

Milk and Food
Sanitation
Practice



By H. S. ADAMS

\$3.25

Milk and Food Sanitation Practice by H. S. Adams is a practical text in the field of environmental sanitation designed to help public health engineers and sanitarians bridge the gap between theory and practice—between what should be done and how to do it. The essential and fundamental principles of the sanitary supervision of milk and food supplies are presented from the standpoint of actual field application.

The author first takes up the problem of milk sanitation, explaining step by step how to plan and administer a milk control program. He points out the potential hazards to sanitation all along the milk production line, and explains fully how to recognize and correct faulty conditions.

In discussing the food control problem Mr. Adams examines in detail the numerous essentials of food establishment sanitation, including the safety of the food itself, the sanitary maintenance of the equipment and premises and the personal hygiene of the food worker. Throughout the book the importance of education as a means of advancing sanitation is recognized and its place in a modern milk and food control program is stressed. The author describes the development of educational programs and tells how to plan and conduct classes of instruction for milk and food handlers. An outline for such a course—complete with detailed lecture notes—is given in the extensive appendix of seven pages which presents an immense amount of pertinent data on the many diverse subjects with which the sanitarian should be familiar to make his work effective.

Public health students, health officers, public health engineers, and sanitarians will benefit by Mr. Adams' wide experience as a sanitarian and teacher of sanitation. After serving with health departments on the local, state and federal level, he is now chief of the Bureau of Environmental Hygiene of the Minneapolis Health Department and lecturer in public health at the University of Minnesota.

MILK AND FOOD SANITATION PRACTICE

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MILK AND FOOD SANITATION PRACTICE

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Minneapolis, and Lecturer, School of Public Health,
University of Minnesota*

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PREFACE

As LECTURER at the School of Public Health, University of Minnesota, the author has felt a need for a text in the field of milk and food sanitation that would combine theory and practice. This book is an outgrowth of that need. It attempts to bridge the gap between what should be done and how to do it. It is intended that it should be useful in orienting the public health student who plans to work in the field of environmental sanitation, and that it should serve as a guide for health officers, public health engineers, and sanitarians whose work in a local health department involves the routine but important duties in the sanitary supervision of milk and food supplies. The book endeavors to present essential and fundamental principles of milk and food control, but it does not attempt to discuss theory exhaustively. It is hoped that the student and the worker alike will find suggestions in it that will make their work more effective and more meaningful.

Modern milk and food control programs emphasize an educational approach as a productive means of advancing sanitation. Classes of instruction for dairymen, milk plant operators, restaurant proprietors, and food handlers offer an excellent opportunity for imparting valuable information to these and other groups. The prominent place instruction plays in an environmental sanitation program has been stressed either directly or by implication in many parts of this book, and in the author's judgment such means of promoting sanitation should always occupy a foremost place in program planning.

References to the literature are intended to be representative rather than exhaustive. In a text such as this it would be impracticable to give the opinions and viewpoints of all persons who have contributed to the vast amount of information in the field. It is assumed that those actively engaged in milk and food sanitation will consult other texts, scientific journals, and special bulletins when additional details are desired, since no single text can encompass the entire field. Furthermore, constant reference to current literature is necessary if one is to keep informed of new methods and techniques as they are developed.

The author wishes especially to express his appreciation to other workers in milk and food control for their critical study of the manu-

script and for their most helpful comments and suggestions: to W. S. Feagan, Public Health Engineer and formerly Chief of the Dairy Section of the Kansas City, Missouri, Health Department, and to H. E. Eagan, formerly assigned to the Mississippi State Board of Health, for assistance with the chapters dealing with milk control; to Ferdinand A. Korff, Director of the Bureau of Food Control of the Baltimore, Maryland, City Health Department, for advice on the food control section; to Roy J. Morton, Professor of Sanitary Engineering, Department of Preventive Medicine and Public Health, Vanderbilt University, for assistance in the development of outlines and early plans for the text. The author is also indebted to manufacturers of dairy and food equipment for many of the illustrations appearing in the text.

It is hoped that this book will prove useful to the many diligent public health workers whose day-to-day duties are so important to the promotion and protection of the public health.

H. S. ADAMS

Minneapolis, Minnesota
January, 1947

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SUPPLEMENTARY SOURCE MATERIAL

PUBLICATIONS ON MILK AND FOOD CONTROL

- American Can Company. Canned food reference manual. New York, 230 Park Avenue. 1943.
- American Public Health Association. Standard methods for the examination of dairy products. 8th ed. New York, 1790 Broadway. 1941.
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GENERAL PUBLICATIONS RELATING TO SANITARY SCIENCE

- Canadian Public Health Association. Manual for sanitary inspectors. 7th ed. Toronto, 150 College St. 1945.
- Dunham, George C. Military preventive medicine. 3d ed. Harrisburg, Pa., Military Service Publishing Co., 1940.
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U. S. Government, War Department. Basic field manual, military sanitation and first aid. FM 21-10, Washington, D. C., Superintendent of Documents, 1940.

U. S. Government, War Department. Insect and rodent control—repairs and utilities. TM 5-632, Washington, D. C., Government Printing Office, October 1945.

Also bulletins and pamphlets from federal agencies and from state and city health departments.

PERIODICALS AND JOURNALS OF SPECIAL VALUE TO SANITARIANS ENGAGED
IN MILK AND FOOD CONTROL

American Journal of Public Health. Published monthly by the American Public Health Association, 1790 Broadway, New York 19, N. Y.

Association of Food and Drug Officials of the United States. Quarterly Bulletin. Published at 1098 W. Michigan St., Indianapolis 7, Ind.

Journal of Dairy Science. Published monthly by the American Dairy Science Association, Science Press Printing Co., Lancaster, Pa.

Journal of Milk Technology. Published bi-monthly by the International Association of Milk Sanitarians, Inc., Albany, N. Y.

Public Health Engineering Abstracts. Issued monthly by the U. S. Public Health Service (Government Printing Office), Washington 25, D. C.

Public Health Reports. Issued weekly by the U. S. Public Health Service (Government Printing Office), Washington 25, D. C.

The Sanitarian, a Journal of Sanitary Technology. Published bi-monthly by the National Association of Sanitarians, Inc., 206 W. Sixth St., Los Angeles 14, Calif.

Also there are many commercial and trade periodicals which contain excellent articles of pertinent interest; consult your public library.

PARTIAL LIST OF ORGANIZATIONS INTERESTED IN THE DAIRY AND FOOD
INDUSTRY*

The Dairy Industry

American Association of Medical Milk Commissions, Inc., 1265 Broadway, New York 1, N. Y.

American Butter Institute, 110 N. Franklin St., Chicago 6, Ill.

American Dairy Association, 20 N. Wacker Drive, Chicago 6, Ill.

American Dairy Science Association, Ohio State University, Columbus 10, Ohio.

American Dry Milk Institute, Inc., 221 N. LaSalle St., Chicago 1, Ill.

American Public Health Association, 1790 Broadway, New York 19, N. Y.

* Some of these organizations have joint interests.

- Association of Official Agricultural Chemists, Inc., P.O. Box 540, Benjamin Franklin Station, Washington, D. C.
- Certified Milk Producers Association of America, 1265 Broadway, New York 1, N. Y.
- Dairy Industries Supply Association, Inc., Albee Bldg., Washington 5, D. C.
- Evaporated Milk Association, 307 N. Michigan Ave., Chicago 1, Ill.
- International Association of Ice Cream Manufacturers, 1105 Barr Bldg., Washington, D. C.
- International Association of Milk Dealers, 309 W. Jackson Blvd., Chicago 6, Ill.
- International Association of Milk Sanitarians, Inc., State Health Dept., Albany, N. Y.
- The Milk Foundation, 75 E. Wacker Drive, Chicago 1, Ill.
- Milk Industry Foundation, Chrysler Bldg., New York 17, N. Y.
- National Cheese Institute, 110 N. Franklin St., Chicago 6, Ill.
- National Dairy Association, Brattleboro, Vt.
- National Dairy Council, 608 S. Dearborn St., Chicago 5, Ill.
- Paper Cup and Container Institute, Inc., 1790 Broadway, New York 19, N. Y.

The Food Industry

- American Bottlers of Carbonated Beverages, Southern Bldg., Washington 5, D. C.
- American Institute of Baking, 1135 W. Fullerton Ave., Chicago 14, Ill.
- American Meat Institute, 59 E. Van Buren St., Chicago 5, Ill.
- American Society of Refrigerating Engineers, 37 W. 39th St., New York 18, N. Y.
- Bakery Equipment Manufacturers Association, c/o American Machine and Foundry Co., 551 Fifth Ave., New York 17, N. Y.
- Biscuit and Cracker Manufacturers Association of America, 233 Broadway, New York 7, N. Y.
- Food Research Institute, Stanford University, Palo Alto, Calif.
- Manufacturing Chemists Association of the United States, 608 Woodward Bldg., Washington 5, D. C.
- National Live Stock and Meat Board, 407 S. Dearborn St., Chicago 5, Ill.
- National Poultry, Butter and Egg Association, 110 N. Franklin St., Chicago 6, Ill.
- National Restaurant Association, 666 N. Lake Shore Drive, Chicago 11, Ill.
- National Restaurant Institute, 2105 Broadway, New York 23, N. Y.

COMMERCIAL SUPPLY CATALOGS FOR THE MILK AND FOOD INDUSTRY*

- Dairy Industries Catalog of Equipment, Supplies, and Services Used by Dairy Products Manufacturers. Edited and published annually by the Olsen Publishing Co., 5th and Cherry Sts., Milwaukee 12, Wisc.

* These list companies, manufacturers, and jobbers of supplies and equipment.

Food Industries Catalog and Directory: Equipment—Supplies—Materials.
Published annually by Food Industries, McGraw-Hill, 330 W. 42nd St.,
New York 18, N. Y.

**PARTIAL LIST OF COMPANIES PRODUCING OR HANDLING SULPHATED HIGHER
ALCOHOLS (WETTING AGENTS*)**

- American Cyanamid and Chemical Corp., 30 Rockefeller Plaza, New York 20,
N. Y.
Carbide and Carbon Chemicals Corp., 333 Hudson St., New York 13, N. Y.
Colgate-Palmolive-Peet Co., 105 Hudson St., Jersey City, N. J. (Trade
name of wetting agent, Arctic Syntex M Beads)
E. I. du Pont de Nemours and Co., Inc., Organic Chemicals Dept., Wilming-
ton, Del. (Trade name of wetting agent, M.P. 189)
J. B. Ford Co., Wyandotte, Mich. (Trade name of wetting agent, Neo Suds)
Monsanto Chemical Co., 1700 S. 2nd St., St. Louis, Mo.
National Aniline Division, Allied Chemical and Dye Corp., 40 Rector St., New
York 6, N. Y.
Onyx Oil and Chemical Co., 15 Exchange Place, Jersey City, N. J.

MANUFACTURERS OF MILKING MACHINES

- | | |
|---|--|
| Ben H. Anderson Mfg. Co., Madi-
son 4, Wisc. | International Harvester Co., Chi-
cago 1, Ill. |
| Anderson Milker Co., Jamestown,
N. Y. | Lacta Separator Co., Chicago 13, Ill.
Perfection Milker Co., Minneapolis
13, Minn. |
| Babson Brothers, Chicago 23, Ill. | Pioneer Manufacturing Co., Mil-
waukee, Wisc. |
| Dairy Equipment Co., Lansing 11,
Mich. | Rite-Way Products Co., Chicago 13,
Ill. |
| DeLaval Separator Co., 165 Broad-
way, New York 6, N. Y. | Universal Dairy Supply Corp., San
Francisco 7, Calif. |
| Hinman Milking Machine Co.,
Oneida, N. Y. | |

MAJOR MANUFACTURERS OF DISHWASHING MACHINES

- American Production Co., 690 Market St., San Francisco 4, Calif. (Surge
Dishwasher)

* Produced by catalytic hydrogenation of natural fats and oils in which fatty acids are reduced to corresponding fatty alcohols and these alcohols reacted with sulphuric acid, neutralized with caustic soda. These products are used in place of soap in many fields; work equally well in hard or soft water; called "soapless suds" because they do not lather and leave no scum when used with hard water. Used as a detergent in home and power laundries; as a wetting, penetrating, scouring, dispersing, and emulsifying agent in many industries, particularly in the textile, dry cleaning, paper, and leather fields; used extensively in hair shampoos, dairy cleaning powders, and dishwashing compounds.

- Anstice and Co., Inc., Rochester 9, N. Y. (Sterling)
Blakeslee and Co., 19th St. & 52nd Ave., Cicero Station, Chicago 50, Ill.
Champion Dishwashing Machine Co., Erie, Pa.
Colt's Patent Fire Arms Mfg. Co., Autosan Division, Hartford 5, Conn.
(Colt-Autosan)
Faspray Corporation, Red Bank, N. J.
Fearless Dishwasher Co., Inc., Rochester, N. Y.
Hobart Mfg. Co., Troy, Ohio
Insinger Machine Co., State and Robbins Ave., Philadelphia, Pa.
Jackson Dishwasher Co., 3703 E. 93rd St., Cleveland, Ohio
Lansing Mfg. Co., 1978 E. 69th St., Cleveland, Ohio. (The L-O Dishwasher)
Universal Washing Machinery Co., Nutley, N. J.

APPENDIX B

ESSENTIAL FIELD EQUIPMENT FOR THE FOOD SANITARIAN

To work effectively and carry on productive field investigations, the food sanitarian should have the following:

1. A maximum self-registering pocket-type thermometer with a range of 20° to 220° F. in two-degree divisions. An armor-clad thermometer six or eight inches in length is recommended.
2. A pocket thermometer for general temperature determinations, with a range of 20° to 120° F. (Catalogs issued by manufacturers of thermometers or companies selling laboratory equipment should be consulted for the type of thermometer desired. Special thermometers are available for a variety of uses, and a study of descriptive literature is recommended.)
3. A field kit for making determinations of available chlorine. Either a kit with color standards and orthotolidine as an indicator or a starch iodide test set may be used. Pocket-size kits are available. Consult catalogs as recommended in (2) above. Starch iodide test papers are obtainable for making rapid estimates of available chlorine, but where more accuracy is desired the test kit is recommended.
4. A light meter. A small pocket-size meter is available from certain manufacturers of electrical equipment.
5. A flashlight. A two-cell standard size flashlight will be found adequate.
6. A camera. A small fixed-focus camera with flashlight attachment is adequate for general use; the flash attachment permits the taking of interior views.
7. One ounce of creosote for denaturing.
8. One-quarter ounce of uranine dye for denaturing.
9. A supply of four-ounce metal screen cap bottles.
10. Ten medium-sized paper bags, one can opener, one meat trier, one butter trier, one box of gummed labels.
11. Ten swab bottles with wood, glass, or metal applicators attached to cap.
12. Ten squares of glossy white paper 8 by 10 inches; ten squares of dull black paper 8 by 10 inches.
13. One cyanide insect bottle.
14. Ten homeopathic vials, wrapped sterile spoons, and tongue blades.
15. A clip board for holding inspection forms.
16. Educational and instructive literature such as bulletins on food-handling methods, line drawings of food equipment and kitchen plans, copies of rules and regulations, and forms for issuing sanitary orders.

