasionally because most meat was received in boxed form. The rails were not cleaned and sanitized in Store A. However, an ultraviolet light was utilized in Store A's meat cooler to limit bacterial growth.

The average rating of sanitation procedures for the meat cooler areas in Stores B and C were below (2.5) the procedures recommended by PCC, while Stores A and D were even lower (2.0).

Employees. Project Consumer Concern recommended that hands, arms, and uniforms of employees be kept clean but PCC did not recommend sanitizing at a specific frequency. All stores exceeded or were the same as PCC's recommendation because a cleaner-sanitizer agent was used in Stores A, B, and C, while a cleaner was used in Store D.[36] Paper towels were used to dry hands

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[36] Septisol, a cleaner-sanitizer, was used in Store A. Scrub, a cleaner-sanitizer, was used in Store B. Amway Liquid Organic Concentrate, a cleaner-sanitizer, was used in Store C. Luron, a cleaner, was used in Store D. The manufacturers of these products are listed in Appendix I.

and arms in Stores A, B, and D, while continuous cloth towels were used in Store C. The cloth towel was cleaned and sanitized by a commercial laundry. An absence of towels in dispensers was not observed in any of the four stores. Cloth uniforms were worn in Stores A, B, and D and were cleaned and sanitized by commercial laundries. Cloth and plastic types of uniforms were worn in Store C. The cloth uniforms were sent to a commercial laundry and the plastic aprons were washed with hot water by employees in the store. Therefore, the sanitation procedures for hands, arms, and uniforms on the average among all four stores rated above those recommended by Project Consumer Concern.

The departmental average ratings for sanitation procedures in the meat departments of Stores A, B and C were the same (2.5), while Store D rated higher (2.9). Store D's higher rating for sanitation procedures was largely accounted for by the high rating assigned to those procedures executed for its food contact equipment as compared to the other three stores.

Weekly Departmental Employee Sanitation Labor

Departmental Summary. The mean proportion of total man-hours devoted to sanitation activities among meat departments ranged between 5.14% and 11.25% (Table 9). The meat department in Store D devoted a lower percent of total man-hours to sanitation, 5.70%,

Table 9. Meat department sanitation labor: estimated percent of time, man-hours, and wage costs of four surveyed Oregon retail food stores, Fall 1974[a]

	Store A					Store B				
	1	2	3	4	5	1	2	3	4	5
			(1)x(2)		(1)x(4)			(1)x(2)		(1)x(4)
Position	Percent of Total M-H	Total M-H/ Week	Sanitation M-H/ Week	Hourly Wage Rate	Sanitation Wage Cost/ M-H	Percent of Total M-H	Total M-H/ Week	Sanitation M-H/ Week	Hourly Wage Rate	Sanitation Wage Cost/ M-H
Manager	6.5%	41	2.7	$6.35	$.44	5.9%	52	3.1	$5.33	$.32
Cutter	8.6	40	3.4	6.00	.54	11.4	75	8.6	4.59	.51
Wrapper, Clerk	2.7	78	2.1	4.34	.13	1.8	48	.9	4.17	.08
Cleanup Boy						71.1	12	8.5	2.44	1.73
Departmental Summary:	5.14%	159	8.2	$5.28	$.271	11.25%	187	21.1	$4.55	$.512
	5.66%[b]			$6.47[c]	$.366	11.77%			$6.05	$.712

Table 9. (Continued)

Position	Store C 1 Percent of Total M-H	Store C 2 Total M-H/ Week	Store C 3 (1)x(2) Sanitation M-H/ Week	Store C 4 Hourly Wage Rate	Store C 5 (1)x(4) Sanitation Wage Cost/ M-H	Store D 1 Percent of Total M-H	Store D 2 Total M-H/ Week	Store D 3 (1)x(2) Sanitation M-H/ Week	Store D 4 Hourly Wage Rate	Store D 5 (1)x(4) Sanitation Wage Cost/ M-H
Manager	1. 9%	46	. 9	$6. 20	$. 12	10. 8%	44	4. 8	$5. 93	$. 65
Cutter	8. 6	176	15. 1	5. 85	. 53	8. 1	91	7. 4	5. 85	. 47
Wrapper, Clerk	2. 5	80	2. 0	4. 77	. 14	2. 1	126	2. 6	4. 61	. 09
Cleanup Boy	88. 3	19	16. 8	2. 20	1. 94					
Departmental Summary:	11. 06%	321	35. 5	$5. 41	$. 598	5. 70%	261	14. 9	$5. 27	$. 300
	11. 69%			$6. 97	$. 815	6. 18%			$6. 22	$. 384

[a] M-H = Man-hours. Sanitation Man-Hours = Percent of Total Man-hours x Total Man-hours or Col. (3) = Col. (1) x Col. (2). Sanitation Wage Cost/ M-H = Percent of Total Man-hours x Hourly Wage Rate or Col. (5) = Col. (1) x Col. (4). Column (3) figures may not add up to the Departmental Summary figures due to rounding error.

[b] The standard sanitation time as a percent of total man-hours. The standard time included not only the time spent on sanitation activities but also included a portion of idle time. Idle time was time spent on nonproductive activities such as personal delays, scheduled rest breaks, and unforeseen delays in planned work schedules.

[c] Weighted average hourly wage rate plus payroll taxes, fringe benefits, and overtime. In the departmental summary the hourly wage rate is the weighted average hourly wage rate according to the proportion of total man-hours for each position in the department for each store.

compared to Stores B and C, with 11.25% and 11.06%, respectively. Store D's lower percent could be accounted for by different methods used to execute sanitation procedures. In Stores B and C manual methods such as mopping, scraping, wiping with hand tools or cloths were used while in Store D water pressure and mechanical methods mainly were used. The portable high pressure washer used in Store D to clean and sanitize equipment such as the display case and the power saw saved man-hours compared to manual methods in Stores B and C. This occurred because the display case and the power saw did not have to be disassembled and reassembled when being cleaned and sanitized. The mobile floor scrubber used in Store D to clean and sanitize the meat cooler floor reportedly saved man-hours compared to hand mopping in Stores B and C.

The meat department in Store A had the lowest percent of total man-hours devoted to sanitation activities, 5.14%, which probably was due to lower frequencies of executing sanitation procedures compared to the other three stores. In addition to Store A, in Store D sanitation procedures for most equipment in the meat preparation area were executed with lower frequencies compared to Stores B and C. The lower frequencies in Stores A and D may be associated with their enclosed and refrigerated preparation areas compared to the open and unrefrigerated preparation areas in Stores B and C. This would be analogous to recommendations made by Project Consumer

Concern that equipment in preparation areas with temperatures below 55^{o} F. be cleaned and sanitized daily compared to twice daily with temperatures above 55^{o} F.

Store C's meat department had the highest number of sanitation man-hours per week (35.5) because it had both a high proportion of time devoted to sanitation and the highest total man-hours with the most employees among all four stores. Store B's meat department had the second highest number of sanitation man-hours per week (21.1) because it had the highest sanitation time percentage but fewer total man-hours compared to Store C. Another possible explanation for Store C's higher total sanitation man-hours compared to Store B even though both stores had similar sanitation time percentages was that Store C processed a larger volume of meat. For example, both stores had similar sanitation procedures and frequencies of executing them for tubs, which were cleaned and sanitized after each use. The use of tubs tended to increase directly with the volume of meat processed. Therefore, more sanitation man-hours could be associated with a larger volume of meat processed.

Store A's meat department had the lowest number of sanitation man-hours per week (8.2) because it had both the smallest proportion of time devoted to sanitation activities and the lowest number of total man-hours with four employees and no overtime. Store D's meat department had the second lowest number of sanitation man-hours per week (14.9) because it had the second lowest sanitation time percentage and possibly because of its different building design and use of specialized sanitation equipment.

The design of the meat preparation area in Store D enabled the use of a high pressure washer system because it included an enclosed room constructed with a floor drain, and waterproof floor, walls, and ceiling. The waterproof design of the room and the use of the portable washer permitted the power saw to be cleaned and sanitized without having to disassemble it; thus, potential labor time savings (man-hours) could be achieved by using fewer steps in the cleaning and sanitizing process. It appeared that further savings in labor time (man-hours) could be achieved in Store D's meat department by having the floor sloped towards the drain compared to the present unsloped floor design which required manual labor to remove water from the floor.

Labor time savings (man-hours) also appeared to exist in cleaning and sanitizing the fresh meat display case in Store D because use of the portable washer did not require disassembly and reassembly of the case. Another labor time savings reportedly existed when the mobile floor scrubbing machine was used to clean and sanitize the meat cooler floor in Store D compared to using a mop.[37]

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[37] Interview with meat department manager in Store D.

The average total amount of sanitation man-hours per day in the meat departments of the four surveyed stores ranged between 1.4 hours in Store A to 5.1 hours in Store C. To calculate daily man-hours, the weekly man-hours were divided by the number of working days in a week for each meat department. Store A's meat department employees worked six days per week while in the other three stores, meat department employees worked seven days per week.

Sanitation wage cost is a function of both the sanitation time percentage and hourly wage rate because it is the proportion of an hourly wage rate accounted for by the percent of man-hours devoted to sanitation activities. The weighted average departmental wage cost is based on hourly wage rates in proportion to total man-hours per position. The sanitation wage cost of Store A was the lowest ($0.271 with a base wage rate of $5.28) because its sanitation time percentage was the lowest. In other words, for Store A's meat department the average cost per man-hour for sanitation was 27 cents. The sanitation wage cost of Store D's meat department was second lowest ($0.300) because its average hourly departmental base wage rate was the second lowest ($5.27) compared to $4.55 in Store B and because it had a low sanitation time percentage. Store B had the second highest sanitation wage cost ($0.512) because it had the highest sanitation time percentage even though it had the lowest hourly base wage rate ($4.55). Finally, Store C's meat department had the highest sanitation wage cost ($0.598) because both its sanitation time percentage was high and the average departmental hourly wage rate was the highest ($5.41) among all four stores.

For purposes of determining total weekly sanitation labor costs in the meat departments of the four stores surveyed, the sanitation time percentage and the weighted average hourly departmental wage rates were adjusted. Sanitation time percentages were adjusted to include a portion of idle time to constitute standard sanitation time percentages. The weighted average hourly base wage rates were adjusted to include a portion of overhead labor costs such as employee fringe benefits, payroll taxes, and overtime wage rates. The adjusted and subsequently higher sanitation wage costs per hour ranged between $0.366 with an hourly wage rate of $6.47 in Store A and $0.815 out of $6.97 in Store C. The sanitation wage costs for Stores B and D were $0.712 and $0.384 with adjusted hourly wage rates of $6.05 and $6.22 respectively. Therefore, the store rankings (low to high - A, D, B, C) did not change with the addition of idle time and overhead labor cost allocations to the hourly base wage rate.

Employee Position. The percent of total man-hours devoted to sanitation among meat managers ranged between 1.9% (Store C) and 10.8% (Store D). In Store C the manager delegated nearly half the sanitation work to a part-time cleanup boy. In contrast, Store D's meat manager with 10.8% did not employ a cleanup boy. Store D's manager operated the portable high pressure washer weekly to clean and sanitize both the preparation area on Sunday and the fresh meat display case on Monday. He also operated the mobile floor scrubber in the meat cooler. The managers in Stores A and B delegated more of the cleaning and sanitizing activities to their meat cutters and to the cleanup boy in Store B compared to the manager in Store D, but less than did the manager in Store C.

The percent of time devoted to sanitation activities by cutters ranged between, 8.1% and 8.6%, for Stores A, C, and D, while in Store B meat cutters spent 11.4% of their time on sanitation activities. The difference in the proportion of total sanitation man-hours by position among meat departments could explain the higher percentage for cutters in Store B. While the percent of sanitation time for the meat department in Store B was the highest of all stores, its meat managers had the second lowest sanitation time percentage of all meat managers and the cleanup boy's percentage was lower than the cleanup boy in Store C. Consequently, the meat cutters in Store B had the highest percent of total man-hours for sanitation among all four stores' cutters.

The wrappers and clerks in the meat departments of all stores spent about the same proportion of their time on sanitation with a range between 1.8% and 2.7%. Their sanitation activities consisted mainly of cleaning and sanitizing around wrapping stations, weighing stations, and delicatessen display cases. This seemed to correspond with a policy followed in all four stores that each employee was held responsible for cleanup in his designated work area.

The cleanup boys' duties primarily entailed cleaning and sanitizing activities but some direct production activities such as carrying meat also were performed. The cleanup boy in the meat department of Store B spent a larger proportion of his time performing "other work" activities compared to the cleanup boy in Store C. Thus, the proportion of total man-hours devoted to sanitation by cleanup boys in Store B was smaller (71.1%) compared to Store C's (88.3%).

Generally, sanitation wage costs in each store increased from clerk and wrapper position to managers, cutters, and cleanup boys respectively. The increase in sanitation wage cost according to this order of positions was reflective of the increase in the proportion of total man-hours devoted to sanitation by each position (Table 9).

Sanitation Costs

Store A had the lowest weekly total departmental sanitation cost ($103.72) and Store D had the highest ($378.47) among the four surveyed meat departments (Table 10).

Table 10. Estimated weekly meat department sanitation costs of four surveyed Oregon retail food stores, Fall 1974

Category	Store A	Store B	Store C	Store D
Departmental Employee Sanitation Labor Costs:[a]				
Weekly	$ 58.19	$133.19	$261.50	$100.26
Prorated	5.08	.95	10.20	6.10
Total	$ 63.27	$134.14	$271.70	$106.36
Sanitation Service Costs:				
Outside	34.90	36.31	54.08	19.05
In-Store (Janitorial)		5.91		226.24
Total	$ 34.90	$ 42.22	$ 54.08	$245.29
Sanitation Equipment Costs	1.33	.93	.53	6.00
Sanitation Supply Costs	4.22	13.20	21.52	20.82
Total	$103.72	$190.49	$347.83	$378.47

[a] Weekly labor costs were incurred for sanitation procedures executed weekly or more often.

Weekly labor cost = total man-hours (X) percent of total man-hours for sanitation including a portion of idle time (X) average hourly wage rate including payroll taxes, fringe benefits, and overtime (Table 9).

Prorated labor costs were incurred for sanitation procedures which were executed less often than weekly. For example, frozen display cases were cleaned every four weeks and incurred a labor cost of $20. The prorated labor cost per week would be $5.

Labor. Breaking down total meat department sanitation costs into departmental employee labor, service, equipment, and supply categories revealed that departmental labor accounted for the largest portion of the costs among the surveyed stores exclusive of Store D in which in-store janitorial service accounted for the largest portion (approximately 60%). While the in-store janitorial service cost was the largest portion in Store D, the in-store janitorial service was not used in place of meat department employee sanitation labor. Store D's departmental employees performed all the sanitation activities within the meat department areas exclusive of those associated with walls and floors of the display area. This was similar to the other three stores. While Store D's in-store janitorial service staff also baled cardboard, which was performed by departmental employees in the other surveyed stores, this activity did not require a significant amount of man-hours. On balance, the lower portion of total sanitation cost incurred by departmental employee labor in Store D compared to the other three stores is not due entirely to the use of its in-store janitorial service staff.

The departmental employee labor cost for sanitation was divided into weekly and prorated costs. The prorated labor costs were those incurred to clean and sanitize equipment and building surfaces which required cleaning and sanitizing less often than weekly. This cost was prorated over the time involved to repeat these sanitation activities. For example, prorated labor cost was computed for cleaning and sanitizing a frozen meat display case quarterly (13 weeks). If the labor cost was $26 quarterly, then the prorated cost per week would be $2.

The prorated labor costs per week in the meat department of Store B ($.95) indicated that its employees performed very few sanitation activities on a cycle longer than weekly (Table 10). This could be accounted for by the formal sanitation program they were following which prescribed frequent cleaning and sanitizing of most equipment and building surfaces. Store C's meat department incurred the highest prorated sanitation labor cost per week ($10.20) of all the stores. This was mainly due to Store C's meat department having the most prorated sanitation man-hours per week and the highest hourly wage rate among all four stores. The prorated sanitation man-hours were accounted for by meat department employees cleaning and sanitizing the meat cooler every two weeks and cleaning and sanitizing the entire walls quarterly. Store D's meat department incurred the second highest prorated sanitation labor cost per week ($6.10). This cost could be accounted for by a lower hourly wage rate compared to Stores A and C, and an extensive semiannual cleanup. Finally, the prorated sanitation labor cost in the meat department of Store A ($5.08) resulted from its hourly wage rate ranked second highest and sanitation man-hours per week ranked second lowest compared to the other three stores.

Besides prorated labor costs departmental employee sanitation labor costs consisted of weekly labor costs, those incurred for labor to execute daily and weekly sanitation activities. The weekly labor costs incurred by the meat departments were \$58.19 in Store A, \$133.19 in Store B, \$261.50 in Store C, and \$100.26 in Store D (Table 10). These differences can be attributed to differences among stores in the number of man-hours devoted to sanitation activities rather than differences in average hourly departmental wage rates.

The rankings among stores for total costs incurred for departmental employee sanitation labor did not differ from the rankings for weekly labor costs (low to high - A, D, B, C). This was due to the weekly labor costs accounting for a much larger portion of total sanitation labor cost compared to prorated labor costs.

Service. In general, sanitation service costs were the second highest sanitation costs. These costs were divided into outside service and in-store janitorial service. Most of the outside service costs were accounted for by laundry, then janitorial, garbage disposal, exterminator (pest control), and steam cleaning in successive lesser amounts. Store C incurred the highest weekly costs for outside services (\$54.08) because its laundry and outside janitorial expenses were the highest among the meat departments of all stores while its other service expenses were similar to the other three stores. Stores A and B incurred lower costs for outside services ($34.90 and $36.31 respectively) due to lower laundry and outside janitorial expenses compared to Store C. Store D incurred the lowest cost for outside sanitation services ($19.05) because it incurred similar laundry expenses compared to Stores A and B, and it employed an in-store janitorial service staff rather than an outside janitorial service firm.

The in-store janitorial service cost of Store D accounted for approximately 60% of its total departmental sanitation cost. Its in-store service cost consisted mainly of labor expense while it also included costs for equipment and supplies. Some of the in-store service labor cost could be accounted for by labor employed to bale cardboard which was also performed by departmental employees in the other three stores. The higher cost of the in-store janitorial service in Store D compared to the outside janitorial service of the other three stores was due to the daily service frequency in Store D. The daily in-store janitorial service seemed to result from the apparent importance senior executive and store management placed on its policy of presenting its customers with a clean appearing store.

Store B's meat department also incurred an in-store janitorial service expense ($5.91) but it was lower than Store D's because it was accounted for by only one part-time employee compared to three full-time employees in Store D.

The total sanitation service cost for Store D's meat department was the highest of all stores because its in-store janitorial service cost was highest. The in-store janitorial service cost of Store B was not significantly large enough to increase the total service cost of Store B's meat department above Store C's.

Equipment. The cost of sanitation equipment such as brooms, mops, buckets, scrapers, and squeegees amounted to 1% or less of the total sanitation costs in all meat departments. The highest cost for sanitation equipment in the meat departments among all four stores was incurred by Store D. The cost of its portable high pressure washer accounted for one-third of its meat department's sanitation equipment cost.

Supply. Sanitation supply costs accounted for less than 8% of total sanitation costs for all meat departments and also were more significant than equipment costs in each meat department. The meat department in Store A incurred the lowest supply cost ($4.22) of all stores and Store B incurred the next higher cost ($13.20). The sanitation supply cost in Store A was substantially lower than Store B mainly because Store A did not use soaker pads, paper hand towels, and used a lower volume of cleaning and sanitizing agents compared to Store B. The sanitation supply cost in the meat department of Store C was higher compared to Store B because in Store C rolls of corrugated cardboard were purchased and laid on the floor of the preparation area of the meat department. The total sanitation supply cost for the meat departments in Stores C and D ($21.52 and $20.82 respectively) were similar, but different types of supplies were used. Soaker pads and rolls of cardboard were used in Store C while in Store D, aluminum foil in the delicatessen display cases, more mop heads, and more cleaner-sanitizer agent were used.

Total. The estimated weekly total sanitation cost for the meat department of Store D ($378.47) was the highest of all four stores due mainly to the high cost of its in-store janitorial service. Store C incurred the second highest cost ($347.83) with the highest cost being accounted for by labor. Store B's total cost ($190.49) ranked third highest with less cost for labor compared to Store C and less sanitation service cost compared to Stores C and D. Store A's meat department incurred the lowest estimated weekly total sanitation cost ($103.72) because it had the lowest sanitation labor, service, and supply costs.

Comparison of Two Alternate Survey Weeks of Store B

A second week of work sampling data was collected in Store B. The percent of total departmental employee man-hours devoted to sanitation activities in the meat department decreased from 11.25% in Week 1 to 9.62% in Week 2 (Table 11). These percentages were not statistically different at the 95% confidence level.[38] However, the lower percentage in Week 2 possibly could be explained by several differences between Week 1 and 2. First, Week 1 data was collected two weeks after a new sanitation program was implemented in Store B whereas Week 2 data was collected two months after Week 1. The employees may have been more accustomed to the program after two months compared to two weeks. A second difference between Week 1 and Week 2 was that while grocery department box boys served as cleanup boys during Week 1 they did not during Week 2. Their unfamiliarity with meat department sanitation procedures may have resulted in a higher sanitation time percentage in Week 1.

A possible implication suggested by the lower percentage in Week 2 is that the use of a cleanup boy in the meat department will increase the sanitation time percentage. This could be caused by other meat department employees creating more cleanup work compared to when they must perform their own cleanup activities. This implication is supported by the high percentage of total man-hours devoted to sanitation time in Store C's meat department which

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[38] The 95% confidence level means there is about 1 chance in 20 of concluding that the sanitation time percentages of two weeks are different when they actually are the same.

Table 11. Meat department sanitation labor: estimated percent of time, man-hours, and wage costs for two alternate survey weeks, of Store B, Fall 1974[a]

	Store B Week 1					Store B Week 2				
	1	2	3	4	5	1	2	3	4	5
			(1)x(2)		(1)x(4)			(1)x(2)		(1)x(4)
Position	Percent of Total M-H	Total M-H/ Week	Sanitation M-H/ Week	Hourly Wage Rate	Sanitation Wage Cost/ M-H	Percent of Total M-H	Total M-H/ Week	Sanitation M-H/ Week	Hourly Wage Rate	Sanitation Wage Cost/ M-H
Manager	5.9%	52	3.1	$5.33	$ .32	4.0%	47	1.9	$5.33	$.21
Cutter	11.4	75	8.6	4.59	.51	15.2	90	13.7	4.59	.69
Wrapper, Clerk	1.8	48	..9	4.17	.08	3.4	39	1.3	4.17	.13
Cleanup Boy	71.1	12	8.5	2.44	1.73					
Departmental Summary:	11.25%	187	21.1	$4.55	$.512	9.62%	176	16.9	$4.69	$.451
	11.77%[b]			$6.05[c]	$.712	10.16%			$6.21	$.631

[a] M-H = Man-hours. Sanitation Man-Hours = Percent of Total Man-hours x Total Man-hours or Col. (3) = Col. (1) x Col. (2).
Sanitation Wage Cost/M-H = Percent of Total Man-hours x Hourly Wage Rate or Col. (5) = Col. (1) x Col. (4).
Column (3) figures may not add up to the departmental summary figure due to rounding error.

[b] The standard time as a percent of total man-hours. The standard time included not only time spent on sanitation activities but also included a portion of idle time. Idle time was time spent on nonproductive activities such as personal delays, scheduled rest breaks, and unforeseen delays in planned work schedules.

[c] Average hourly wage plus payroll taxes, fringe benefits and overtime. In the departmental summary the hourly wage rate is the weighted average hourly wage rate according to the proportion of total man-hours for each position in the department for each week.

employed a cleanup boy. It is also supported by the low percent of sanitation time in the meat departments of Stores A and B which did not employ cleanup boys.

The percent of total man-hours devoted to sanitation activities by position changed between Week 1 and Week 2. Besides not having a cleanup boy in Week 2, the manager spent a smaller percent of his time performing sanitation activities. However, sanitation time percentages increased from Week 1 to Week 2 for cutters, wrappers, and clerks.

The sanitation wage costs by positions changed similarly to the change in the sanitation time percentage from Week 1 to Week 2 because hourly wage rates remained the same. The weighted average hourly wage rate for the meat department increased from Week 1 to Week 2 because the average was weighted by man-hours for each position and the man-hours of high paid meat cutters increased while the man-hours of lower paid cleanup boys decreased. Therefore, the average sanitation wage cost for the department did not decrease in proportion to the decrease in the percent of time devoted to sanitation.

The weekly sanitation labor costs decreased $22.15 from $133.19 in Week 1 to $111.04 in Week 2 due to the lower sanitation time percentage and thus lower sanitation man-hours. Estimates of service, equipment, supply and prorated labor costs did not differ between Week 1 and Week 2 because the method used to determine these costs entailed averaging them over a specific time period such as three months or one quarter.

Summary

Sanitation management practices and procedures affect the quality as well as the safety of meat and delicatessen products. Practices and procedures must be properly executed from the receiving point to the customer in the store in order to maintain the quality and safety of meat and delicatessen products.

Sanitation management practices were executed by meat department personnel of all four stores surveyed. However, there were situations observed in all four stores where prescribed practices were not followed. The improper temperature control practice of storing meat and delicatessen products outside of refrigeration units was the most frequently observed malpractice in all four meat departments. While temperature control practices were violated by all four stores, there were no perishable meat and delicatessen products observed on display which outwardly appeared unfit for human consumption due to improper temperature control practices.

Another frequently observed malpractice was failing to wear hair covering in the preparation areas at all times. A few observations also were made of employees eating and smoking in meat preparation areas which also violated prescribed practices. On the other hand, meat department employees did not appear to have health conditions which precluded them from working in preparation areas.

One store's policy of limiting entry of unauthorized persons to the meat cooler could be extended to cover the meat department preparation area as well. This practice should help minimize potential contamination from persons who may not be following proper sanitary practices for these departmental areas such as wearing hair coverings, clean uniforms, or who may be in poor health.

Product management practices were followed such as rewrapping leakers and removing products with expired pull dates from regular display sections.

Due to the scope of this study, the manner in which meat and delicatessen products were handled prior to receiving them at the store was not investigated. However, meat department management should consider the investigation of such handling practices because the store is responsible for the food products which it sells.

Prevention of cross contamination between types of meat products was a sanitation practice followed in most cases. However, some observations were made of situations which could allow potential cross contamination such as failing to clean and sanitize equipment between processing poultry and beef, or employees wearing cloth gloves when handling unpackaged meat products.

Finally, pest control practices were being followed. Meat departments with enclosed and refrigerated preparation areas tended to have fewer flying insects compared to stores with open and unrefrigerated preparation areas. One problem observed with pest control practices was spraying insecticides in the preparation area without covering processing equipment.

Sanitation procedures of the meat department in each store were rated with procedures recommended by Project Consumer Concern. The average ratings for sanitation procedures of most meat department areas of the four stores were below the procedures recommended by Project Consumer Concern (PCC). However, Store D's procedures for food contact equipment rated above PCC's recommended sanitation procedures. This high rating was based on such procedures as cleaning and sanitizing cutting tables between each batch of meat processed which minimized any potential public health hazard. An enclosed refrigerated preparation area also contributed to the high rating in Store D. This type of preparation area in Store A also contributed to its higher rating for procedures compared to Stores B and C. The sanitation procedure ratings for food contact equipment in the meat department preparation areas of Stores B and C were below PCC's recommendations primarily because several pieces of equipment were used intermittently during the day in an unrefrigerated area while being cleaned and sanitized only daily. However, sanitation procedures associated with employees of all four stores rated above PCC's recommendations. Food contact equipment and employees tended to be primary potential contaminators compared to other equipment and building surfaces in the meat department areas. The weighted average rating of sanitation procedures for all areas of Store D's meat department was slightly below (2.9) PCC's recommendations while the average ratings of the other three stores were even lower (2.5)(Table 8).

A problem expressed by a meat department employee of Store B was the lack of a floor drain in the preparation area to facilitate the cleaning and sanitizing process. Furthermore, a problem identified by Store D's meat department manager was the lack of slope in the preparation area floor toward the drain which could alleviate using a squeegee to remove water from the floor.

Store A's sanitation time percentage for the meat department was the lowest (5.14%) of all four stores. This percentage could be attributed to lower execution frequencies of its procedures compared to the other three stores. The proportion of total departmental man-hours devoted to sanitation activities in Store D's meat department was second lowest (5.70%) compared to Stores B and C (11.25% and 11.06%). This tended to occur because Store D used more labor saving equipment such as a portable high pressure washer and mobile floor scrubber to clean and sanitize the meat department areas compared to Stores B and C.