APPENDIX C

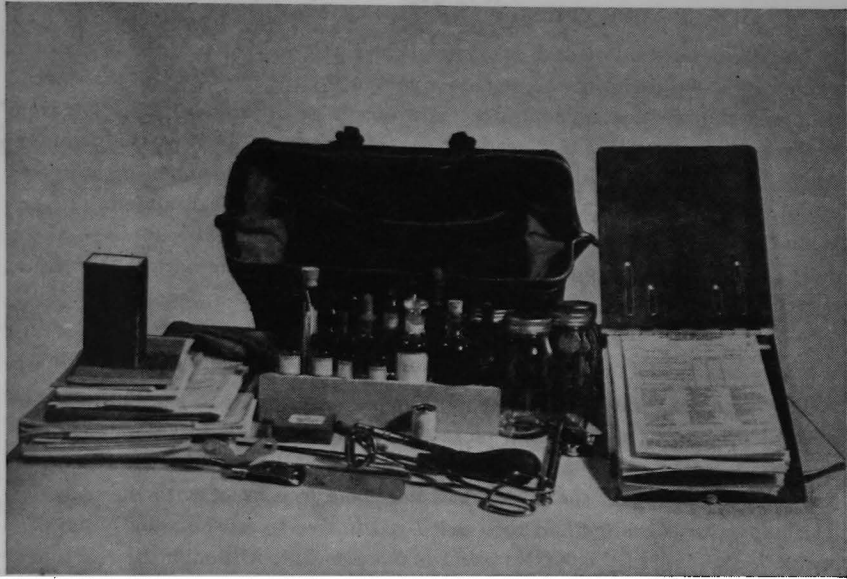
SPECIAL FIELD EQUIPMENT AND ANALYTICAL PROCEDURES

Food sanitarians in the Baltimore, Maryland, City Health Department carry special equipment on their rounds and are prepared to do certain screening tests in the field. Each inspector has a convenient leather case (see Figures 59 and 60) which contains the usual detention cards, violation notices, copies of laws, educational forms and leaflets, sample identification cards, and such conventional equipment as flashlight, thermometer, can opener, and meat trier. Paper bags and paper spoons are carried for collecting food samples, sterile four-ounce bottles for water samples, and sampling vials for food utensil swabbing. Portable apparatus is also provided for the detection of fluorides, cyanides, cadmium, arsenic, and sulphites; equipment is included for testing



Courtesy Baltimore City Health Dept.

Figure 59. Sanitarian's carrying case for holding supplies needed in the field



Courtesy Baltimore City Health Dept.

Figure 60. Contents of the sanitarian's carrying case

the strength of chlorine solutions used as disinfectants and for the detection of spoilage of shucked oysters and crab meat. Wherever possible, testing materials are contained in uniform glass vials and each case is fitted with a wooden rack to hold the apparatus. All solutions, test papers, and other equipment are periodically replaced and reconditioned by the Bureau of Laboratories.

Special procedures that may be carried out by the sanitarian are described below.*

DETECTION OF SPOILAGE OF SHUCKED OYSTERS

The pH of fresh shucked oysters varies between 6.0 and 7.0. A pH value of 5.4 to 5.8 is regarded with suspicion, while values below this range are indicative of decomposition. A convenient field examination is made by transferring 5 ml. of oyster liquor to a test tube graduated at 5 ml. and adding 0.5 ml. of methyl red indicator solution (0.02 per cent methyl red in 50 per cent alcohol). After mixing, the color produced is compared with the methyl red color standards in sealed glass ampules. Standards reading pH 5.4 and 6.0 are provided. If there are indications that the oysters have been recently washed, several drops of the indicator solution are placed directly on the oyster. The production of a persistent red color indicates spoilage.

* These are quoted in part, with bibliographical references, from Korff, Ferdinand A., and Kaplan, Emanuel, "Field Equipment for Food Inspectors," *American Journal of Public Health*, 32:1110-1116, October 1942.

DETECTION OF SPOILAGE OF CRAB MEAT

The decomposition of crab meat involves a progressive proteolysis, accompanied by a rapid rise in the ammonia content of the meat. In 1932, Harris¹ proposed the Nessler ammonia test as a means of differentiating fresh from spoiled crab meat. The test used by our inspectors is done in this manner: About 1 gm. of crab meat is transferred to a test tube and shaken with several ml. of water, and 2 to 3 drops of Nessler's reagent are then added. The immediate development of a deep yellow or brown color indicates spoilage of the meat. The test is used only as an aid to organoleptic examination of the suspected crab meat.

DETECTION OF CYANIDE IN METAL POLISH

The qualitative detection of cyanide in metal polishes in the field may be conveniently made with sodium picrate test papers.² This test paper is moistened with water and is then suspended in the container of the suspected polish. Care is taken that the paper does not come in contact with the material. The paper turns orange and then brick-red in five to ten minutes if the concentration of cyanide (asKCN) exceeds 0.5 per cent. Although the reaction is not wholly specific for cyanide, the method serves as a ready screening test in the field.

DETECTION OF CADMIUM PLATING ON UTENSILS

A simple testing unit was devised to detect cadmium during the inspection of food establishments in Baltimore.³ The outfit consists of two small vials. One contains strips of filter paper which have been impregnated with a 20 per cent sodium sulphide solution and dried; the other contains small cotton swabs immersed in 10 per cent nitric acid. The swab is rubbed on the suspected metal and is then applied to the sodium sulphide paper which has been previously moistened with water. The instantaneous appearance of a canary-yellow stain on the paper indicates the presence of cadmium.

DETERMINATION OF AVAILABLE CHLORINE IN DISINFECTANT SOLUTIONS

The strength of chlorine rinse waters is determined by a modification of the orthotolidine test.⁴ Inspectors carry a 2-ounce dropping bottle of orthotolidine solution, a 100-p.p.m. permanent chlorine standard in a sealed ampule, a test tube of the same diameter as the standard and graduated at 10 ml., and a medicine dropper calibrated to deliver 20 drops of water per ml. Ten ml. of tap water are added to the tube, followed by four drops (0.2 ml.) of the rinse water under test, and one ml. of the orthotolidine solution. After five to ten minutes, comparison is made with the standard. The permanent standard actually corresponds to 2 p.p.m. of chlorine. However, the sample is diluted 1 to 50 in the test. The permanent standards are prepared by the method of Scott, which permits color-matching irrespective of the tube length.⁵

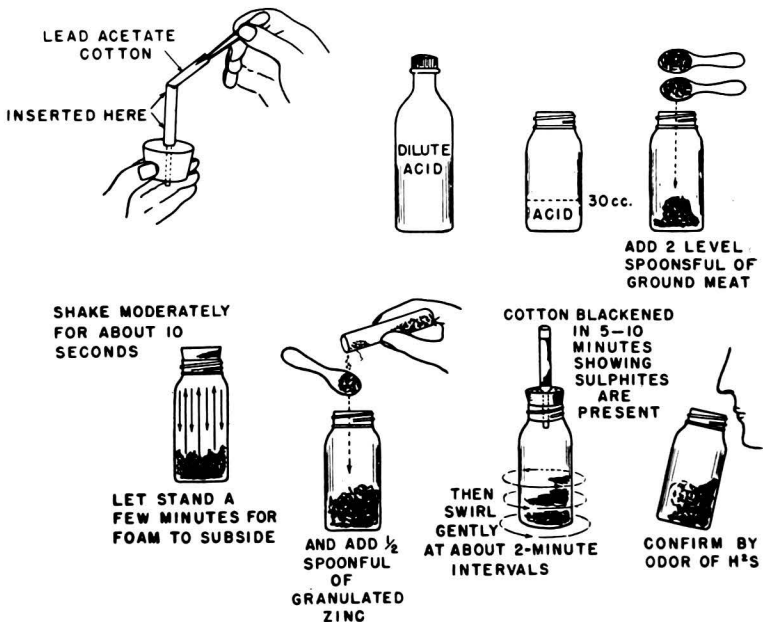
TESTING OF FLUORIDE-CONTAINING INSECTICIDE POWDERS

Inspectors are equipped with vials of fluoride test paper. The test depends on the fact that in the presence of strong acids soluble fluorides decolorize the zirconium lake of sodium alizarin sulphonate. Strips of filter paper are impregnated with the fluoride reagent⁶ and are then dried. The test is made by moistening a test paper with diluted hydrochloric acid (the orthotolidine solution carried by the inspectors for the residual chlorine test may be used). The moist strip is then touched to the suspected powder and, in the presence of a large amount of soluble fluoride, decolorization of the paper will occur in about five seconds. Decolorization is evident in about 30 seconds when a 1 to 1,000 dilution of sodium fluoride powder in flour is used. A reaction time of five minutes should be allowed for traces of fluoride. Phosphates and oxalates may yield false tests and therefore positive findings should be confirmed in the laboratory.

DETECTION OF SULPHITES IN MEAT PRODUCTS

Sulphites in ground meat serve partly as a preservative but are employed chiefly to deodorize and to restore the bright red color of fresh meat.⁷

To make the test (see Figure 61), about 10 gm. of ground meat are trans-



Adapted from drawing in Korff and Kaplan, "Field Equipment for Food Inspectors," A.J.P.H., October 1942

Figure 61. Step-by-step field procedure for testing ground meat for presence of added sulphites

ferred to a wide-mouthed bottle containing 30 ml. of ten per cent sulphuric acid. The bottle is stoppered and shaken moderately for ten seconds. Several minutes are allowed for foam to subside. Three grams of 30-mesh granulated zinc (arsenic and sulphur free) are added. A stopper containing a Gutzeit scrubber tube previously fitted with a No. 2 cotton dental roll which has been impregnated with 20 per cent lead acetate solution is immediately inserted. The cotton roll will become black in five to ten minutes and after about ten minutes the bottle may be opened, when there will be a decided odor of hydrogen sulphide if sulphites are present. The test will detect as little as one grain of sodium sulphite in a pound of ground meat. Traces of sulphites in foods may yield false positive tests, and because of this the outfits are intended for screening tests only. All samples which show positive reactions are submitted to the laboratory for confirmatory analyses.

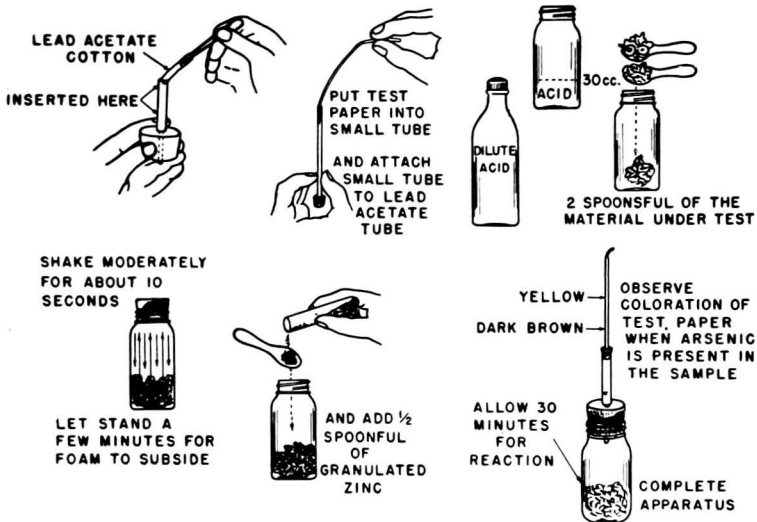
DETECTION OF ARSENIC SPRAY RESIDUE

The presence of excessive amounts of arsenic spray residue on fruits and vegetables is suspected when there are unusual deposits on the foods. In order to eliminate the detention of truck, boat, or railroad shipments pending laboratory examination, testing for arsenic is done in the field. The test generally used is an adaptation of the official Gutzeit method for arsenic of the Association of Official Agricultural Chemists;⁸ similar modifications have been used by others.⁹

The equipment designed for the sulphite determination in ground meat is also used for the arsenic test. A piece of glass tubing is fitted to the Gutzeit scrubber tube to hold a strip of sensitized mercuric bromide paper. In addition, 15 ml. of 40 per cent stannous chloride solution are added to each liter of the 10 per cent sulphuric acid reagent. In practice the acid used for the sulphite test contains the stannous chloride addition and is thus also suitable for the arsenic examination. The details of the test are indicated in Figure 62. The directions are essentially the same as in the case of the sulphite examination. Scrapings of suspected material are introduced into the generator. The acid and zinc are added and the reaction is allowed to proceed for thirty minutes. A decided yellow to dark brown coloration of the sensitized mercuric bromide paper indicates the presence of arsenic.

1. Harris, M. M. A bacteriological study of decomposing crabs and crab meat. *Am. J. Hyg.*, 15:260-275, January 1932.
2. Official and tentative methods of analysis of the Association of Official Agricultural Chemists. 5th ed. Washington, D. C., 1940, p. 366.
3. *Baltimore Health News*, 19:23, March 1942.
4. Standard methods for the examination of water and sewage. 8th ed. New York, American Public Health Association, 1936, p. 20.
5. Scott, R. D. Improved standards for the residual chlorine test. *Water Works and Sewerage*, 82:399, November 1935.

6. Snell, F. D., and Snell, C. T. *Colorimetric methods of analysis*. New York, D. Van Nostrand Co., Inc., 1936, p. 581.
7. Leach, A. E., and Winton, A. L. *Food inspection and analysis*. 4th ed. New York, John Wiley & Sons, Inc., 1920, p. 216.
8. *Ibid.*, p. 390.
9. Mayo, N., and Taylor, J. J. *Enforcement of arsenical spray law, 1931-1932*. Florida Quart. Bull., 42:12, 1933.