The amount of sanitation activities performed differed among positions. Meat cutters performed the bulk of the daily sanitation activities except in Stores B and C where cleanup boys also were employed. In these cases, sanitation man-hours for cutters were about equal to the cleanup boy's sanitation man-hours. In proportion to total man-hours by position, cleanup boys accounted for the highest percent, then cutters, managers, and finally wrappers and clerks in successive smaller proportions.

The estimated total weekly sanitation costs of the meat department ranged from \$103.72 in Store A to \$378.47 in Store D. The sanitation labor cost of departmental employees accounted for the most variation in costs between meat departments and constituted over 50% of the total departmental sanitation costs compared to service, equipment, and supply costs exclusive of Store D. The weekly sanitation labor cost in Store D's meat department accounted for only 28% of total sanitation costs while its in-store janitorial service costs accounted for about 60% of the total costs.

According to a statistical test, the departmental employee sanitation time percentage of Store B's meat department was not significantly different between Week 1 and Week 2 although the percentage decreased from 11.25% to 9.62% respectively. While this decrease in time percentage was not statistically significant, two reasons may account for the lower percentage in Week 2 compared to Week 1.

First, employees may have been more accustomed to a formal sanitation program implemented two months prior to Week 2 compared to two weeks prior to Week 1. Second, grocery department box boys were used as cleanup boys in Week 1, but not during Week 2 and their unfamiliarity with meat department sanitation procedures may have resulted in a higher sanitation time percentage in Week 1 compared to Week 2.

On balance, the findings of this study suggest cost savings may be possible by substituting cheaper labor, or improving building design and utilizing sanitation equipment as a substitute to reduce in-store man-hour requirements.

Total meat department sanitation labor cost can be reduced by using lower paid employees when possible compared to higher paid meat department employees such as managers to perform sanitation activities. For example, this would be most applicable to a meat department such as Store B's where employees tend to work overtime quite frequently. A hypothetical example illustrating the substitution of a cleanup boy for overtime man-hours of meat cutters is shown below:

2 Meat Cutters	1 Cleanup Boy
4 hr. /wk. overtime per cutter	8 hr. /wk.
\$5.75 hrly. base wage rate	\$2.40 hrly. base wage rate
1.5 time and half base wage rate	No overtime
2 x 4 x \$5.75 x 1.5 = \$69.00	1 x 8 x \$2.40 = \$19.20

This results in a $49.80 savings per week assuming that the same number of man-hours will be required for cleaning and sanitizing either with meat cutters or cleanup boys.

This may not however, be a valid assumption. A possible implication suggested by work sampling data was that those meat departments with cleanup boys spent more man-hours on sanitation activities compared to those meat departments without cleanup boys. This could be caused by other meat department employees creating more cleanup work compared to when they must perform their own cleanup activities. Nevertheless, in the above examples it would cost less to employ a cleanup boy up to approximately 20 additional man-hours. Therefore, a store's sanitation labor cost could be reduced by substituting lower paid employees for higher paid employees to perform sanitation activities.

Another possible way to minimize sanitation man-hours and still maintain sanitation procedures consistent with recommendations established by Project Consumer Concern may be to design meat department preparation areas similar to Store D's. Its preparation area consisted of a refrigerated room enclosed with waterproof floor, walls, and ceiling. The refrigerated room could save man-hours because sanitation procedures do not have to be executed as frequently as compared to the frequency required in an unrefrigerated preparation area. In addition to Store D's design, the floor should slope toward one or more drains for removal of water without the use of a squeegee. Moreover, power equipment such as meat saws should be designed with waterproof encased motors. The waterproof design of equipment and building surfaces would allow the use of a cleaning and sanitizing water pressure system.

A portable high pressure washer like the one used in Store D or a built-in water pressure washer system may save man-hours because less disassembly and reassembly of equipment is required during the cleaning and sanitizing process compared to cleaning and sanitizing equipment in a sink. Another piece of equipment used in Store D's meat department which reportedly saved man-hours compared to the use of a mop and bucket was a mobile floor scrubber. It was utilized to clean the meat cooler floor.

Grocery Department

Profile

The weekly sales volume of the grocery departments in the four surveyed stores ranged between \$30,000 and \$65,000 while the floor areas ranged between 13,000 square feet and 18,000 square feet (Table 12). Stores A and B had lower sales volumes and smaller floor areas compared to Stores C and D. The grocery departments of Stores A, B, and C were integrated (containing food and nonfood products in the same display area). The grocery department in

Table 12. Grocery department profiles of four surveyed Oregon retail food stores, Fall 1974

	Store			
Category	A	B	C	D
Total Store Weekly Sales	$40,000-60,000	$40,000-60,000	$90,000-110,000	$90,000 110,000
Weekly Departmental Sales	$35,000-40,000	$30,000-35,000	$60,000-65,000	$60,000-65,000
Area (Sq. Ft.)	13,725	12,810	17,810	18,225
Integrated[a]	Yes	Yes	Yes	No
Check Stands	8	6	10	9
Employees				
Total	27	17	45	35
Manager	1	1	3	4
Clerk	17	11	23	24
Box Boys	9	5	19	7

[a] An integrated grocery department stocks both food and nonfood products in the same display area. In a nonintegrated department these products are stocked in separate display areas.

Store D was not integrated because it sold a small amount of nonfood products. This could be attributed to the fact that Store D was a food department type of supermarket located in a general merchandise store while the other three stores were conventional supermarkets. The front ends also were included in the grocery departments of the four surveyed stores.[39] The number of check stands ranged from 6 to 10.

The number of grocery department employees among the four stores ranged between 17 and 45 people. Assistant store managers were considered grocery department managers because most of their time was spent working in the grocery department areas. The number of clerks employed in the stores increased as sales volumes increased. More box boys were used in Store C compared to the other three stores.

Empty Beverage Containers Handling Practices

Under the Oregon bottle law, supermarkets are required to handle empty beverage containers. These containers can cause sanitation problems for a store, such as an upside down container dripping on the floor. They also can serve as potential habitats for pests. Therefore, the practice of handling empty beverage containers was

[39] The front end refers to the area and/or operations at the front of the store which includes checkstands, checking, and bagging.

observed in this study and a flow process chart (Figure 14) was developed to diagram the movement of the containers from receiving to storage areas as a means of identifying sanitation problem areas.

Beverage containers were received and counted at the front end of the four surveyed stores by clerks and box boys, except in Store C where only box boys counted them. Only one store required customers to sign a credit sheet for the containers.[40] No observations were made of store employees refusing to accept empty beverage containers because of insanitary conditions such as containers covered with dirt, or partially filled with cigarette butts.

Once the empty beverage containers were counted, they were temporarily stored at the front end. In Stores A and B grocery carts were used for storage purposes while Store C had long low deep carts with solid bottoms and Store D had small square deep carts with solid bottoms (Figure 15). The solid bottoms of the bottle carts tended to keep liquids, which may spill out of overturned containers, from dripping onto floors. In Stores A and B, empty beverage cans were separated from bottles by clerks and box boys as they were counted. The cans were placed in tall plastic lined cardboard boxes at the front

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[40] The credit sheet contained the customer's signature and dollar amount of the empty beverage container refund paid to him or credited against any of his purchases.

FIGURE 14. PRODUCT FLOW CHART FOR PROCESSING EMPTY RETURNABLE BEVERAGE CONTAINERS IN A SUPERMARKET

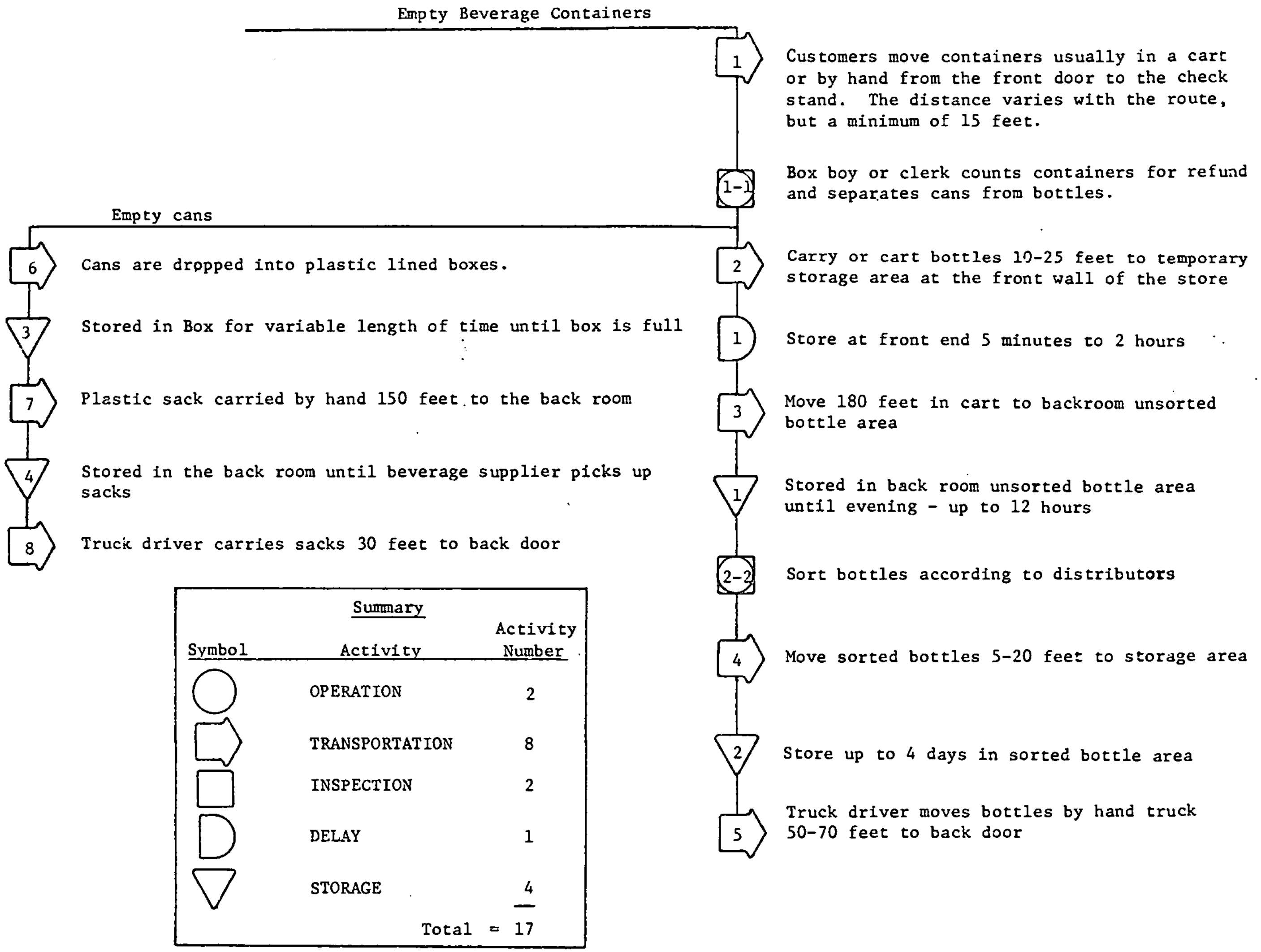
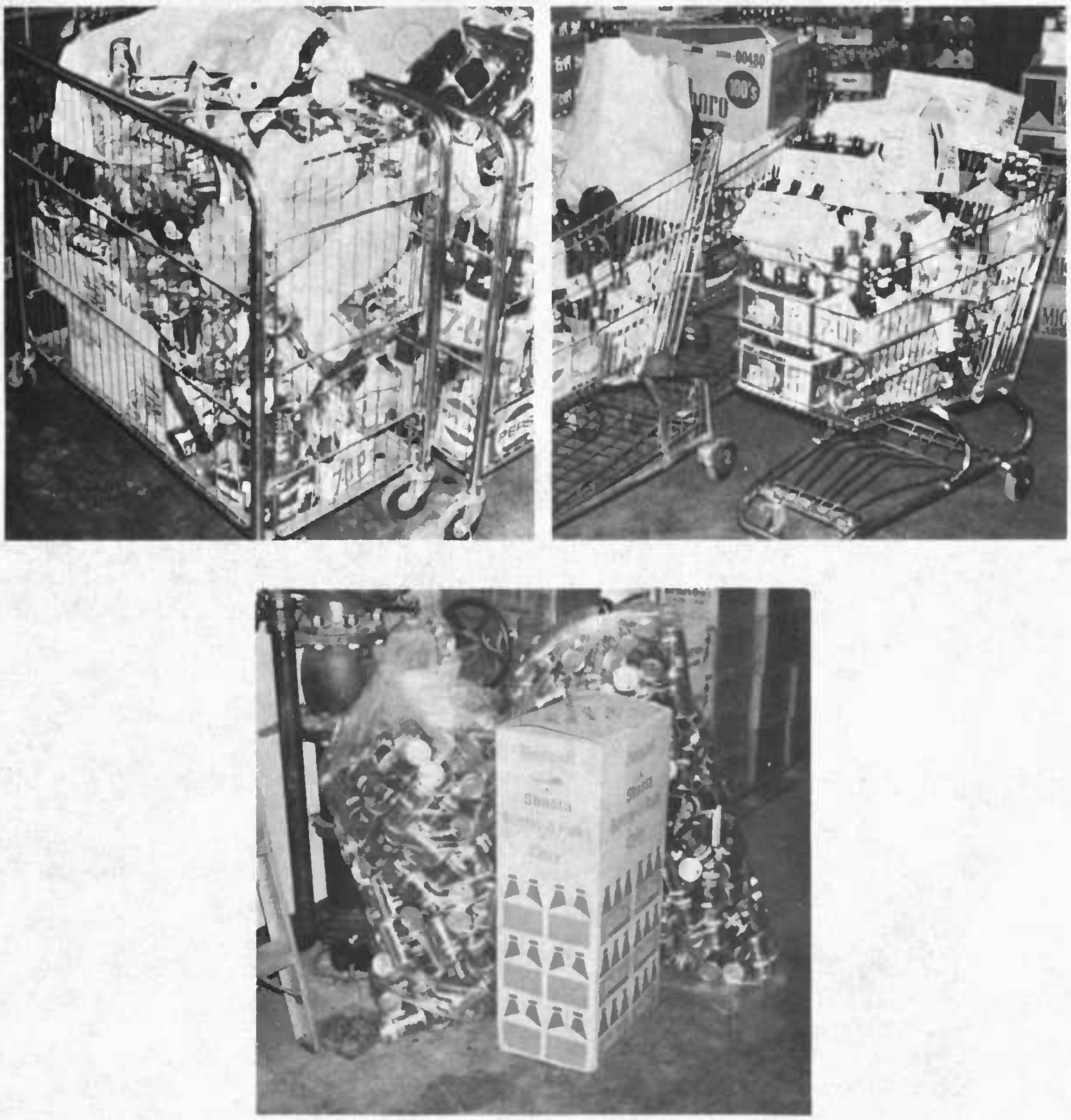


Figure 15. Solid bottom carts (left) and grocery carts (right) used to transport and temporarily store empty beverage containers; and cardboard box and plastic bags (bottom) used to store empty beverage cans, survey of four Oregon retail food stores, Fall 1974



end. Stores C and D did not utilize cardboard boxes at the front end (Figure 15).

Box boys in all four stores moved the empty beverage container carts to the back room when the front end became congested with full carts. In Store D, the containers were transferred from holding carts to grocery carts before moving the containers to the back room. The plastic sacks of empty cans at the front end of Stores A and B were tied and carried to the back room when they became full.

Box boys sorted empty containers two to four hours daily in each surveyed store. The containers were sorted according to kind and stored in stacks of boxes until beverage distributors picked them up. The empty carts were then returned to the front end after they were emptied.

Handling empty beverage containers in the four surveyed supermarkets caused problems associated with store sanitation. One problem involved liquids dripping onto floors from overturned containers. This problem was most frequently observed in the front end temporary storage area and in the back room sorting area in all four stores. Occasionally spots on the floor throughout the display area also were created by empty containers in customer carts. These spots were cleaned when the rest of the display floor was cleaned. This problem had been noticeably reduced in Stores C and D where solid bottom carts were used. A second problem associated with stores handling empty beverage containers was the potential contamination induced into the store by the containers. While stores had the right to refuse to accept empty beverage containers due to insanitary conditions such as being covered with dirt or being partially filled with cigarette butts, no bottles were rejected for these conditions. To minimize the transfer of contamination from empty containers to food products via employees, the containers usually were handled by box boys who specifically were assigned to handle empty beverage containers and perform a limited number of other operations.

To minimize a third problem, pest infestation in food products induced by empty containers, the empty containers were stored separately from food products in the back rooms of all four stores. The least segregation existed in Store B's back room because it was the smallest (1,080 square feet compared to 4,525 square feet in the next larger back room).

Sanitation Management Practices

In this study sanitation management practices were classified into four areas: product management, temperature control, pest control, and employee hygiene.

Product Management. One group of sanitation management practices observed in the grocery departments of all four surveyed stores was the removal of damaged or decayed products from display cases or shelves. These types of products included leaking milk containers, dented or swollen cans, and broken packages of frozen or dry foods. Some observations of employees removing outdated products were made in the grocery departments of all four stores. Little removal was necessary because the stock turned rapidly and the surveyed stores used a first in, first out (FIFO) system of restocking display cases and shelves. There were several observations of cloth or paper packaged food products such as cereal or flour placed on the floor in front of display shelves. This practice was not approved by the Oregon sanitation code. Products set on the floor were apt to be damaged by customers walking or pushing carts into them. Secondly, being on the floor increased the possibility of crawling insects entering these packages.

Breakage and spillage of full beverage bottles occurred in all four stores. The resulting messes usually were cleaned up immediately by box boys. The empty beverage containers were segregated from food products in the back rooms of all four stores. Segregation reduced the possibility of pest infestation spreading to paper and cloth packaged food products from pests that could enter the store via returned empty beverage containers.

According to store management and as observed in several surveyed stores, customers created an additional sanitation problem when they discarded napkins, toothpicks, and paper cups from in-store demonstrations of products such as cheese, soft drinks, and pizza. These demonstrations required extra cleanup by employees responsible for floor cleanup. The sanitation procedures associated with this problem mainly were for merchandising purposes in terms of enhancing the appearance of the store as compared to maintaining the safety of food products.

Another sanitation management practice concerned with products entailed managing the morgue area in the dairy cooler. The morgue is a place for holding products that are damaged or spoiled and will be returned to distributors or salesmen. Generally, two types of morgues are used in the grocery department: dairy morgue and dry goods morgue (Figures 16 and 17). In one store dried broken eggs, and spilled and dried milk were observed on the cooler floor which suggested infrequent cleaning and sanitizing in this area. Furthermore, none of the stores were in accord with Project Consumer Concern's recommendation to store morgue items in closed containers. The purpose of this practice is to keep malodors expelled by old and decaying products from being absorbed by fresher products. A similar problem related to off-flavors among dairy products involved storing both dairy and produce products in the same cooler. This practice was observed in two stores.

Observations also were made in the surveyed grocery

Figure 16. Dairy morgue area in a cooler of one of the four surveyed Oregon retail food stores, Fall 1974

Figure 17. Dry goods morgue in the grocery department back room of one of the four surveyed Oregon retail food stores, Fall 1974

departments of practices associated with handling potential food contaminants such as insecticides, herbicides, and cleaning agents. Baggers at check stands in all four stores were observed properly placing hazardous substances such as insecticides in separate bags from food products. Hazardous substances in the display areas of all four stores were displayed on shelves separate from food products.

Temperature Control. A sanitation management problem common to all four grocery departments involved failure to maintain proper temperature levels of perishable products. This problem occurred because refrigerated frozen cases often were overfilled. In addition, employees and customers often covered air ducts of these cases when filling them with products and selecting a purchase.

Another temperature control problem involved keeping perishable products in unrefrigerated areas. In one grocery department this practice occurred during the price labeling process of milk containers prior to moving them into the cooler. This allowed milk temperature levels to increase. However, perishable products in all four stores usually were transported into coolers or freezer boxes promptly upon reception. A second example of this temperature control problem involved the display of perishable products in unrefrigerated areas, such as eggs displayed in front of their display case.

This type of problem was an exception rather than a common practice in all four stores.

In three of the stores, storage cooler and freezer doors often were left open. In addition, on one of these grocery departments the seals were missing or badly damaged around the freezer and cooler doors. The one grocery department which did not have a problem with open doors utilized flaps to cover the door way; therefore, the doors could be left open without an exchange of air occurring between the cooler and surrounding area. Moreover, it is expected that additional energy is required to operate coolers and freezers with open doors.

The temperature levels of coolers, freezers, and display cases in the grocery department reportedly were inspected daily or more often by employees in all four stores. This practice could not be observed because employees could inspect temperature levels of thermometers installed in the refrigeration units while performing other activities. Temperature levels of thermometers were within recommended limits as observed in this study. Another study which included these four stores supports this finding.[41]

Pest Control. All four stores had contractual agreements with exterminator service firms to maintain bait boxes for rodents in the back room of the grocery departments. The departmental employees in some of the stores also killed flying insects. In one store cockroaches were observed in the display and back room areas, while in another store, there were vermin tracks in flour spilled in the display area.

Employee Hygiene. Employees in the grocery departments of the four stores wore clean uniforms and appeared clean. Employees that were ill did not work in any of the grocery departments and several employees reported by telephone to their managers of illnesses.

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[41] In a study of 30 Oregon retail food stores, the temperature levels of dairy products in the coolers were not higher than the legal maximum (45° F.) established by the Oregon Department of Agriculture. In addition the temperature of the air in front of the blowers of dairy display cases where the thermometers usually were installed were below the legal maximum. However, average temperatures of milk products in the front row on four of six display shelves were above the legal maximum for the 30 retail food stores studied. Therefore, the temperature levels indicated by installed thermometers do not necessarily indicate temperature levels of products on display (Bodyfelt and Davidson, 1975).

Sanitation Procedures

Display Area. The sanitation procedure for check stands in grocery departments as recommended by Project Consumer Concern (PCC) was to clean and sanitize them daily or more often "as needed" (Table 13).[42] The procedure in Store B was in accord with this recommendation, while in Stores A, C, and D the procedures were below PCC's recommendation because the check stands were cleaned daily but not sanitized. Box boys cleaned check stands daily in all four stores and checkers occasionally wiped the counter tops between servicing customers. Cash registers would malfunction in one store whenever cleaning agents were used; therefore, registers were cleaned only with water.

All four stores were below PCC's recommended sanitation procedure for dairy display cases which was to clean and sanitize these cases weekly. The milk section was to be cleaned and sanitized daily. All four stores rated below PCC's recommendation. Stores A, C, and D were rated below because the cases were not sanitized and the milk sections were not cleaned and sanitized daily. Store B was rated below PCC's recommendation because the milk section was not

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[42] "As needed" defines an irregular frequency determined on the basis of subjective judgment by store management. For example, the walls of a display area are cleaned only when visibly dirty or as needed.

Table 13. Grocery department sanitation procedures of four surveyed Oregon retail food stores, Fall 1974, compared to procedures recommended by Project Consumer Concern[a]

Item	Recommended by PCC	Store A	Store B	Store C	Store D
	Display Area				
Check Stands	CS-DY CS-"as needed"[b]	2[c]	3	2	2
Dairy Case	CS-WK (Milk Section)-CS-DY	2	2	2	2
Gondolas	C-as stock rotated CS-QT	2	2	2	2
Frozen Food Case	CS-QT	2	2	2	2
Grocery and Bottle Carts	C-"as needed" CS-MT	2	2	2	2
Floors	CS-WK	4	4	4	4
Walls	C-QT	2	2	4	2
Ceiling	C-QT	2	2	2	2
Windows	No Recommendation	------------ C-2WK ------------			
Drinking Fountain	No Recommendation	NA	CS-WK	C-2 Days	NA
Trash Cans	No Recommendation	NA	C-DY Empty- "As Needed"	C-DY Empty- WK	C-DY Empty- "As Needed"
Ash Tray Cans	No Recommendation	NA	Empty- DY CS-MT	C-Dy	C-DY
	Average	2.3	2.4	2.5	2.3
	Storage Area				
Ice Machine	No Recommendation	NA	NA	CS-QT	NA
Cooler					
Floor	CS-WK	2	3	2	2
Ceiling, Walls	CS-WK	2	3	2	2
Blower	CS-QT	2	4	2	2
Freezer Box	CS-A	2	2	2	2
Back Room					
Floor	C-WK CS-QT	2	4	4	2
Walls, Ceiling	C-SA	2	2	2	2
Stairs	C-WK CS-QT	NA	NA	4	NA
	Average	2.0	3.0	2.6	2.0

Table 13. (Continued)

Item	Recommended by PCC	Store A	Store B	Store C	Store D
	Employees				
Hands	C	3	4	3	3
Uniforms	C	4	4	4	4
	Average	3.5	4.0	3.5	3.5
	Departmental Average[d]	2.3	2.8	2.7	2.3

[a] A United States Department of Agriculture (USDA) and National Association of Retail Grocers of the United States (NARGUS) committee established Project Consumer Concern (PCC) which developed sanitation procedures for all departmental areas of a retail food store (USDA-NARGUS, 1973).

C	Clean	DY	Daily	MT	Monthly
S	Sanitize	WK	Weekly	QT	Quarterly
CS	Clean and Sanitize	BWK	Biweekly	SA	Semiannually
				NA	Not Applicable

[b] "As needed" defines an irregular frequency determined on the basis of subjective judgment by store or departmental managers. For example, walls of the display area are cleaned when visibly dirty or as needed.

[c] Rating System:

5 Above procedures recommended by PCC and also minimize public health hazard.
4 Above PCC's recommendation.
3 Same as recommended by PCC.
2 Below PCC's recommendation.
1 Below procedures recommended by PCC and could be a potential public health hazard.

[d] The departmental average is the average rating of all items rated in comparison to PCC or the average rating of all areas weighted by the number of items in each area rated with PCC.

cleaned and sanitized daily. A problem with Store B's dairy display case identified by the store manager was the appearance of grey marks on those shelves used to display milk containers. These marks were caused by employees and customers sliding milk containers across display shelves. This problem was avoided in the other stores because milk containers were set on wire racks on the shelves and paper was placed between the shelves and the racks to absorb leakage from milk containers.

Project Consumer Concern recommended that gondolas be cleaned as they were restocked, and cleaned and sanitized quarterly. None of the four stores were in accord with the quarterly recommendation, although the gondolas were cleaned during restocking operations. However, this cleaning was not necessarily performed during each restocking. Box boys cleaned the gondola shelves in Store C compared to the stockers in the other three stores. Store C's manager considered gondolas with metal shelves easier to clean compared to those with wooden shelves as once utilized in Store C. The gondolas were cleaned semiannually in Store D. This was accomplished by having most of the grocery department employees in Store D spend one evening every six months after closing hours on cleanup. All products were removed from the shelves before they were cleaned and restocked.

PCC's recommended sanitation procedure for frozen food display cases was to clean and sanitize them quarterly. None of the store's procedures were in accord with this recommendation. In Store B the box boys cleaned and sanitized the outside surfaces of the case weekly and the inside semiannually. In Store A, only the ice cream section was cleaned every two months, but not sanitized while other sections were cleaned less frequently. In Store C, any ice build up in the cases was chipped away monthly. The frozen food cases in Store D were cleaned, but not sanitized quarterly. Besides scheduled cleaning times, frozen food cases were cleaned whenever they failed to function properly, and thus had to be disassembled for repairs.

Grocery and bottle carts were recommended by PCC to be cleaned "as needed" and sanitized monthly. None of the stores were in accord with the monthly frequency recommendation; however, the carts in all the grocery departments were steam cleaned by a cart servicing firm. The steam cleaning was repeated as often as three to four months in Stores C and D respectively, and semiannually in Stores A and B. Carts which became noticeably dirty between steam cleanings were hosed or wiped clean. In Store C, solid bottoms of bottle carts were cleaned every one or two weeks.

The grocery department display floors were to be cleaned and sanitized weekly according to PCC's recommendations. The procedures in all four stores rated above this recommendation because the floors were cleaned daily in addition to being sanitized weekly. Box boys cleaned the floors daily in Stores A, B, and C while in Store D, the in-store janitorial staff cleaned them daily. Any liquids spilled onto the floor during the day were immediately mopped up by box boys. Store C's manager revealed a problem with using bleach as a sanitizer for mopping because it stripped the wax off the floor.

Besides daily cleaning by box boys in Stores A, B, and C, outside janitorial service firms were utilized to clean, sanitize, and wax the display floors on a contractural basis. This service was performed weekly in Stores A and B and every two weeks in Store C. The outside janitorial service firms also cleaned the large plate glass front windows on the stores so that every two weeks both sides were cleaned, although PCC did not establish a recommended procedure for store windows.

Project Consumer Concern recommended that display walls and ceilings be cleaned quarterly. The procedures for the walls in Store C exceeded this recommendation. The procedures in the other three stores were below PCC's recommendation. The grocery department display walls in Stores A, C, and D were cleaned when dirt was visible. This activity also was performed monthly in Store C and semi-annually in Store D. The display walls were not cleaned in Store B. The ceiling was vacuumed irregularly in Store C while the ceilings reportedly were never cleaned in the other three stores.

Project Consumer Concern did not establish recommendations for drinking fountains, trash cans, and ash tray cans. Only two stores had drinking fountains. In Store B, the fountain was cleaned and sanitized weekly while in Store C it was cleaned every two or three days. In Stores B, C, and D, trash cans were placed throughout the grocery department display areas and beside customer entrance and exit ways. The cans were emptied daily or weekly "as needed." Plastic liners were utilized in the trash cans. The outside surfaces of the cans were cleaned daily. Ash trays also were cleaned daily. In addition, the entire ash tray can was cleaned and sanitized monthly in Store B.

The average ratings for sanitation procedures in the display areas of the grocery departments of all four surveyed stores were below procedures recommended by Project Consumer Concern. These low ratings could be attributed both to lower execution frequencies and less sanitizing than recommended.

Storage Area. An ice machine was located in the back room of Store C, which was cleaned and sanitized quarterly by the box boys. However, PCC did not recommend a sanitation procedure for ice machines.

PCC's recommended procedure for the floor, walls, and ceiling of the dairy and beverage cooler consisted of cleaning and sanitizing them weekly. Only Store B's procedure rated the same as PCC's. The floors of the dairy and beverage coolers were cleaned every two weeks by box boys in Stores A and C, but sanitized only every one to two months. In Store D the cooler floor was cleaned with hot water weekly, but not sanitized. The cooler walls in Store D were cleaned weekly while in Store A a frequency of only every two weeks was followed and in Store C a frequency of four to five months was followed.

PCC's recommended sanitation procedure for blowers in dairy and beverage coolers entailed cleaning and sanitizing them quarterly. Store B's procedure rated above this recommendation because the blower was cleaned and sanitized weekly. The procedure for the other three stores rated below PCC's recommended procedure. The blower was vacuumed semiannually in Store A and cleaned annually in Store C. In Store D, the blower was not cleaned and sanitized regularly; however, repairmen cleaned the blower whenever it failed to function properly.

All four stores rated below PCC's recommended sanitation procedure for the freezer storage box, which consisted of cleaning and sanitizing it annually. The only sanitation procedures executed by grocery department employees for the frozen food boxes was to remove ice build up with scrapers. The frequency for removing the ice varied from "as needed" in Store A, monthly in Store C, every two months in Store B, to semiannually in Store D.

PCC's recommended sanitation procedure for the back room floor entailed cleaning it weekly and sanitizing it quarterly. The procedures in Stores B and C rated above PCC's recommendation and Stores A and D rated below. The floors in Stores B and C were swept daily and mopped weekly with a cleaner-sanitizer solution. A sealer was also applied once to the concrete floor in Store B to facilitate cleanup, but the application of sealer did not last a month. Therefore, this practice was not continued. The box boys in Store A swept the back room irregularly and mopped it with a cleaner-sanitizer solution semiannually. The in-store janitorial staff in Store D cleaned the back room floor with a mobile floor scrubber twice weekly.

PCC recommended that walls and the ceiling in the back room be cleaned semiannually; however, they were not cleaned in any of the four stores. The box boys in Store C cleaned and sanitized the stairs in the back room every two weeks. This procedure rated above PCC's recommendation of cleaning weekly and sanitizing quarterly.

The average rating of sanitation procedures for the grocery department storage area of Store C was below (2.6) PCC's recommended procedures while the ratings in Stores A and D were even lower (2.0). These low ratings could be accounted for mostly by executing procedures less frequently than recommended. The average rating in

Store B was the same as PCC's recommendation mainly because some procedures rated above PCC's because they included sanitizing steps and higher frequencies not included in PCC's recommendation. These high ratings assigned to Store B were offset by some procedures being executed less frequently than PCC recommended. Therefore, Store B's average rating was the same as PCC's recommendations.

Employees. PCC's recommended sanitation procedures for employees consisted of being clean, including wearing clean uniforms. Store B rated above PCC's recommendation for hands while Stores A, C, and D rated the same as PCC. These ratings could be attributed to the practice in Store B of dispensing a germicidal hand detergent in the rest room while the other stores dispensed only a cleaning agent such as hand soap. Grocery department employees changed uniforms at least weekly in Stores B, C, and D and twice weekly in Store A. All the stores rated above PCC's recommendation for uniforms because in addition to cleaning them, the uniforms were also sanitized by commercial laundry service firms. Therefore, the average ratings for employee sanitation procedures of Stores A, C, and D were above PCC's recommendation (3.5) while Store B rated highest (4.0) among all four surveyed stores.

The ratings of grocery department sanitation procedures in Stores A and D averaged 2.3 for each department. These low ratings as compared to PCC's average of 3.0 were accounted for because (1) they lacked sanitizing steps and (2) low execution frequencies of some sanitation procedures. The ratings of grocery departments in Stores B and C averaged 2.8 and 2.7 respectively. These ratings were higher compared to Stores A and D because some sanitation procedures were executed more frequently. Overall, variations in grocery department ratings were largely accounted for by differences between the ratings assigned to their storage area procedures.

Weekly Departmental Employee Sanitation Labor

Departmental Summary. The mean proportion of total departmental employee man-hours devoted to sanitation activities among grocery departments ranged from 2.58% in Store D to 5.63% in Store C (Table 14). Store D's grocery department had the lowest sanitation time percentage. This may be due to Store D relying upon an in-store janitorial staff to perform more sanitation activities compared to the outside janitorial service firms used by the other three stores. The grocery department of Store B incurred the second lowest sanitation time percentage (3.94%), which may be accounted for by the employment of a part-time in-store janitor and the performance of some sanitation procedures more frequently compared to Store D. Store A's sanitation time percentage in the grocery department was second highest (5.41%) which possibly could be attributed to the use of

Table 14. Grocery department sanitation labor: estimated percent of time, man-hours and wage costs of four surveyed Oregon retail food stores, Fall 1974[a]

	Store A					Store B				
	1	2	3	4	5	1	2	3	4	5
			(1)x(2)		(1)x(4)			(1)x(2)		(1)x(4)
Position	Percent of Total M-H	Total M-H/ Week	Sanitation M-H/ Week	Hourly Wage Rate	Sanitation Wage Cost/ M-H	Percent of Total M-H	Total M-H/ Week	Sanitation M-H/ Week	Hourly Wage Rate	Sanitation Wage Cost/ M-H
Manager	1.0%	52	.5	$4.50	$.05	2.1%	54	1.1	$5.09	$.11
Clerk	2.7	531	14.3	3.65	.10	2.1	353	7.4	4.41	.09
Box Boy	14.6	182	26.6	2.15	.31	14.2	72	10.2	2.34	.33
Departmental Summary:	5.41%	765	41.4	$3.35	$.181	3.94%	479	18.9	$4.17	$.162
	5.74%[b]			$4.33[c]	$.249	4.12%			$5.04	$.208

Table 14. (Continued)

Position	Store C 1 Percent of Total M-H	2 Total M-H/ Week	3 (1)x(2) Sanitation M-H/ Week	4 Hourly Wage Rate	5 (1)x(4) Sanitation Wage Cost/ M-H	Store D 1 Percent of Total M-H	2 Total M-H/ Week	3 (1)x(2) Sanitation M-H/ Week	4 Hourly Wage Rate	5 (1)x(4) Sanitation Wage Cost/ M-H
Manager	1.9%	119	2.3	$4.86	$.09	1.2%	142	1.7	$4.62	$.06
Clerk	0.8	821	6.6	4.20	.03	1.8	712	12.8	4.15	.07
Box Boy	15.7	439	68.9	2.25	.35	7.5	148	11.1	2.79	.21
Departmental Summary:	5.63%	1379	77.6	$3.63	$.203	2.58%	1002	25.9	$4.02	$.104
	5.96%			$4.51	$.269	2.69%			$4.71	$.127

[a] M-H= Man-Hours. Sanitation Man-hours = Percent of Total Man-Hours x Total Man-hours or Col. (3) = Col. (1) x Col. (2). Sanitation Wage Cost/M-H = Percent of Total Man-Hours x Hourly Wage Rate or Col. (5) = Col. (1) x Col. (4). Column (3) figures may not add up to the departmental summary figure due to rounding error.

[b] The standard time as a percent of total man-hours. The standard time included not only the time spent on sanitation activities but also included a portion of idle time. Idle time was time spent on nonproductive activities such as personal delays, scheduled rest breaks, and unforeseen delays in planned work schedules.

[c] Average hourly wage rate plus payroll taxes, fringe benefits and overtime. In the departmental summary the hourly wage rate is the average hourly wage rate weighted according to the proportion of total man-hours for each position in the department for each store.

departmental employees to perform some sanitation activities that were performed by the in-store janitorial staff in Stores B and D. Store C's grocery department had the highest percent of sanitation time (5.63%) among all four stores. This could be attributed to the lack of an in-store janitorial staff compared to Stores B and D, and because Store C executed some sanitation procedures more frequently compared to Store A.

Store C's grocery department used the most sanitation man-hours per week (77.6) among all four stores which could be accounted for by having the highest percent of sanitation time and the most total man-hours. Store A's grocery department used the second largest number of sanitation man-hours per week (41.4). This could be accounted for because it had the second highest sanitation time percentage and the third highest total man-hours. The grocery department of Store D used the second lowest number of sanitation man-hours per week (25.9) because it had the lowest percent of sanitation time even though it had the second highest total man-hours. Store B's grocery department had the lowest number of sanitation man-hours per week (18.9) among all four stores because it had the second lowest overall sanitation time percentage and the lowest number of total man-hours.

Sanitation wage cost is a function both of sanitation time percentage and the hourly wage rate because it is the portion of an hourly wage rate accounted for by the percent of man-hours devoted to sanitation activities. The weighted average departmental sanitation wage cost is based on individual hourly wage rates in proportion to total man-hours per position. The grocery departments of Stores A and C incurred higher sanitation wage costs ($0.181 and $0.203 respectively) compared to Stores B and D ($0.162 and $0.104 respectively). This occurred because Stores A and C had higher sanitation time percentages even though their weighted average hourly base wage rates were lower ($3.35 and $3.63 respectively) compared to Stores B and D ($4.17 and $4.02) respectively). The sanitation wage cost could be stated another way such that in Store A the average cost per man-hour for sanitation was 18 cents.

For purposes of determining total weekly sanitation labor costs in the grocery departments of the four surveyed stores, the sanitation time percentage and weighted average hourly departmental wage rates were adjusted. Sanitation time percentages were adjusted to include a portion of idle time to constitute standard sanitation time percentages. The weighted average hourly base wage rates were adjusted to include a portion of overhead labor costs such as employee fringe benefits, payroll taxes, and overtime wage rates. The adjusted and subsequently higher sanitation wage costs ranged between $0.127 in Store D and $0.269 in Store C. The store rankings (low to high - D, B, A, C) did not change with the addition of idle time and overhead labor costs to the weighted average departmental sanitation wage costs.

Employee Position. Store A's grocery department manager spent the smallest percent of his total man-hours performing sanitation activities (1.0%) compared to all other grocery department managers. He appeared to spend more time on management activities compared to other grocery department managers. The four grocery department managers of Store D had the second lowest percent of their total man-hours devoted to sanitation activities (1.2%) because store management delegated most of the sanitation activities to the in-store janitorial staff. The managers of the grocery departments in Stores B and C spent 2.1% and 1.9% respectively of their total man-hours performing sanitation activities. These slightly higher percentages could possibly be accounted for by using time not needed for normal management and other duties to perform sanitation activities.

Store C's grocery department clerks had the lowest sanitation time percentage (0.8%) among all four stores and was smaller than the managers' percentage. Their sanitation time was accounted for by wiping check stands and performing some irregular sanitation activities in the display area to fill slack time in their schedule. Store D's grocery department clerks had the second lowest sanitation time percentage (1.8%). A reason for this could be that they performed activities similar to Store C's clerks and also removed cardboard from the display area. The clerks in the grocery departments of Stores A and B with 2.7 and 2.1 sanitation time percentages respectively performed similar sanitation activities compared to Store D's clerks and also baled cardboard.

The box boys in Store D's grocery department had the lowest percent of sanitation time (7.5%) among all four stores which could be accounted for by the more extensive use of an in-store janitorial staff compared to the other three stores. Store B also employed one part-time janitor which could account for its grocery department box boys having the second lowest sanitation time percentage (14.2%). Their time was higher compared to Store D's box boys because they also baled cardboard. Store A's box boys had the second highest percent of sanitation time (14.6%) because they performed sanitation activities similar to Store B's box boys and executed some of the sanitation procedures that the in-store janitorial staff executed in Store B. Finally, Store C's box boys had the highest sanitation time percentage (15.7%) because in addition to performing the same sanitation activities as Store A's box boys, they removed and baled all loose cardboard from the display area compared to the other three stores. Among all positions in the four stores, the box boys devoted a larger proportion of their total man-hours to sanitation activities compared to clerks and managers.

The hourly base wage rates by position among stores varied due to different wage levels within individual positions and because the employees of the grocery departments in Stores B and D were unionized while in Stores A and C they were not.

Generally sanitation wage costs in the grocery department of each store were higher for box boys compared to clerks and managers (Table 14). This occurred because box boys devoted a higher proportion of their time to sanitation activities even though they received a lower hourly wage rate.

Sanitation Costs

The estimated weekly total costs of sanitation for the grocery departments of the four surveyed stores ranged between $185.19 in Store B and $679.76 in Store D (Table 15).

Labor. Breaking down total grocery department sanitation costs into departmental employee labor, service, equipment, and supply categories revealed that departmental labor accounted for the largest portion of total sanitation costs for grocery departments among all four stores exclusive of Store D where the in-store janitorial service cost was the largest portion. While the in-store janitorial service cost was the largest portion in Store D, the janitorial staff was used as a substitute for grocery department labor by performing daily sanitation activities associated with grocery department floors, garbage cans, ashtray cans, and rest rooms. In addition, the

Table 15. Estimated weekly grocery department sanitation costs of four surveyed Oregon retail food stores, Fall 1974

Category	Store A	Store B	Store C	Store D
Departmental Employee Sanitation Labor Costs:[a]				
Weekly	$190.17	$ 99.44	$370.68	$127.09
Prorated	4.75	.75	8.71	28.31
Total	$194.92	$100.19	$379.39	$155.40
Sanitation Service Costs:				
Outside	74.27	65.92	105.83	21.61
In-Store (Janitorial)		14.91		492.88
Total	$ 74.27	$ 80.83	$105.83	$514.49
Sanitation Equipment Costs	2.54	1.83	2.88	3.80
Sanitation Supply Costs	4.58	2.34	6.60	6.07
Total	$276.31	$185.19	$494.70	$679.76

[a] Weekly labor costs were incurred for sanitation procedures executed weekly or more often.

Weekly labor cost = total man-hours (x) percent of total man-hours for sanitation including a portion of idle time (x) average hourly wage rate including payroll taxes, fringe benefits, and overtime (Table 14).

Prorated labor costs were incurred for sanitation procedures executed less often than weekly. For example, frozen display cases were cleaned every four weeks and incurred a labor cost of $20. The prorated labor cost per week would be $5.

in-store janitorial staff baled cardboard which was performed by departmental employees in other stores. A significant amount of man-hours was associated with baling cardboard from the grocery department. Therefore, the lower portion of total sanitation cost for departmental employee labor in Store D was partially accounted for by a higher cost proportion of service performed by its in-store janitorial staff.

The departmental employee labor cost for sanitation was divided into weekly and prorated costs. The prorated labor costs were those incurred to clean and sanitize equipment and building surfaces which required cleaning and sanitizing less often than weekly. This cost was prorated over the time involved in repeating these sanitation activities. For example, a prorated labor cost was computed for cleaning and sanitizing a frozen food display case quarterly (13 weeks). If the labor cost was $26 per quarter, then the prorated cost per week would be $2.

The prorated labor costs per week in the grocery department of Store B ($.75) indicated that its employees performed very few sanitation activities on a cycle longer than weekly. This could be attributed to the formal sanitation program they were following which prescribed frequent cleaning and sanitizing of most equipment and building surfaces. Store A's grocery department incurred the second lowest prorated sanitation labor cost per week ($4.75). This cost mainly was accounted for by labor used to clean dairy and beverage cooler walls every two weeks. The grocery department in Store C incurred the second highest cost ($8.71) which primarily was accounted for by labor used to clean frozen food cases, the dairy case, and bottle carts. Store D's grocery department incurred the highest prorated sanitation labor cost ($28.31) among all four stores. This cost was accounted for by approximately 150 man-hours used in a semiannual cleanup session.

Besides prorated labor costs, departmental employee sanitation labor costs consisted of weekly labor costs, those incurred for labor to execute daily and weekly sanitation procedures. The weekly labor costs in the grocery departments ranged from $99.44 in Store B to $370.68 in Store C while in Stores A and D they were $190.17 and $127.09 respectively. These differences can be attributed to differences among stores in the number of man-hours devoted to sanitation activities rather than differences in average hourly departmental wage rates.

The rankings (low to high - B, D, A, C) among stores of total departmental employee sanitation labor cost did not differ from the rankings of weekly labor costs. This was due to the weekly labor costs accounting for a much larger portion of total sanitation labor costs compared to prorated costs.

Service. In general, sanitation service costs were the second highest sanitation costs. These costs were divided into outside and in-store janitorial service. Most of the outside service costs were accounted for by janitorial, followed by laundry, garbage disposal, steam cleaning, and exterminator (pest control) in successive lesser amounts. Store C's grocery department incurred the highest cost for outside servide ($105.83) because its garbage disposal, laundry, and outside janitorial service firm expenses were the highest incurred among the grocery departments of all four stores while its exterminator and steam cleaning service expenses were similar to the other three stores. Stores A and B incurred lower costs for outside services ($74.27 and $65.92 respectively) due to lower outside janitorial, laundry, and garbage disposal expenses compared to Store C. This could be accounted for because Store C had more floor area cleaned by its janitorial service firm, more uniforms laundered and a larger garbage disposal unit. Store A's costs were higher than Store B's because it had a higher charge assessed by its janitorial service firm. Store D's grocery department incurred the lowest cost for outside service ($21.61) because it employed an in-store janitorial staff.

The in-store janitorial staff cost of Store D's grocery department, which included the cost of employing three full-time employees and their equipment and supplies, accounted for approximately 73% of its total departmental sanitation cost. Store D's janitorial staff maintained floors and rest rooms, and baled garbage and cardboard. The higher cost of the in-store janitorial service compared to the outside janitorial service firm costs of the other three stores was due primarily to the daily service frequency in Store D. This daily janitorial service appeared indicative of the importance store management placed on a policy of presenting customers with a clean appearing store. Store B's grocery department also incurred an in-store janitorial expense ($14.91) which was accounted for by one part-time employee.

Total sanitation service costs for Store D's grocery department were the highest ($514.49) of all stores due to its high in-store janitorial service cost. The in-store janitorial service cost of Store B was large enough to make Store B's total service cost ($80.83) higher than Store A's ($74.27), while Store C's total service cost ($105.83) was second highest among grocery departments of all four stores because it incurred the highest costs for outside services.

Equipment. The cost of sanitation equipment such as brooms, mops, buckets, trash cans, and dust pans amounted to approximately 1% of the total sanitation costs for all four grocery departments. The highest cost for sanitation equipment was incurred by Store D. The cost of the trash cans accounted for three-fourths of its sanitation equipment expenses.

Supply. Sanitation supply costs accounted for less than 2% of the total sanitation costs incurred by all four grocery departments. The grocery department in Store B incurred the lowest sanitation supply cost per week ($2.34) which mainly was accounted for by paper towels and hand cleaner-sanitizer agents. Store A incurred the second lowest cost ($4.58). This cost primarily was accounted for by the cost of mopheads, cleaner agents, and sanitizer agents. The sanitation supply cost of Store D's grocery department was second highest ($6.07) and was mainly accounted for by the cost of soaker pads and aluminum foil used to cover bottom panels of refrigerated display cases. Store C's grocery department incurred the highest sanitation supply cost ($6.60) among all four grocery departments. Bleach, mopheads, window cleaner, and paper towels accounted for most of this cost.

Total. The estimated weekly total sanitation cost for the grocery department of Store D ($679.76) was the highest of all four stores mainly due to the high cost associated with utilizing a full-time in-store janitorial service staff and its associated equipment and supply expenses. Store C incurred the second highest total cost ($494.70) with the highest departmental labor cost of all four stores. Store A's total grocery department sanitation costs ($276.31) ranked third highest with lower costs incurred for labor compared to Store C and lower sanitation service costs compared to Stores C and D. Store B's grocery department incurred the lowest estimated weekly sanitation cost ($185.19) because it incurred the lowest sanitation labor, equipment, and supply costs among all four stores.

Comparison of Two Alternate Survey Weeks of Store B

A second week of work sampling data was collected in Store B. The percent of total departmental employee man-hours devoted to sanitation activities in the grocery department decreased from 3.94% in Week 1 to 3.88% in Week 2 (Table 16). These percentages were not statistically different at the 95% confidence level.[43]

Since total man-hours were only slightly different, the weekly sanitation labor costs were $99.44 in Week 1 and $99.50 in Week 2. Estimates of service, equipment, supply, and prorated labor costs did not differ between Week 1 and Week 2 because the method used to determine these costs entailed averaging them over a specific time period such as three months or one quarter.

Summary

Four sanitation problems were identified that were associated

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[43] The 95% confidence level means there is about a 1 in 20 chance of concluding that sanitation time percentages of two weeks are different when they actually are the same.

Table 16. Grocery department sanitation labor: estimated percent of time, man-hours, and wage costs for two alternate survey weeks of Store B, Fall 1974[a]

	Store B Week 1					Store B Week 2				
	1	2	3	4	5	1	2	3	4	5
			(1)x(2)		(1)x(4)			(1)x(2)		(1)x(4)
Position	Percent of Total M-H	Total M-H/ Week	Sanitation M-H/ Week	Hourly Wage Rate	Sanitation Wage Cost/ M-H	Percent of Total M-H	Total M-H/ Week	Sanitation M-H/ Week	Hourly Wage Rate	Sanitation Wage Cost/ M-H
Manager	2.1%	54	1.1	$5.09	$.11	1.4%	34	.5	$5.09	$.07
Clerk	2.1	353	7.4	4.41	.09	2.6	390	10.1	4.41	.11
Box Boy	14.2	72	10.2	2.34	.33	13.0	60	7.8	2.34	.30
Departmental Summary:	3.94%	479	18.9	$4.17	$.162	3.88%	484	18.8	$4.17	$.162
	4.12%[b]			$5.04[c]	$.208	4.08%			$5.04	$.206

[a] M-H = Man-Hours. Sanitation Man-Hour = Percent of Total Man-Hours x Total Man-Hours or Col. (3) = Col. (1) x Col. (2).
Sanitation Wage Cost/M-H = Percent of Total Man-Hours x Hourly Wage Rate or Col. (5) = Col. (1) x Col. (4).
Column (3) figures may not add up to the departmental summary figure due to rounding error.

[b] The standard time as a percent of total man-hours. The standard time included not only time spent on sanitation activities but also included a portion of idle time. Idle time was time spent on nonproductive activities such as personal delays, scheduled rest breaks, and unforeseen delays in planned work schedules.

[c] Average hourly wage rate plus payroll taxes, fringe benefits and overtime. In the departmental summary the hourly wage rate is the weighted average hourly wage rate according to the proportion of total man-hours for each position in the department for each week.

with handling empty returned beverage containers in retail food stores: (1) potential contaminates of food products could be transmitted into the store by empty containers with foreign material clinging to outer or inner surfaces, (2) pest infestation of food products could be induced by contaminated containers held in storage areas, (3) pests such as flies and rodents tend to be attracted to storage areas by odors emitted from empty beverage containers, and (4) liquids tend to drip onto floors from overturned containers while being transported into the store by customers and transported to the back room by employees.

Sanitation management practices were followed in the grocery departments of all four stores. However, there were situations observed in all four stores where prescribed practices were not followed. The most frequent problems observed were associated with improper temperature control practices for perishable grocery products such as dairy and frozen food. These temperature control malpractices primarily involved overfilling refrigerated units or temporarily storing products outside of refrigerated units. Another practice observed which contributed to improper temperature control entailed leaving cooler and freezer doors open. This problem was alleviated in one store by installing flaps in door ways of refrigerated storage units which generally closed automatically. While temperature control practices were violated in all four stores, there were no perishable grocery products observed in display cases, which outwardly appeared to be unfit for human consumption due to improper temperature control practices.

Most product management practices were followed in the grocery departments of all four stores. Old or damaged products were removed from regular display shelves and either placed in reduced price display sections or discarded. Hazardous substances such as insecticides and cleaning agents were displayed separately from food products. One product management malpractice commonly found in all four stores entailed employees failure to place morgue items such as milk and egg cartons in leakproof covered containers.

Each store contracted with an exterminator service firm which maintained bait boxes in the back room of the grocery departments. There were few signs of vermin such as flies and mice in the grocery departments. However, one recommendation for better pest control would be to increase light intensity in the back rooms of the surveyed stores as prescribed by the Oregon sanitation code. This also would help to improve detection of other insanitary conditions. Hygienic practices of grocery department employees appeared to be satisfactory with some employees absent from work due to illness while those reporting to work appeared healthy with no signs of infected wounds, open sores, or acute respiratory infections.

Generally, sanitation procedures for equipment and building surfaces in all areas of the four surveyed stores' grocery departments rated below procedures recommended by Project Consumer Concern (PCC). The sanitation procedures executed in Stores B and C rated somewhat higher (2.8 and 2.7 respectively) compared to Stores A and D (2.3) (Table 13). Sanitation procedures associated with employees rated above PCC's recommendations for all four stores. Although some store procedures rated below PCC's recommendations, none were rated so low as to be considered a potential public health hazard.

The amount of sanitation activities performed by departmental employees differed among positions. Box boys devoted a larger proportion of their total man-hours to sanitation activities compared to clerks and managers of all four stores. This also accounted for the sanitation wage costs of box boys being higher compared to clerks and managers even though box boys received a lower hourly wage. An inference based on sanitation wage costs for grocery department employees is that store management in most of the surveyed stores seemingly tended to consider sanitation activities to require less skill; thus they often were performed by lower paid employees. The sanitation time percentage of Store D's box boys was approximately one half as high compared to box boys in the other three stores. This could be attributed to use of an in-store janitorial staff in Store D which performed some of the duties usually performed by box boys in the other three surveyed stores. Clerks and managers of grocery departments had low sanitation time percentages compared to box boys. Their daily or weekly sanitation activities usually were performed whenever other work activities were completed or temporarily delayed.

The proportion of total grocery department employee man-hours devoted to sanitation activities ranged from 2.58% in Store D to 5.63% in Store C while total sanitation man-hours per week ranged from 18.9 man-hours in Store B to 77.6 man-hours in Store C. Furthermore, the average departmental sanitation wage cost per man-hour including a portion of idle time and overhead labor costs ranged between \$0.127 in Store D and \$0.269 in Store C. The differences in sanitation wage costs between stores were due mainly to differences in sanitation time percentages rather than average departmental hourly wage rates.

The estimated total weekly sanitation costs of the grocery departments ranged from \$185.19 in Store B to \$679.76 in Store D. The largest portion of these costs was accounted for by departmental employee sanitation labor costs exclusive of Store D (70% in Store A, 54% in Store B, and 77% in Store C) followed by sanitation service costs (27% in Store A, 44% in Store B, and 21% in Store C). In Store D, the full-time in-store janitorial service staff costs accounted for 73% of its total cost while departmental labor accounted for 23%. Sanitation equipment and supply costs accounted for 3% or less of total sanitation costs in the grocery departments of all four stores. Differences in weekly labor costs between stores were due to differences in sanitation man-hours rather than average hourly departmental wage rates. Store D's prorated labor costs were over three times as high as Store C which had the next highest prorated labor cost. Store D's high prorated labor cost was accounted for by an extensive semiannual cleanup program. Finally, the difference between sanitation time percentages of Week 1 and Week 2 of Store B was not statistically significant. This could be attributed to few adjustments required to implement a formal sanitation program in the grocery department. In other words, few changes were made in execution of sanitation procedures after implementation of Store B's formal program.

Produce Department

Profile

Weekly sales of the produce departments in Stores A, B, and C ranged from \$4,000 to \$6,000 and in Store D from \$8,000 to \$10,000 (Table 17). The total area of the produce departments ranged from approximately 1,500 square feet in Store B to 3,200 square feet in Store D. Two to five people were employed in the produce departments. Each department had one manager and the remainder of the employees were designated as produce clerks.