Adapted from drawing in Korff and Kaplan, "Field Equipment for Food Inspectors," A.J.P.H., October 1942

Figure 62. Field test for arsenic spray residue, showing apparatus and procedure

FOOD UTENSIL SWABBING

The collection of samples from drinking glasses, silverware, dishes, etc., for bacteriological examination is another procedure for which the food sanitarian should be equipped. Satisfactory containers consist of screw-cap swab bottles 23 by 70 mm., or bacteriological test tubes 15 by 100 mm. with cork or rubber stoppers. Cotton plugs are not satisfactory. A stiff wire or glass applicator attached to the bottle cap with a firmly twisted cotton swab on the end may be used. The swab bottles contain a buffered distilled water solution. (For preparing this solution see *Standard Methods for the Examination of Dairy Products*, 8th ed., New York, American Public Health Association, 1941, p. 126; also *Public Health Bulletin 280, Ordinance and Code Regulating Eating and Drinking Establishments*, U. S. Public Health Service, Washington, D. C., 1943.)

The properly prepared solution is then distributed in the swab containers

in amounts that will provide, after autoclaving for thirty minutes, exactly one ml. for each utensil examined per swab; e.g., 4 ml. for four utensils, 5 ml. for five utensils, etc.

*Collecting samples.** Utensils to be examined shall include at least glasses, cups, and spoons, if used, and at least 4 of each shall be selected at random from the shelves upon which clean utensils are stored. If a direct check of the dishwashing methods is desired, utensils should be selected from those recently washed. Care shall be taken to prevent contamination by handling.

Use 1 swab for each group of 4 or more similar utensils. Take the swab from a freshly opened container of dilution water, and squeeze it against the side of the container so as to remove excess water, leaving the swab moist but not wet. Rub the swab slowly and firmly three times over the significant surfaces of 4 or more similar utensils. After swabbing each utensil, return the swab to the container of dilution water, rotate the swab in the dilution water, and press out the excess water against the side of the container before swabbing the next of the 4 or more utensils in the group.

The significant surfaces of utensils consist of the upper one-half inch of the inner and outer rims of cups and glasses and the entire inner and outer surfaces of the bowls of spoons. If it is desired to examine forks and surfaces of dishes, etc., the area to be swabbed should include the entire inner and outer surfaces of the tines of forks, and the inner surfaces of plates and bowls over an area of 4 square inches that would come in contact with the food. The area to be swabbed on plates and bowls may be delineated by using the flexible metal frame, which must be sterilized immediately before use. Flaming or burning off with alcohol constitutes satisfactory sterilization for this purpose.

After completing the swabbing of all utensils in the group of 4 or more, replace the swab in the container of dilution water. Use a new swab container for the next group of utensils. Keep the containers iced while in transit to the laboratory, and plate the dilution water samples as soon as possible, preferably within 4 hours of swabbing.

* Quoted from United States Public Health Service. Ordinance and code regulating eating and drinking establishments recommended by the United States Public Health Service. Washington, Government Printing Office, Public Health Bulletin No. 280, 1943, p. 34.

APPENDIX D

PHYSICAL EXAMINATION FOR SIGNS OF FOOD SPOILAGE

POULTRY

Dressed poultry decomposition can be detected by a stickiness under the wings, under the thigh, at the tip of the wings, and around the apron. There is a sebaceous gland at this latter portion that is often cut out by the dresser because of its quick spoilage-detecting property.

SEAFOOD

Fresh fish is very perishable. The condition of raw fish can be judged by noting certain points. The gills should be pink to dark red in color and firm; their odor should be not unpleasant but one which might be described as "marine"; as decomposition takes place the gills become faded until in putrid fish they become gray or grayish green, and slimy. In fresh fish the eyes are bright, clear, and not sunken in the head; as decomposition progresses the eye becomes dull and sunken. In three to four days the eyes become gray and shrunken. When decomposed blood cells diffuse into the meat, causing the flesh around the backbone to assume a reddish color, the flesh is not strictly fresh. The intensity of this discoloration may be used to judge the length of time since the fish was caught.

Spoilage of shrimp can be detected when the flesh becomes soft and when pink areas appear on the shell; in fresh shrimp the shell is gray.

Spoilage of soft-shell crabs can be detected when the gills or "deadmen" are mushy, when the shell pulls away from the body, and when the odor is abnormal.

EGGS

Egg spoilage can be detected by candling. Directions for candling will be found in the United States Department of Agriculture Farmer's Bulletin No. 1878 entitled "Marketing Eggs."

MEAT

Consult "Textbook of Meat Hygiene" by Edelman, Mohler, and Eichhorn, Philadelphia, Lea and Febiger, 8th ed., 1943. See also Regulations Governing Meat Inspection of the United States Department of Agriculture, known as B.A.I. (Bureau of Animal Industry) Regulations, B.A.I. Order 211, Revised; and "Microbiology of Meats" by L. B. Jensen, Champaign, Ill., Garrard Press, 2d ed., 1945.

APPENDIX E

FOOD POISONINGS AND INFECTIONS

One of the chief duties of the food sanitarian is to promote wholesome conditions within the food industry so that food-borne outbreaks can be averted. To do this the sanitarian must know the causes of food poisonings and infections and learn to recognize signs that may be conducive to their occurrence. Table IX is designed to assist him in this connection.

INVESTIGATING FOOD-POISONING OUTBREAKS

Determining the cause of outbreaks of food poisoning is frequently a challenge to the food sanitarian. If he is to be successful in his investigation, he must follow a carefully laid out procedure. The following material, quoted from "Food Poisoning" by G. M. Dack (Chicago, University of Chicago Press, 1943, pp. 2-7) should be of assistance:

Investigation of Food-Poisoning Outbreaks

Small outbreaks of gastrointestinal upsets occurring in the family are usually not reported. In general, no recognition is given the event, and the family physician is seldom summoned. When a number of people are affected, however, particularly when they have attended a banquet or recently eaten at the same public eating establishment, considerable attention is given the episode by health authorities and the press. Illnesses in small family groups due to the fatal type of food poisoning known as "botulism" are usually reported, but this type of food poisoning is relatively uncommon.

Such small family outbreaks as do become known are usually brought to light through complaints made by a member of the family to the grocer or butcher regarding a suspected item of food. In the majority of cases the complaint is carried no farther, but reports are sometimes made by the retailer to the manufacturer or producer, and these, in most instances, are investigated. Much time often elapses between the illness and the investigation, thus making it difficult or impossible to determine the causative agent. Frequently meat is suspected by the family as the cause, since it conforms with the false "ptomaine" notion of food poisoning. Very often upon investigation the food item alleged by a member of a family to be responsible for an outbreak is exonerated, and some other item of food or other cause is found.

One of the distinctive characteristics of an outbreak of food poisoning is the sudden illness of several individuals following a specific meal and usually ascribed to a definite item of food served at that meal. Often only one person in such a group develops gastrointestinal symptoms. Some of

these single illness cases are actually brought to court for trial. The alleged symptoms are one or more of the following: nausea, vomiting, diarrhea, and abdominal cramping. Careful study of such individuals often reveals one of a large variety of other illnesses to which these symptoms can be attributed. Such illnesses are coronary heart disease, gall-bladder disease, passage of renal calculi, appendicitis, brain tumors, certain forms of intestinal allergy, cerebral hemorrhage, onset

TABLE IX. Causes of food poisoning and infections*

Causative agents	Foods often implicated	Usual time of onset
OF BACTERIAL ORIGIN		
<i>Clostridium botulinum</i> toxins	Improperly processed canned and bottled food	12 to 24 hours
<i>Staphylococcus enterotoxin</i>	Custard pastries, cooked ham, hollandaise sauce, sliced cooked meats	3 to 6 hours
<i>Salmonella</i> infections	Sliced cooked meats, meat and poultry salads, "warmed over" foods, custard-filled pastries	6 to 18 hours
Enteric infection:		
Typhoid fever	Oysters, raw milk, other dairy products	3 to 36 days
Bacillary dysentery	Salads, "warmed over" foods, milk, and other dairy products	1 to 7 days
Tularemia	Wild rabbits (by handling)	1 to 10 days
OF NON-BACTERIAL ORIGIN		
Inorganic chemicals:		
Arsenic, Lead Fluorides Antimony Cyanides Cadmium, Zinc Copper, Barium Others	Any food accidentally contaminated	Several minutes to hours, depending upon dosage
Poisonous animals and plants	Rhubarb leaves, mussels in certain seasons, poisonous mushrooms, poisonous fish	Variable
Animal parasites	Trichinella in pork Diphyllobothrium in some fish Taenia in beef	Several days to weeks
Allergies and environmental circumstances	Specific foods consumed by persons allergic to these foods Consuming food while exposed to dangerous gases (CO), high temperatures, etc.	Immediate to several hours

* From Korff, Ferdinand A. Food establishment sanitation in a municipality. American Journal of Public Health, 32:739-744, July 1942.

of infectious diseases, and functional bowel distress associated with emotional upsets.

It is important when an outbreak of food poisoning occurs that it be immediately investigated if the true cause is to be established. A delay of hours after vomiting and diarrhea have occurred may mean that chemical poisons have been discarded in the vomitus and excreta. If none of the original food is left, it may be difficult to identify the specific agent. In food poisoning of bacterial origin, a delay of hours may often bring about marked bacterial changes in a perishable product which were not present at the time of consumption. From a legal standpoint, a prompt and intelligent investigation may prevent unnecessary litigation expense and afford the basis of a just settlement if settlement appears warranted. It is generally important to ascertain in so far as possible what items of food had been eaten at previous meals for a period of forty-eight hours. When a large number of cases occurs within a short a period as two to three hours after partaking of food, attention should be centered particularly on the last meal and on any food eaten by all or a majority of the persons afflicted. When the onset of symptoms in different individuals appears over a period of many hours, it is important to know the items of food in the diet for several meals past. If the outbreak involves persons who have shared in a particular meal or eaten at a particular place, it is a good plan to prepare a list of the various items of food served and check these items with persons who ate the meal or who ate at the place in question. Frequently a single item may be found to be the common denominator for those who are made ill. If this fact is observed, much time may be saved by making a laboratory examination directly on the incriminated item of food. Usually not every individual will be made ill when a specific item is involved. Such variables as the amount eaten (dosage) and individual resistance play an important part. Generally, however, the majority of people partaking of the involved food will be affected when such an outbreak occurs. Sometimes psychic disturbances account for symptoms in some individuals who are present during the illness of others but who have not eaten the incriminated food. If too long a time elapses before the investigation is started, the data obtained are less reliable, since most people find it difficult to remember what they have eaten at previous meals or whether they experienced any symptoms at the time in question. An excellent questionnaire [given here in condensed form] has been prepared by individuals concerned with the investigation of food-poisoning outbreaks.

Form 1: Questions for Persons Alleging Illness from Food

1. What is the name? Age? 2. Address? 3. Are you employed in any business and, if so, by whom? 4. Married or single? 5. How long after eating were you made ill? 6. Were others made ill? If so, who? (Age

of each.) 7. Did any person eat the same foods without becoming ill? 8. If so, who? (Names and addresses.) 9. What were the first symptoms of your illness and when did they occur? 10. Was there pain in the stomach or abdomen? 11. Was there vomiting? For how long? 12. Was there diarrhea or constipation? 13. Please tell anything else you remember about your illness and the events leading up to it. 14. How long did the acute illness last? 15. Please itemize expenses, if any, resulting from your illness. 16. What is name and address of the doctor who attended you during your illness? 17. Is he your regular doctor? If not, who is? 18. When were you last attended by a doctor before this illness and for what cause? 19. Have you ever undergone an operation and, if so, for what? 20. Have you had stomach or digestive trouble in the past? 21. If so, of what nature? 22. To what did the doctor attribute the illness? 23. Do you attribute the illness to the eating of any particular food? 24. If so, what food? 25. Why? 26. What foods did you eat at the suspected meal? 27. What was eaten at the four meals preceding the suspected meal? (All foods eaten at each meal, if possible, and also between meals.) 28. What foods, if any, did you eat between the suspected meal and the onset of your illness? 29. Did the doctor take the container or any of the suspected food left after the meal? 30. Did you feed any of the suspected food to dogs, chickens, or other animals? If so, were they made sick? 31. Have you the container or any portion of the foods which you believe caused the illness? 32. If not, what was done with them? 33. From whom was food purchased and by whom? 34. Date of purchase. 35. Give name of brand and of manufacturer or distributor on label. 36. Did you ask for that particular brand? 37. Are you accustomed to buying that particular brand? 38. Where was the food left before using? 39. Where was the food kept after unwrapping or opening? 40. State as exactly as possible how the food was prepared and served. 41. Did the appearance or odor indicate anything unusual in the food on unwrapping or opening? If so, please give particulars. 42. On what date and at what meal was the food eaten? 43. At the time of eating the food, did you notice any peculiarity in the appearance, taste, or odor of it? If so, please describe.

Witness: _____

Date: _____

_____ [Signature]

Form 2: Questions for the Attending Physician in Case of Alleged Illness

1. Name and address of physician. 2. Name of patient. 3. On what date or dates did you treat this patient? 4. How long had the patient

been ill when you arrived? 5. Was the onset of the disease sudden or had there been previous illness? 6. How many persons were ill of the same type of disease and under your observation? 7. What were the general symptoms (appearance of patient, continuous or spasmodic pains, nervous, excited, or in coma, vomiting, or diarrhea)? 8. What was the pulse rate? 9. Regular or intermittent? 10. Pulse tension? 11. Was the temperature persistently above or below normal? 12. What was the highest and lowest point reached? 13. Was a temperature and pulse record kept? 14. What was the number of respirations per minute and character? 15. Was there any disturbance of vision? 16. What disturbance of the reflexes, if any, was noted? 17. How long did the attack continue? 18. General remarks. 19. Was any bacteriological or chemical examination made of the blood, vomitus, or excreta? 20. What was your diagnosis? 21. If food poisoning, what food do you believe caused the illness? 22. Was a laboratory examination made of any suspected food? 23. If so, what was found? 24. What treatment was followed or prescribed? 25. Was any morphine or opiate used to alleviate pain? 26. Was any strychnine or other stimulant used? 27. Do you consider recovery complete? 28. Have you a detailed record of the case? 29. Have you attended this patient before? If so, for what ailment?

In case of death: 30. Was an autopsy performed or any post-mortem specimens examined? 31. If so, by whom was such autopsy or examination made?