Table 17. Produce department profiles of four surveyed Oregon retail food stores, Fall 1974

	Store			
Category	A	B	C	D
Total Store Sales	$40,000- 60,000	$40,000- 60,000	$90,000- 110,000	$90,000- 110,000
Weekly Departmental Sales	$4,000- 6,000	$4,000- 6,000	$4,000- 6,000	$8,000- 10,000
Area (Sq. Ft.)	2,120	1,460	1,725	3,243
Employees				
Total	4	2	5	4
Manager	1	1	1	1
Clerk	3	1	4	3

In all four stores most of the produce was displayed without being packaged; however, plastic and paper bags were available for customers to bag produce they selected. Some commodities such as carrots, tomatoes, and bean sprouts were prepackaged. Metal trays were used to handle produce in one store. The produce was trimmed and placed on the metal trays. The full trays were temporarily stored on portable racks in the cooler and transported to the display area when needed. Restocking the display case consisted of replacing empty metal trays on the display racks with full ones. According to this store's produce manager, this method reduced the cleaning of the display case and the number of times produce was handled.

In two stores, galvanized barrels were used to store produce trimmings, while in the other two stores, the boxes in which produce was received were used to store produce trim until it was removed from the store. The produce trim from three stores was utilized as animal feed and the trim from the fourth store was removed by a garbage disposal service firm.

Sanitation Management Practices

In this study sanitation management practices were classified into four areas: product management, temperature control, pest control, and employee hygiene.

Product Management. One practice observed in all four stores involved discarding decayed produce. Usually this was performed in the preparation area before displaying the product. However, some products which decayed in the display cases were removed at least daily. Product decay was minimized in all four stores by using the first in, first out method of restocking. Generally, produce display case racks were free of noticeable bacterial growth with the exception of one section of a display case in one of the four surveyed stores. A slimy substance indicated the presence of bacteria in this one display case section. This condition could have developed in other sections and on products in the display case as produce department employees contacted the slimy substance and then worked with uncontaminated products in other sections.

A common problem experienced by the surveyed stores was that individual berries from bunches of grapes would fall on the display floor while being handled by customers or produce employees. The grapes then would be stepped upon and spread across the display floor by shoes and cart wheels. In three of the stores this problem was reduced by placing a rug with rubberized backing in front of the grape section. Most of the grapes that fell to the floor were smashed into the rug which was cleaned daily.

Another problem observed in two of the produce departments involved employees hanging brooms and dust mops over the storage area of unrefrigerated produce, thereby causing potential contamination to exist for products beneath this cleaning equipment. A similar problem existed in the other two produce departments because cleaning and sanitizing agents were stored on shelves directly above the sinks which were used to rinse produce prior to placing it in the display case.

Temperature Control. Several temperature control practices were observed in the surveyed produce departments. Products which required refrigeration were stored in coolers and displayed in refrigerated cases. The produce in the coolers was stored above the floor and usually away from walls to allow circulation of refrigerated air (Figure 18). Also, produce cooler doors were kept closed between movements in and out of them. One produce cooler was equipped with flaps for doors which were self-closing. However, produce was observed displayed above load lines of refrigerated cases in all four stores which was in violation of the Oregon sanitation code and the practices recommended by Project Consumer Concern (PCC).

The temperature levels of coolers and display cases reportedly were inspected daily or more often by produce department employees in all four stores. This practice was not observed because employees could inspect temperature levels of thermometers installed in the refrigeration units while performing other activities. Temperature

Figure 18. Produce properly stored in the cooler above the floor and away from the walls to allow air circulation in one of the four surveyed Oregon retail food stores, Fall 1974

levels of these thermometers were observed within prescribed limits of the Oregon sanitation code (45° F.).

Pest Control. Each store had a contractual agreement with an exterminator service firm for pest control. Employees of the service firm maintained bait boxes in each produce department's dry storage areas. In addition, employees of some produce departments manually exterminated flying insects with fly swatters. Flies appeared to be attracted to uncovered trim barrels of two stores while they were less attracted to the preparation area of the other two stores which utilized cardboard boxes for trimmings and where these boxes were frequently removed from the building by employees.

Employee Hygiene. Produce department employees of all four stores failed to wear hair covering which was in violation of the Oregon sanitation code and recommended practices of PCC. Smoking and eating in produce department preparation areas were not observed with the exception of one store. Employees appeared clean and free of infected wounds, open sores, or acute respiratory infections as prescribed by the Oregon sanitation code.

Sanitation Procedures

Display Area. The sanitation procedure recommended by Project Consumer Concern for all display cases in the produce departments consisted of cleaning and sanitizing them weekly (Table 18). The procedure in all four surveyed stores were rated below PCC's recommendation. This could be attributed to low frequencies of execution in all four stores and failure to sanitize in Stores A and D. A monthly cleaning cycle was followed for display cases with wet racks in Stores A, B, and D while in Store C the entire wet rack case was cleaned and sanitized one evening a month.[44] The dry rack display cases in Store A were cleaned "as needed" during their restocking cycle.[45] The dry rack display cases were cleaned and sanitized every two months in Store B, monthly in Store C, and cleaned weekly, but not sanitized in Store D. A plastic net to collect debris was placed over the racks of refrigerated display cases in all four stores. The net was replaced monthly in Store C while the employees of the other produce departments cleaned the netting each time the case was cleaned and the same netting was used for several years. In Store B the part-time janitor assisted produce employees with cleaning and sanitizing the display cases. A problem associated with cleaning and

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[44] Wet rack produce display cases refer to those which hold vegetables such as lettuce which usually are sprayed with water frequently during the day. Dry rack produce display cases refer to those which hold fruit or vegetables that usually are not sprayed with water.

[45] "As needed" defines an irregular frequency determined on the basis of subjective judgment by store management. For example, walls of the display area are cleaned and sanitized only when visibly dirty or "as needed."

Table 18. Produce department sanitation procedures of four surveyed Oregon retail food stores, Fall 1974, compared to procedures recommended by Project Consumer Concern[a]

Item	Recommended by PCC	Store A	Store B	Store C	Store D
	Display Area				
Wet Rack Display Case	CS-WK	2[b]	2	2	2
Dry Rack Display Case	CS-WK	2	2	2	2
Mirrors	No Recommendation	CS-MT 1 Sec/ WK	C-DY	C-MT	C-WK C-SA
Scale Pans	No Recommendation	No-CS	CS-DY	CS-WK	C-WK
Floor	CS-WK	2	4	4	2
Walls, Ceiling	C-QT	2	2	2	2
	Average	2.0	2.5	2.5	2.0
	Preparation Area				
Work Bench	CS-DY	2	3	NA	2
Sink	CS-DY	2	3	2	2
Knives	CS-DY	2	3	2	2
Trays	CS-DY	NA	NA	NA	2
Trim Barrels	CS-WK	NA	2	NA	2
Carts	No Recommendation	Steam C-QT	CS-WK Steam C-SA	C-WK Steam C-QT	C-WK Steam C-QT
Floors	CS-DY	2	3	3	3
Walls	C-QT	2	4	2	2
Ceilings	C-QT	2	2	2	2
	Average	2.0	2.9	2.2	2.1
	Storage Area				
Dry Storage:					
Floor	No Recommendation	C-DY CS-WK	C-3 times WK CS-WK	CS-as stock	C-DY C-BWK
Walls	No Recommendation	No-CS	CS-WK	C-SA	No-CS
Ceiling	No Recommendation	---------------No-CS---------------			
Cooler:					
Floors	CS-WK	3	3	2	2
Walls, Ceilings, Blower	CS-MT	2	4	2	2
	Average	2.5	3.5	2.0	2.0

Table 18. (Continued)

Item	Recommended by PCC	Store A	B	C	D
	Employees				
Hands	C	3	4	3	3
Uniforms	C	4	4	4	4
	Average	3.5	4.0	3.5	3.5
	Departmental Average[c]	2.3	3.0	2.5	2.2

[a]A United States Department of Agriculture (USDA) and National Association of Retail Grocers of the United States (NARGUS) committee established Project Consumer Concern (PCC) which developed sanitation procedures for all departmental areas of a retail food store (USDA-NARGUS, 1973).

C	Clean	DY	Daily	MT	Monthly
S	Sanitize	WK	Weekly	QT	Quarterly
CS	Clean and Sanitize	BWK	Biweekly	SA	Semiannually
				NA	Not Applicable

[b]Rating System:

5 Above procedures recommended by PCC and also minimizes public health hazard.
4 Above PCC's recommendation.
3 Same as recommended by PCC.
2 Below PCC's recommendation.
1 Below procedures recommended by PCC and could be a potential public health hazard.

[c]The departmental average is the average rating of all items rated in comparison to PCC or the average rating of all areas weighted by the number of items in each area rated with PCC.

sanitizing Store B's produce display case was its rusty surfaces. The produce manager felt that more time was required to clean the rusty surfaces compared to rust-free surfaces.

Although PCC did not establish recommended sanitation procedures for mirrors on the display cases, mirrors were cleaned on the same schedule as the wet rack display cases and more often "as needed." Keeping the mirrors from being water spotted was cited as a problem by all the produce managers. Special cleaning agents for mirrors were utilized in two stores. One store also hired a commercial mirror cleaning service firm to remove water spots.

PCC also did not establish recommended sanitation procedures for scale pans in the display area. The scale pans in Store A were not cleaned; however, they were cleaned and sanitized daily in Store B and weekly in Store C. The pans also were cleaned weekly in Store D.

The sanitation procedures recommended by PCC for produce department display floors entailed cleaning and sanitizing them weekly. The procedures in Stores A and D rated below PCC's recommendation because the floors were not sanitized although they were mopped "as needed" during the day. The display floor in Store A also was cleaned weekly by a janitorial service firm and in Store D it was cleaned nightly by the in-store janitorial staff using a mobile floor scrubber. The sanitation procedures for display floors in the produce departments of Stores B and C rated above PCC's recommendation because their floors were cleaned and sanitized daily by departmental employees. In addition the floor was dust mopped hourly during the day in Store B while in Store C it was dust mopped "as needed" throughout the day.

PCC recommended that walls and ceilings in the produce departments be cleaned quarterly. The procedures in all four stores rated below PCC's recommendation because the walls and ceilings reportedly were not cleaned as frequently as recommended.

The average ratings of sanitation procedures for the produce department display areas in Stores B and C were below (2.5) PCC's recommendations. The ratings in Stores A and D were even lower (2.0). The failure to sanitize equipment and building surfaces and to execute procedures as frequently as recommended by PCC contributed to the low ratings in all four stores.

Preparation Area. Project Consumer Concern's recommended sanitation procedure for work benches, sinks, and knives consisted of cleaning and sanitizing them daily. The procedures in Store B rated the same as recommended while Stores A and D rated below PCC's recommendation because their procedures did not include sanitizing. Store B's produce manager considered the galvanized sink difficult to clean because its surfaces were rusty. The recommended procedure for work benches did not apply in Store C because benches were not utilized. Instead, produce was trimmed into boxes set on carts. However, Store C's procedures for sinks and knives were rated below PCC's recommendation because sinks and knives were not sanitized.

Trays were utilized only in Store D and were cleaned after each use. PCC's recommended procedure entailed cleaning and sanitizing them daily; therefore, Store D's procedure rated below this recommendation because it lacked a sanitizing step although the frequency exceeded PCC's recommendations.

The recommended sanitation procedure for trim barrels consisted of cleaning and sanitizing them weekly. This procedure was not applicable in Stores A and C because cardboard boxes were used on a single service basis. The trim barrel sanitation procedures in Stores B and D rated below PCC's recommended procedure because these barrels were not sanitized. In Store B the barrels were cleaned and lined with plastic liners. In Store D the barrels were hosed out after being emptied and also were steam cleaned quarterly.

Carts were used in the produce departments of all four stores; however, PCC did not establish recommended sanitation procedures. The carts were steam cleaned quarterly to semiannually, the same frequency as utilized for grocery carts. In addition they were hosed off weekly with water in Stores C and D while the carts in Store B were required to be cleaned and sanitized weekly according to the formal procedures of its newly established sanitation program. Nevertheless, the procedures followed by Store B were similar to Stores C and D.

The sanitation procedure recommended by PCC for the floors of the produce department preparation areas was to clean and sanitize them daily. The procedures in Stores B, C, and D rated the same as PCC. Store A's procedure rated below PCC's because the frequency was only weekly. A problem expressed by produce managers in Stores A and C entailed the accumulation of dirt and mud on the preparation area floor from traffic not associated with the produce department. This could be attributed mainly to the location of building entrances.

PCC recommended that walls in the preparation areas be cleaned quarterly. Store B's procedure rated above PCC's because the walls were cleaned and sanitized weekly. The procedures in the other three stores rated below PCC's recommendation because in Store A they were cleaned annually, in Store C semiannually, and in Store D they reportedly were not cleaned. PCC also recommended that ceilings in the preparation area be cleaned quarterly. All four stores rated below PCC's recommended procedure because the ceilings reportedly never were cleaned.

The average rating of sanitation procedures in the produce department preparation area of Store B was slightly below (2.9) PCC recommendations. The ratings of Stores A, C, and D were even lower (2.0, 2.2, and 2.1 respectively) because the procedures of these stores generally lacked sanitizing steps or were not executed as frequently as recommended.

Storage Area. There were two types of storage areas in the produce departments: cooler and dry storage. Project Consumer Concern did not establish sanitation procedure recommendations for the dry storage area. The floor of the dry storage area in Store A was swept daily where it was not covered with produce and mopped weekly with a cleaner-sanitizer. The same procedure was followed in Store B, but the floor was swept only three times weekly. In Store C the floor was swept and mopped with a cleaner-sanitizer as the stock was rotated. In Store D the in-store janitorial staff cleaned the floor twice weekly with the mobile floor scrubber.

The walls were not cleaned in the dry storage area of Store A or Store B. However, the outside of the cooler wall next to the dry storage area was cleaned and sanitized weekly. In Store C the walls were hosed down semiannually. The ceilings in the dry storage area of all stores were not cleaned and sanitized.

PCC's recommended sanitation procedure for cooler floors was to clean and sanitize them weekly. The procedures in Stores A and

B rated the same as PCC. In Store C, the procedure for cooler floors rated below PCC's recommendation because it was cleaned weekly but not sanitized. The procedure in Store D rated below PCC's procedure because the floor was not sanitized even though it was cleaned daily by departmental employees and twice weekly by the in-store janitorial staff using a mobile floor scrubber.

The sanitation procedure recommended by PCC for walls, ceilings, and blowers in produce coolers consisted of cleaning and sanitizing them monthly. The procedure in Store B rated above PCC's because it was executed weekly. The procedures for walls, ceilings, and blowers in Stores A and D rated below PCC's recommendations because they reportedly were never cleaned and sanitized. The procedure in Store C rated below PCC's because the walls, ceiling, and blower in the cooler were cleaned weekly, but not sanitized. A problem expressed by the manager was that the drain in the cooler floor was built too high. Thus, water did not drain off the floor after cleaning, rather it had to be removed manually with a squeegee.

The average ratings for sanitation procedures in the storage area of Store B's produce department were above (3.5) PCC's recommendations because some procedures were executed more frequently than recommended. Store A's procedures rated below (2.5) PCC's recommendation because employees failed to sanitize and/or execute procedures as frequently as recommended by PCC.

The sanitation procedures in Stores C and D rated even lower (2.0) for the same reasons as Store A.

Employees. Project Consumer Concern's recommended sanitation procedure for employees was to maintain clean hands and uniforms. The procedures for employee hands in Stores A, C, and D were the same as PCC's recommendation. In Store B, the procedure rated above PCC's because a cleaner-sanitizer agent was used for hands. The procedures for uniforms in all four stores rated above PCC's recommendation because uniforms were cleaned and sanitized by a commercial laundry service firm. The uniforms were changed by employees as often "as needed" in Store A and at least every other day in Stores B, C, and D. Therefore, the average ratings for sanitation procedures of produce department employees in Stores A, C, and D were above (3.5) the procedures recommended by PCC. The sanitation procedures in Store B rated even higher (4.0).

The ratings of produce department sanitation procedures in Stores A, C, and D averaged 2.3, 2.5, and 2.3 respectively. These low ratings as compared to the average rating of 3.0 assigned to PCC's recommendations were accounted for because (1) the procedures lacked sanitizing steps, and (2) the execution frequencies for some of the sanitation procedures were low. Store B's produce department had the highest rating (3.0) for sanitation procedures because some of its procedures were executed more frequently than recommended by PCC while others were executed less frequently. Thus, the average rating of Store B's produce department corresponded to the average rating assigned to PCC's recommendations.

Weekly Departmental Employee Sanitation Labor

Departmental Summary. The mean proportion of total man-hours devoted to sanitation activities among produce departments ranged from 4.31% in Store D to 10.00% in Store B (Table 19). Store D's produce department had the lowest sanitation time percentage. This could be attributed to its method of displaying produce on trays set onto the display case racks compared to the other three stores where the produce was placed directly on the rack. The tray method reduced the accumulation of dirt in the case and retarded the growth of slime producing bacteria. Thus, fewer man-hours were required to clean and sanitize the display case. The trays were cleaned each time they were emptied; however, this cleaning process involved a low number of man-hours of labor because the trays were soaked in a cleaner solution and rinsed. The sanitation time percentage of Store D's produce department being lower compared to the other stores could also be due to its reliance upon a full-time in-store janitorial staff to perform sanitation activities usually performed by departmental employees in the three other stores.

Table 19. Produce department sanitation labor: estimated percent of time, man-hours, and wage costs of four surveyed Oregon retail food stores, Fall 1974[a]

	Store A					Store B				
	1	2	3	4	5	1	2	3	4	5
			(1)x(2)		(1)x(4)			(1)x(2)		(1)x(4)
Position	Percent of Total M-H	Total M-H/ Week	Sanitation M-H/ Week	Hourly Wage Rate	Sanitation Wage Cost/ M-H	Percent of Total M-H	Total M-H/ Week	Sanitation M-H/ Week	Hourly Wage Rate	Sanitation Wage Cost/ M-H
Manager	3.2%	40	1.3	$4.50	$.14	10.4%	46	4.8	$4.59	$.48
Clerk	8.1	103	8.3	3.87	.31	9.4	36	3.4	4.49	.42
Departmental Summary:	6.74%	143	9.6	$4.05	$.271	10.00%	82	8.2	$4.54	$.454
	7.37%[b]			$5.19[c]	$.383	10.58%			$5.74	$.608

Table 19. (Continued)

	Store C					Store D				
	1	2	3	4	5	1	2	3	4	5
			(1)x(2)		(1)x(4)			(1)x(2)		(1)x(4)
Position	Percent of Total M-H	Total M-H/ Week	Sanitation M-H/ Week	Hourly Wage Rate	Sanitation Wage Cost/ M-H	Percent of Total M-H	Total M-H/ Week	Sanitation M-H/ Week	Hourly Wage Rate	Sanitation Wage Cost/ M-H
Manager	3.8%	54	2.1	$5.40	$.21	2.4%	48	1.2	$4.59	$.11
Clerk	6.5	109	7.1	2.95	.19	5.4	85	4.6	4.49	.24
Departmental Summary:	5.62%	163	9.2	$3.76	$.211	4.31%	134	5.8	$4.52	$.194
	5.95%			$4.74	$.282	4.53%			$5.52	$.250

[a] M-H = Man-Hours. Sanitation Man-Hours = Percent of Total Man-Hours x Total Man-Hours or Col. (3) = Col. (1) x Col. (2). Sanitation Wage Cost/M-H = Percent of Total Man-Hours x Hourly Wage Rate or Col. (5) = Col. (1) x Col. (4). Column (3) figures may not add up to the departmental summary figure due to rounding error.

[b] The standard time as a percent of total man-hours. The standard time included not only the time spent on sanitation activities but also included a portion of idle time. Idle time was time spent on nonproductive activities such as personal delays, scheduled rest breaks, and unforeseen delays in planned work schedules.

[c] Average hourly wage rate plus payroll taxes, fringe benefits and overtime. In the departmental summary the hourly wage rate is the weighted average hourly wage rate according to the proportion of total man-hours for each position in the department of each store.

Store C's produce department used the second lowest proportion of total man-hours for sanitation activities (5.62%). This could be accounted for because the sanitation procedures for display cases were executed only monthly compared to the other three stores which cleaned one or two sections of the case each week. The sanitation time percentage of Store A's produce department was second highest (6.74%). This could be explained by Store A's system for handling produce trim. Boxes were set on the preparation floor for most of the trimming operation. The produce employee stood over the boxes and trimmed the produce. A significant amount of trimmings fell outside of the boxes to warrant cleanup after each box was filled. Although using boxes eliminated the sanitation time requirements for cleaning trim barrels, this advantage was diminished by the additional floor cleanup requirements. However, by placing the boxes on a cart or bench closer to the trimming operation, sanitation time possibly could be reduced.

Store B's produce department had the highest sanitation time percentage (10.00%) among all four stores. This could be accounted for, in part, by frequently cleaning its produce display floor as prescribed by store policy in order to be in accord with insurance policy agreements. Furthermore, the sanitation procedures in Store B's produce department were executed more frequently compared to the other three stores which could be attributed to the formal sanitation program it was following. Another reason was that additional man-hours were utilized to clean and sanitize the produce display case because it had not been cleaned regularly prior to implementation of the formal sanitation program.

The produce departments in Stores A and C used more sanitation man-hours per week (9.6 and 9.2 respectively) compared to the other two stores. This occurred because they had a higher sanitation time percentage compared to Store D and they used more total man-hours compared to Store B. The produce department of Store B used the second lowest number of sanitation man-hours per week (8.2) because it had the highest sanitation time percentage but the lowest total number of man-hours. Store D's produce department used the lowest number of sanitation man-hours per week (5.8) among all four stores. This occurred because it had the lowest sanitation time percentage and the second lowest total man-hours.

The sanitation wage cost is the proportion of an hourly wage rate accounted for by the percent of man-hours devoted to sanitation activities. The weighted average departmental sanitation wage cost is based on individual hourly wage rates in proportion to total man-hours per position. The produce departments of Stores A and B incurred higher sanitation wage costs ($0.271 and $0.454 with average hourly wage rates of $4.05 and $4.54 respectively) compared to Stores C and D ($0.211 and $0.194 with average hourly wage rates of \$3.76 and \$4.52 respectively). This mainly occurred because of sanitation time percentage differences among departments while average hourly base wage rates were mixed between stores with higher and lower sanitation wage costs. The sanitation wage cost could be stated another way such that for Store A the average cost per man-hour for sanitation was 27 cents.

For purposes of determining total weekly sanitation labor costs in the produce departments of all four surveyed stores, the sanitation time percentages and weighted average hourly departmental wage rates were adjusted. Sanitation time percentages were adjusted to include a portion of idle time to constitute standard sanitation time percentages. The weighted average hourly base wage rates were adjusted to include a portion of overhead labor costs such as employee fringe benefits, payroll taxes, and overtime wage rates. The adjusted and subsequently higher sanitation wage costs ranged between \$0.250 with a weighted hourly wage rate of \$5.52 in Store D and \$0.608 out of \$5.74 in Store B. The store rankings (low to high - D, C, A, B) did not change with the addition of idle time and overhead labor costs to the weighted average departmental sanitation wage costs.

Employee Position. Store D's produce department manager spent the lowest proportion of his total man-hours performing sanitation activities (2.4%) compared to other produce managers in the other three stores. He delegated more daily sanitation activities to departmental employees that worked the evening shift compared to other stores. The managers of the produce departments in Stores A and C had higher sanitation time percentages (3.2% and 3.8% respectively) compared to Store D's manager because they performed more of the daily sanitation activities. Store B's produce department manager had the highest sanitation time percentage (10.4%) among all four stores because less division of duties was possible with only two employees and 82 total man-hours per week for the department compared to the other three produce departments with more employees and total man-hours. Hence, the manager performed more daily and weekly sanitation activities.

Store D's produce department clerks had the lowest sanitation time percentage (5.4%) among all four stores. This could be accounted for by the use of the tray method of displaying produce and the use of an in-store janitorial staff to perform some of the daily sanitation activities compared to departmental employees executing them in the other surveyed stores. The sanitation time percentage of Store C's produce department clerks was second lowest (6.5%) because they only cleaned and sanitized the display cases monthly compared to the weekly frequency executed by clerks of the other three stores. On the other hand, the clerks in Store A's produce department had the second highest percent of their total man-hours devoted to sanitation activities (8.1%). This could be accounted for by their frequent cleanup of produce trim from the preparation area floor compared to the other stores and their weekly execution of display case sanitation procedures. The one clerk in Store B's produce department had the highest sanitation time percentage (9.4%) among all four stores' produce clerks. His frequency of executing sanitation procedures was higher compared to the other stores produce clerks which probably was because he was following a formal sanitation program.

Overall, clerks in the produce departments devoted a larger proportion of their total man-hours to sanitation activities compared to managers, exclusive of Store B, which had only two employees with less division of labor.

The hourly base wage rates by position among stores varied because employees in the produce departments of Stores B and D were unionized while in Stores A and C they were not. Sanitation wage cost is that portion of an hourly wage rate accounted for by the percent of man-hours devoted to sanitation activities. Comparison among manager and clerk positions of the produce departments revealed that managers in Stores B and C incurred higher sanitation wage costs than their clerks while in Stores A and D the clerks' sanitation wage costs were higher than managers (Table 19). This could be accounted for by Store C's produce manager receiving the highest hourly base wage while in Store B the manager not only received a higher wage rate but also had a higher sanitation time percentage compared to his one clerk.

Sanitation Costs

The estimated weekly total costs of sanitation for the produce departments of the four surveyed stores ranged between $65.57 in Store B and $134.02 in Store C (Table 20).

Labor. Breaking down total produce department sanitation costs into departmental employee labor, service, equipment, and supply categories revealed that departmental labor accounted for the largest portion of total sanitation costs for produce departments among all four stores exclusive of Store D where the in-store janitorial service cost was the largest portion. The in-store janitorial staff was used in place of produce departmental employee labor to perform some sanitation activities associated with display, preparation, and storage areas; however, this did not account for a significant number of sanitation man-hours. Therefore, the low sanitation cost for departmental employee labor in Store D was not entirely accounted for by the high cost of service performed by the in-store janitorial staff. The tray method of handling produce also could account for the low sanitation labor cost.

Table 20. Estimated weekly produce department sanitation costs of four surveyed Oregon retail food stores, Fall 1974

Category	Store A	Store B	Store C	Store D
Departmental Employee Sanitation Labor Costs:[a]				
Weekly	$54.65	$49.85	$45.96	$ 33.52
Prorated			20.46	
Total	$54.65	$49.85	$66.42	$ 33.52
Sanitation Service Costs:				
Outside	12.18	7.98	9.37	3.35
In-Store (Janitorial)		1.91		88.88
Total	$12.18	$ 9.89	$ 9.37	$ 92.23
Sanitation Equipment Costs	1.07	3.25	5.62	2.70
Sanitation Supply Costs	4.90	2.58	9.02	5.57
Total	$72.80	$65.57	$90.43	$134.02

[a]Weekly labor costs were incurred for sanitation procedures executed weekly or more often.

Weekly labor costs = total man-hours (x) percent of total man-hours devoted to sanitation including a portion of idle time (x) average hourly wage rate including payroll taxes, fringe benefits, and overtime (Table 19).

Prorated labor costs were incurred for sanitation procedures executed less often than weekly. For example, the display case was cleaned every four weeks and incurred a labor cost of $20. The prorated labor cost per week would be $5.

The departmental employee labor cost for sanitation was divided into weekly and prorated costs. Prorated labor costs were those incurred to execute sanitation procedures for equipment and building surfaces which required cleaning and sanitizing less often than weekly. This cost was prorated over the time required to repeat these sanitation activities. For example, a prorated cost was computed for cleaning and sanitizing a produce display case monthly (4 weeks). If the labor cost was $60 per month, then the prorated cost per week would be $15. However, only Store C's produce department incurred a prorated labor cost ($20.46). Most of this was accounted for by monthly cleaning and sanitizing of produce display cases. Other stores performed this sanitation activity weekly.

Besides prorated labor costs, departmental employee sanitation labor costs consisted of weekly labor costs, those incurred for labor to execute daily and weekly sanitation activities. Store A's produce department incurred the highest weekly sanitation labor cost ($54.65) of all four stores because it used the most sanitation man-hours and had the third highest weighted average hourly departmental wage rate. The weekly sanitation labor cost of Store B's produce department was second highest ($49.85). This cost was accounted for by Store B having the highest average hourly departmental wage rate and because it had the third highest number of sanitation man-hours. Store C's produce department incurred the third highest weekly sanitation labor cost ($45.96) mainly because it had the lowest weighted average hourly departmental wage rate and because its sanitation man-hours were second highest. The weekly sanitation labor cost of Store D's produce department was the lowest ($33.52) among all four stores because it used the fewest sanitation man-hours even though it had the second highest average hourly departmental wage rate.

Total departmental employee sanitation labor costs were the same as the weekly labor costs among all produce departments exclusive of Store C's because only Store C incurred a prorated labor expense. When the weekly and prorated labor costs were combined for Store C, its total sanitation labor cost ($66.42) was the highest among all four stores while Store D's was lowest.