Witness: _____

Date: _____ 194_____

[Signature]

When the investigator has obtained the necessary information, it is generally possible to get some clue as to the nature of the agent involved so that treatment of the patient may be immediately instituted. Furthermore, if a specific agent is suspected, much time is saved in the laboratory tests. The problem of determining whether the agent is chemical, plant, or animal poison, intoxication with bacterial products, or a food-borne infection is often difficult. The solution of this problem is simplified by a careful field investigation.

REHEATING OR "PASTEURIZING" CUSTARD-FILLED PASTRIES

Staphylococcic outbreaks of food poisoning have frequently been traced to custard-filled pastries such as cream puffs, éclairs, and Boston cream pies. Certain precautions should be followed in the preparation of these pastries. Instructions issued in bulletin form by the Baltimore City Health Department are quoted herewith, as they serve as an excellent guide for bakers, res-

taurants, and hotels. The material in the bulletin was based on studies by Stritar, Dack, and Jungewaelter, *Food Research*, May-June 1936.

The Baltimore City Health Department urges bakers, pastry cooks and chefs to "pasteurize" or rebake all custard-filled pastries because:

1. This process destroys the bacteria or germs that may cause food poisoning.
2. It gives assurance that a precaution has been taken to prevent illness which may result from this type of bakery product.
3. The souring of the custard within the pastry is delayed often for several days.

The rebaking process, briefly, consists of placing the finished pastry, after the custard has been filled into the shell or on the layers, into a hot oven at 425 to 450 degrees Fahrenheit for about twenty or twenty-five minutes or until the custard reaches 180 degrees Fahrenheit. The following methods are recommended:

Éclairs and Cream Puffs

1. Bake the shells and prepare the custard.
2. Fill the pastry shells with the custard as soon as the custard has jelled, which should be not more than one-half hour after it has been taken from the fire or double boiler.
3. Place the filled éclairs or cream puffs on an icing grate. Place this icing grate in a shallow bun pan, cover the bun pan with a deep pan and the entire equipment is then placed into the oven at 425-450 degrees Fahrenheit.
4. Allow the filled pastry to remain in the oven until the temperature of the custard reaches 180 degrees Fahrenheit. The exact time depends upon the temperature of the oven, the type of oven, whether hearth or rotary, and where the pans have been placed in the oven.
5. After the filled pastry has been reheated so that the custard within the shell is 180 degrees Fahrenheit, remove the pans from the oven and allow the éclairs or cream puffs to cool on the grate out of the pan.
6. Icing may be placed on the finished product after it has cooled.

Boston Cream Pies or Custard Cakes

1. Bake the cake layers and prepare the custard.
2. As soon as the custard has jelled and within one-half hour after it has been taken from the fire or double boiler, spread the custard on one layer of cake.
3. Place the custard-spread layers on the icing grate and rebake the same as for cream puffs and éclairs until the custard reaches 180 degrees Fahrenheit.

4. Remove the pans from the oven and immediately put the upper layer of cake on the rebaked layer. Allow the finished cake to cool on the grate out of the pan.
5. Icing may be placed on the finished product after it has cooled.

Napoleons

1. Bake the napoleon layers and prepare the custard.
2. As soon as the custard has jelled spread the custard on one layer of the pastry, place the top layer on the custard and then slice into the desired number of sections.
3. Place the sliced sections on the icing grate and rebake them the same as for éclairs, cream puffs and cream pies or custard cakes, until the custard reaches 180 degrees Fahrenheit.
4. Remove the pan from the oven and allow the sliced sections to cool on the grate out of the pan.
5. Icing may be placed on the finished product after it has cooled.

Custard-Filled Doughnuts

Fill the custard into the doughnuts in the same manner as for éclairs or cream puffs and likewise rebake or "pasteurize" the custard-filled doughnuts the same as for éclairs or cream puffs.

As an alternate procedure to the rebaking of custard-filled doughnuts, filling the doughnuts with the hot, recently-made custard is suggested. In this method the custard should be filled into the doughnuts immediately after the custard is made and while it is still at a temperature of 180 degrees Fahrenheit or more. Be sure that the custard is at a temperature of 180 degrees Fahrenheit or more.

It is also suggested that marshmallow or jelly be substituted for custard in this type of pastry.

APPENDIX F

COURSES FOR THE INSTRUCTION OF FOOD HANDLERS

Chapter XIII was devoted to a discussion of plans and methods for organizing and conducting classes of instruction for food handlers. The following information, including a suggested course, is presented to supplement the material given there.

The amount of material that can be included in a course will obviously depend upon how many class periods are to be held, and their length. In a Texas program six two-hour sessions were held and the following topics covered:

Bacteriology. History, nature, growth, reproduction; shapes and groupings; common diseases of man caused by bacteria

Communicable Diseases. Relation of bacteria to disease; methods of disease transmittal; causes of decay and fermentation

Medical Zoology. Spread of disease by insects and animals; life cycles and habits; how they spread disease and contaminate and destroy food

Foods. Food spoilage, refrigeration, and preservation; relation of microorganisms and animal life; food poisoning and infection and resulting illnesses

Disinfection and Sterilization. Effects of chemical agents on bacteria; sanitization of utensils and equipment

Personal Hygiene and Sanitation. Hand-washing, rest-room sanitation, health certificates, blood tests, uniforms, personal appearance, use of side towel

In Flint, Michigan, four one-hour class periods are conducted covering these subjects:

Public Enemies. Elementary facts are given about bacteria, how they cause disease, and how communicable disease is transmitted. Bacteria are shown to be both helpful and harmful. The transmission of disease spread by infected food is emphasized.

Good Housekeeping. Particular emphasis is placed upon the importance of approved dishwashing and sanitizing methods as a means of preventing the spread of saliva-borne disease. Equipment and methods needed to obtain satisfactory results are discussed and certain essential apparatus is demonstrated.

Protecting Food. Refrigeration, storage, and display of foods to preserve and protect them from contamination are discussed at this lecture. Considerable attention is directed to common food contaminants such as insects, rodents, human droplet material, chemicals, and liquid wastes.

Points directing the food handler to store, protect, and display foods carefully form the main theme of this lecture.

The Individual. Personal cleanliness, hand cleanliness, correct uniforms, use of toilet and washrooms, and habits and practices which relate directly to the safety of food and drink are features included in this session.

These four lectures, supplemented by the use of appropriate slides, charts, demonstration material, and motion pictures, cover most of the essentials in food sanitation and should give the food worker a reasonably comprehensive appreciation of his responsibilities. While the exact amount and kind of material to be included in each lecture are of course best left to the judgment of the person conducting the course, the following outlines serve to demonstrate the general content of the course material given at Flint, Michigan.

LECTURE 1: PUBLIC ENEMIES

- A. In a study of public enemies, in this case bacteria which cause communicable disease, some understanding of their nature is extremely valuable for a broader appreciation of sanitary precautions which must be followed in the handling of food.
 1. Bacteria are everywhere
 - a. They are invisible; in size they measure about 1/25,000 of an inch.
 - b. Bacteria are both helpful and harmful to man. The harmful types are known as *pathogens* because they cause disease. The helpful bacteria serve man in the manufacture of such products as cheese, buttermilk, alcohol, vinegar, sauerkraut, etc. If bacteria were not present our earth would be covered with waste and refuse of all kinds.
 - c. Bacteria serve a useful purpose in the field of sanitation since their presence or absence is a measure of sanitary quality. Bacteria are used to determine the safety of water, the sanitary quality of milk and oysters, the efficiency of dishwashing, etc.
- B. Bacteria occur in different shapes and groupings.
 1. Oval or globular cells
 - a. Single cells—the cocci
 - b. Two cells—the diplococci
 - c. Chains of cells—the streptococci
 - d. Irregular clusters—the staphylococci
 2. Rod-shaped cells—bacilli
 - a. Single cells
 - b. Chains of cells
 3. Spiral cells—thread-like—spirilla
 4. Viruses—so small that they cannot be seen under an ordinary microscope—will pass through porcelain material similar to that used in automobile spark plugs

- C. To live, bacteria must have conditions suitable to them.
1. Conditions necessary for their growth are food, moisture, and temperature
 - a. Food—If bacteria do not have food they soon die, except for some who may change to a resting or spore stage.
 - b. Moisture—Like all living things, moisture is necessary to the life of bacteria. Man makes use of this fact when foods are preserved by drying and dehydration. (Name a few dried foods.)
 - c. Temperature—There are temperatures which are favorable and unfavorable to bacteria. The effect of temperature on bacteria is applied to food preservation by keeping it cold (refrigeration) and by cooking it at high temperatures (canning). Many bacteria grow best at human body temperature.
 - d. Other conditions—Air, light, pressure, chemicals, etc.
- D. In relation to food handling, our main interest is to control bacteria so that disease is not spread in food establishments.
1. The U. S. Public Health Service lists sixty-two communicable diseases. Twenty-five, or 40 per cent, can be transmitted in food-handling establishments.
 - a. Some of the diseases that may be transmitted through faulty food-handling methods are: common colds, trench mouth, strep throat, pneumonia, scarlet fever, typhoid fever, and dysentery.
 2. Bacteria multiply rapidly under favorable conditions
 - a. They reproduce by dividing in two. When conditions are favorable they divide about every 20 to 30 minutes.
- E. An elementary understanding of bacteria as given in this discussion should result in a fuller appreciation of the "why" of sanitary procedures necessary to proper operation of a food establishment.
1. The following sanitary precautions are important factors in the control of disease bacteria:
 - a. Protection of food—To protect food from bacteria that may get on or in it and cause respiratory diseases, food must be kept properly covered
 - b. Prohibiting use of common articles by employees, such as common cloth towels, toilet articles, and common cups or glasses
 - c. Providing adequate hand-washing arrangements for food handlers to use and insisting that they be used
 - d. Using pasteurized milk and dairy products
 - e. Using a safe water supply and plumbing that is correctly installed to prevent back siphonage
 - f. Proper cooking of meat, particularly pork, to kill the *Trichinella* worm. Proper refrigeration of perishable foods
 - g. Proper washing and sanitizing of dishes and eating utensils to prevent the transmission of saliva-borne diseases

- h. Other sanitary procedures similar to those mentioned are designed to promote sanitation and prevent bacterial contamination
- F. Slides to show types of bacteria that cause disease are shown with this lecture. (A. S. Aloe Company, 1819-23 Olive, St. Louis, Mo., can supply a bacteriological chart from which pictures may be taken for these slides.)
1. The bacteria shown in the first group are those associated with respiratory diseases, e.g., those involving the mouth, nose, throat, and lungs.*
 - a. Long chain streptococci
 - b. Vincent's angina organisms
 - c. Mouth of patient with Vincent's angina
 - d. Tubercle bacilli
 - e. Patient having chest x-ray
 2. The next group are those spread by discharges of the bowel and bladder.
 - a. Chart to show common channel of distribution of typhoid, bacillary dysentery and other diseases of intestinal origin. (An excellent chart suitable for this purpose can be found in Dunham's "Military Preventive Medicine," 3d ed., Military Service Publishing Co., Harrisburg, Pa., 1940, p. 155.)
 - b. Typhoid organisms
 - c. Amoebic dysentery (protozoa)
 3. Food poisoning
 - a. Staphylococci
 - b. Group of foods frequently involved
 - c. Food handler with bandaged finger working with food
 4. Venereal disease
 - a. Gonorrhea (gonococci)
 - b. Microscopic examination of smear being made by bacteriologist
 - c. Syphilis organism
 - d. Taking a blood specimen

The venereal diseases have been over-emphasized in relation to food handling. Their transmission is mainly by direct sexual contact. However, the venereal diseases present a very significant public health problem, and one of utmost importance in relation to individual and community health. (Present a brief discussion of syphilis and describe treatment required.)

- G. The chief duty of every food handler is to prepare and serve wholesome food to his patrons in the most careful and sanitary manner.
1. In the light of facts presented in this lecture it should be appreciated that the fight against these invisible public enemies must continue on all fronts and be an unrelenting battle for cleanliness. Disease traced to

* In this group are 2-by-2 Kodachrome slides. While slides in color are probably more appealing, ordinary black and white slides can be profitably used.

carelessness in any food establishment causes untold suffering among those involved and economic loss to the business itself.

(To supplement this lecture the 16-mm. silent film "Man vs. Microbe," available through the Metropolitan Life Insurance Company, New York, may be shown. Also, the sound slide film "Germs Take Pot Luck," produced by the U. S. Public Health Service, is excellent for this lecture.)

LECTURE 2: GOOD HOUSEKEEPING

- A. Good housekeeping is a broad term applicable to the many and varied procedures that are carried out to maintain a food establishment in a clean and sanitary condition. From the standpoint of communicable disease control, that portion of good housekeeping which deals with the washing and sanitizing of dishes, food containers, and eating utensils is of particular importance and the major part of this discussion will be devoted to it.
1. Public health reasons for proper sanitizing procedures
 - a. Historical—Legislation by the State of Kansas in the early 1900's prohibiting use of common drinking cups. Use of paper cups on common carriers now required.
 - b. Diseases of respiratory origin such as common colds, trench mouth, strep throat, and measles can be transmitted from person to person by unclean eating utensils.
 - c. Army experience has demonstrated less influenza among troops when mess-kit sanitizing is properly done (Camp Tanforan, Calif., 1917).
 - d. Glass sanitizing is a real problem. Repeal of prohibition, increase in soft drink business, and popularity of bars, lunch counters, and soda fountains add to the problem. Glass washing may be hurriedly and poorly done during rush hours.
 - e. Tests have revealed counts as high as 100,000 bacteria per rim from glasses supposedly clean.
 - f. Complaints by the public about dirty dishes and lipstick on glasses must be heeded.
 2. Equipment necessary to give desired results
 - a. Safe and abundant supply of running hot and cold water (discuss briefly protection of water supply)
 - b. Sinks, vats, or mechanical dishwashing machine
 - c. Hot water heating facilities
 - d. Cleaning compounds and detergents
 - e. Cabinets or cupboards for clean dish storage
 3. Methods necessary to give desired results
 - a. The washing procedure must be carefully done
 - (1) Scrape dishes
 - (2) Pre-rinsing is desirable and recommended
 - (3) Hand dishwashing to be done in water as warm as can be borne

by operator (110°–120° F.); mechanical washing temperatures 120°–140° F.