Service. Sanitation service costs were divided into outside service and in-store janitorial service. Most of the outside service costs were accounted for by outside janitorial service firm expenses, followed by laundry, garbage disposal, steam cleaning, and exterminator (pest control) expenses in successive lesser amounts. Store A's produce department incurred the highest cost for outside service ($12.18) because its outside janitorial expense was the highest among produce departments of all four stores while its other outside service expenses were similar to the other three stores. The outside service costs of Store C's produce department were second highest ($9.37) because it incurred lower outside janitorial expenses compared to Store A. Store B's produce department incurred the third highest outside service cost ($7.98) because its expenses for outside janitorial and laundry were lower compared to Stores A and C. The produce department of Store D incurred the lowest cost for outside sanitation services ($3.35) because it relies primarily upon an in-store janitorial staff.

The in-store janitorial service cost of Store D's produce department, which included costs of three full-time employees, their equipment and supplies, accounted for approximately 66% of its total departmental sanitation cost. The in-store janitorial staff maintained floors in the display, preparation, and storage areas and baled cardboard for the produce department. The higher cost incurred for in-store janitorial service compared to the outside janitorial service cost of the other three stores was due mainly to Store D's daily service requirements. This daily janitorial service requirement appeared to be indicative of the importance store management placed on a policy of presenting its customers with a clean appearing store. Store B's produce department also incurred an in-store janitorial service expense ($1.91) accounted for by its one part-time janitorial employee.

The total sanitation service cost for Store D's produce department was the highest ($92.93) of all stores due to its high in-store janitorial service cost. The in-store janitorial service cost of Store B was large enough to make Store B's total service cost ($9.89) higher than Store C's ($9.37), while Store A's total service cost ($12.18) was second highest among produce departments of all four stores.

Equipment. The cost of sanitation equipment such as brooms, mops, buckets, and trash cans amounted to 5% or less of the total sanitation cost incurred by all four produce departments. The highest cost for sanitation equipment was incurred by Store C. The cost of the netting used on the display case racks accounted for two-thirds of its sanitation equipment cost. The netting was replaced monthly in Store C while employees of the other produce departments cleaned the netting each time the case was cleaned and the same netting was used for several years.

Supply. Sanitation supply costs ($9.02) of Store C's produce department were the highest among all four stores. This mainly was due to the expense of cleaning and sanitizing agents. One-fourth of the supply cost was incurred for a cleaning agent to help maintain spotless mirrors on display cases. This cost was not incurred by the other three stores.

The other three stores incurred sanitation supply costs that were less than 7% of their total sanitation costs. Store D's produce department incurred the second highest sanitation supply cost ($5.57) of which most could be attributed to the cost of paper towels. The supply costs of the produce departments in Stores A and B were lower ($4.90 and $2.58 respectively) and were primarily accounted for by the cost of cleaning and sanitizing agents.

Total. The estimated weekly total sanitation cost for the produce department of Store D ($134.02) was the highest among all four stores due mainly to the expense associated with its in-store janitorial service. Store C incurred the second highest total cost ($90.43) with the highest cost for departmental labor of all four stores. Store A's total produce department sanitation costs ($72.80) ranked third highest with lower expenses incurred for sanitation labor, equipment, and supplies compared to Stores C and D and lower sanitation service costs compared to Store D. Store B's produce department incurred the lowest estimated weekly sanitation cost ($65.57) because it incurred the lowest sanitation labor and supply costs.

Comparison of Two Alternate Survey Weeks of Store B

A second week of work sampling data was collected in Store B. The percent of total departmental employee man-hours devoted to sanitation activities in the produce department decreased from 10.00% in Week 1 to 6.07% in Week 2 (Table 21). These percentages were

Table 21. Produce department sanitation labor: estimated percent of time, man-hours, and wage costs for two alternate survey weeks of Store B, Fall 1974[a]

	Store B Week 1					Store B Week 2				
	1	2	3	4	5	1	2	3	4	5
			(1)x(2)		(1)x(4)			(1)x(2)		(1)x(4)
Position	Percent of Total M-H	Total M-H Week	Sanitation M-H/ Week	Hourly Wage Rate	Sanitation Wage Cost/ M-H	Percent of Total M-H	Total M-H/ Week	Sanitation M-H/ Week	Hourly Wage Rate	Sanitation Wage Cost/ M-H
Manager	10.4%	46	4.8	\$4.59	\$.48	6.1%	51	3.1	\$4.59	\$.28
Clerk	9.4	36	3.4	4.49	.42	6.0	33	2.0	4.49	.27
Departmental Summary:	10.00%	82	8.2	\$4.54	\$.454	6.07%	84	5.1	\$4.54	\$.278
	10.58%[b]			\$5.74[c]	\$.608	6.39%			\$5.74	\$.367

[a] M-H = Man-Hours. Sanitation Man-Hours = Percent of Total Man-Hours x Total Man-Hours or Col. (3) = Col. (1) x Col. (2). Sanitation Wage Cost/M-H = Percent of Total Man-Hours x Hourly Wage Rate or Col. (5) = Col. (1) x Col. (4). Column (3) figures may not add up to the departmental summary figure due to rounding error.

[b] The standard time as a percent of total man-hours. The standard time included not only time spent on sanitation activities but also included a portion of idle time. Idle time was time spent on nonproductive activities such as personal delays, scheduled rest breaks, and unforeseen delays in planned work schedules.

[c] Average hourly wage rate plus payroll taxes, fringe benefits and overtime. In the departmental summary the hourly wage rate is the weighted average hourly wage rate according to the proportion of total man-hours for each position in the department for each week.

statistically different at the 95% confidence level.[46] The decline in the departmental sanitation time percentage is partially explained by shifting cleaning and sanitizing responsibilities for the produce display case from departmental employees to a part-time janitor. The janitor was not a departmental employee; thus, his sanitation time was not included in the computation of weekly departmental employee labor. Nevertheless, some of the sanitation procedures used for display cases continued to be executed by departmental employees. Another reason could account for the higher sanitation time percentage in Week 1 compared to Week 2. While Week 1 observations were collected two weeks after the store had implemented a formal storewide sanitation program, Week 2 observations were collected two months after implementation of the new program. This time employees may have become more proficient with the program.

The sanitation time percentage of the produce department manager decreased from 10.4% in Week 1 to 6.1% in Week 2 but was still higher compared to produce managers in the other three stores. This could be attributed to the small number of employees in Store B's produce department which allowed less division of labor among employees. The sanitation time percentage for the one produce

[46] The 95% confidence level means there is about 1 chance in 20 of concluding that sanitation time percentages of two weeks are different when they actually are the same.

department clerk decreased from 9.4% in Week 1 to 6.0% in Week 2 due to less time spent cleaning and sanitizing display cases.

The departmental sanitation man-hours of Store B's produce department decreased 3.1 hours per week from 8.2 hours in Week 1 to 5.1 hours in Week 2. This decline could be attributed to the overall lower sanitation time percentage because total man-hours remained approximately the same between the two weeks. The reduction in sanitation time percentage also accounted for the lower departmental sanitation wage cost (including a portion of idle time and overhead labor costs), which decreased $0.241 from $0.608 in Week 1 to $0.367 in Week 2, while the average hourly departmental wage rate remained the same between the two weeks. Because the sanitation time percentage declined in Store B's produce department from Week 1 to Week 2, its sanitation wage cost declined from being higher than Store A's to being lower than Store A's.

The weekly sanitation labor costs decreased $19.01 from $49.85 in Week 1 to $30.84 in Week 2 due to the lower sanitation time percentage while total man-hours for all work between the two weeks remained similar. Estimates of service, equipment, supply, and prorated labor costs did not differ between Week 1 and Week 2 because the method used to determine these costs entailed averaging them over a specific time period such as three months or one quarter.

Summary

To varying degrees sanitation management practices were followed in the produce departments of all four stores. Produce was sold on a first in, first out basis and decayed products were discarded into trim containers. Two stores used galvanized garbage cans as trim containers while the other two stores used boxes in which produce was received. Trim barrels generally were not covered and attracted flying insects. Produce trim boxes were removed frequently and insects appeared to be less attracted to the preparation areas of the two produce departments using trim boxes compared to the two using trim barrels. Exterminator service firms also were contracted to control pests in produce departments of all four stores.

The problem of grapes being dropped by customers upon display floors and creating a slippery surface wherever they were smashed was alleviated somewhat in three of the stores through the use of a rug placed beneath the grape display section. A sanitation management problem observed in all four produce departments involved storing hazardous substances such as cleaning agents above produce storage areas and preparation equipment. Another malpractice observed in all four stores involved the display of perishable products above fill lines in refrigerated units. This practice directly violated the Oregon sanitation code. The health of produce department employees appeared satisfactory. No observations were made of employees eating or smoking in the produce department preparation areas exclusive of one store. However, all produce department employees failed to wear hair covering.

Sanitation procedures for equipment and building surfaces in all areas of the four surveyed stores' produce departments with the exception of Store B rated below procedures recommended by Project Consumer Concern (PCC). For all areas, Store B's procedures rated highest (3.0) compared to the other three stores, and they also were the same as PCC's recommendations (Table 18). Store C's procedures rated below (2.5) PCC's recommendations while Stores A and D were even lower (2.3 and 2.2 respectively.) Store B's rating might be attributed to its recent instigation of a formal sanitation program which required use of a cleaner-sanitizer agent and a high execution frequency for procedures. The ceilings were one surface commonly not cleaned by all four stores. Although some sanitation procedures in all four stores were rated below PCC's recommendations, none were rated so low as to be considered a potential public health hazard. Store sanitation procedures rated below PCC's recommendations due to: (1) their lack of sanitizing steps; and (2) their low execution frequencies.

Store B's manager considered the sink and display case more difficult to clean and sanitize because they were rusty compared to unrusty equipment. A common problem experienced by all four stores involved maintaining spotless mirrors on display cases. Mineral deposits developed on them because they were sprayed with water several times daily.

Generally, clerks in the produce departments devoted a larger proportion of their total man-hours to sanitation activities than managers exclusive of Store B which only had two produce department employees and thus less opportunity for division of labor. The proportion of total produce department man-hours devoted to sanitation activities ranged from 4.31% in Store D to 10.00% in Store B while total sanitation man-hours per week ranged from 5.8 man-hours in Store D to 9.6 man-hours in Store A. Furthermore, the average departmental sanitation wage cost per man-hour including a portion of idle time and overhead labor costs ranged between $0.250 in Store D to $0.608 in Store B. The variations in sanitation wage costs between stores were due mainly to differences in sanitation time percentages while average hourly base wage rates accounted for some of the differences in sanitation wage costs. Store D's lower sanitation time percentage and wage cost compared to the other stores could be attributed partially to its use of the tray method of handling produce. The tray method tended to reduce the accumulation of dirt in the display case and also retarded the growth of slime producing bacteria according to the produce manager interviewed; thus, reducing the number of man-hours required to clean and sanitize the case. In addition, Store D's produce department relied upon daily services provided by a full time in-store janitorial staff which performed some sanitation activities similar to those performed by produce department employees in the other three stores surveyed.

The estimated total weekly sanitation costs of the produce departments ranged from $65.57 in Store B to $134.02 in Store D. The largest portion of these costs were accounted for by departmental employee sanitation labor costs exclusive of Store D (75% in Store A, 76% in Store B, and 74% in Store C) followed by sanitation service costs (17% in Store A, 15% in Store B, and 10% in Store C). In Store D, in-store janitorial service costs accounted for 66% of its total cost while departmental labor accounted for 25%. Sanitation equipment and supply costs accounted for the remainder (8% in Store A, 9% in Store B, 16% in Store C, and 6% in Store D) of total departmental sanitation costs among all four stores. The cost of netting used on the display case racks in Store C's produce department accounted for two-thirds of its sanitation equipment costs which was the highest among all four stores. The netting was replaced monthly in Store C because the produce manager considered the cost of replacing netting monthly to be less than the overtime labor cost incurred for cleaning it. Employees in other produce departments cleaned the netting each time the display case was cleaned and the same netting was used for several years.

Finally, according to a statistical test, the departmental employee sanitation time percentage of Store B's produce department decreased significantly from 10.00% in Week 1 to 6.07% in Week 2. This could be attributed to more assistance being provided by a part-time janitor to clean and sanitize the display case in Week 2 compared to Week 1. Also, departmental employees probably had become more familiar in Week 2 with the procedures of a recently implemented formal sanitation program. Implementation of the new program required adopting some additional sanitation procedures in the produce department compared to those executed during its previously followed informal sanitation program. Thus, a period of time may have been required for produce department employees to become accustomed to Store B's new sanitation program.

Bakery Department

Profile

Stores B and C had in-store bakeries in addition to meat, grocery, and produce departments. The weekly sales of the bakery departments in Stores B and C ranged from \$3,000 to \$5,000 (Table 22). The total area of Store B's bakery department was approximately 2,000 square feet while Store C's was approximately 2,500 square feet. The smaller area in Store B compared to C could be accounted for by less square footage in preparation and storage areas. Both

Table 22. Bakery department profiles of two surveyed Oregon retail food stores, Fall 1974

Category	Store B	Store C
Total Store Weekly Sales	\$40,000-60,000	\$90,000-110,000
Weekly Departmental Sales	\$3,000-5,000	\$3,000-5,000
Area (Sq. Ft.)	2,000	2,490
Type[a]	Scratch	Scratch
Total Employees	11	11
Manager	1	1
Baker	3	3
Decorator	2	1
Clerks	4	6
Cleanup Boy	1	-

[a]There are two basic types of in-store bakeries, bake-off and scratch. Scratch type bakery operations consist of fabricating (mixing ingredients and shaping products), baking, decorating, and packaging products. The bake-off type receives prefabricated products and performs operations from baking to packaging.

in-store bakeries were scratch type which meant the product was fabricated (ingredients were mixed and products were shaped), baked, decorated, and packaged in the store compared to a bake-off type which receives prefabricated products and performs operations from baking to packaging.

Both bakery departments employed eleven people. Each department had a manager who performed baker operations such as mixing ingredients and shaping products besides managing the department. Three bakers worked in each department while Store B employed two decorators and Store C employed one decorator. Store B also empolyed four clerks in the bakery department whereas Store C employed six clerks. Store B also employed a part-time cleanup boy.

Sanitation Management Practices

In this study, sanitation management practices were classified into four areas: product management, temperature control, pest control, and employee hygiene.

Product Management. A practice observed in the bakery departments of both stores involved removal of old product from display cases. This practice occurred daily when cases were restocked. Bakery products in both stores were sold on a first in, first out basis (FIFO). One section of the display case was designated for day old products, even though most bakery products generally were sold the same day they were baked. Otherwise, products that were several days old were reprocessed into a fruit-bar type of pastry. This product was discarded if it did not sell to assure safety and fitness for human consumption.

All bakery products were packaged or displayed in enclosed cases so that customers could not contact the unpackaged food product while selecting a purchase. This practice also tended to deter potential pest infestation. However, an exception to this practice was an uncovered tray of doughnuts which was placed daily on the service counter in the bakery department display area of one store. Broken packages were observed being removed from display shelves in both stores. Bakery department clerks who serviced customers handled unpackaged products with waxed paper to reduce the possibility of contaminating the product, although one service clerk was consistently observed handling the unpackaged product without using this protective paper.

The inventory of ingredients in the storage area was utilized on a FIFO basis. The ingredients and unfinished products were stored above the floors on shelves and racks (Figure 19). In some instances they were not stored away from walls which increased the likelihood of pest infestation. Ingredients in storage areas were covered while some ingredients in preparation areas were left uncovered when not

Figure 19. Dry bakery ingredients stored above the floor and away from walls to reduce the likelihood of pest infestation in one of the two bakery departments of the four surveyed Oregon retail food stores, Fall 1974

Figure 20. Flour dust tracks from the bakery department in one of four surveyed Oregon retail food stores, Fall 1974

being used. Thus, vermin and foreign material could contact ingredients kept in uncovered containers.

<u>Temperature Control</u>. Temperature levels of refrigerated display cases for cream and custard filled products were observed below the Oregon Department of Agriculture's (ODA) maximum legal limit (45^{o} F.) as indicated by case thermometers. The temperature levels of the retards, which are refrigeration units, in both stores also were maintained below ODA's prescribed temperature. In addition, temperature levels of freezer units were under ODA's maximum legal limit (0^{o} F.) as observed on installed thermometers. Temperature levels were inspected by departmental employees daily. However, this practice was not observed during the study because employees could inspect temperature levels while performing other activities.

<u>Pest Control</u>. Numerous flies were observed in both bakery departments. An employee of one bakery department sprayed the preparation area after daily production had terminated using an ODA approved inspect spray. He covered all food prior to spraying, but failed to cover surfaces of equipment such as the work bench which contacted food during production. Contracts also were consummated with commercial exterminator service firms to control vermin such as mice and insects in both bakery departments.

Employee Hygiene. Generally bakery department employees wore hair coverings in the preparation area, although on some occasions an employee failed to wear hair covering as prescribed by the Oregon sanitation code. Employees were observed eating in the preparation areas of the bakery departments which also was in violation of the Oregon sanitation code.

In addition, employees were observed smoking in the preparation area of one bakery department, another violation of Oregon sanitation standards. The general health of bakery department employees appeared satisfactory with no signs of infected wounds, open sores, or acute respiratory infections.

Sanitation Procedures

Display Area. Project Consumer Concern (PCC) recommended sanitation procedures for equipment and building surfaces in bakery departments. All procedures for the display areas in Stores B and C rated below the procedures recommended by PCC which entailed cleaning and sanitizing daily (Table 23). The display cases were cleaned daily, but not sanitized in Store B while in Store C the doughnut case was cleaned daily, the cake case twice weekly, and the cookie case weekly, but none of the cases were sanitized as recommended. The display cases were constructed primarily of glass so that glass cleaner was the main cleaning agent used by bakery

Table 23. Bakery department sanitation procedures of two surveyed Oregon retail food stores, Fall 1974, compared to procedures recommended by Project Consumer Concern[a]

Item	Recommended by PCC	Store B	Store C
	Display Area		
Doughnut Case	CS-DY	2[b]	2
Cake Case	CS-DY	2	2
Cookie Case	CS-DY	2	2
Floor	CS-DY	2	2
Walls	CS-MT	2	2
Ceilings	C-QT	2	2
	Average	2.0	2.0
	Preparation Area		
		Food Contact Equipment	
Bread Slicer	C-DY, CS-WK	4	2
Wrapping Station	C-DY, CS-WK	4	2
Deep Fat Fryer	C-WK	4	4
Fry Racks	C-WK	4	2
Glazer Pot	CS-DY	2	2
Doughnut Pans	CS-DY	3	2
Cake Pans	C-WK	4	2
Bread Pans	C-WK	2	2
Work Bench (Bakers')	C-after each use, CS-DY	2	2
Work Bench (Decorators')	C-after each use, CS-DY	3	2
Utensils	CS-after each use	3	2
Mixing Machines	CS-after each use	3	2
Bowls	CS-after each use	3	2
Bread Molder, Bun Former	No Recommendation	CS-DY	C-DY
Bun Divider	No Recommendation	CS-2WK Steam C-SA	C-DY Steam C-3MT
Bench Scales	No Recommendation	CS-3WK	C-3WK
Bins Under Work Benches	No Recommendation	CS-WK	C-WK
Icing Warmer	No Recommendation	CS-DY	C-DY
	Average	3.2	2.2

Table 23. (Continued)

Item	Recommended by PCC	Store B	Store C
	Preparation Area (Continued)		
		Equipment and Building Surfaces Which Usually Do Not Contact Food	
Retard Coils	No Recommendation	C-3MT	C-3MT
Retard	CS-WK	4	2
Carts, Dollies	CS-WK	2	2
Proof Box	CS-DY	2	2
Oven	C-2WK	2	2
Sinks	CS-after each use, CS-DY	2	2
Floor	CS-DY	2	2
Walls around Fryer	CS-DY	3	2
Walls	CS-MT	4	2
Ceiling	C-QT	2	2
	Average	2.6	2.0
	Storage Area		
Shelves (dry ingredient area)	No Recommendation	C-MT	C-2WK
Floor (dry ingredient area)	C-MT	4	4
Walk-in Freezer	CS-A	2	2
Transient Trays (freezer)	No Recommendation	C-SA	C-SA
	Average	3.0	3.0
	Employees		
Hands	C-between production activities, C-"as needed"[c]	4	3
Uniforms	C	4	4
	Average	4.0	3.5
	Departmental Average[d]	2.8	2.2

[a]A United States Department of Agriculture (USDA) and National Association of Retail Grocers of the United States (NARGUS) committee established Project Consumer Concern (PCC) which developed sanitation procedures for all departmental areas of a retail food store (USDA-NARGUS, 1973).

C	Clean	DY	Daily	MT	Monthly
S	Sanitize	WK	Weekly	QT	Quarterly
CS	Clean and Sanitize	BWK	Biweekly	SA	Semiannually
				NA	Not Applicable

[b]Rating System:

5 Above procedures recommended by PCC and also minimizes public health hazard.
4 Above PCC's recommendation.
3 Same as recommended by PCC.
2 Below PCC's recommendation.
1 Below procedures recommended by PCC and could be a potential public health hazard.

[c]"As needed" defines an irregular frequency determined on the basis of subjective judgment by store management or departmental managers. For example, walls in the display area are cleaned only when visibly dirty or as needed.

[d]The departmental average is the average rating of all items rated in comparison to PCC or the average rating of all areas weighted by the number of items in each area rated with PCC.

department clerks. The floor behind the display cases was swept daily, but not sanitized, by the evening shift clerks in both stores. The floors in the customer area were cleaned daily by grocery department box boys, but not sanitized. PCC's recommended sanitation procedure for the display area walls was to clean and sanitize them monthly; however, this procedure was executed only "as needed" by grocery department box boys.[47] PCC recommended that ceilings in bakery department display areas be cleaned quarterly. The ceilings in both stores reportedly were not cleaned.

The average ratings for sanitation procedures in the bakery department display areas of Stores B and C were below (2.0) PCC's recommendations. These low ratings mainly were due to the failure of employees to sanitize equipment and building surfaces.

Preparation Area. The preparation area sanitation procedures were divided into two groups: those associated with food contact equipment, and those associated with equipment and building surfaces which usually did not contact food. The sanitation procedures recommended by PCC for the bread slicer and wrapping station were to clean them daily and sanitize them weekly. The procedures in Store

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[47] "As needed" defines an irregular frequency determined on the basis of subjective judgment by store management. For example, walls in the display area are cleaned only when visibly dirty or "as needed."

B rated above PCC's recommendations because the bread slicer and wrapping station were cleaned and sanitized daily while in Store C, the procedures rated below because the bread slicer and wrapping station were cleaned daily, but not sanitized. PCC recommended that the deep fat fryer be cleaned weekly. This procedure in both stores rated above PCC's due to the use of a filtering system which continuously cleaned the deep fat fryer's grease. Disposable paper filters were changed daily. PCC also recommended that fry racks be cleaned weekly. The procedure in Store B rated above PCC's recommendation because these racks were cleaned and sanitized daily. Store C's procedure rated below due to its lower execution frequency (two weeks) compared to PCC's recommended weekly frequency. The sanitation procedure recommended by PCC for the glazer pot consisted of cleaning and sanitizing it daily. Procedures executed in both stores rated below PCC's recommendation because the pot was scraped daily, but not sanitized. Every two weeks the pot was cleaned and sanitized in Store B while in Store C it was only cleaned with water.

PCC recommended that doughnut pans be cleaned and sanitized daily. The procedure in Store B rated the same as PCC's while Store C's procedure rated below because its pans were not sanitized. The recommended sanitation procedure for cake pans entailed cleaning them weekly. Store B's procedure rated above PCC's recommendation because its pans were cleaned and sanitized after each use. Store C's procedure rated below with a frequency of cleaning its pans every two months. PCC recommended that bread pans be cleaned weekly but both stores rated below this recommendation because the pans reportedly were not cleaned. However, the pans were reglazed periodically to keep bread from adhering to them.

The sanitation procedures recommended by PCC for work benches were to clean them after each use and sanitize them daily. Both stores' procedures rated below PCC's recommendation for work benches used by bakers because the benches were not sanitized, although they were cleaned after each use. Store B's procedure for the decorators' bench was the same as recommended while Store C's procedure rated below because its bench was not sanitized. PCC recommended that utensils, mixing machines, and bowls be cleaned and sanitized after each use. Store B's procedures rated the same as PCC's procedures. The procedures in Store C rated below PCC's recommendations because utensils and bowls were cleaned, but not sanitized after each use, and the mixing machines were cleaned only on a monthly cycle.

Project Consumer Concern did not establish recommended sanitation procedures for bread molders, bun formers and dividers, bench scales, bins under work benches, and icing warmers. In Store B, the bread molder and bun former were cleaned and sanitized daily while in Store C they were cleaned daily, but not sanitized. The bun divider in Store B was cleaned and sanitized every two weeks by the bakery department cleanup boy, and steam cleaned semiannually by a commercial steam cleaning service firm. In Store C, the bun divider was cleaned daily by a baker. A problem experienced by Store B's cleanup boy with executing this sanitation procedure was that it was difficult to clean the bun divider manually because it could not be easily disassembled. The steam cleaning process helped to overcome this difficulty but was performed infrequently. The bench scales in Store B were cleaned and sanitized every three weeks while in Store C the same procedure was utilized but without a sanitizing step. The bins under the work benches were cleaned weekly in both bakery departments and also sanitized in Store B. Finally, the icing warmers in both stores were cleaned daily and also sanitized in Store B.

The average rating of sanitation procedures for food contact equipment in the preparation area of Store B's bakery department were slightly above (3.2) PCC's recommendations. This could be attributed to their higher execution frequencies compared to PCC's recommended frequencies. Store C's rating was below (2.2) PCC's recommendations because its procedures lacked sanitizing steps and/or were executed less frequently than recommended.

PCC also recommended sanitation procedures for equipment and building surfaces in the bakery department preparation area which usually did not contact food; although, no recommendations were established for retard coils. These coils were cleaned every three months in both stores. The remainder of the retard as recommended, was to be cleaned and sanitized weekly. Store B's procedure rated above PCC's because in addition to a weekly frequency, surfaces which were touched frequently such as door handles were cleaned and sanitized daily. Store C's procedure rated below PCC's due to their lower execution frequency (every two weeks) compared to the weekly frequency recommendation. Both stores' procedures rated below PCC's recommendation to clean and sanitize carts and dollies weekly. This was accounted for by their low execution frequency because carts and dollies were steam cleaned semiannually by a steam cleaning service firm in Store B and quarterly in Store C. In addition, the carts and dollies were cleaned and sanitized every two months by the cleanup boy in Store B and cleaned every two weeks in Store C by a departmental employee.

The recommended sanitation procedure for proof boxes, which are enclosures with controlled temperatures and humidities for raising dough for such products as bread, consisted of cleaning and sanitizing them daily. Both stores rated below PCC's recommendation. In Store B the floor of the proof box was scraped daily while the entire box was cleaned and sanitized weekly. In Store C, the floors were scraped weekly and the entire box cleaned and sanitized monthly. Both stores' procedures for ovens rated below PCC's recommendation which entailed cleaning them every two weeks. Burnt spillage on oven racks was scraped off irregularly. Both stores' sanitation procedures for sinks also rated below PCC's recommendation which consisted of cleaning and sanitizing them after each use and daily as well. This low rating was accounted for by low execution frequency (daily only in both stores) and the lack of a sanitizing step in Store C.

PCC recommended that floors of bakery department preparation areas be cleaned and sanitized daily. The procedures for floors in both stores rated below PCC's recommendation because the floors were not sanitized daily even though they were scraped and swept daily. The floors were mopped weekly in both stores; a sanitizer was used in Store B while only hot water was used in Store C. A problem encountered in both stores involved employees tracking flour dust out of the bakery department to other areas of the store (Figure 20). This tracking was reduced in Store B by placing a rubberized mat at entry and exit ways to the bakery. The sanitation procedures recommended by PCC for walls around the deep fat fryer entailed cleaning and sanitizing them daily. Store B's procedure was the same as recommended by PCC while Store C's rated below because its monthly execution frequency was less often than recommended by PCC. The other walls in the bakery department preparation area were to be cleaned and sanitized monthly as recommended by PCC. Store B's procedure rated above PCC's because the walls around the sink were cleaned and sanitized daily. Store C's procedure rated below PCC's recommendation because the walls only were cleaned semiannually by grocery department box boys. The ceilings in both bakery department preparation areas reportedly were never cleaned, while PCC recommended cleaning them quarterly.

The average rating for sanitation procedures of equipment and building surfaces in the bakery department preparation area of Store B was below (2.6) PCC's recommendations mainly because of lower execution frequencies compared to PCC's recommendations. Store C rated below (2.0) PCC's recommendations because its procedures lacked sanitizing steps and/or were not executed as frequently as recommended.