- (4) Washer arms, jets, spray nozzles to be kept clean. Frequent inspection needed. Booster heater under wash water tank to be used. Add detergent frequently during operation.
 - (5) Dish racks for mechanical washers not to be overloaded. Entire dish surface must be washed.
4. Sanitization of all dishes, food containers, and eating utensils. (If advisable, read section from local food ordinance dealing with dishwashing and sanitizing.)
- a. Sanitization signifies the destruction of disease germs and all others indicative of contamination
- (1) Scalding hot water—170° F. or above—a most satisfactory sanitizing agent
 - (2) Hypochlorites (chlorine compounds) when correctly used give satisfactory results. Explain proper use
 - (3) Quaternary ammonium chlorides. Explain proper use
 - (4) Water temperature, disinfectant strength, and time of exposure are important factors to effect sanitization
 - (5) Toweling of dishes not recommended, but if done, towels must be clean and used for no other purpose
 - (6) Clean dishes to be carefully handled. Invert glasses, separate and protect silverware, keep fingers out of clean bowls, cups and glasses, handle silverware by handles
 - (7) Single-service paper cups, plates, and wooden spoons are approved and recommended

Dishwashing and utensil cleaning are important procedures in the conduct of any public food establishment. Good housekeeping practices are essential. All possible means must be employed to prevent the spread of disease likely to result from faulty dishwashing and sanitizing methods.

B. Demonstration material arranged on a table at the front of the room is used in connection with this lecture. As the different steps relating to dishwashing are explained, certain points are demonstrated. In a discussion of dish sanitizing by immersion in scalding water, the use of the dipping basket, for example, is explained. The following articles are used as a supplement to the discussion: sample cans of cleaning compounds, samples of liquid and powdered bactericides, brushes, dish-dipping basket, dish rack for mechanical washers, metal glass storage rack, plates, glasses, silverware, and paper containers.

C. Slides, too, are used to illustrate points relating to essential equipment and methods. The following 2-by-2 Kodachrome slides are used:

1. Operator using dish-dipping basket
2. Glass-washing sinks with brushes, suitable for use in beverage places

3. Exterior view of dishwashing machine, showing wash and rinse water temperature gauges
4. Interior view of mechanical washer, showing clean jets and nozzles
5. Proper arrangement of dishes in rack about to be placed in washer
6. Large insulated hot water storage tank
7. Dust-tight dish storage cupboard
8. Waitress handling clean glasses correctly
9. Waitress handling silver (spoons) by handles
10. Storage of coffee cups in an inverted position.

(With this lecture "Twixt the Cup and the Lip," a 16-mm. sound film produced by the New York State Department of Health, may be used; or the U. S. Public Health Service's sound slide film "In Hot Water"; or "Dishwashing Dividends," a production of Economics Laboratories, St. Paul, Minn.)

LECTURE 3: PROTECTING FOOD

- A. The protection of food from contamination must receive consideration by all persons engaged in the food business. Keeping good food good is a real responsibility in every well-operated food establishment.
1. Food protection means control of certain conditions within the establishment itself
 - a. Historical—Formerly, twenty or thirty years ago, foods did not receive the protection we take for granted today. In the country store stood the open cracker barrel, milk was dipped and sold raw, foods were sold in bulk form, merchandise was promiscuously displayed without protection. Now we understand the dangers of these practices and take steps to prohibit them. Open displays subject food to several types of contamination.
 - b. Human droplet infection, the mucous material from the mouth and nose when one sneezes or coughs—such material sprayed over food is highly dangerous.
 - c. Insects, including the fly and cockroach—the fly breeds in filth, thrives on all types of refuse, and carries harmful germs to food. The fly's habits and structure are such that he is a constant menace and must be controlled. (Further discussion of the fly, with control measures, can be interjected here if desired.) The cockroach has to be combatted in nearly all places where food is handled. Roaches crawl over food, soiling and ruining it. (Control measures, habits of the roach, and other facts pertinent to this insect may be pointed out in more detail.)
 - d. Rats and mice—mice not as serious a problem as rats, mainly because they are relatively easy to trap. The rat, moreover, is more difficult to control, is a spreader of disease and an economic liability.

Through food which he contaminates he can spread typhoid, dysentery, food-borne infections, and infectious jaundice.

- e. Poisonous chemicals—roach powder containing sodium fluoride should be colored to distinguish it from other powders. Sodium cyanide in silver polish is not permitted. Cadmium used in plating cans may be included in the list of poisonous chemicals.
2. Food protection also involves refrigeration of perishables
 - a. Modern refrigeration has contributed much to the safety of our food supply
 - (1) Perishables like meat, fish, poultry, and dairy products must be held at 50° F. or below
3. Foods must be carefully handled to prevent contamination by employees
 - a. To eliminate direct hand contact, in so far as possible, utensils such as scoops, tongs, butter forks, cream and sugar dispensers must be used. Pasteurized milk must be served from half-pint bottles.
- B. For the second portion of this lecture slides are used to show some of the means that can be employed to afford protection to food. Slides shown are 2-by-2 Kodachrome, as follows:
 1. A glass-enclosed meat display case
 2. Transparent covered case for fried cakes
 3. Cookies in glass-topped boxes
 4. Covered cream dispenser
 5. Glass-enclosed pastry case
 6. Handling baked goods with tongs
 7. Serving candy with scoop
 8. Serving crackers in waxed paper envelopes
 9. Using sugar dispenser
 10. Using butter fork for butter pats
 11. Serving customer with milk from half-pint bottle
 12. Serving ice cream with clean scoop taken from dipper vat
 13. Interior view of neatly arranged refrigerator
 14. Elevated food display
 15. Proper garbage and waste disposal.

(Two films are used with this lecture: the first is a 16-mm. film—there is a sound version and a silent version—entitled "The Fly," produced by Erpi Films, 1841 Broadway, New York 19, N. Y.; the second, entitled "Keep 'Em Out," deals with rat control and is distributed by Stark Films, Howard and Centre Streets, Baltimore, Md.)

LECTURE 4: THE INDIVIDUAL

- A. Of particular importance to the safe and sanitary handling of food are the health and personal habits of the food handler.

1. The term "personal hygiene" as used in this discussion means an application of rules and laws governing personal health. Individual habits and practices are very important in the food business.
 - a. There is a direct relationship between personal habits and practices and the contamination of food.
 - b. Cleanliness of person with regard to both body and clothing is significant. The odor of perspiration is offensive but can be controlled by regular bathing and the use of deodorants.
 - c. Appropriate uniforms must be worn when working with food.
 - d. Five principles of personal cleanliness must be borne in mind. These protect the public and serve to protect you, the food handler, as well.
 - (1) Keep the body clean by frequent use of soap and water.
 - (2) Wash hands thoroughly with soap and water after visiting the toilet and always before handling food or food equipment.
 - (3) Keep the hands and any unclean articles used by others for toilet purposes away from the mouth, nose, eyes, and genitals.
 - (4) Avoid the use of common or unclean eating and drinking utensils or toilet articles such as towels, handkerchiefs, hairbrushes, and drinking cups.
 - (5) Avoid close exposure to the spray from the nose and mouth of other persons.
 - e. All food ordinances require personal cleanliness on the part of food handlers. (Section of sanitary code on cleanliness of food personnel may be read.)
- B. Hand cleanliness on the part of the food handler is of tremendous importance.
 1. Outbreaks of food-borne disease have frequently been traced to food contaminated by persons with soiled hands.
 - a. Many soiled articles are handled daily in the course of duties. A record of how hands are used during an ordinary working day will convince one that they must be washed frequently.
 - b. To have clean hands one must have warm water, plenty of soap, and time for a thorough job. Dry the hands on paper towels.
 - c. The history of "Typhoid Mary" teaches a valuable lesson in the importance of personal cleanliness. (Discuss food-borne typhoid caused by this famous carrier.)
 - d. When working with food, hands must be kept away from nose, face, mouth, and hair. Head covering or hair nets should be required.
 - e. Persons handling food must be free of boils, skin infections, and infected cuts, particularly on hands, arms, neck, and face.
 - f. Material from skin infections getting into certain foods, particularly cream-filled pastries, may cause staphylococcus food-poisoning outbreaks. (Give history of an outbreak traced to such a source.)
 - g. Personal health and cleanliness are the number one rule for all food

handlers. Careless personal habits and practices cannot be tolerated in the food business.

C. Service practices which relate to personal hygiene indirectly deserve some consideration. A neat, clean personal appearance, plus prompt, efficient service will increase patronage and please the customer.

1. A few good service rules to keep in mind are:

- a. The food handler who gives prompt, courteous service is an asset to the business. A smile followed by "May I help you please?" puts the customer at ease.
- b. Feel clean!—Look clean!—Be clean! Cleanliness is the foundation of a well-conducted food business.
- c. Keep your hands immaculate. There is no place for dirty hands or nails in the food business.
- d. Use proper utensils. Do not serve butter with the fingers. Use forks, spoons, ladles, and dippers in transferring or dispensing food.
- e. If a side towel is carried, fold it over the forearm, don't carry it under the arm.
- f. Use a clean towel to wipe tables and counters. Even though clean, towels are best kept out of sight.

D. Slides are used with this lecture. All slides listed are 2-by-2 Kodachromes, as follows:

1. Waitress correctly attired in neat, clean, well-fitting uniform.
2. Waitress standing before mirror placing hair net.
3. Food handler covering nose with clean handkerchief when sneezing.
4. Food handler washing hands.
5. View of neat, well-appointed dressing room.
6. View of modern sanitary toilet room.
7. View of large sign over wash basin directing employees to wash hands.
8. Proper and improper position of side towel.

(The 16-mm. silent film "Eating Out," a production of the Flint, Michigan, Department of Health, or the U. S. Public Health Service's sound slide film "Service with a Smile," or the Texas film "From Hash Slinging to Food Handling" may be used with this lecture.)

These outlines and the visual educational materials listed have been used effectively in training courses for food handlers. However, the instructor should be on the alert for new techniques and educational aids which will increase the value of his instruction. While many successful courses have been held, there is always the opportunity to develop better methods and then to pass on to others suggestions that have proved effective.

For those wishing to explore this activity further the following references are suggested:

Andrews, John, and Champion, Frances T. A guide to safe food service. Washington, U. S. Public Health Service, Tentative Edition, February 1946, 65 pp.

Eskil, R. B. Food poisoning is avoidable. *Hygeia*, 21:716, October 1943.

Felsen, J. Food, fingers, and flies—dysentery and Salmonella infections. *Hygeia*, 21:502, July 1943.

Morgan, H. A., and others. Making food handlers health-conscious. *American Journal of Public Health*, 35:28, January 1945.

Physician, policeman, or pedagogue—control of food handlers. *American Journal of Public Health*, 34:756, July 1944.

Robertson, A. A. A course of instruction for food handlers. *Journal of Milk Technology*, 7:349-353, November-December 1944.

Texas State Department of Health. Food handling and disease prevention. Austin, Texas, February 1945, 80 pp.

APPENDIX G

SUGGESTIONS FOR EFFECTING CORRECTIONS IN SANITATION

The public health worker is basically an instructor and an educator. His constant aim is to improve conditions so that disease will be minimized or eliminated. Unfortunately, all persons with whom he comes in contact do not have a similar point of view. There are, however, certain procedures, listed below, that can be followed to bring about desired corrections. While these should be done progressively, extenuating circumstances or serious infraction may require more direct measures, such as license suspension or court action. The merit of the case and the judgment of the sanitarian will determine the most logical steps to follow.

1. Give advice and instruction directly to the person or persons involved.
2. Give clear and explicit written instructions, setting forth the time interval allowed for compliance. (Retain copy of instructions.)
3. Report violation to a superior officer, with request that a letter be written to violator ordering correction. (Registered mail, return receipt requested, may be used if necessary.)
4. Send written order to violator requiring him to be present for a hearing on the matter; decide disposition at hearing and take necessary follow-up action.
5. Require violator to sign written statement that correction will be completed within time interval agreed upon.
6. Suspend license if business is licensed under city ordinance and if health officer or his duly appointed agent has authority to take such summary action, suspension to continue until sanitary defect is remedied.
7. If (6) cannot be followed, assistance from either a state or a federal agency may be of aid.
8. Preliminary to instituting legal action, make re-inspection in company with a health officer, another sanitarian, or a state inspector. (Inspection by two or more persons frequently hastens corrective measures.)

Indirect methods may be used, such as making contact by phone, by letter, or by personal call to persons who may have influence with violator. These include business partner or associate, silent partner, wholesaler, or financial backer; domestic associates (wife, brother, children, parents, or other relative); and religious associates (rabbi, minister, or priest). In instances where business is operated as a branch, chain, or affiliate, contact local, district, or national office of the company.

Direct methods for dealing with a food ordinance violator may include:

1. Detention of food in establishment pending laboratory examination.
2. Condemnation of food.
3. Court action (warrant and summons).
4. Indictment for criminal action through proper legal channels (county or city attorney).

PREPARING CASES FOR LEGAL ACTION

1. The specific law and its many ramifications, weaknesses, and past cases tried under the law must be studied diligently.
2. The facts concerning the incidents must be carefully put down in writing—names (in full), dates, times, witnesses, and the specific violations.
3. Authorization from head of Department or Legal Department must be obtained before summons or warrant is issued.
4. Entire violation must be discussed with attorney for the official agency.
5. Facts of the case must not be discussed with others prior to trial.
6. A rehearsal of the case should be carried out and repeated with the prosecuting attorney.
7. In instances where no prosecuting attorney is available and the sanitarian has to carry out the proceedings with only the help of a superior, a second sanitarian should accompany him (for moral support).
8. All records, evidence, and exhibits must be kept in the possession of the sanitarian prior to the trial or locked in a safe place. If evidence is transferred from one person to another, signed receipts should be obtained.
9. The sanitarian must be thoroughly familiar with the procedure in sampling and submitting specimens for laboratory analysis. (Representatives of the Federal Food and Drug Administration are expert in this activity.)
10. Records after trials must not be destroyed or lost. They may be valuable in future cases.

Visits by the sanitarian to local police stations and city or county civil and criminal courts to observe procedures will facilitate and expedite his court cases.

APPENDIX H

CODE OF ETHICS FOR THE PUBLIC EMPLOYEE*

The Public Employee should:

1. Be ever mindful that he is but an integral part of the entire governmental structure
2. Perform his tasks to the best of his ability
3. Realize that his employment is not a personal right, but a privilege embodying a trust
4. Be courteous and considerate in all contacts with the public and his fellow employees
5. Maintain his dress and personal equipment in a manner consistent with the effective performance of his work
6. Appreciate the other fellow's point of view

He should avoid:

1. The acceptance of gratuities
2. The practice of nepotism
3. Private conduct that is likely to reflect adversely on the public service
4. Engaging in political activity in his official capacity
5. Irresponsible gossip about colleagues
6. Treading upon the rights of others to gain personal objectives

He should realize:

1. That disagreement with policy and practice should be voiced with his superiors
2. That when personal opinion conflicts with policy the latter should control his actions and utterances

* *From* The Sanitarian (National Association of Sanitarians, Los Angeles, Calif.), September 1938.

APPENDIX I

FACTS ABOUT DDT AND ITS USE AS AN INSECTICIDE

What is DDT?

The technical grade chemical is a harmless-looking, white, practically odorless powder resembling flour, especially flour with lumps in it, as the particles of pure DDT have a tendency to stick or clump together. Dichloro-diphenyl-trichloroethane is the chemical name for DDT.

What is DDT technical grade?

DDT technical grade is that which has a setting point of 89° C. or higher, meaning that degree of temperature at which a crystallized DDT will melt upon heating. The setting point of a para-para-prime DDT isomer is approximately 109° C., and for the ortho-para-prime isomer 65° C.

Any compound having the formula $C_{14}H_9Cl_5$ is an isomer of DDT. It has been calculated that there are forty-five possible DDT isomers. From the technical grade DDT only two isomers have been isolated—the para-para-prime isomer and the ortho-para-prime isomer. The former represents 65 to 73 per cent of the technical grade; the latter 19 to 21 per cent. The remaining parts of DDT technical are a small percentage of DDT isomers and some by-products of reaction, not DDT isomers at all but various chlorinated and sulphonated compounds classified as impurities. In ordering DDT technical grade the supplier should be advised that it must meet Army-Navy specifications, JAN-D-56, issued June 30, 1944.

*What is meant by a residual spray?**

DDT acts both as a contact and stomach poison. Its most unusual property is its lasting or residual effect. When DDT is sprayed or dusted on walls, ceilings, floors, and other surfaces, it leaves a deposit or residue of tiny crystals. If flies, mosquitoes, cockroaches, fleas, bedbugs, and certain other insects walk over or rest on this deposit long enough to obtain a sufficient exposure, they will be killed. The use of DDT as a coating or residual is quite different from that of ordinary fly spray. Space sprays which create a poisonous mist in the air and may not contain more than 1½ to 2½ per cent DDT are not suitable for application where DDT residuals are desired.

How does DDT residue kill insects?

Just how DDT kills is not fully understood at present. Evidently it is absorbed through the insects' feet as they walk over a spray deposit or DDT

* The material from here to page 288 has been taken from two bulletins issued by the United States Public Health Service, Malaria Control in War Areas: "DDT for Control of Household Pests" and "Handbook of DDT Residual Spray Operations."

residue. After a short period of exposure, the affected insects become restless, drag their legs, and move about in a jerky and spasmodic manner. They may turn over on their backs and be unable to right themselves. Finally they may develop tremors and die, although death may not take place until hours later.

Mosquitoes and flies often move toward the light when they are first affected. After they receive a toxic dose of DDT, they may fly away and die elsewhere. So the user should not be disappointed at not finding a large number of dead insects after an area has been treated. The best test of DDT's effectiveness is the absence of live insects, not the presence of dead ones. However, flies, cockroaches, and other insects may reinfest the premises from outside sources. If this happens, live insects may be seen before they have received a toxic dose, thus giving the erroneous idea that the spray is ineffective. Every effort should be made to prevent this reinfestation by other sources, even though residual sprays are used.

Preparation of DDT residual sprays

Solutions of DDT can be prepared by using highly refined, deodorized, *white* kerosene or some other commercial solvents regularly used in ordinary fly sprays. For effectiveness as a residual spray, oil solutions must contain at least 5 per cent DDT. Weaker solutions of DDT, 1 to 2 per cent or less, require such large amounts of spray that it is impractical to try to get enough on a wall or other surface to give an effective residue.

A 5 per cent DDT solution may be prepared by dissolving seven ounces of DDT technical grade in each gallon of oil or commercial solvent. Before using the spray solution, it should be strained to remove particles that may clog the spray nozzle. In the average household, one cup of 5 per cent spray is sufficient to treat effectively each 60 square feet of surface against flies and mosquitoes for about three months. When it is applied to newly painted surfaces, the effect is lost rapidly. Dust and grease deposits covering treated surfaces reduce the length of effectiveness. Vibrations cause a flaking-off of the DDT deposit, and shorten the period of residual effect.

Preparation of DDT emulsion concentrate

Although DDT can be applied in various oil solutions such as kerosene, many of these materials dissolve only small quantities of DDT and others may stain walls and fabrics. For this reason, xylene has been selected as a solvent since it dissolves relatively large quantities of DDT, does not stain, and is fairly cheap. In order to spray the small quantities of DDT desired, further dilution with water is necessary.

Since DDT-xylene solution does not mix with water, the two liquids will very quickly separate after shaking. To prevent this, a DDT-xylene emulsion, using Triton X-100 as an emulsifying agent, has been developed.

An *emulsion* differs from a solution. DDT readily dissolves in xylene to

form a DDT-xylene *solution*; but if water is added, the two liquids do not mix. When shaken violently, the DDT-xylene breaks up into tiny drops which are dispersed throughout the water. If allowed to stand, the tiny drops of DDT-xylene come in contact with one another. When two touch, they combine to form a larger drop and so on—until the DDT-xylene and the water have separated.

If an emulsifier such as Triton is added to the mixture and the material shaken vigorously, the DDT-xylene is broken up into little drops and dispersed throughout the water. In this instance, each drop of DDT-xylene is surrounded by a thin layer of emulsifier. This prevents them from joining, and the many tiny drops of DDT-xylene remain suspended in the water giving it a milky appearance. This is an *emulsion* of DDT-xylene in water.

Shipping a ready-to-use DDT-xylene emulsion spray is not economical since the finished spray contains about 93 per cent water. To avoid transporting such large quantities of water, a DDT-xylene-Triton emulsion *concentrate* has been developed. This can be diluted with the proper amount of water at the spraying site.

Xylene will dissolve more DDT at higher temperatures. For this reason, a 35 per cent DDT concentrate is used in the summer when temperatures are above 60° F. In the winter or early spring, when temperatures are below 60° F., a 20 per cent DDT concentrate must be used. The basic formulas for these different concentrates are given below:

	<i>Summer formula</i>	<i>Winter formula</i>
DDT	3 lbs.	1 lb.
Xylene	3 qts.	2 qts.
Triton	6 fluid oz.	3.2 fluid oz.
	<hr style="width: 50px; margin: 0 auto;"/> 1.03 gals.	<hr style="width: 50px; margin: 0 auto;"/> 0.6 gal.

To prepare the DDT spray in the proper dilution, mix one part of summer concentrate with 13 parts of water or one part of winter concentrate with 7 of water. This will result in a 2½ per cent (not a true percentage—expressed in percentage for simplicity) DDT spray containing 25 mg. DDT/cc. of spray solution. When this milky liquid is sprayed on a surface, the water and xylene evaporate, leaving the desired residue of DDT crystals.

DDT suspensions

A DDT powder containing a chemical which permits the DDT particles to be mixed readily with water may also be used as a residual spray. In this mixture, called a suspension, small particles of DDT are distributed evenly throughout the liquid.

A 5 per cent DDT spray is prepared from such a DDT powder by diluting it with water. The amount of water necessary depends upon the concentration

of DDT in the commercial product. The manufacturer's label should supply this information.

The DDT suspension can be sprayed on surfaces. It has no odor, presents no fire hazard, and is harmless when applied to the skin of man or to the coats of animals. When the water evaporates, small flecks of both DDT and the carrier remain on the sprayed surface. So the spray shows as a white spotting on dark surfaces such as dark-stained furniture, dark-colored paints, varnished floors, and window glass. However, it is very effective and is easy to apply where spotting is unimportant.

DDT powders or dusts

A number of dry mixtures of DDT are available for dusting. These contain 5 to 10 per cent DDT diluted with some powder, such as talc or pyrophyllite, which serves as a carrier. The usual dilution is one part of DDT in 9 parts of carrier. For most home use, the dust should contain no less than 10 per cent DDT.

Use of DDT against various insects

HOUSE FLIES—Use DDT as a 5 per cent residual spray. Apply with hand sprayer, large air pressure garden sprayer, wide paint brush, or roller applicator. Spray surfaces where flies are most likely to light. Treating an entire room may not be necessary.

COCKROACHES—A 10 per cent DDT powder is effective for treating the hiding places of the roach. Use a small hand dust gun to force the dust into cracks and crevices, along shelving, behind equipment, cupboards, and sinks. Allow time for the dust to take effect. A week may elapse after the dust is used before any marked reduction of infestation is noticed.

For quicker results a 5 per cent oil solution, suspension, or emulsion may be used. Most of the roaches will be killed almost immediately if the spray contacts them. A combination of spraying and dusting will be found most effective in roach control. Painting a DDT solution on cupboard shelves, undersides of tables, counters, etc., is an efficient way to treat these surfaces, with special attention given to crevices and small openings where these insects hide. DDT has killed roaches a month after original application, but its effect is most noticeable during the first week after spraying.

BEDBUGS—Apply a 5 per cent spray to bedsteads and mattresses. A small hand sprayer can be used. A single treatment is effective for six months or longer. In heavy infestations walls, cracks along baseboards, surfaces behind loose wall paper, and similar hiding places should be treated. About $\frac{1}{2}$ cup of 5 per cent spray should be sufficient for each bed.

ANTS—Certain species of ants can be controlled with DDT. First, locate their entrances to the premises and treat those areas with a heavy spray or dust deposit. A 5 per cent spray solution or 10 per cent powder may be used.

SILVERFISH—The general treatment recommended for cockroaches will be equally effective against silverfish.

*Precautions for the use of DDT**

1. Do not spray food, dishes, toys, or other articles from which the material may be taken internally.
2. Wear rubber gloves while spraying or handling materials or freshly sprayed surfaces.
3. Wear face mask or respirator while spraying or while in the room during treatment, especially if sprayer vaporizes material greatly.
4. Wash hands, arms, or face with warm water and plenty of soap suds if material is spilled on them.
5. Avoid spilling on mattresses or upholstery, or over-spraying smooth hard surfaces, especially mahogany or dark-colored surfaces, because white streaking will result if the spray runs.
6. Do not spray near open flames.
7. Do not smoke or eat until hands and face are thoroughly washed.
8. Take hot showers, using plenty of soap suds.
9. Saturated or sprayed clothes should be laundered after spraying.
10. In case any appreciable amount of DDT is swallowed, one should take a tablespoon of mustard in a glass of warm water.

DDT is not harmful to animals or humans after spray dries.

The following bulletins on DDT are available from the United States Public Health Service, Malaria Control in War Areas, 605 Volunteer Building, Atlanta, Georgia: "DDT for Control of Household Pests," "Handbook of DDT Residual Spray Operations," "Larviciding," and "DDT Residual Spray Operations."

* From the News Letter of the National Pest Control Association, Brooklyn, N. Y.

APPENDIX J

PARTIAL LIST OF FILMS RELATING TO MILK AND FOOD SANITATION*

Sources from which films may be available for loan or rent

State departments of health

District offices of the U. S. Public Health Service

State departments of education

University extension divisions

Health Officers News Digest, 1790 Broadway, New York 19, N. Y.

Y. M. C. A. Motion Picture Bureau, 347 Madison Ave., New York 17, N. Y.

Castle Films, Inc., 30 Rockefeller Plaza, New York 20, N. Y.

Film catalogs

ONE THOUSAND AND ONE, 75¢, The Educational Screen, 64 E. Lake St., Chicago 1, Ill.

HEALTH FILMS, 25¢; supplements 20¢. Two supplements issued to date.
American Film Center, Inc., Section on Health and Medical Films, 45
Rockefeller Plaza, New York 20, N. Y.

SOUND FILMS FOR THE CLASSROOM, Erpi Classroom Films, Inc., 1841 Broadway, New York 19, N. Y.

Key to listing of films for suitability. (Those marked with an asterisk are specially suited for the purpose indicated.)

- (1) For schools for foodhandlers
- (2) For schools for milk handlers
- (3) For food sanitation seminars for sanitarians
- (4) For milk sanitation seminars for sanitarians
- (5) For the general public
- (6) Listed in various catalogs but not viewed

GENERAL RESTAURANT SANITATION

Eating out (1940) (1*, 3*, 5*) 26 min., silent, 16 mm., black and white. City Health Department, Flint, Michigan. Contrasts insanitary foodhandling practices with proper methods as used in a well-managed eating place and finally reviews the rules for good food-handling and restaurant sanitation.

Hashslingin' to foodhandling (1945) (1*, 3*, 5*) 20 min., sound, 16 mm., color. Texas State Department of Public Health. Sanitary and insanitary methods of handling food and utensils are demonstrated by a sloppy waitress (a Hashslinger) and a well-trained waitress (a Foodhandler). Dark

* Issued by the Federal Security Agency, United States Public Health Service, Washington, D. C., January 1946.

coloring material is used to illustrate the travel of germs from the mouth of a customer to utensils, the Hashslinger's hands and mouth, and another customer. Good, sanitary service protects the health of customers and employees and brings larger tips to waitresses and greater profits to the management.

In your hands (1939) (1*, 3*) 22 min., sound slide film, black and white. Public Health Committee of the Cup and Container Institute, 1790 Broadway, New York 19, N. Y. An inspector discusses the reasons for and methods of proper cleaning and sanitization of eating and drinking utensils with a soda fountain operator and bartender. The use of paper cups is emphasized. (When used at foodhandlers' schools, it should be explained that the health department considers both properly sanitized utensils and paper utensils to be satisfactory.)

It's no picnic (1941) (1*, 3*, 5) 10 min., sound, 16 mm., black and white. New Mexico School Supply Co., 207 W. Copper Ave., Albuquerque, N. M. A picnic results in food poisoning. Bacteriological follow-up incriminates the potato salad, infected by improper handling. Correct foodhandling practices are shown.

Our health in your hands (1945) (1*, 3*, 5) Series of four 10-15 minute sound slide films, black and white. Castle Films, Inc., 30 Rockefeller Plaza, New York 20, N. Y. (\$10 for complete series; \$9 to non-profit institutions.)