Storage Area. The major storage areas of the two bakery departments were dry ingredient storage and the walk-in freezer. Some of the dry ingredients were stored under work benches in metal containers; however, a separate section of the department was used as the main storage area for dry ingredients. PCC's recommended sanitation procedure for the floor was to clean it monthly. Both stores' procedures rated above PCC's because the floors were swept weekly. PCC did not establish recommended procedures for dry ingredient storage shelves even though they were cleaned monthly in Store B and every two weeks in Store C. PCC's recommended sanitation procedure for the walk-in freezer consisted of cleaning and sanitizing it annually. Both stores' procedures rated below PCC's due to their lack of sanitizing steps and because only ice was scraped off the freezer floor weekly in Store B and monthly in Store C. PCC also did not establish recommended sanitation procedures for freezer transient trays while both stores cleaned them semiannually.

The average ratings (3.0) for sanitation procedures for the bakery department storage areas of both stores were the same as recommended by PCC.

Employees. Project Consumer Concern recommended that bakery department employees clean hands between production activities and more often "as needed." Store B's procedure rated above PCC's recommendation because a hand cleaner-sanitizer was used between production activities and as often "as needed," while Store C's procedure was the same as recommended. Both stores' procedures for uniforms rated above PCC's recommendation which was to wear a clean one. The uniforms in both stores were cleaned and sanitized by commercial laundry service firms. Employees changed their uniforms daily. The average rating for sanitation procedures of bakery department employees in Store C were above (3.5) PCC's recommendations while Store B's procedures rated even higher (4.0).

The ratings of bakery department sanitation procedures averaged 2.8 in Store B and 2.2 in Store C. These ratings differed largely because Store C's sanitation procedures lacked sanitizing steps.

Weekly Departmental Employee Sanitation Labor

Departmental Summary. The mean proportion of total man-hours devoted to sanitation activities for the two bakery departments was 11.79% in Store B and 11.99% in Store C (Table 24). These percentages were not statistically different at the 95% confidence level. This could be attributed to similar frequencies for execution of most sanitation procedures performed by departmental employees.

Store C's bakery used more sanitation man-hours per week (45.0) compared to Store B's (42.7) due mainly to higher total man-hours.

Sanitation wage cost is the portion of an hourly base wage rate accounted for by the percent of man-hours devoted to sanitation activities (Table 24). A weighted average departmental sanitation wage cost is computed on individual hourly wage rates in proportion to total man-hours per position. The weighted average departmental sanitation wage costs for bakery departments in Stores B and C were \$0.491 and \$0.475 respectively. In other words, for Store B's bakery department the average cost per man-hour for sanitation was 49 cents.

Table 24. Bakery department sanitation labor: estimated percent of time, man-hours, and wage costs of two surveyed Oregon retail food stores, Fall 1974[a]

	Store B					Store C				
	1	2	3	4	5	1	2	3	4	5
			(1)x(2)		(1)x(4)			(1)x(2)		(1)x(4)
Position	Percent of Total M-H	Total M-H Week	Sanitation M-H/ Week	Hourly Wage Rate	Sanitation Wage Cost/ M-H	Percent of Total M-H	Total M-H/ Week	Sanitation M-H/ Week	Hourly Wage Rate	Sanitation Wage Cost/ M-H
Manager	6.6%	45	3.0	$6.15	$.41	4.4%	44	1.9	$6.15	$.27
Baker	8.6	111	9.5	5.03	.43	9.0	120	10.8	4.97	.48
Decorator	6.9	56	3.9	4.85	.33	6.3	40	2.5	4.85	.31
Clerk	9.2	134	12.3	2.71	.25	17.2	171	29.4	2.62	.45
Cleanup Boy	87.5	16	14.0	2.20	1.93					
Departmental Summary:	11.79%	362	42.7	$4.16	$.491	11.99%	375	45.0	$3.96	$.475
	11.98%[b]			$5.58[c]	$.668	12.75%			$4.90	$.625

[a]M-H = Man-Hours. Sanitation Man-Hours = Percent of Total Man-Hours x Total Man-Hours or Col. (3) = Col. (1) x Col. (2).
Sanitation Wage Cost/M-H = Percent of Total Man-Hours x Hourly Wage Rate or Col. (5) = Col. (1) x Col. (4).
Column (3) figures may not add up to the departmental summary figures due to rounding error.

[b]The standard time as a percent of total man-hours. The standard time included not only the time spent on sanitation activities but also included a portion of idle time. Idle time was time spent on nonproductive activities such as personal delays, scheduled rest breaks, and unforeseen delays in planned work schedules.

[c]Average hourly wage rate plus payroll taxes, fringe benefits and overtime. In the departmental summary the hourly wage rate is the weighted average hourly wage rate according to the proportion of total man-hours for each position in the department for each store.

For purposes of determining total weekly sanitation labor cost in the bakery departments of the two surveyed stores, the sanitation time percentages and weighted average hourly departmental wage rates were adjusted. Sanitation time percentages were adjusted to include a portion of idle time to constitute standard sanitation time percentages. The weighted average hourly base wage rates were adjusted to include a portion of overhead labor costs such as employee fringe benefits, payroll taxes, and overtime wage rates. These adjusted and subsequently higher sanitation wage costs for the bakery departments of Stores B and C were $0.668 to $0.625 with average hourly wage rates of $5.58 and $4.90 respectively. The store rankings did not change with the addition of idle time and overhead labor costs to the weighted average sanitation wage costs.

Employee Position. Store C's bakery department manager had a lower sanitation time percentage (4.4%) compared to Store B's (6.6%). This could be accounted for in Store C because the manager delegated sanitation duties primarily to bakers and clerks while in Store B the manager participated in the execution of sanitation procedures since Store B had recently implemented a formal store-wide sanitation program. The bakers in Store B's bakery department devoted a similar proportion of their total man-hours to sanitation (8.6%) compared to Store C's bakers (9.0%). This could be attributed to Store B's bakery department recent implementation of a formal sanitation program even though it included employment of a cleanup boy to execute most sanitation procedures. More time may have been required while becoming familiar with the new program.

The decorators in the bakery departments of Stores B and C had similar sanitation time percentages (6.9% and 6.3% respectively). Their sanitation activities consisted mainly of cleaning and sanitizing the equipment they used. This seemed to correspond with a policy followed in all four stores where each employee was held responsible for cleanup in his designated work area. The clerks in Store B's bakery department devoted a lower proportion of their total man-hours to sanitation (9.2%) compared to Store C's (17.2%). This also could be attributed to Store B's bakery department's employment of a cleanup boy to execute most sanitation procedures. The cleanup boy in Store B's bakery department devoted 87.5% of his total man-hours to the execution of sanitation procedures. He also performed some "other work" activities such as transporting baking supplies from the receiving area to storage area. In general, the cleanup boy in Store B devoted the highest proportion of total man-hours to sanitation among all bakery department employees in both stores.

The hourly base wage rate varied between stores for positions of bakers and clerks even though both bakery departments were unionized because their wage rates for different employees differed within these positions. Sanitation wage cost is that portion of an hourly wage rate accounted for by the percent of man-hours devoted to sanitation activities and is a function of both sanitation time percentages and hourly base wage rates. The sanitation wage costs among positions of managers, bakers, decorators, and clerks ranged between \$0.25 and \$0.48 per hour (Table 24). In other words, among these positions, the average cost per man-hour for sanitation ranged between 25 cents and 48 cents. The cleanup boy in Store B incurred the highest sanitation wage cost per hour (\$1.93) among all positions in both bakery departments because he had the highest sanitation time percentage even though his hourly base wage rate was the lowest (\$2.20).

Sanitation Costs

Labor. Separating the estimated weekly total cost of sanitation for bakery departments into departmental employee labor, service, equipment, and supply categories revealed that departmental labor accounted for the largest portion of total sanitation costs for both Stores B and C (Table 25). The total departmental sanitation labor cost for Store B's bakery department was somewhat lower, \$241.79, compared to Store C, \$251.79. This cost was divided into weekly and prorated costs.

The prorated labor costs were those incurred to execute sanitation procedures for equipment and building surfaces which required cleaning and sanitizing less often than weekly. This cost was prorated

Table 25. Estimated weekly bakery department sanitation costs of two surveyed Oregon retail food stores, Fall 1974

Category	Store B	Store C
Departmental Employee Sanitation Labor Costs:[a]		
Weekly	$241.79	$234.39
Prorated		17.40
Total	$241.79	$251.79
Sanitation Service Costs	30.04	31.59
Sanitation Equipment Costs	1.44	1.39
Sanitation Supply Costs	10.14	2.03
Total	$283.41	$286.80

[a]Weekly labor costs were incurred for sanitation procedures executed weekly or more often.

Weekly labor costs = total man-hours (x) percent of total man-hours devoted to sanitation including a portion of idle time (x) average hourly wage rate including payroll taxes, fringe benefits, and overtime (Table 24).

Prorated labor costs were incurred for sanitation procedures executed less often than weekly. For example, the walk-in freezer was cleaned every 13 weeks and incurred a cost of $52. The prorated cost per week would be $4.

over the time required to repeat these sanitation activities. However, only Store C's bakery department incurred prorated labor costs ($17.40). Most of this was accounted for by the semiannual cleaning and sanitizing of preparation area walls in the bakery department by grocery department box boys. Store B's bakery department did not incur any prorated labor costs because its cleanup boy executed sanitation procedures at frequencies less often than weekly without scheduling additional man-hours. Each week he performed some of these sanitation activities. Therefore, his sanitation man-hours remained fairly constant from week to week.

Besides prorated labor costs, departmental employee sanitation labor costs consisted of weekly labor costs, those incurred for labor to execute daily and weekly sanitation activities. Store B's bakery department incurred a higher weekly sanitation labor cost ($241.79) compared to Store C ($234.39). This could be accounted for even though Store C had more sanitation man-hours compared to Store B because Store B had a higher weighted average hourly departmental wage rate.

<u>Service</u>. The bakery departments of Stores B and C incurred similar sanitation service costs ($30.04 and $31.59 respectively). Most of the sanitation service costs were accounted for by laundry expense, followed by janitorial, garbage disposal, steam cleaning, and exterminator (pest control) expenses in successive lesser amounts.

Equipment and Supply. Sanitation equipment costs accounted for less than 1% of total sanitation costs. Equipment costs of the bakery departments in Stores B and C were $1.44 and $1.39 respectively and were accounted for mainly by costs incurred for brooms, scrapers, mops and mop buckets. The sanitation supply costs in Store B's bakery department were 4% of its total sanitation costs, while in Store C they were only 1%. The difference in supply costs between the two stores could be attributed to the use of a cleaning-sanitizing agent in executing most of the sanitation procedures in Store B, while in Store C only a detergent was used to clean doughnut pans as well as some equipment and building surfaces in the front end of the bakery department.

Total. The estimated weekly total sanitation cost for the bakery departments of Stores B and C were $283.41 and $286.80 respectively. Most of the total cost could be accounted for by departmental employee labor.

Comparison of Two Alternate Survey Weeks in Store B

A second week of work sampling data was collected in Store B. The percent of total departmental employee man-hours devoted to sanitation activities in the bakery department decreased from 11.79% in Week 1 to 9.35% in Week 2 (Table 26). These percentages were

Table 26. Bakery department sanitation labor: estimated percent of time, man-hours, and wage costs for two alternate survey weeks of Store B, Fall 1974[a]

	Store B Week 1					Store B Week 2				
	1	2	3	4	5	1	2	3	4	5
			(1)x(2)		(1)x(4)			(1)x(2)		(1)x(4)
Position	Percent of Total M-H	Total M-H/ Week	Sanitation M-H/ Week	Hourly Wage Rate	Sanitation Wage Cost/ M-H	Percent of Total M-H	Total M-H/ Week	Sanitation M-H/ Week	Hourly Wage Rate	Sanitation Wage Cost/ M-H
Manager	6.6%	45	3.0	$6.15	$.41	3.4%	44	1.5	$6.15	$.21
Baker	8.6	111	9.5	5.03	.43	5.3	110	5.8	5.03	.27
Decorator	6.9	56	3.9	4.85	.33	4.3	55	2.4	4.85	.21
Clerk	9.2	134	12.3	2.71	.25	7.4	147	10.9	2.71	.20
Cleanup Boy	87.5	16	14.0	2.20	1.93	83.9	17	14.3	2.20	1.85
Departmental Summary:	11.79%	362	42.7	$4.16	$.491	9.35%	373	34.9	$4.16	$.387
	11.98%[b]			$5.58[c]	$.668	9.53			$5.46	$.521

[a]M-H = Man-Hours. Sanitation Man-Hours = Percent of Total Man-Hours x Total Man-Hours or Col. (3) = Col. (1) x Col. (2).
Sanitation Wage Cost/M-H = Percent of Total Man-Hours x Hourly Wage Rate or Col. (5) = Col. (1) x Col. (4).
Column (3) figures may not add up to the departmental summary figures due to rounding error.

[b]The standard time as a percent of total man-hours. The standard time included not only the time spent on sanitation activities but also included a portion of idle time. Idle time was time spent on nonproductive activities such as personal delays, scheduled rest breaks, and unforeseen delays in planned work schedules.

[c]Average hourly wage rate plus payroll taxes, fringe benefits and overtime. In the departmental summary the hourly wage rate is the weighted average hourly wage rate according to the proportion of total man-hours for each position in the department for each week.

statistically different at the 95% confidence level.[48] One reason possibly accounting for the lower sanitation time percentage in Week 2 compared to Week 1 was that Week 1 observations were collected after Store B had recently implemented a formal store-wide sanitation program while Week 2 observations were collected two months later at which time employees probably had become familiar with executing the new procedures. The sanitation time percentages were lower for all positions in Week 2 compared to Week 1.

The sanitation wage costs for each position also were lower for Week 2 compared to Week 1 because the sanitation time percentages were lower for each position while hourly base wage rates remained the same between the two weeks. The departmental sanitation wage cost (including a portion of idle time and overhead labor costs) decreased \$0.147 from \$0.668 in Week 1 to \$0.521 in Week 2. This could be accounted for by the lower departmental sanitation time percentage and a lower weighted average hourly departmental wage rate. The lower wage rate was due to more clerk man-hours whose hourly wage rate was below the departmental average.

The weekly sanitation labor costs decreased \$47.50 from \$241.79 in Week 1 to \$194.29 in Week 2 due to a lower sanitation

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[48] The 95% confidence level means there is about 1 chance in 20 of concluding that sanitation time percentages of two weeks are different when they actually are the same.

time percentage and hourly base wage rate. This resulted in a lower sanitation wage cost even though more total man-hours were utilized in Week 2. Estimates of service, equipment, supply, and prorated labor costs did not differ between Week 1 and Week 2 because the method used to determine these costs entailed averaging them over a specific time period such as three months or one quarter.

Summary

Stores B and C were the only stores of the four surveyed which had in-store bakeries. Both bakery departments were scratch type.

Sanitation management practices in both bakery departments included removal of old products and products in damaged packages. Some of these products were reprocessed and some were discarded. To prevent pest infestation and customer contact with unpackaged food, all bakery products generally were displayed in packages or enclosed cases. Dry ingredients also were stored in enclosed containers or in paper packages placed on shelves. In addition to this type of pest control practice, extermination service firms were used to control pests in the bakery departments. One employee sanitation problem observed involved failure to cover equipment before it was sprayed for insects even though bakery products were covered.

Temperature control of perishable bakery products was practiced in both stores. Two observed personal habits of employees, usually considered problems, involved eating and smoking in the bakery department preparation areas. Occasionally employees also failed to wear hair covering in preparation areas. The health of bakery department employees appeared to be satisfactory with no signs of infected wounds, open sores or acute respiratory infections.

Generally, the sanitation procedures for equipment, building surfaces, and employees in Store B's bakery department rated above Project Consumer Concern's (PCC) recommended procedures, exclusive of the procedures executed for the display area, and equipment and building surfaces in the preparation area which usually did not contact food. Those procedures in Store B which rated below PCC's were due mainly to low execution frequencies. In Store C's bakery department most of the sanitation procedures rated below those recommended by PCC exclusive of procedures for the storage area and employees. The low ratings in Store C were due to: (1) a lack of sanitizing steps in its sanitation procedures, and (2) low execution frequencies. The weighted average rating of Store B's bakery department procedures was slightly below (2.8) PCC recommendations while Store C's were even lower (2.2) (Table 23). Although some sanitation procedures rated below PCC's recommendations, none were rated so low as to be considered a potential public health hazard. One problem observed in both stores was tracking flour dust from the bakery department to other areas of the store, which was resolved in Store B with the placement of mats in doorways of the bakery department.

Store B employed a cleanup boy in the bakery department who performed a majority of the sanitation activities while in Store C the clerks and the lowest paid baker performed most of the sanitation activities. Managers devoted the lowest proportion of their total man-hours to sanitation among all bakery department employees. Therefore, lower paid employees were utilized to perform more sanitation activities compared to the higher paid employees such as managers. The proportion of total bakery department man-hours devoted to sanitation activities was 11.79% and 11.99% in Stores B and C respectively. These percentages were not statistically different at the 95% confidence level, which could be attributed to similar execution frequencies for most sanitation procedures performed by departmental employees in both stores. Total sanitation man-hours per week were 42.7 and 45.0 in Stores B and C respectively. The average departmental sanitation wage costs per man-hour including a portion of idle time and overhead labor cost were $0.668 in Store B and $0.625 in Store C.

The estimated total weekly sanitation costs of the bakery departments were $283.41 in Store B and $286.80 in Store C. The largest portion of these costs were accounted by departmental labor costs (85% in Store B and 82% in Store C) followed by sanitation service costs (11%). Sanitation equipment and supply costs accounted for 5% or less of total departmental sanitation costs. Finally according to a statistical test, the departmental employee sanitation time percentage of Store B's bakery department decreased significantly from 11.79% in Week 1 to 9.35% in Week 2. A possible reason accounting for the lower sanitation time percentage in Week 2 compared to Week 1 was Store B's employees adjustment to a formal sanitation program implemented two weeks prior to Week 1's work sampling data collection process while Week 2 observations were collected two months after Week 1's observations had been completed. Implementation of the formal program required making some changes in sanitation procedures compared to the previously followed informal program in the bakery department. Thus, a period of time may have been required for bakery department employees to become accustomed to the new sanitation program.

IV. SUMMARY AND CONCLUSIONS

Scope of Study

Those involved with various aspects of food store sanitation have argued that maintenance of proper and/or implementation of improved sanitation practices and procedures in retail food stores should contribute to improved food quality and a reduction in potential food-borne illnesses, thus benefiting consumers with a more wholesome and safe food supply. Moreover, in recent years regulatory agency emphasis on maintaining proper sanitation practices in food stores has intensified. For many food stores, the above focus on sanitation implies a need to make changes in their current sanitation programs which also may be accompanied by increased costs associated therewith. Presently, there is a lack of information on the costs and operating problems associated with existing sanitation procedures and practices in retail food stores.

The major objective of this study has been to develop more information on the procedures, costs, and management practices of sanitation programs in retail food stores. The specific objectives were: (1) to identify and evaluate current procedures and problems associated with cleaning and sanitizing all areas of retail food stores; (2) to develop comparative labor, supply, equipment, and service cost data for existing procedures in retail food stores; (3) to identify and analyze current retail food store sanitation management practices; and (4) to develop recommendations for improving sanitation procedures and management practices, and for controlling sanitation program costs in retail food stores. The data for this study were developed from a survey of four Oregon retail food stores. Three of the stores were conventional supermarkets while the fourth store was a food department in a general merchandise store. Two stores were chain operations and two were independently owned. Two of the stores had weekly sales volumes ranging between \$40,000 and \$60,000 while the other two had weekly sales volumes ranging from \$90,000 to \$110,000.

Summary of Empty Beverage Container Handling Practices

Grocery department handling practices for empty beverage containers in the four surveyed retail food stores were studied to identify associated sanitation problems. One problem identified involved potential contamination of food products transmitted into the store by empty containers with foreign material clinging to outer or inner surfaces. This problem could be minimized by a store's refusal to accept grossly contaminated beverage containers. The Oregon bottle law provides stores with this option. According to managers in the surveyed stores, however, few grossly contaminated containers were brought into the stores for redemption during the time this study was conducted (Fall, 1974) compared to the initial period after the law became effective in October 1972. Nevertheless, the contamination problem can be minimized by training employees who handle both containers and food products to clean and sanitize their hands after handling returned empty beverage containers in order to prevent cross contamination of food products. In addition, it is recommended that stores consider limiting the number of employees who handle returned beverage containers in conjunction with food products.

A second problem identified entailed pest infestation of food products induced by contaminated containers held in storage areas. Project Consumer Concern's recommended practice to minimize this problem is to segregate the storage of food products from the storage of empty beverage containers in the back room.

A third problem involved liquids dripping onto floors from overturned containers while being transported into the store by customers and transported to the back room by employees. The use of solid bottom carts by store employees to transport containers received at the front end to the back room would help to eliminate this problem because spillage would tend to be limited to cart bottoms compared to being spread across display and storage floors when containers are transported in regular open bottom grocery carts. The cart bottoms should be cleaned and sanitized when dirt is visible similar to recommendations made by Project Consumer Concern for grocery cart sanitation procedures.

A fourth problem identified in this study involved odors emitted from empty beverage containers. These odors tend to attract pests such as rodents and flies.

While the above major sanitation problems were identified in this study, other sanitation problems also may exist with handling empty beverage containers which were not identified in this study but which must be contended with by store personnel. On balance, employees of the four surveyed stores appeared to be handling empty returned beverage containers in a manner which appeared to maintain the wholesomeness and safety of food products sold by their respective stores.

Summary of Sanitation Management Practices

Sanitation management practices include such things as monitoring and maintaining proper temperature levels of perishable food products and minimizing pest infestations. These practices affect the quality as well as the safety of food products in all departments of a retail food store. Proper sanitation management practices must be followed from the receiving point to the customer in order to maintain the quality and safety of food products.

A field inspection trip with an Oregon Department of Agriculture

(ODA) retail food store sanitation inspector, along with a review of state sanitation standards, Project Consumer Concern recommendations, and other research studies served as the basis for developing a checklist form for identifying and collecting data on sanitation management practices. Observations of each surveyed store's sanitation management practices were made over a seven-day period and recorded on the data collection checklist form. These practices were classified into four categories: product management, temperature control, pest control, and employee hygiene. A summary of sanitation management practices observed in the four surveyed stores is listed in Table 27.

Product Management

A common practice observed in all departments of the four surveyed stores consisted of selling products on the basis of those received first, or on a first in, first out cycle (FIFO). The FIFO method was used for inventory control both in storage and display areas. In addition to using the FIFO method, employees inspected products and removed those with expired pull dates from regular display sections. They also removed damaged food packages such as leaking packages of meat products and dented cans. Among the above products, those which were still fit for human consumption were reduced in price and placed in a section of the display cases separately

Table 27. Summary of prominent positive and negative sanitation management practices observed in four surveyed Oregon retail food stores, Fall 1974[a]

Product Management

+ Removal of damaged, leaking, and decayed food products from display cases.

+ First in, first out method (FIFO) of selling food products.

+ Separation of hazardous substances from food products.

+ Bakery products packaged or enclosed in display cases in the display area.

- Trim containers uncovered when not being used.

- Some observations of cross contamination between different types of raw meat products and between raw and fully cooked meat products.

Temperature Control

+ Inspection of temperature controlled display and storage units by employees.

+ Temperature levels within limits set by the Oregon Department of Agriculture (140° F. or above for hot fully cooked products, 45° F. or below for refrigerated products, 0° F. or below for frozen products) as measured by installed thermometers on all temperature controlled units.

+ Use of plastic door flaps in doorways of coolers and a freezer in two departments of two surveyed stores.

- Cooler and freezer doors left open without the use of flaps.

- Food products stored above fill lines in refrigerated display cases.

- Some observations of perishable products kept in unrefrigerated areas for extended periods of time.

- Food products covering air ducts of refrigerated display cases.

Table 27 (cont.)

Pest Control

+ Use of exterminator service firms to control pest infestation.
+ Use of in-store fly control methods such as enclosed meat preparation areas and fly spray.
- Improper application of insecticides by not covering food processing equipment.
- Evidence of pest infestation in all four surveyed stores.
- Low light intensity in some parts of back rooms.
- Products and ingredients left uncovered in preparation areas.

Employee Hygiene

+ Clean appearance of employees.
+ Healthy appearance of employees with no signs of infected wounds, open sores, or acute respiratory infections.
+ Employees reporting by telephone to their managers of illnesses rather than working while ill.
- Lack of hair covering worn by some employees working in the preparation areas of meat, bakery, and produce departments.
- Some observations of smoking in preparation areas.
- Some observations of eating in preparation areas.

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[a]+ A sanitation management practice considered to positively contribute to the maintenance of the wholesomeness and safety of food products sold to consumers.

\- A sanitation management practice considered to negatively contribute to the maintenance of the wholesomeness and safety of food products sold to consumers.

from other food products. Those products deemed unfit for human consumption were deposited into a departmental morgue, a container for discarded and/or decayed products. For example, discarded produce and meat products were placed in trim barrels. The trim barrels were emptied several times each week by a contractual waste disposal service firm.

On balance, it is recommended that the four surveyed stores continue using the FIFO method and removing old and/or damaged products from display sections as a means of helping to maintain the quality and safety of food products sold to consumers.

A common problem observed with morgues was that containers often were left uncovered. In meat and dairy morgues, this practice tends to allow emission of malodors from morgue products which can adversely affect the flavor of fresh food products especially in storage coolers where the morgues usually are located. In bakery, dry grocery, and produce morgues, the uncovered morgues could attract pests and spread molds. The above problems can be limited by covering containers used to store morgue items in all departments of a retail food store. Moreover, morgues should be cleaned and sanitized at specified frequencies as recommended by Project Consumer Concern.

Prevention of cross contamination is a sanitation management practice which applies mainly to the meat department where different types of unpackaged meat products contact the same processing equipment surfaces. Pathogenic microorganisms can be transferred at these contact points from one product to another. Generally, cross contamination problems appeared minimal in the four surveyed stores. However, some observations were made in meat departments where meat products such as poultry and beef were processed with food contact equipment which had not been cleaned and sanitized between changes in the two types of meat products being processed. Hence, it is recommended that sanitation procedures should be executed at least as often as every time a change occurs in the type of meat processed. In addition, the observed practice of wearing cloth gloves when cutting meat should be discontinued to prevent cross contamination, unless clean and sanitary gloves are changed every time a change occurs in the type of meat being processed.

Another recommended cross contamination preventative measure entails cleaning and sanitizing equipment used to process special orders after each order is processed. This procedure will help to minimize the growth of spoilage and potential pathogenic microorganisms on equipment which is used on an intermittent basis. Furthermore, this procedure should reduce the possibility of cross contamination attributed to processing different types of products on the same equipment.

Another cross contamination problem observed in one surveyed store was that fully cooked products were not covered when stored with raw products in the cooler. Fully cooked products should be covered when stored with raw products in coolers to prevent cross contamination from raw to cooked products.

Hazardous substances such as insecticides and cleaning agents sold by and/or used in the surveyed stores generally were stored and displayed in a manner which minimized the possibility of contaminating food products. However, cleaning and sanitizing agents were observed over sinks in two produce department preparation areas. This problem could be alleviated by removing shelving above sinks and placing it below the sinks.

Finally, senior executive management in consultation with their store manager(s) should also consider investigating the manner in which food products are handled and stored prior to delivery to the store. The quality and wholesomeness of food delivered to the store may not easily be discernible by store management. For example, it may be difficult for them to access the microbiological quality of meat. However, an investigation of sanitation practices associated with processing and handling meat at slaughter and packinghouses, and/or during transportation may help to identify those practices which may adversely affect shelf life and/or the quality of food products offered for sale to consumers.

Temperature Control

Many products sold in the four surveyed stores were highly perishable. In order to insure the quality and safety of perishable food products offered to consumers, proper temperature levels must be adhered to especially for those products cooked in the store and for certain products requiring refrigeration due to their high degree of perishability. In Oregon, hot cooked products must be maintained above 140° F., refrigerated products below 45° F., and frozen products below 0° F. according to the Oregon sanitation code.

Temperature control problems were observed in the meat, grocery, and produce departments of all four stores surveyed. The most frequent types of temperature control problems observed involved refrigerated display cases being filled above load lines and air ducts of open refrigerated display cases being covered by food products. While the first problem was due to employee stocking practices, both employees and customers caused the second problem. An ongoing educational training program for all employees including both store and department managers and stockers, which focuses on the importance of maintaining proper temperature levels as it relates to the shelf life, wholesomeness of food products, and store profits should go a long way toward alleviating the above types of problems. In addition, as part of such a program, an employee should be designated to inspect temperature levels of refrigerated display cases twice daily as recommended by Project Consumer Concern. Also, any products found covering air ducts or stacked above load lines by customers should be placed back into the normal display area of the cases. The frequency of this practice should be determined by store management in consultation with a food sanitarian. In addition, food products should be transported by the above employee(s) back to proper storage areas from display cases overfilled by stockers and this problem when identified should be reported to both store and departmental managers to initiate corrective action. Another control problem involved temporarily storing perishable products in unrefrigerated areas. Implementation of an ongoing temperature control education training program should also help to minimize the occurrence of this problem.