1. *Germs take pot luck.* The spread of disease in restaurants is discussed and dramatized; the habits of germs are shown by cartoons; the importance of each restaurant worker's part in preventing the spread of disease is pointed out.
2. *Service with a smile.* A customer visits a restaurant where proper serving methods as well as good food are featured. His waitress demonstrates correct methods and explains the more important rules of personal hygiene and cleanliness. The manager discusses the employee training program and the importance of providing the essential sanitary facilities.
3. *In hot water.* An inspector discusses the customers' reaction to unclean eating utensils, the health hazards involved, and the importance of proper dishwashing. Good manual methods are shown in a step-by-step sequence. Machine dishwashing, glass washing, and the cleaning of cooking utensils are briefly covered.
4. *Safe food for good health.* A county health officer emphasizes that food must be safe as well as nutritious. He visits a restaurant where the manager and several employees discuss proper selection, preparation, storage, and protection of food and the elimination of flies, roaches, rats, and mice. After a brief summary of the four strips, the importance of overall cleanliness is again emphasized.

Slinging hash (1940) (1*, 3) 15 min., silent, 16 mm., black and white. Texas State Department of Health, Austin, Texas. Using an average restaurant

as a background, the film explains graphically the sanitary and insanitary handling of food and eating utensils.

The community cup (6) 15 min., silent, 16 mm., black and white. West Virginia State Department of Health, Charleston, W. Va.

The danger point (1943) (1*, 3*, 5*) 12 min., sound, 16 mm., color. Public Health Committee of the Cup and Container Institute, 1790 Broadway, New York 19, N. Y. Discusses the spread of respiratory diseases and prevention by proper foodhandling sanitation. Transmission by improperly sanitized glasses is demonstrated. The use of paper cups is emphasized. (When used at foodhandlers' schools, it should be explained that the health department considers both properly sanitized utensils and paper utensils to be satisfactory.)

Tommy Fork and his fountaineers (1945) (1*, 3*) 10 min., sound slide film, black and white. Syndicate Store Merchandiser, Inc., 79 Madison Ave., New York 16, N. Y. Using a soda fountain background, animated eating utensils and a counter-girl interestingly and humorously demonstrate proper handling and serving of food and utensils. Personal appearance is briefly covered. A silent photo-quiz trailer is included for audience participation.

Twist the cup and the lip (1940) (1*, 3*, 5*) 22 or 13 min., sound, 16 mm. or 35 mm., black and white. G. S. Jacobsen, 204 Washington Ave., Albany, N. Y. After an outbreak of colds, the health department goes into action to obtain good dishwashing or single-service utensils at local restaurants. Shows proper methods of sanitization of multi-use utensils and methods of examination. Long version includes information on detergents. (For use at foodhandlers' schools, the sequence referring to "this cheap help" should be deleted.)

BACTERIOLOGY AND COMMUNICABLE DISEASE

Another to conquer (1941) (1, 2, 3, 4, 5*) 18 min., sound, 16 mm., black and white. National Tuberculosis Association, 1790 Broadway, New York 19, N. Y. Diagnosis and treatment of tuberculosis among the American Indians of the Southwest. Excellent pictorial photography.

Body defenses against disease (1937) (1*, 2*, 3*, 4*, 5*) 11 min., sound, 16 mm., black and white. Erpi Classroom Films, Inc., 1841 Broadway, New York 19, N. Y. Animated portrayal of the body's three lines of defense against disease. Microphotographs show the action of phagocytic cells in attacking and engulfing bacteria.

Confessions of a cold (1, 2, 5) 10 min., sound; 15 min., silent; 16 mm., black and white. National Motion Picture Co., Mooresville, Ind. The dangers of the common cold and how to treat it. Animation used to emphasize the method of infection.

Goodbye Mr. Germ (1940) (1, 2, 5) 14 min., sound, 16 mm., black and white. National Tuberculosis Association, 1790 Broadway, New York 19, N. Y. Animated cartoon on the transmission of tuberculosis.

- Let my people live* (1938) (1, 2, 5) 15 min., sound, 16 mm., black and white. National Tuberculosis Association, 1790 Broadway, New York 19, N. Y. Tuberculosis control in the South. Colored cast. Excellent sound including the Tuskegee Choir.
- Man against microbe* (1932) (6) 10 min., sound; 15 min., silent; 16 mm., black and white. Metropolitan Life Insurance Co., New York, N. Y. Dramatizes discoveries that were decisive in the fight against infectious disease.
- Preventing the spread of disease* (1, 2, 5) 10 min., sound; 15 min., silent; 16 mm., black and white. National Motion Picture Co., Mooresville, Ind. Stresses measures which the individual and community may use to reduce the amount of communicable disease.

FLIES

- Swat the fly* (1936) (1*, 2*, 3*, 4*, 5*) 10 min., sound, 16 mm., black and white. Edited Picture System, 330 W. 42nd St., New York 18, N. Y. Development and anatomy of the housefly; its role in disease transmission and some methods of control.
- The housefly* (1935) (1*, 2*, 3*, 4*, 5*) 10 min., sound, 16 mm., black and white. Erpi Classroom Films, Inc., 1841 Broadway, New York 19, N. Y. Life cycle of the fly; its role in disease transmission; methods of control.
- The housefly* (1933) (6) 15 min., silent, 16 mm., black and white. Eastman Kodak Co., Rochester, N. Y. Life cycle of the fly; its role in disease transmission; some methods of control.

MILK

- All washed up for clean safe milk* (2*, 4) 15 min., sound slide film. Audio-Vision, Inc., 285 Madison Ave., New York 17, N. Y. Prospective plant-producer discusses the sanitation requirements with the milk sanitarian and observes good methods at a neighbor's dairy.
- From moo to you* (6) 10 min., sound, 16 mm., color. The Borden Co., 350 Madison Ave., New York 17, N. Y. Animated cartoon in which Elsie, the cow, tells the story of milk.
- Home of the free* (1941) (1, 2, 5*) 11 min., sound, 16 mm., color. National Dairy Council, 111 N. Canal St., Chicago 6, Ill. The role of milk nutrition in the national emergency; scenes in army kitchens and messes and in the home; illustrating proper selection and preparation of food.
- Milk* (6) 10 min., sound, 16 mm., black and white. Bell & Howell Co., 1801 Larchmont Ave., Chicago 13, Ill.
- Milk and its products* (6) 10 min., sound, 16 mm., black and white. Films Incorporated, 330 W. 42nd St., New York 18, N. Y.
- Milk parade* (5*) 10 min., sound, 16 mm., black and white. Milk Industry Foundation, Chrysler Bldg., New York 17, N. Y. Steps in the production, pasteurization, and bottling of milk.

- Milk production* (6) 16 mm., silent. Illinois State Health Department, Springfield, Ill.
- Milk—the master builder* (6) 10 min., sound; 15 min., silent; 16 mm., black and white. National Motion Picture Co., Mooresville, Ind. Nutritional value of milk and milk products.
- Milk—white magic* (6) 30 min., sound, 16 mm., color. The Borden Co., 350 Madison Ave., New York 17, N. Y.
- Miracle of the meadow* (6) 25 min., sound, 16 mm., black and white. Bailey Film Service, P. O. Box 2528, Hollywood, Calif.
- Modern magic* (1943) (2, 5*) 16 min., sound, 16 mm., color. Parrott Film Studios, 1700 Keo Way, Des Moines, Iowa. Stresses the importance of good milk. Does not give detailed procedures of milk production and processing.
- More life in the living* (1939) (1, 2, 5*) 12 min., sound, 16 mm., black and white. National Dairy Council, 111 N. Canal St., Chicago 6, Ill. An entertaining and stimulating film emphasizing the role of milk in nutrition.
- More milk* (1944) 11 min., sound, 16 mm., black and white. U. S. Department of Agriculture, Motion Picture Service, Washington, D. C. A film designed to promote greater milk production. Not suitable for milk handlers' sanitation courses unless it is desired to urge increased milk production at the course.
- Quality milk* (2) 15 min., silent, 16 mm., black and white. U. S. Department of Agriculture Motion Picture Service, Washington, D. C. The production of quality milk from the producer to the milk plant. An old film.
- Quality milk production* (1944) (2*, 4*, 5) 33 min., sound, 16 mm., black and white. National Dairy Products Corp., 230 Park Ave., New York 17, N. Y. The importance of safeguarding milk by using sanitary production methods is stressed. Proper methods are shown, including barn cleaning, grooming of cows, washing udders with chlorine water, use of strip cup, use of milking machine including manipulation of udder, prompt straining and cooling, and protection during hauling. Sequences on cleaning of utensils stress the use of brushes, soapless cleaner, hot water, disassembly of milking machines, and chlorine rinse before use. Sequences at the milk plant show platform and laboratory tests with follow-up by field man. At end the film stresses the importance of training of future dairy farmers in FFA and 4-H.
- Safeguarding the milk of millions* (1944) (2*, 4*) 30 min., sound, 16 mm., color. Portland Cement Association, 33 W. Grand Ave., Chicago 10, Ill. Deals chiefly with the construction of milk houses, cooling tanks, and barns, stressing the use of cement.
- Sentinels of milk* (1944) (2*, 4*, 5*) 16 min., sound, 16 mm., color. R. Hunter, 1105 East Grand River, East Lansing, Mich. Milk production, pasteurization, and bottling. Stresses sanitation and gives good information on cleaning and sanitizing milking machines.
- The milky way* (4*) 25 min., sound, 16 mm., color. The Diversey Company, 53 W. Jackson St., Chicago 4, Ill. The bactericidal treatment of dairy farm

and pasteurization plant equipment, stressing the use of hypochlorites. A commercial film.

The problem of bacteria in milk (2*, 4) 14 min., sound slide film. William M. Hickman, Pennsylvania Salt Manufacturing Company, 1000 Widener Bldg., Philadelphia 7, Pa. A humorous film using cartoons to explain bacteriology to farmers and producers. Sound on reverse of record for *What are bacteria?*

The story of milk (6) 20 min., sound, 16 mm., black and white. Bailey Film Service, P. O. Box 2528, Hollywood, Calif.

What are bacteria? (2*, 4) 13 min., sound slide film. William M. Hickman, Pennsylvania Salt Manufacturing Company, 1000 Widener Bldg., Philadelphia 7, Pa. A humorous film using cartoons to explain bacteriology to farmers and producers. Sound on reverse of record for *The problem of bacteria in milk*.

Your daily milk (4, 5) 10 min., sound, 16 mm., color. Milk Industry Foundation, Chrysler Bldg., New York, N. Y. Modern milk distribution with emphasis on economics. Animated charts of the milk distributor's dollar.

NUTRITION

Food and nutrition (1, 3, 5) 11 min., sound, 16 mm., black and white. Erpi Classroom Films, Inc., 1841 Broadway, New York 19, N. Y. Normal dietary requirements of carbohydrates, fats, proteins, minerals, and water. Rather technical for foodhandlers. Contains no information on sanitation.

Hidden hunger (1942) (5*) 22 min., sound, 16 mm., black and white (color trailer). "Hidden Hunger," 420 Lexington Ave., New York 17, N. Y. Dramatic film on nutrition. Crusading farmer campaigns to reform the nation's eating habits. Shows correct cooking procedures to preserve vitamins.

Meat and romance (1, 3, 5*) 40 min., sound, 16 mm., black and white (color trailer). Castle Films, Inc., 30 Rockefeller Plaza, New York 20, N. Y. Correct procedures in buying, cooking, and carving meats; nutritional value of various meats. Although too long for general use of foodhandler schools, it is considered excellent for those operators who might wish to remain after the regular session.

What's cookin'? (1, 3, 5*) 15 min., sound slide film. Zurich General Accident and Liability Insurance Co., Chicago, Ill. A film stimulating interest in nutrition. Restaurant setting.

RODENT CONTROL

Keep 'em out (1942) (1*, 2*, 3*, 4*, 5*) 10 min., sound, 16 mm., black and white. U. S. Public Health Service, Washington 14, D. C. Expository film; how rats spoil food, destroy property, and spread disease; rat control by poisoning, trapping, and ratproof construction.

Rat destruction (1942) (6) 10 min., sound, 16 mm., black and white. British Information Service, 30 Rockefeller Plaza, New York 20, N. Y.

Vandals in the night (1*, 2*, 3*, 4*, 5*) 20 min., sound, 16 mm., color. Acting Director, Fish and Wildlife Service, U. S. Department of Interior, Merchandise Mart, Chicago 54, Ill. An excellent film emphasizing the economic reasons for rat control in cities and rural areas.

REFRIGERATION

40 billion enemies (1941) (1, 3, 5*) 25 min., sound, 16 mm., color. Westinghouse Electric & Manufacturing Co., Visual Education Section, Mansfield, Ohio. Contains good information on maintenance and use of home refrigeration units and the storage of different foods. The causes of spoilage and the influence of temperature on germ growth are explained. No commercial message.

How to get the most out of your refrigerator (1941) (1, 3, 5*) 30 min., sound, 16 mm., black and white. General Motors, Department of Public Relations, 1775 Broadway, New York 19, N. Y. Information on the care and use of home refrigeration units and the storage of different foods. No commercial message.

WATER AND PLUMBING

City water supply (6) 10 min., sound, 16 mm., black and white. Erpi Classroom Films, Inc., 1841 Broadway, New York 19, N. Y.

Contamination of water supplies by back siphonage (1937) (3*, 4*, 5) 20 min., sound, 16 mm., black and white. University of Minnesota, Bureau of Visual Education, Minneapolis, Minn. Several types of faulty plumbing fixtures are shown and proper corrective measures explained. Laboratory models illustrate back-siphonage.

Every drop a safe one (1939) (6) 11 min., sound; 15 min., silent; 16 mm., black and white. National Motion Picture Co., Mooresville, Ind.

Safe drinking water from small supplies (1939) (3*, 4*, 5*) 12 min., sound, 16 mm., black and white. University of Minnesota, Bureau of Visual Education, Minneapolis, Minn. Correct measures for the installation of small water supplies. Bored, drilled, and driven wells illustrated diagrammatically.

Safe water (1943) (3*, 4*, 5*) 15 min., sound slide film. U. S. Public Health Service, Washington 14, D. C. The importance of safe water, with emphasis on country supplies.

The ominous arms case (1942) (3*, 4*, 5*) 30 min., sound, 16 mm., black and white. Pure Water Films Company, 1251 N. Clark St., Chicago 10, Ill. Using a story based on a lawsuit, the film shows that disease may result from the drinking of polluted water caused by back-siphonage.

APPENDIX K

PRECISION TESTING OF HIGH-TEMPERATURE SHORT-TIME PASTEURIZERS

The use of high-temperature short-time pasteurization has increased rapidly in recent years, and indications are that its popularity as a method of pasteurizing milk and dairy products will continue to grow. The equipment now available to the milk processor is precision built and equipped with many sensitive controls (see Figure 63) which, when used under correct operating conditions, insure the proper pasteurization of milk. Heating milk to a temperature of not less than 160° F. and holding it at such temperature for not less than fifteen seconds has been demonstrated to be effective in the destruction of pathogens which may be present in the milk. Milk pasteurized by the high-temperature method in properly installed and operated equipment satisfactorily fulfills the definition of pasteurization.

One of the major concerns of the milk sanitarian in relation to the use of this equipment is to be certain that every particle of milk passing through the holding tube under normal operating conditions is at the correct temperature (not less than 160° F.) and is held for the correct time (not less than fifteen seconds).

To ascertain whether this fine temperature-time combination obtains, certain apparatus has been developed which will permit an accurate determination to be made. At present there are two methods which may be employed: the first involves using a colored dye solution (methylene blue, or uranine dye) and observing the time required for the solution to pass through the holding tube of the pasteurizer; the second consists of introducing a salt solution of high conductivity near the upstream end of the holding tube, and, by employing appropriate measuring devices, determining the time required for the injected solution to reach the downstream end of the holding tube with the equipment operating under normal conditions. Experience has demonstrated that tests employing a salt solution give accurate results and overcome such objections to the dye method as staining of equipment and possibility of human error and decreased accuracy. In this discussion the procedure given pertains to the use of the salt solution only.

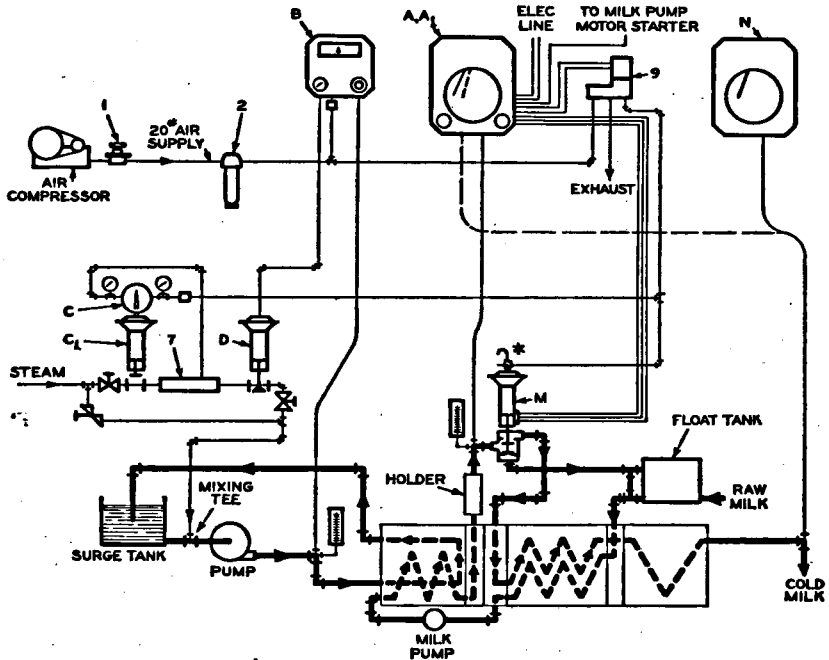
It should be noted at this point, moreover, that the following discussion is limited mainly to the apparatus needed for conducting the timing test and the procedure to follow. There are other tests which should be made, especially to insure the accuracy of thermometer equipment. For this the reader is referred to Item 16p, Pasteurization, pp. 96-115, in the 1939 edition of the Milk Ordinance and Code Recommended by the United States Public Health Service.

DESCRIPTION OF OPERATION FOR FIGURE 63

Steam pressure is controlled by "C" and "C₁" set about 15 psi below minimum line or boiler pressure, to provide a constant steam pressure ahead of the control valve "D."

The milk temperature is controlled indirectly by maintaining the water inlet temperature at a given value by controller "B," with its bulb located in the outlet from the water circulating pump, actuating diaphragm valve "D" and thus regulating the quantity of steam necessary for maintaining a constant water temperature.

The Safety Thermal Limit Recorder Controller "A," with the bulb in the milk outlet from the holder, records the temperature of the milk leaving the holder. If the milk temperature falls below the predetermined minimum, it actuates solenoid valve "9," bleeding the air from the top of the flow diversion valve "M," the disc of which moves upward to divert milk. This same air supplies pressure controller "C." With no air supplied to controller "C," valve "C₁" is wide open, allowing all available boiler steam pressure to be used for heating the water in the shortest possible time. This feature, known as accelerated heating, provides first for quick recovery of the milk temperature both in the initial heating period and also in case of subsequent diverted flow. Second, it permits setting pressure controller "C" at the correct value for optimum performance of water temperature controller "B," without being concerned that this pressure might be too low for quick recovery. The Safety Thermal Limit Recorder also provides on the outer edge of the chart a record of the frequency and duration of the flow diversion which is actuated by the micro-switch on the flow diversion valve.

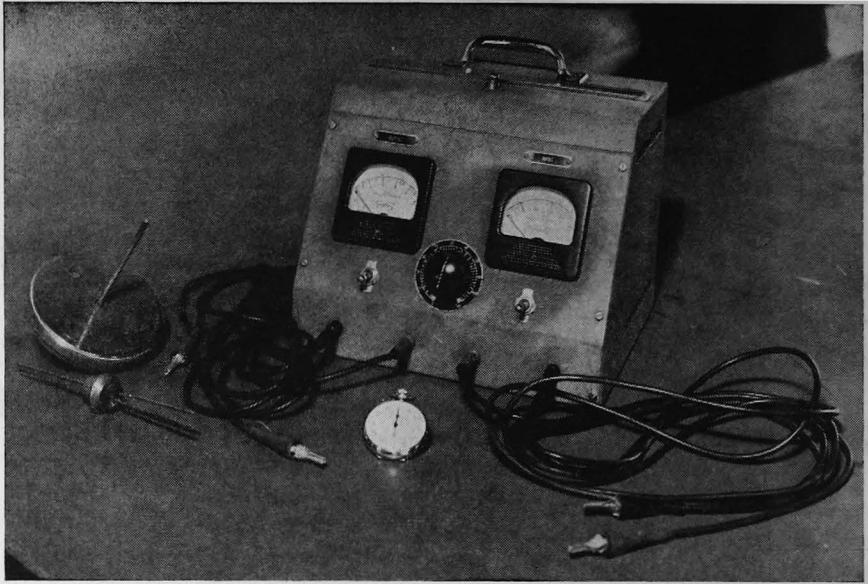


NOTE: SOLENOID VALVE IS SUPPLIED ON MOUNTING BRACKET OF FLOW DIVERSION VALVE. FOR CONVENIENCE THEY ARE SHOWN SEPARATED.

*-OPTIONAL. SUPPLIED AS STANDARD FOR INSTALLATIONS IN NEW YORK CITY AREA.

Courtesy Taylor Instrument Cos., Rochester, N.Y.

Figure 63. Air-operated control system for high-temperature short-time pasteurization.



Courtesy Dr. A. C. Fay, H. P. Hood & Sons, Boston

Figure 64. Apparatus for making timing tests: a manually controlled ammeter box with resistance coil, lead wires, one double-type electrode, one single-type, and a stop watch

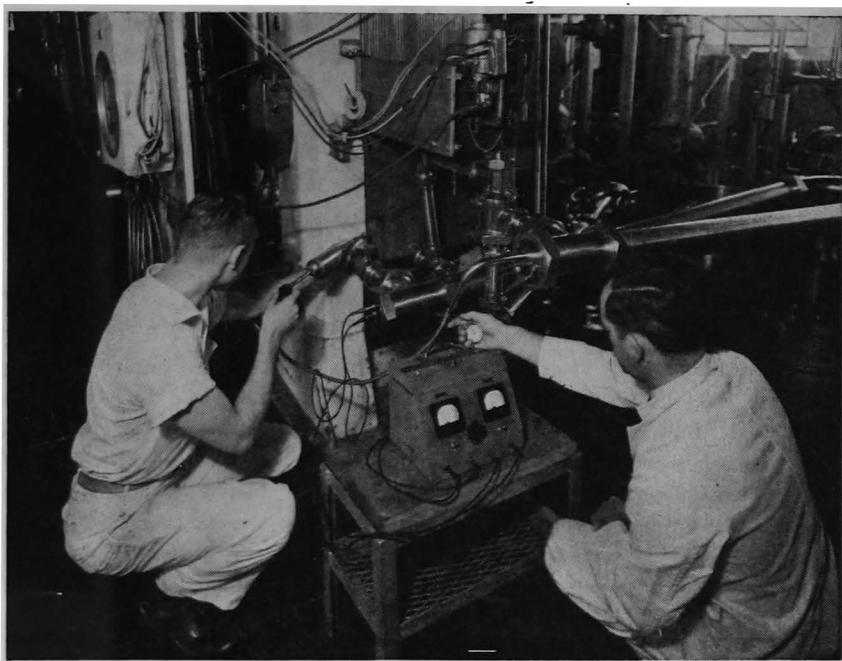
APPARATUS REQUIRED FOR MAKING THE TIMING TEST* (SEE FIGURE 64)

1. One ammeter registering 25 milliamperes with electric wire leads and a second registering 5 milliamperes with wire leads, both in a resistance box and each ammeter connected with a dry cell through a switch and two lead wires. The knob on the dial in the center of the box is connected with a resistance coil to be used only when the conductivity of the water supply used to operate the pasteurizer during the testing period is sufficiently high to deflect the needles of the ammeters before the salt solution is injected. Under these conditions the ammeter is less sensitive and the measurements less accurate.

2. Double type electrodes. One set for use at the upstream end of the tube made by inserting two brass or copper wires through a two-hole rubber stopper in a beveled metal ring. A second set for use at the downstream end of the holding tube made by inserting two brass or stainless steel rods about six inches long through holes bored in a cap end plate. These rods are insulated from the cap end plate by plastic sleeves.

3. A special cap end with one-half-inch threaded brass pipe fittings to be inserted at the opening normally occupied by the indicating thermometer

* Fay, A. C., and Fraser, Joseph. Precision timing of short-time high-temperature pasteurizers. *Journal of Milk Technology*, 6:321-330, November-December 1943.



Courtesy Dr. A. C. Fay, H. P. Hood & Sons, Boston

Figure 65. Timing test about to be started, showing properly connected equipment ready for operation

between the outlet of the final heater section and the upstream end of the holding tube.

4. An alemite gun or large veterinary type syringe with appropriate fittings. The fitting where the alemite gun is connected is provided with a small stopcock to permit removal of the alemite gun for refilling without removal of the cap end from the line.

5. A stop watch.

6. A saturated salt (sodium chloride) solution.

PROCEDURE FOR MAKING THE TIMING TEST

1. The ammeter labeled "input" (25 milliamperes) is connected with the electrodes located in the upstream end of the holding tube, and the ammeter labeled "output" (5 milliamperes) is connected with electrodes in the downstream end of the holder.

2. With the electrodes properly mounted and connected to the ammeter box, the alemite gun or syringe full of saturated salt solution and connected to the assembly as shown in Figure 65, and the pasteurizer operating with water instead of milk at normal temperatures so as to keep the flow-diversion valve in the forward-flow position, the measurement is ready to be made. The

stopcock in the half-inch brass pipe connecting the alemite gun and the "milk" line is opened and immediately the salt solution is injected by shoving the piston of the alemite gun forward. The pressure applied to the piston of the alemite gun should be firm but not sufficiently rapid to encourage driving of the salt solution into the tube at a rate faster than the normal speed of the flow of the water (or milk) through the tube. The pressure applied should also be uniform with replicate measurements. It is important to note that the salt solution is injected into a tube which is at right angles to the holding tube. This is done to avoid channeling of the salt, which might occur if the alemite gun were attached to the inlet cap end of the holding tube and the salt solution forced directly into the channel of the stream.

Almost immediately after the salt solution is injected (see Figure 65), the needle on the input ammeter will be suddenly deflected because the ions of salt have greatly increased the conductivity of the water separating the electrodes in the upstream end of the holding tube, thereby completing the circuit of the battery and the ammeter. The stop watch should be started at the first deflection of the needle of the input ammeter. At this time the needle on the output ammeter shows no deflection because the electrodes are separated by pure water, which is a poor conductor. The instant the injected salt ions reach these output electrodes, however, the needle shows deflection, and the watch should be stopped. Although a large amount of salt is injected, it is sufficiently diluted in its travel around the holding tube to make the deflection of the needle on the output ammeter less sharply defined than is obtained with the input ammeter. For this reason, a more sensitive ammeter is needed for the output assembly and more attention must be given to the sensitivity of the electrodes employed at this point. The electrodes may be rendered more sensitive by making them longer or by placing them closer together, but they should not be so long as to extend beyond the "T" fitting in the end of the holding tube. There is a practical limit, however, beyond which the sensitivity of the output assembly should not be increased, because the normal conductivity of the water may cause deflection of the ammeter and thereby interfere with accurate determinations. Although some difficulty may be encountered in determining just the instant to stop the watch, reasonably uniform replicate determinations can be made with a little experience and perhaps some trial-and-error readjustments of the electrodes at the output end of the assembly.

While this discussion has been devoted primarily to a method of precision testing of high-temperature equipment, first-hand experience in the field will serve to crystallize in the sanitarian's mind the actual steps to follow. To insure a thorough technical knowledge of the entire process, assistance and advice should be enlisted from state milk sanitarians in connection with this work, manufacturers' catalogs should be consulted, and careful observations made in plants where high-temperature pasteurization is used.

In addition to the Fay and Fraser article from which much of the material in this discussion is quoted, the following publications may be consulted on the general subject of high-temperature pasteurization:

Farrall, Arthur W. Dairy engineering. New York, John Wiley & Sons, Inc., 1942.

Federal Security Agency, U. S. Public Health Service. Milk ordinance and code recommended by the U. S. Public Health Service, Public Health Bulletin 220, Washington, D. C., 1939.

Journal of Milk Technology, September–October 1944. A series of four articles on certain aspects of high-temperature pasteurizers.

Catalogs of the Cherry-Burrell Corporation, 427 W. Randolph St., Chicago 6, Ill.; the Creamery Package Manufacturing Co., 1243 W. Washington Blvd., Chicago 7, Ill.; the Taylor Instrument Companies, Rochester 1, N. Y.; and the York Corporation, York, Pa.

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