The temperature levels of refrigerated units reportedly were inspected by employees daily or more often as measured by installed thermometers. Moreover, researchers have accurately measured product temperature and temperatures near installed thermometers in 30 retail food stores including the four stores surveyed in this study (Davidson, 1975). This study found temperatures below load lines on the average to be within ODA legal limits.

However, the study also found some of the product temperatures in the front part of refrigerated display cases above the legal limits set by ODA. Several factors may account for this problem. First, a regular maintenance program for refrigeration equipment including frequent cleaning around refrigeration coils may be nonexistent. Second, the equipment may not be designed to handle the demands placed on it to operate at ODA temperatures. In these instances senior executive management should give attention to providing store management with guidelines for establishing refrigeration equipment maintenance programs. In line with the above recommendation the employee(s) who are required to inspect temperature controlled unit load levels should be required to record these unit's temperatures in writing using an accurate portable thermometer as the measuring device.

Another temperature control problem observed involved leaving cooler and freezer doors open. This problem was eliminated in the grocery department of one store and the produce department of another store by installing plastic flaps in the doorways which closed automatically. The costs associated with the use of flaps compared to no flaps were not determined in this study.

Pest Control

All four stores contracted with exterminator (pest control) service firms which maintained rodent bait boxes and sprayed some areas for insects. However, observations were made of pest inhabitations in all four stores surveyed. Store employees executed pest control practices in several instances by spraying to kill flies. Although they used approved insecticides and covered food before spraying, they failed to cover processing equipment which usually contacted unpackaged food before spraying the area with insecticides. This improper application of insecticides occurred most often in meat and bakery departments.

The enclosed and refrigerated preparation areas of two stores' meat departments appeared to discourage flies from entering and remaining in these areas. Conversely, flies were more prevalent in the two meat department preparation areas that were not enclosed and refrigerated. Therefore, enclosed and refrigerated areas could be considered one method to control flies.

The use of boxes for produce trim and their frequent removal also tended to reduce fly infestation compared to the use of trim barrels which were removed less often and usually were left uncovered. While it was not observed whether or not lids were available for those barrels that were left uncovered, it appeared that senior executive management should encourage store managers to make sure that tightly fitting lids are provided for and placed on trim barrels.

Use of a fly electrocuter constitutes another method suitable for fly control. "Probably the safest, most effective method of controlling those flies that do get into a store is the placement of a fly electrocuter in the processing area" (Rishoi, 1976, p. 128). The advantages would be that it is a continuous operation and equipment does not have to be covered during its operation which is necessary when spraying insecticides.

A further recommendation for controlling pest infestation in the four surveyed stores would be to increase the light intensity in the back room. Light intensity could be increased by painting grey concrete walls a lighter color. Also some areas of the back rooms lacked a light source and additional light fixtures could be installed to increase light intensity.

Each store should give attention to covering food products or ingredients in preparation areas whenever they are not being processed or handled. This will help reduce the possibility of contamination resulting from pest infestation. Finally, to further reduce the possibility of pest infestation in bakery departments, bakery ingredients should be stored away from walls and off the floor. This practice tended to be overlooked in one of the surveyed store's bakery department.

Employee Hygiene

In general, employees of all four stores appeared clean and healthy with no signs of infected wounds, open sores, or acute respiratory infections. Several employees reported by telephone to their managers that they were ill. This suggests an awareness on the part of employees of the potential effects of poor health on store sanitation. Hair covering was a required part of the uniform for employees in preparation areas of the meat, produce, and bakery departments. However, in all these departments of the four surveyed stores, some employees failed to wear hair covering. There also were observed instances of employees eating and smoking in preparation areas but these generally were exceptions rather than common practices among the four surveyed stores.

Sanitation management practices could be improved in all four stores by requiring employees to wear prescribed hair coverings, and to avoid eating and smoking in the preparation areas of meat, produce, and bakery departments at all times. Establishment of a policy which allows smoking and eating only in designated areas such as an employee lounge would tend to eliminate this problem. Furthermore, sanitation operating policies of this nature could be conveyed to employees through an ongoing sanitation education program.

One store's policy of limiting entry of unauthorized persons to the meat cooler could be extended to cover the meat and bakery department preparation areas of all the surveyed stores as well. This practice should help to minimize potential contamination of food products by persons who may not be following sanitary practices prescribed for these departmental areas such as wearing proper hair coverings, clean uniforms, or who may be in poor health.

On balance, employees of the four surveyed stores followed sanitation management practices which appeared conducive to maintaining the wholesomeness and safety of food products offered for sale to consumers. However, as discussed above, there also were sanitation management practices which could be improved to further insure the wholesomeness and safety of these food products. Initiating an improvement in these practices is highly dependent upon senior executive management's commitment to store sanitation.

Summary of Sanitation Procedures and Recommendations for a Store-Wide Sanitation Program

Sanitation procedures in all departments of the four surveyed stores were rated on a comparative basis with procedures developed and recommended by Project Consumer Concern (PCC), a joint committee of the United States Department of Agriculture and the National Association of Retail Grocers of the United States. The rating system used in this study was developed to compare procedures executed in the four surveyed stores with PCC's recommended procedures on a scale of 1 to 5 (low to high). A sanitation procedure assigned a rating of 5 indicated that an observed procedure exceeded PCC's recommendations and minimized potential public health hazards. A rating of 3 meant that the store sanitation procedure was the same as recommended by PCC. A sanitation procedure assigned a rating of 1 indicated that it was below PCC's recommendation and constituted a potential public health hazard. Weighted average ratings were computed for specific areas within departments, for the total department, and for the total store. These ratings were computed for each store surveyed in this study (Table 28).

The ratings of meat department sanitation procedures in Stores A, B, and C averaged 2.5 for each department. These low ratings as compared to the average rating of 3.0 assigned to PCC's recommendations were accounted for largely by store personnel executing some procedures less frequently than recommended by PCC. Store D's average rating for meat department sanitation procedures was 2.9. This could be attributed to some procedures being executed less frequently than recommended by PCC and some procedures being executed more frequently. Thus, the average rating in Store D's meat department was only slightly below PCC's recommendations.

The ratings of grocery department sanitation procedures in Stores A and D averaged 2.3 for each department. These low ratings as compared to the average rating of 3.0 assigned to PCC's recommendations were accounted for because (1) they lacked sanitizing steps and (2) the low execution frequencies of some sanitation procedures. The ratings of grocery department sanitation procedures in Stores B and C average 2.8 and 2.7 respectively. These ratings were higher compared to Stores A and D because some sanitation procedures were executed more frequently. Variations in grocery

Table 28. Summary of sanitation procedures executed in all departments of four surveyed Oregon retail food stores, Fall 1974 rated in comparison with Project Consumer Concern's recommended procedures[a]

Category	Store A	Store B	Store C	Store D
Meat Department Areas				
Display	2.3[b]	2.2	2.3	2.3
Preparation	2.6	2.5	2.5	3.2
Cooler Area	2.0	2.5	2.5	2.0
Employee	4.0	4.0	3.5	3.5
Departmental Average	2.5	2.5	2.5	2.9
Grocery Department Areas				
Display	2.3	2.4	2.5	2.3
Storage	2.0	3.0	2.6	2.0
Employee	3.5	4.0	3.5	3.5
Departmental Average	2.3	2.8	2.7	2.3
Produce Department Areas				
Display	2.0	2.5	2.5	2.0
Preparation	2.0	2.9	2.2	2.1
Storage	2.5	3.5	2.0	2.0
Employee	3.5	4.0	3.5	3.5
Departmental Average	2.3	3.0	2.5	2.2
Bakery Department Areas				
Display		2.0	2.0	
Preparation		3.0	2.1	
Storage		3.0	3.0	
Employee		4.0	3.5	
Departmental Average		2.8	2.2	
Total Store Average	2.4	2.8	2.4	2.6

[a] Sanitation procedures of equipment and building surfaces in the four surveyed stores were rated in comparison to procedures recommended by Project Consumer Concern (PCC). PCC was a joint committee of the United States Department of Agriculture and the National Association of Retail Grocers of the United States (USDA-NARGUS, 1973).

[b] Rating System:

5 Above procedures recommended by PCC and also minimizes public health hazard.
4 Above PCC's recommendation.
3 Same as recommended by PCC.
2 Below PCC's recommendation.
1 Below procedures recommended by PCC and could be a potential public health hazard.

Departmental and total store averages were weighted in proportion to the number of procedures rated in each area.

department ratings were largely accounted for by differences between the ratings assigned to their storage area procedures.

The ratings of produce department sanitation procedures in Stores A, C, and D averaged 2.3, 2.5, and 2.3 respectively. These low ratings as compared to the average rating of 3.0 assigned to PCC's recommendations were accounted by (1) a lack of sanitizing steps, and (2) low execution frequencies for some sanitation procedures. Store B's produce department had the highest rating (3.0) for sanitation procedures because some of its procedures were executed more frequently than recommended by PCC while others were executed less frequently. Thus, the average rating in Store B's produce department corresponded to the average rating of PCC's recommendations.

The ratings of bakery department sanitation procedures averaged 2.8 in Store B and 2.2 in Store C. These ratings differed largely because Store C's sanitation procedures lacked sanitizing steps.

The weighted average rating of all sanitation procedures executed in Store A was 2.4 which was below PCC's recommendation (Table 28). A small variation occurred among Store A's departments. Store A's rating was low because some of its sanitation procedures lacked sanitizing steps and were not executed as frequently as recommended by PCC. The overall weighted average rating of sanitation procedures executed in Store B was the highest (2.8) among all four stores surveyed. This largely may be attributed to the formal sanitation program its employees were following. Store B's meat department rated below its total store average while its grocery, produce, and bakery departments rated the same or above. The meat department rated lower than the store average because sanitation procedures were executed less frequently than recommended by PCC for an unrefrigerated meat preparation area.

Store C's overall weighted average rating of sanitation procedures was 2.4 ranging among departments from 2.2 in the bakery department to 2.7 in the grocery department. Store C's policy of assigning a grocery department box boy the responsibility of cleaning up the display area during all operating hours typifies the emphasis that Store C's management placed on its grocery department appearance. The bakery department rated low largely because some of its sanitation procedures lacked sanitizing steps and were not executed as frequently as recommended by PCC.

The overall weighted average rating of all sanitation procedures executed in Store D was 2.6. The meat department rating was above (2.9) the store average while grocery and produce were below (2.3 and 2.2) respectively. This may be an indication of grocery and produce department employees' reliance on the store's in-store janitorial staff and the store's semiannual cleanup program to cover most of their department's sanitation needs. Conversely, the meat department followed a formal sanitation program and relied little upon the in-store janitorial staff for service or upon Store D's semi-annual cleanup program.

While many individual sanitation procedures were higher or lower than the departmental average ratings, only eight procedures were rated at the extreme ends of the rating scale (1 or 5). These procedures were associated with food contact equipment in meat department preparation areas. Store A had a rating of 1 for hooks and trees because they were never cleaned and sanitized. There also were six ratings of 1 assigned to sanitation procedures executed for cubers, slicers, and power saws in the meat departments of Stores B and C. This was due to the low execution frequency associated with meat processing equipment used intermittently in unrefrigerated areas. The rating of 5 assigned to the sanitation procedure applied to cutting tables in Store D's meat department was the only rating of this magnitude among all the procedures rated in this study. This high rating was assigned because cutting tables were cleaned and sanitized between each batch of meat processed.

Ceilings represented one building surface commonly not cleaned in any department of the four surveyed stores. This lowered the overall store ratings. Some of the ratings assigned to sanitation procedures for equipment and building surfaces which were below PCC's recommendation were accounted for largely by the sanitation procedure's lack of sanitizing steps while others were accounted for by the procedure's low execution frequencies.

The findings of this study suggest implementation of the following procedures. In general, a dispenser containing a hand cleaner-sanitizer agent should be installed adjacent to each hand sink in the store to allow all employees who contact food to clean and sanitize their hands as often as necessary. This procedure has been completed for all hand sinks in Store B and in the meat departments of Stores A and C as well.

Cloth towels were used as cleaning supplies in the meat and bakery departments of the four surveyed stores during the execution of sanitation procedures. As an alternative to using cloth towels, it is recommended that consideration be given to using single-service towels to prevent potential cross contamination occurring from the use of unclean cloth towels on food contact surfaces.

Stores B and C had open and unrefrigerated meat department preparation areas. Food contact equipment which was used intermittently in these areas should be cleaned and sanitized after each use in order to minimize any potential public health hazard.

One sanitation procedure which readily could be implemented by those stores not already executing it would be to place floor mats in the doorways of bakery department preparation areas and in front of grape section display areas. This procedure should help to reduce tracking of flour dust by employees from the bakery department in Store C to other areas. Store B had implemented this procedure between Week 1 and Week 2 of this study's labor data collection process. The use of floor mats in the produce department should help reduce spreading of crushed grapes across the display floor in Store A; the other three stores already were using these mats at the time of this study.

A slimy substance caused by bacterial growth was observed in the produce display cases of two stores. This problem could be reduced by increasing the execution frequencies of sanitation procedures.

Sanitation procedures also were applied to equipment and building surfaces in nondepartmental areas which included rest rooms, offices, and lounges; however, PCC did not establish any recommended procedures for these areas. In general, these areas were cleaned daily or every other day in the four surveyed stores. PCC also did not establish recommended sanitation procedures for some equipment and building surfaces such as the barbecue unit and carts used in the meat department, trash cans and drinking fountains in the grocery department, scale pans and the floor of the dry storage area in the produce department, and for the bun divider, bench scales, and icing warmer in the bakery department. In summary, Project Consumer Concern or another similar group should consider devoting further attention to developing recommended sanitation procedures and/or general sanitation procedures and guidelines for cleaning and sanitizing those areas and items not specifically mentioned in PCC's original recommendations.

For those sanitation procedures applying to building surfaces and equipment but which rated below PCC's recommendations, it is suggested that senior executive management and each store's manager(s) consult with a food sanitarian to evaluate each procedure separately to determine whether or not improved procedures would result in minimizing potential public health hazards. In addition, it is suggested that attention be given to developing sanitation procedures for those building surfaces and equipment for which PCC did not establish recommended procedures.

Overall Store B was assigned the highest weighted average rating for total store sanitation procedures among the four stores surveyed. This could be attributed to its formal store-wide sanitation program which was implemented in the Fall of 1974 and to senior executive management's apparent commitment to see that store management implemented the program as recommended. Store D's meat department also followed a formal sanitation program and it's average departmental rating was the highest among all four meat departments. This suggests that formal sanitation programs are more apt to result in the establishment, implementation and follow through with sanitation procedures designed to meet recommended sanitation procedures compared to informal sanitation programs. In Stores B and D, the wall placards located in departmental preparation areas also may have strongly influenced the high ratings assigned to their sanitation procedures. These placards provided specific guidelines and procedures for cleaning and sanitizing which could easily be referred to by employees responsible for cleanup.

Store B's formal total store sanitation program was implemented in the Fall of 1974. This program as implemented consisted of written instructions and a monitoring system for those sanitation procedures executed for building surfaces and equipment in all areas of the store. The instructions were contained both in a store sanitation manual and on wall placards posted in the meat, produce, and bakery departments. There were no wall placards posted in the grocery department. The manual contained more complete instructions for each department compared to the wall placards. These instructions appeared organized, easily understandable, and also provided reasons supporting the actions required. Most sanitation procedures as stipulated in the manual and/or on the wall placards were being followed by store employees.

Although Store B had implemented a formal store-wide sanitation program, it had some shortcomings. While the program involved a monitoring system for sanitation procedures which required an employee to complete a monitor checklist form, this procedure was not being executed at the time of this study. A second shortcoming of Store B's sanitation program was that it limited itself mainly to procedures and did not direct itself to the area of sanitation management practices as defined in this study. The manual, however, did contain some instructions for personal hygiene and pest control, and for such management practices as handling hazardous substances and leakers. These instructions were interspersed throughout the instructions given for sanitation procedures. Another major sanitation management practice category not included in Store B's program was that of temperature control as applied to highly perishable food products. On balance, the sanitation program lacked a monitoring system for sanitation management practices.

Finally, a major shortcoming associated with implementation of Store B's store-wide sanitation program was that while educational materials on sanitation were provided to the store by a division trainer, these materials were not being used by store personnel at the time of this survey. The sanitation education materials available included slide-cassette programs and films on sanitation.

The findings of this study suggest that implementation of formal store-wide sanitation program should include both written and oral instructions for sanitation procedures and management practices and should include alleviation of those shortcomings cited for Store

B's program. In addition, a formal educational training program should be included as part of a store-wide sanitation program and it should encompass all aspects of sanitation from senior executive management's supervisory responsibility to store personnel's execution of sanitation procedures and management practices. Moreover, training employees appears essential to the program's effectiveness and should be continuous compared to a single session at the start of the program. Maintenance of an ongoing training program also is necessary because of employee turnover and to instill a constant awareness among employees of the importance of store sanitation. Furthermore, an ongoing training program is necessary to upgrade the sanitation program as required changes are made from time to time in selected sanitation procedures and management practices.

Beyond educating store employees, the program should be designed to educate consumers about food sanitation in the home. This could be accomplished by placing placards in display areas outlining food sanitation in the home and by providing pamphlets of similar content conveniently located for customer accessibility. A store's image and consequently the entire food industry's image as well should be enhanced by educating consumers on how food can be maintained wholesome and safe for human consumption. Consequently, fewer food-borne illnesses caused by mishandling in the home should occur. Furthermore, it is expected that more knowledgeable consumers would be less apt to cite retail food stores or food manufacturers as the principal source of food-borne illnesses.

In addition to the education and training part of a formal store-wide sanitation program, it should include a workable monitoring system as well. This system should involve not only on-site inspections by senior executive and store management of equipment and building surfaces which are to be cleaned and sanitized as required by the monitoring system in Store B, but also an inspection of sanitation management practices including temperature control measurements. The monitoring system also should be designed to be executed by different levels of store management which could be determined by senior executive management in consultation with store management. For example, the system might consist of departmental managers making daily inspections, and a store manager, a sanitation director, or a person with similar responsibilities in a firm making unannounced inspections. Furthermore, adequate illumination on surfaces in all areas of the store should enhance inspections for cleanliness and signs of pest infestation.

In conclusion, senior executive management's commitment to implementing and following through with a formal store-wide sanitation program is probably the key to its success.

Summary of Departmental Employee Sanitation Labor and Total Store Sanitation Costs

General Procedures

Several procedures were utilized to develop cleaning and sanitizing cost data for each of the four stores surveyed. Cost data for sanitation services such as laundry, janitorial, and waste disposal were obtained from accounting records. Store management provided estimates of the weekly usage of sanitation supplies such as detergents, sanitizers, and meat case soaker pads. Estimates on the useful life of sanitation equipment such as mops, mop buckets, and brooms also were obtained from store and departmental management. The prices of sanitation equipment and supplies were obtained directly from suppliers, or from the prices marked on these goods if they were obtained from a store's display shelf. Labor cost data were developed using hourly wage rates, weekly labor schedules and by using an industrial engineering technique known as work sampling. The work sampling technique is a procedure often used to determine the proportion of time an individual spends on specific work activities. In this study, the work sampling technique provided a basis for estimating the proportion of total weekly departmental man-hours devoted to sanitation activities in each store. Work sampling data were collected over a continuous seven-day period for three of the stores surveyed and for two separate weeks in the fourth store.

Cross-classification tables were constructed to permit analysis by department of relationships between employee position and sanitation man-hours, sanitation labor time as a percent of total labor time, and sanitation wage costs as a proportion of hourly wage rates. Additional cross-classification tables were constructed to analyze sanitation equipment, supply, labor, and service cost differences among and between each department of each store surveyed.

Finally, statistical tests also were made to determine the presence of significant differences in the average proportion of total store man-hours devoted to sanitation between each of the four stores and between weeks in the one store surveyed for which two separate weeks of work sampling data were collected.

Man-Hours

The proportion of total departmental employee man-hours devoted to sanitation activities for the meat, grocery, and produce departments was 5.55% in Store A, 6.44% in Store B, 6.56% in Store C, and 3.33% in Store D (Table 29). These sanitation time percentages were tested for statistically significant differences between the stores at the 95% confidence level. The findings revealed no significant differences between sanitation time percentages in Stores A and B and between Stores B and C (Table 30). The absence of a significant difference in sanitation time percentages between Stores A and B could

Table 29. Total store summary of sanitation labor: estimated percent of time, man-hours, and wage costs for four surveyed Oregon retail food stores, Fall 1974[a]

Department	Store A 1 Percent of Total M-H	Store A 2 Total M-H/ Week	Store A 3 (1)x(2) Sanitation M-H/ Week	Store A 4 Hourly Wage Rate	Store A 5 (1)x(4) Sanitation Wage Cost/ M-H	Store B 1 Percent of Total M-H	Store B 2 Total M-H/ Week	Store B 3 (1)x(2) Sanitation M-H/ Week	Store B 4 Hourly Wage Rate	Store B 5 (1)x(4) Sanitation Wage Cost/ M-H
Meat	5.14%	159	8.2	$5.28	$.271	11.25%	187	21.1	$4.55	$.512
	5.66%[b]			$6.47[c]	$.366	11.77%			$6.05	$.712
Grocery	5.41	765	41.4	3.35	.181	3.94	479	18.9	4.17	.162
	5.74			4.33	.249	4.12			5.04	.208
Produce	6.74	143	9.6	4.05	.271	10.00	82	8.2	4.54	.454
	7.37			5.19	.383	10.58			5.74	.608
Bakery						11.79	362	42.7	4.76	
						11.98			5.58	.491
										.668
Total Store Summary										
Excluding Bakery Dept.	5.55%	1067	59.2	$3.73	$.207	6.44%	748	48.2	$4.31	$.278
	5.95%			$4.76	$.283	6.75%			$5.37	$.362
Including Bakery Dept.						8.18%	1110	90.9	$4.26	$.348
						8.49%			$5.44	$.462

Table 29. (C.ontinued)

Department	Store C 1 Percent of Total M-H	Store C 2 Total M-H/ Week	Store C 3 (1)x(2) Sanitation M-H/ Week	Store C 4 Hourly Wage Rate	Store C 5 (1)x(4) Sanitation Wage Cost/ M-H	Store D 1 Percent of Total M-H	Store D 2 Total M-H/ Week	Store D 3 (1)x(2) Sanitation M-H/ Week	Store D 4 Hourly Wage Rate	Store D 5 (1)x(4) Sanitation Wage Cost/ M-H
Meat	11.06%	321	35.5	$5.41	$.598	5.70%	261	14.9	$5.27	$.300
	11.69%			$6.97	$.815	6.18%			$6.22	$.384
Grocery	5.63	1379	77.6	3.63	.203	2.58	1002	25.9	4.02	.104
	5.96			4.51	.269	2.69			4.71	.127
Produce	5.62	163	9.2	3.76	.211	4.31	134	5.8	4.52	.194
	5.95			4.74	.282	4.53			5.52	.250
Bakery	11.99	375	45.0	3.96	.475					
	12.75			4.90	.625					
Total Store Summary										
Excluding Bakery Dept.	6.56%	1863	122.2	$3.95	$.259	3.33%	1397	46.5	$4.30	$.143
	6.94%			$4.95	$.343	3.50%			$5.07	$.177
Including Bakery Dept.	7.45%	2238	166.7	$3.95	$.227					
	7.89%			$4.94	$.390					

[a] M-H = Man-Hours. Sanitation Man-Hours = Percent of Total Man-hours x Total Man-hours or Col. (3) = Col. (1) x Col. (2). Sanitation Wage Cost/Man-Hour = Percent of Total Man-hours x Hourly Wage Rate or Col. (5) = Col. (1) x Col. (4). Column (3) figures may not add up to the summary figure due to rounding error.

[b] The standard time as a percent of total man-hours. The standard time included not only time spent on sanitation activities but also included a portion of idle time. Idle time was time spent on nonproductive activities such as personal delays, scheduled rest breaks, and unforeseen delays in planned work schedules.

[c] Average hourly wage plus payroll taxes, fringe benefits and overtime. The hourly wage rate was the weighted average hourly wage rate according to the proportion of total man-hours for each position in a department per week.

Table 30. Statistical difference of the percent of departmental employee man-hours devoted to sanitation between four surveyed Oregon retail food stores, Fall 1974[a]

Store	Store B	Store C	Store D
A	No	Yes	Yes
B		No	Yes
C			Yes

[a]The 95% confidence level was used to test for statistically significant differences, which means there is about 1 chance in 20 of concluding that the sanitation time percentages between two stores are different when they actually are the same.

Conclusion:

Yes = Statistical difference between sanitation time percentages of the two stores.

No = No statistical difference between sanitation time percentages of the two stores.

be accounted for by the lower time percentage in Store A's meat department compared to Store B's and the higher time percentage in Store A's grocery department compared to Store B's. Thus, the difference between time percentages of the meat departments of the two stores was offset by the difference between time percentages of the grocery departments. Furthermore, the higher time percentage of Store B's produce department did not have as much affect on the total store average time percentage compared to Store A's produce department. This occurred because Store B's produce department had fewer total man-hours compared to Store A's. As a result, the total store sanitation time percentages of Stores A and B were not significantly different.

The absence of a significant difference in sanitation time percentages between Stores B and C was partially due to similar time percentages in both stores' meat departments. Furthermore, the absence of a significant difference could be accounted for by the lower time percentage in Store B's grocery department compared to Store C's and the higher time percentage in Store B's produce department compared to Store C's. Thus, the difference between time percentages of the grocery departments of the two stores was offset by the difference between time percentages of the produce departments. As a result, total store sanitation time percentages of Stores B and C were not significantly different.

However, a significant difference in sanitation time percentages occurred between Stores A and C. This could be attributed to differences in time percentages between both stores' meat and produce departments while the time percentages of the two stores' grocery departments were very similar.

Store D's sanitation time percentage differed significantly from the time percentages estimated for the other three stores surveyed. This could be accounted for by Store D's use of an in-store janitorial staff which performed some of the sanitation activities performed by departmental employees in the other three stores. The difference also could be attributed to the use of labor saving equipment and methods such as a high pressure washer and the produce tray method used in Store D's meat and produce departments.

A comparison of sanitation time percentages between each department within each store revealed that meat departments on the whole accounted for the largest proportion of departmental man-hours spent on sanitation activities followed next by the produce and grocery departments (Table 29). However, in Stores B and C, the bakery departments incurred similar sanitation time percentages compared to their respective store's meat departments. These rankings among types of departments could be attributed to the type of processing carried out in different departments. For example, food products handled in the grocery department were prepackaged and the only cleanup associated with them involved removal of cardboard boxes. On the other hand, many food products handled in the meat department were cut and wrapped before being displayed. Operations associated with cutting meat and its high perishability required that the meat department preparation area be cleaned and sanitized more frequently compared to the grocery department. Therefore, departmental rankings of sanitation time percentages appeared to be directly related to the type of processing performed by different departments. Thus, it could be expected that sanitation time percentages would tend to be higher in departments handling products which require more processing compared to less processing.

The total sanitation man-hours per week used for the meat, grocery, and produce departments ranged from 46.5 in Store D to 122.2 in Store C (Table 29). Among these three departments, the grocery departments of the four surveyed stores accounted for the highest total departmental sanitation man-hours because they utilized the highest total departmental man-hours even though they generally incurred lower sanitation time percentages. Thus, total departmental employee sanitation man-hours per week are functions both of sanitation time percentages and total departmental employee man-hours.

Sanitation man-hours for the meat departments of the four surveyed stores usually were second highest while man-hours for the produce departments were the lowest. When the bakery departments of Stores C and B were included in the analysis, these departments utilized the highest and second highest sanitation man-hours respectively when compared to all departments of the four surveyed stores. This could be attributed both to their high sanitation time percentages along with their high total departmental man-hours.

The findings of this study suggest that average daily sanitation man-hours could be calculated by dividing the weekly average by the number of operating days per week to provide guidelines for daily scheduling requirements. However, a daily average would tend to over or under estimate the actual number of sanitation man-hours required for a particular day because certain sanitation activities are performed only on a weekly basis. Consequently, it is recommended that labor scheduling for executing sanitation procedures be developed on a weekly rather than a daily basis and for each department according to the work to be accomplished.

Wage Costs

The sanitation wage costs per man-hour estimated in this study are both functions of sanitation time percentages and weighted average hourly wage rates of employees. Moreover, for purposes of determining total departmental employee sanitation labor costs, sanitation time percentages were adjusted to include a portion of idle time. Idle time was time spent in nonproductive activities such as personal delays, scheduled breaks, and unforeseen delays in planned work schedules. Average hourly base wage rates also were adjusted to include overhead labor costs such as payroll taxes, employee fringe benefits, and overtime wage rates. The adjusted and subsequently higher weighted average sanitation wage costs per man-hour for meat, grocery, and produce departments ranged from \$0.177 with a weighted average hourly wage rate of \$5.07 in Store D to \$0.362 out of \$5.37 in Store B (Table 29). In other words, the average cost of departmental labor for sanitation in Store D amounted to approximately 18 cents per man-hour. Generally, differences between weighted average sanitation wage costs among the stores were accounted for by differences in sanitation time percentages and hourly wage rates on an equal basis.

In most stores, the meat departments incurred the highest departmental weighted average sanitation wage costs among all departments followed next by the produce and grocery departments in descending order. In those stores with bakery departments, the sanitation wage costs of bakery departments were next highest to the meat department among all four departments. These rankings among departments could be attributed to differences both in sanitation time percentages and hourly wage rates.

<u>Comparison of Two Alternate Survey Weeks in Store B</u>

Sanitation labor data were developed for two separate weeks in Store B. Week 1 labor data were collected two weeks after Store B's implementation of a formal store-wide sanitation program, while Week 2 labor data were collected two months after Week 1.

Comparing the labor data findings among all departments in Store B between Week 1 and Week 2 revealed a reduction in the total store's sanitation time percentage from 8.18% in Week 1 to 6.82% in Week 2 (Table 31). However, the findings of the study indicated that total store sanitation time percentages between Week 1 and Week 2 were not statistically different at the 95% confidence level (Table 32). This could be attributed to the absence of statistical differences in sanitation time percentages between Week 1 and Week 2 for the meat and grocery departments which nullified the statistical differences occurring in time percentages between Week 1 and Week 2 for the produce and bakery departments.

While Store B adopted a store-wide sanitation program, the changes required by the program in sanitation procedures used by the meat and grocery departments were not as great as were the changes made in the produce and bakery departments. This partially was due to the employees in the meat and grocery departments using similar procedures after the store-wide program was implemented as they had used prior to its implementation. Moreover, additional

Table 31. Total store summary of sanitation labor: estimated percent of time, man-hours, and wage costs for two alternate survey weeks of Store B, Fall 1974[a]

Department	Store B Week 1					Store B Week 2				
	1	2	3	4	5	1	2	3	4	5
			(1)x(2)		(1)x(4)			(1)x(2)		(1)x(4)
	Percent of Total M-H	Total M-H/ Week	Sanitation M-H/ Week	Hourly Wage Rate	Sanitation Wage Cost/ M-H	Percent of Total M-H	Total M-H/ Week	Sanitation M-H Week	Hourly Wage Rate	Sanitation Wage Cost/ M-H
Meat	11.25%	187	21.1	$4.55	$.512	9.62%	176	16.9	$4.69	$.451
	11.77%[b]			$6.05[c]	$.712	10.16%			$6.21	$.631
Grocery	3.94	479	18.9	4.17	.162	3.88	484	18.8	4.17	.162
	4.12			5.04	.208	4.08			5.04	.206
Produce	10.00	82	8.2	4.54	.454	6.07	84	5.1	4.54	.278
	10.58			5.74	.608	6.39			5.74	.367
Bakery	11.79	362	42.7	4.16	.491	9.35	373	34.9	4.16	.387
	11.98			5.58	.668	9.53			5.46	.521
Total Store Summary										
Excluding Bakery Dept.	6.44%	748	48.2	$4.31	$.278	5.52%	744	40.1	$4.33	$.239
	6.75%			$5.37	$.362	5.81%			$5.40	$.314
Including Bakery Dept.	8.18%	1110	90.9	$4.26	$.348	6.81%	1117	76.1	$4.28	$.291
	8.49%			$5.44	$.462	7.09%			$5.42	$.384

[a] M-H = Man-Hours. Sanitation Man-Hours = Percent of Total Man-hours x Total Man-hours or Col. (3) = Col. (1) x Col. (2).
Sanitation Wage Cost/Man-Hour = Percent of Total Man-hours x Hourly Wage Rate or Col. (5) = Col. (1) x Col. (4).
Column (3) figures may not add up to the summary figure due to rounding error.

[b] The standard time as a percent of total man-hours. The standard time included not only time spent on sanitation activities but also included a portion of idle time. Idle time was time spent on nonproductive activities such as personal delays, scheduled rest breaks, and unforeseen delays in planned work schedules.

[c] Average hourly wage plus payroll taxes, fringe benefits and overtime. The hourly wage rate is the weighted average hourly wage rate according to the proportion of total man-hours for each position in a department per week.

Table 32. Summary of statistically significant differences between sanitation time percentages for two alternate survey weeks of Store B, Fall 1974[a]

Department	Week 1 vs. Week 2
Meat	No
Grocery	No
Produce	Yes
Bakery	Yes
Total Store	No

[a]The 95% confidence level was used to test for statistically significant differences. This means there is about 1 chance in 20 of concluding that the sanitation time percentages of two weeks are different when they actually are the same.

Conclusion:

Yes = Statistical difference between sanitation time percentages of the two weeks.

No = No statistical difference between sanitation time percentages of the two weeks.

sanitation procedures were required to be executed in the produce and bakery departments following implementation of the new program compared to the period preceding its implementation. Thus, employees in the produce and bakery departments were required to make more adjustments to the new program during Week 1 compared to employees working in the meat and grocery departments. Finally, it is suspected that employees in all departments probably had become adjusted to the new sanitation program by the time Week 2's data collection process began.

Because the total store sanitation time percentages between Week 1 and Week 2 in Store B were not significantly different, the overall conclusions of this study drawn on the basis of Week 1's data should for the most part be applicable to the findings resulting from Week 2's data as well.

Total Store Sanitation Costs

The estimated weekly total store sanitation costs for meat, grocery, and produce departments ranged between \$441.25 and \$1,192.25 with Stores B, A, C, and D ranking from low to high respectively (Table 33). In most stores, grocery departments incurred the highest portion of these costs followed by meat and produce departments in successive lesser amounts. On an annual basis, the estimated total store sanitation costs would range between

Table 33. Estimated weekly departmental sanitation costs of four surveyed Oregon retail food stores, Fall 1974

Category	Store A	Store B	Store C	Store D
Total Store Weekly Sales Volume	$40,000-60,000	$40,000-60,000	$ 90,000-110,000	$ 90,000-110,000
Meat Department:				
Labor	$63.27	$134.14	$271.70	$106.36
Service	34.90	42.22	54.08	245.29
Equipment	1.33	.93	.53	6.00
Supply	4.22	13.20	21.52	20.82
Subtotal	103.72	190.49	347.83	376.47
Grocery Department:				
Labor	194.92	100.19	379.39	155.40
Service	74.27	80.83	105.83	514.49
Equipment	2.54	1.83	2.88	3.80
Supply	4.58	2.34	6.60	6.07
Subtotal	276.31	185.19	494.70	679.76
Produce Department:				
Labor	54.65	49.85	66.42	33.52
Service	12.18	9.89	9.37	92.23
Equipment	1.07	3.25	5.62	2.70
Supply	4.90	2.58	9.02	5.57
Subtotal	72.80	65.57	90.43	134.02
Bakery Department:				
Labor		241.79	251.79	
Service		30.04	31.59	
Equipment		1.44	1.39	
Supply		10.14	2.03	
Subtotal		283.41	286.80	
Total Store Excluding Bakery[a]	$452.83	$441.25	$932.96	$1,192.25
Total Store Including Bakery		$724.66	$1,219.76	

[a] The bakery department sanitation costs were excluded from these total cost figures in order to provide a basis for comparing total costs between all four stores surveyed.

$22,945 and $61,997. However, caution should be exercised in interpreting these annual cost data because they are based on departmental sanitation labor data collected for one week only in each of three stores surveyed and for two weeks in a fourth store.

The findings of this study revealed that departmental employee labor costs accounted for the largest portion of total store sanitation costs followed next by service, supply, and equipment costs in successive lesser amounts exclusive of Store D's costs (Table 34). Sanitation service costs in Store D were larger than departmental employee sanitation labor costs. A larger proportion of the sanitation service cost in Store D was accounted for by its in-store janitorial staff and their associated supplies and equipment.

Four factors were identified that accounted for the reversal in proportions of labor and service costs in Store D compared to the other three stores. First, Store D's janitorial service staff performed some sanitation activities performed by departmental employees in the other three stores such as cleaning the back room floor. Second, daily service was provided by the in-store janitorial staff. As a result, the cost associated therewith was much higher compared to the cost incurred by the other three stores using outside janitorial service firms which provided their services weekly or less often. Store D's daily janitorial service requirements appeared to be indicative of the importance store management placed on a policy of

Table 34. Estimated weekly total store sanitation costs including total sanitation costs for labor, service, equipment, and supplies of four surveyed Oregon retail food stores, Fall 1974

Category	Store A		Store B		Store C		Store D	
Total Weekly Sales Volume	$40,000-60,000		$40,000-60,000		$90,000-110,000		$90,000-110,000	
All Departmental Employee Labor	$312.84	69%	$284.18	65%	$717.51	77%	$ 295.28	25%
Service	121.35	27	132.94	30	169.28	18	852.01	71
Equipment	4.94	1	6.01	1	9.03	1	12.50	1
Supplies	13.70	3	18.12	4	37.14	4	32.46	3
Total Excluding Bakery[a]	$452.83	100%	$441.25	100%	$932.96	100%	$1,192.25	100%
Total Including Bakery			$724.66		$1,219.76			

[a]The bakery department sanitation costs were excluded from these cost figures in order to provide a basis for comparing total costs between all four stores surveyed.

presenting its customers with a clean appearing store.

Third, Store D executed a semiannual cleanup program. Thus, some sanitation procedures in Store D were executed semiannually compared to more often in the other three stores surveyed. Consequently, sanitation labor costs in Store D were lower than they normally would be with a more frequent execution of sanitation procedures.

Fourth, labor saving equipment was utilized by departmental employees in Store D which appeared to reduce total departmental employee sanitation man-hours. In the meat department, a portable high pressure washer and mobile floor scrubber were utilized which reduced sanitation man-hours. The tray method of displaying and storing produce in the produce department also appeared to reduce sanitation man-hours. Store D's labor saving methods required utilization of more expensive types of sanitation equipment compared to Stores A, B, and C. However, the prorated equipment costs in Store D were only somewhat higher compared to the other three stores. Moreover, these costs did not account for a higher portion of total store sanitation costs when compared to each of the other surveyed stores.

The addition of bakery department sanitation costs to meat, grocery, and produce department sanitation costs in Stores B and C significantly increased their total sanitation costs. As a result, the total store sanitation cost rankings (low to high) changed from B, A, C, and D to A, B, D, and C. This was accounted for mainly by the added cost of bakery department employee sanitation labor.

The total departmental employee sanitation labor cost in Store B decreased $88.60 from $525.97 in Week 1 to $437.37 in Week 2. Half of this decrease was accounted for by a decrease in costs incurred by the bakery department while produce and meat departments accounted for the other half. The grocery department's labor cost did not decline from Week 1 to Week 2. Estimates of service, equipment, supply, and prorated labor costs did not differ between Week 1 and Week 2 for each department because the method used to determine these costs entailed averaging them over a specific time period (three months or a quarter of a year).

Total store sanitation costs as a percent of total store sales for all four stores averaged 1.14%. Stated another way, an average of 1.14 cents was attributed to total store sanitation cost per dollar of sales. Bakery department sanitation costs as a percent of total bakery department sales were the highest percentage among departments followed next by produce, meat, and grocery departments. This finding indicates that the cost of sanitation as a percent of sales volume is higher for those departments in which processing of unpackaged products occur such as bakery, produce, and meat compared to those departments in which only packaged products are handled such as grocery.

A positive relationship appeared to exist between sales volumes and total store sanitation costs; higher total store sales volumes were accompanied by higher sanitation costs. Stores A and B had weekly sales volumes of $40,000 to $60,000 while Stores C and D had sales of $90,000 to $110,000. Estimated weekly total store sanitation costs were $452.83 in Store A, $724.66 in Store B, $1,219.76 in Store C, and $1,192.25 in Store D. The apparent relationship between sales volumes and total store sanitation costs could be accounted for by sanitation labor costs because they represented a large portion of total sanitation costs. Sanitation labor costs were functions of sanitation time percentages, total departmental man-hours, and average hourly wage rates. There did not appear to be any relationship between sanitation time percentages and sales volumes or between average hourly wage rates and sales volumes. However, a relationship appeared to exist between total store sanitation man-hours and total store sales volumes among the four surveyed stores because more total store sanitation man-hours were utilized in stores with higher sales volumes. As a result, the relationship between sales volumes and the cost of sanitation appears to be dependent on total departmental man-hours.

The following recommendations are offered as a means by which the four surveyed stores can possibly reduce their sanitation labor costs.

Sanitation labor costs could be reduced in Store A's produce department by modifying the method used to trim produce over a cardboard box placed on the preparation area floor. This study found that in most instances, a significant amount of trimmings fell on the floor beside the box to warrant cleaning up after each box was filled. Sanitation time could be reduced by placing the box on a cart or bench which would place the box closer to the trimming operation, thus less trimmings would fall outside the box.

Sanitation labor cost in the produce departments of Stores A, B, and C may also be reduced by the use of trays to hold produce for storage and display purposes. The tray method used in Store D reportedly reduced accumulation of dirt in the case and retarded the growth of slime producing bacteria. Thus, fewer man-hours were required to clean and sanitize the display case. The cleaning process for these trays required a low number of man-hours because the trays were soaked in a cleaner solution and rinsed. Further research in this area is necessary to support this conclusion.

Allocating sanitation responsibilities among employee positions also can affect total store and departmental sanitation labor cost. Some sanitation responsibilities in the four stores surveyed were delegated by departmental management on the basis that each employee was held responsible for cleaning up his own area. An argument favoring this practice is that employees will tend to create more sanitation work when cleanup boys are utilized compared to when employees are required to perform their own cleanup activities. The sanitation labor cost data developed in this study for meat departments of the four surveyed stores tends to support this argument. However, a significant difference was not evident in sanitation labor costs between the bakery department of Store B which utilized a cleanup boy when compared to Store C's bakery department which did not utilize a cleanup boy.

Another basis used by store and department managers in this study to allocate sanitation labor involved requiring lower paid employees, and thus less skilled ones such as cleanup boys to execute sanitation activities compared to higher paid employees. Sanitation activities also tended to be delegated on the basis of other work activity. For example, for a specific hour during one surveyed store's operating hours, five clerks were scheduled to be checkers; however, only four checkers were actually used for this duty. The fifth clerk was then required to perform sanitation activities such as cleaning display shelves.

Similar outside sanitation services such as laundry, janitorial, garbage disposal, and pest control, were employed by the four surveyed stores; however, Stores B and D also employed an in-store janitorial service staff compared to the outside service firms used exclusively by Stores A and C. The in-store janitorial service staff utilized in Store B consisted of one part-time janitor, while in Store D, it consisted of four full-time employees including their equipment, and supplies. Store D did not use any outside janitorial service firms while Store B used one once a week. In conclusion, those stores which use both in-store and outside sanitation services tend to build in additional alternatives for controlling costs and service quality. Furthermore, this practice may be especially beneficial when evaluating the need to make changes in existing sanitation programs and policies.

Sanitation service costs such as those incurred by Store D for its in-store janitorial service staff, equipment, and supplies may be justified on grounds other than strictly sanitation. These practices may enhance the appearance of the store to the customer and thus, the use of an in-store janitorial service staff and its associated service aspect also becomes part of a store's overall merchandising strategy.

Replacement of equipment, such as display racks or sinks whose surfaces have corroded, with equipment which is noncorroded or less apt to corrode should improve the ease of cleaning them. Waterspots on produce display mirrors also were a problem cited by managers in the four surveyed stores. Chemical agents used to remove these waterspots constituted a large portion of the sanitation supply costs for some store's produce departments. This problem can be minimized by directing the water being sprayed onto the produce away from mirror surfaces to the degree this practice is feasible. It is essential that employees be trained with regard to this practice in order to insure its success.

The cost of netting used on the display case racks in Store C's produce department accounted for two-thirds of its sanitation equipment cost. The netting was replaced monthly when the display case was cleaned and sanitized because the produce manager considered the cost of replacing the netting to be less than the overtime labor cost required to clean it. Presently, the frequency of executing sanitation procedures for the produce display cases including netting in the other three stores consists of cleaning and sanitizing a section weekly with the entire case being cleaned and sanitized on a monthly cycle. In these cases, the netting was replaced after several years of use. However, the increased man-hours required to clean the entire cases weekly as recommended by PCC may require a store to incur overtime labor.

The findings of this study suggests two alternatives for cleaning and sanitizing produce department display cases: (1) weekly replacement of netting or (2) cleaning the netting each week and replacing it after several years. The cost of the first alternative would be the weekly replacement cost of the netting. The cost of the second alternative is the amount of labor expense incurred to clean the netting each week plus the weekly prorated cost for netting to be replaced after several years of use. It is recommended that each store give attention to evaluating selection of the alternative which results in the lowest cost in order to minimize total store sanitation costs.

General Conclusions

A general characteristic among meat departments of the four surveyed stores involved the form in which they received their wholesale cuts. While the surveyed stores used carcass and boxed meat, these forms appeared to have little affect on the sanitation costs incurred by the meat departments. Hooks and trees were used less with boxed meat compared to carcass and thus, less cleaning and sanitizing of this equipment was required. On the other hand, use of boxed meat required disposal of cardboard boxes and other packaging materials. These sanitation activities appeared to be the only differences associated with using boxed and carcass meat. Thus, it is expected that sanitation costs should not differ materially when using the two forms.

Boxed meat also could be more apt to adversely affect temperature control practices of meat coolers compared to hanging meat because air circulation could be reduced by an overfilled cooler. This could occur more easily with boxed meat compared to carcass meat.

Further research would be required to determine the economic implications of differences in the shelf life of meat processed from the two forms.

There did not appear to be a relationship between total store and departmental average ratings of sanitation procedures and total store and departmental sanitation costs of the four surveyed stores. For example, the bakery departments of Stores B and C incurred similar total weekly sanitation costs ($283.41 and $286.80 respectively) while Store B's average sanitation procedure rating (2.8) for the bakery department was above Store C's (2.2). The variation in average ratings was mainly due to the use of a sanitizing agent in Store B's bakery department while Store C did not use one. The cost of the sanitizer in Store B's bakery department accounted for only a small portion of its total weekly sanitation cost. Therefore, a relationship between departmental average sanitation procedure ratings and sanitation costs did not appear to exist between bakery departments of Stores B and C. In addition, among other departments of the four stores surveyed, there also did not appear to be a relationship between total departmental sanitation costs and average sanitation procedure ratings. The above relationships would tend to suggest that an improvement in sanitation procedure ratings could be achieved without necessarily increasing total sanitation costs.

Conversely, stores might incur higher total sanitation costs in the process of improving their sanitation procedure ratings. An increase in executing sanitation procedures might create higher labor costs while similarly improving sanitation procedures. For example, even though a sanitizer was being used in Store B's bakery department, its overall sanitation procedure rating possibly could be increased from 2.8 to a somewhat higher rating by executing some sanitation procedures more frequently. Consequently, in Store B, this would require more sanitation man-hours utilizing the present manual methods; and thus higher sanitation costs would be incurred. Therefore, caution should be exercised in drawing the conclusion from this study's findings that either total store sanitation costs will remain the same, increase, or decline with improvements in sanitation procedure ratings. Further research would be necessary to determine the exact relationship between sanitation procedure ratings and sanitation costs.

Stores B and D had sanitation centers, an area in a store utilized to store sanitation equipment and supplies while they were not being used. In those stores surveyed which operated without sanitation centers, sanitation equipment and partially used containers of cleaning and sanitizing agents could be observed located in several areas throughout the stores. As a result, additional time was required by employees to locate these materials before performing a sanitation activity. The findings of this study suggest that a store-wide sanitation program should include use of a sanitation center. Moreover, use of the center should tend to eliminate storage of sanitation equipment near food with the potential of contaminating it. The center also should enable store management to maintain tighter control over their store's inventory of sanitation equipment and supplies, and help to alleviate the aforementioned problems associated with the absence of a center.

It is recommended that Store D's sanitation center be expanded to include an area which would be open for use by departmental employees. In this way, the apparent conflict between its in-store janitorial staff and departmental employees could be resolved.

The use of an enclosed and refrigerated preparation area in the meat department is recommended for several reasons. First, a refrigerated area retards the growth of pathogenic microorganisms and microorganisms which decay meat and reduce the shelf life of meat products. Second and directly related to the above, the frequency of executing sanitation procedures can be lower and thus, fewer sanitation man-hours should be required to clean and sanitize a refrigerated area compared to an unrefrigerated area. Third, an enclosed and refrigerated area provides less access as well as a nonconducive habitat for pests such as flies.

Building and equipment design can affect the costs of cleaning and sanitizing a retail food store as well. Floors should be sloped toward drains to allow excess water to flow off the floor without the use of a squeegee. Waterproof designs of building surfaces and equipment such as those found in the meat department preparation area can allow use of pressurized washing systems and also help reduce sanitation costs. For example, the portable high pressure washer used in Store D's meat department appeared to reduce the number of sanitation man-hours required for cleaning and sanitizing activities compared to mopping and the execution of other manual methods as practiced in the other three surveyed stores. Therefore, senior executive management should suggest to store building planners and architects that stores be designed in such a way as to minimize sanitation man-hour requirements for cleaning and sanitizing because labor accounted for a majority of total store sanitation costs in three of the four stores surveyed.

Extraordinary accumulation of dirt in the preparation areas of two produce departments was identified as a problem by produce managers. The dirt was carried into the preparation area by grocery department vendor traffic which could be rerouted other than through preparation areas by properly locating outside store entry ways. This should be taken into consideration when constructing new stores or remodeling old ones.

This study has attempted to provide retail food store management with information useful for managing existing and improved store-wide sanitation programs. Implementation of sanitation procedures and management practices recommended by this study and PCC should benefit the consuming public with a more wholesome and safe food supply. Furthermore, this study has provided regulatory agencies with information on sanitation costs incurred by retail food stores to comply with new sanitation regulations and standards such as those now in effect in Oregon. For example, the information developed on meat department sanitation costs for the four surveyed stores in this study should give federal or other state regulatory agencies an indication of the magnitude of sanitation costs associated with operating a meat department within the new legal limits of microbial standards in Oregon.

Sanitation affects all aspects of a retail food store operation. Increasing regulatory and public pressure on retail food stores to provide consumers with a more wholesome and safe food supply suggests that senior executive management focus more attention in the future upon developing and implementing effective store-wide sanitation programs. The extent to which these programs are effective is largely dependent upon the commitment made to them by all store personnel from senior executive management down to box boys and part-time cleanup employees.

Recommendations for Further Research

While estimates for the costs of existing sanitation programs were developed for four stores in this study, a lack of information associated with the economic benefits and costs derived from implementing an improved store-wide sanitation program continues to prevail. Meat department sanitation would provide a reasonable area to demonstrate the economics of implementing improved sanitation procedures and practices. This type of research should include a microbiological survey to measure the effectiveness of sanitation procedures. A temperature control study of temperature levels maintained in different areas of the meat department should accompany this research. Finally, the benefits as well as the costs associated with executing old and new sanitation procedures and practices should be measured.

In conjunction with this research, the effects of using alternative forms of wholesale cuts (boxed and carcass) on meat department sanitation could be studied in terms of the microbiological quality of the two forms and their economic implications.

Another area for further research involves determining the efficiencies of alternative methods of executing sanitation procedures. While the use of mechanical methods such as high pressure washing and mobile floor scrubbing appeared to save man-hours in this study compared to manual methods such as hand mopping, an industrial engineering technique known as time study should be specifically designed to measure the actual man-hours associated with using these alternative methods. Moreover, this type of study should include a determination of the economic implications associated with using these alternative methods as well as an evaluation of the sanitation level achievable therewith.

The alternative methods of handling produce (trays versus no trays) could also be studied to specifically measure their affect on the level of sanitation and the alternative costs associated therewith. The overall cost of the tray method should be analyzed in conjunction with this study.

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APPENDICES

APPENDIX I

Appendix Table 1. Commercial cleaning and sanitizing agents (listed by manufacturing company) used by the four surveyed Oregon retail food stores, Fall 1974

Company	Cleaning and Sanitizing Agents[a]
Amway Corporation	Amway L.O.C. (Liquid Organic Concentrate) - CS
Paulsen and Roles Laboratory	Ten and Forty Cleaner and Finisher - C
U. S. Borax Co.	Luron - C
Vestal Laboratories	Septisol - CS
West Chemical Co.	Westosan - CS Westpower - C Scrub - CS

[a]C = Cleaning agent.
S = Sanitizing agent.
CS = Combined cleaning and sanitizing agent.

APPENDIX II

VARIABILITY OF WORK SAMPLING DATA OF THE FOUR SURVEYED OREGON RETAIL FOOD STORES, FALL 1974

The number of clusters of observations collected per week for each store was tallied by total store and by type of department (Appendix Table 2). From the work sampling data collected in the four surveyed stores, estimates were computed of the mean proportion of total man-hours devoted to sanitation activities and the variance of the mean (Appendix Table 3). The coefficient of variation, the value of the standard error of the mean expressed as a percent of the mean, also was computed for each store by total store and type of department. The coefficients of variation among all departments ranged between 5.3% and 19.5%. In general, produce departments had the highest coefficients of variation among departments due to their low number of observations. Bakery departments had the lowest coefficients of variation due to their high sanitation time percentages and high number of observations.

The coefficients of variation among total store sanitation time percentages which included meat, grocery, and produce departments ranged between 3.9% and 7.1%. The standard errors in Stores C and D were lower compared to Stores A and B. This could be accounted for because a larger number of observations were collected in Stores

C and D, which had more employees compared to Stores A and B. Therefore, the coefficients of variation differed among stores due both to the number of observations and the mean proportions of sanitation time.

Appendix Table 2. Number of clusters of observations for work sampling data collected in the four surveyed Oregon retail food stores, Fall 1974[a]

Category	Store A	Store B Week 1	Store B Week 2	Store C	Store D
Grocery Department	2,299	1,431	1,401	3,151	2,999
Meat Department	477	562	526	957	784
Produce Department	433	246	252	467	394
Bakery Department	____	1,082	1,117	1,080	____
Total Store:					
Excluding Bakery	3,209	2,239	2,179	4,575	4,177
Including Bakery		3,321	3,296	5,655	

[a]Each cluster consisted of five instantaneous observations of an employee's activities. Instantaneous observations of a cluster were spaced approximately one minute apart.

Appendix Table 3. Variability of work sampling data collected in the four surveyed Oregon retail food stores, Fall 1974[a]

Category	Store A	Store B Week 1	Store B Week 2	Store C	Store D
Meat Department:					
$\bar{p}$	5.14%	11.25%	9.62%	11.06%	6.78%
$S_{\bar{p}}$	0.8377	0.8993	1.077	0.6302	0.8946
C. V.	16.3	8.0	11.2	5.7	13.2
Grocery Department:					
$\bar{p}$	5.41	3.94	3.88	5.63	2.58
$S_{\bar{p}}$	0.4119	0.4135	0.4145	0.3023	0.2328
C. V.	7.6	10.5	10.7	5.4	9.0
Produce Department:					
$\bar{p}$	5.14	10.00	6.07	5.63	4.31
$S_{\bar{p}}$	1.003	1.504	1.112	0.7787	0.8266
C. V.	19.5	15.0	18.3	13.8	19.2
Bakery Department:					
$\bar{p}$		11.79	9.35	11.99	
$S_{\bar{p}}$		0.6292	0.5863	0.7402	
C. V.		5.3	6.3	6.2	

Appendix Table 3 (cont.)

Category	Store A	Store B Week 1	Store B Week 2	Store C	Store D
Total Store Excluding Bakery:[b]					
$\bar{p}$	5.55	6.44	5.52	6.56	3.33
$S_{\bar{p}}$	0.3477	0.3848	0.3938	0.2581	0.2236
C.V.	6.3	6.0	7.1	3.9	6.7
Total Store Including Bakery:					
$\bar{p}$		8.18	6.82	7.45	
$S_{\bar{p}}$		0.3306	0.3277	0.0395	
C.V.		4.0	4.8	0.5	

[a] $\bar{p}$ is the mean proportion of total man-hours devoted to sanitation activities expressed as a percent

$S_{\bar{p}}$ is the standard error of the mean proportion expressed as a percent.

C.V. is the coefficient of variation expressed as a percent where

$$C.V. = \frac{S_{\bar{p}}}{\bar{p}} \times 100.$$

[b] This category included only meat, grocery, and produce departments to provide a basis for comparing the variability in the mean proportions of sanitation time among all four stores surveyed.