

Abbreviations of societies and agencies

AMI	American Meat Institute
AOAC	Association of Official Analytical Chemists
APHA	American Public Health Association
CEC	Commission on the European Communities
DHSS	Department of Health and Social Security (UK)
EEC	European Economic Community (now European Communities)
FAO	Food and Agriculture Organization of the United Nations
FDA	United States Food and Drug Administration
FPI	Food Processors Institute
HPB	Health and Protection Branch, Health and Welfare Canada
HWC	Health and Welfare Canada
IAMS	International Association of Microbiological Societies
ICMSF	International Commission on Microbiological Specifications for Foods
IDF	International Dairy Federation
IEC	International Egg Commission
IOCC	International Office of Cocoa and Chocolate
ISO	International Standards Organization
IUBS	International Union of Biological Societies
IUMS	International Union of Microbiological Societies
NAS	National Academy of Sciences of the United States
NCA	National Canners Association
NCDC	United States National Communicable Disease Center
NCI	National Cheese Institute
NFPA	National Food Processors Association
NRC	National Research Council of the United States

NSDA	National Soft Drink Association
OSU	Oregon State University
USDHEW	United States Department of Health, Education and Welfare
USPHS	United States Public Health Service
WHO	World Health Organization of the United Nations

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Collecting and handling sample and analytical units

The objective of sampling is to obtain a representative sample of a food and to submit sample units to the laboratory in a condition bacteriologically unchanged from that existing at the time of sampling. All persons concerned with sampling should take appropriate measures to prevent, as far as possible, any contamination of either the food consignment or the sample units and any microbial growth or death within the sample units during transport to the laboratory and during subsequent storage and handling.

The sampling directions given in this chapter are considered good practice and should be followed whenever possible. The directions are those that apply generally, in collecting, labelling, transporting, and storing sample units, and in preparing them for laboratory analysis. It is, of course, difficult to lay down fixed rules to be followed in every situation, and in particular circumstances they may require some modification. Specific sampling directions relating to a given food or class of food are given in Chapters 11–26.

A. SAMPLE UNIT VS ANALYTICAL UNIT

A sample may consist of one or more sample units. A sample unit is the individual portion or container of food randomly taken as part of the overall sample; an analytical unit is that part of the sample unit actually used in an individual analysis in the laboratory. The two may be the same. In many situations, sample units will consist of unopened containers (e.g., hermetically sealed cans, consumer-size packages of frozen foods) holding many times the amount of food needed for the analytical unit.

Each sample unit provides only one result for each test carried out.

The food homogenate prepared from one analytical unit (ICMSF, 1978, pp. 108–111) will often provide enough material for a number of different microbial tests, but occasionally it will be necessary to take two or more analytical units from the same sample unit. For example, when tests for coliforms, staphylococci, and *Salmonella* are being run on the same food, one analytical unit is required for the preparation of the homogenate (to be used for tests for both the coliforms and staphylococci) and one other for *Salmonella* enrichment.

B. GENERAL DIRECTIONS

(a) *Materials*

1 *Sample containers.* Use clean, dry, sterile, leakproof containers such as wide-mouth glass or plastic jars or bottles, stainless metal cans, or disposable plastic bags, whose capacity is adequate for the sample unit desired. Usually they have a capacity of at least 8 oz (227 g). Containers to be reused should be of a quality suitable for repeated sterilizations (see (b) below). Use jars, bottles, and cans with screw-type caps. Insoluble non-absorbent cap liners are necessary; impervious liners made of pressed pulp faced with vinylite are satisfactory. Moulded rubber, plastic, or cork stoppers may be used, but should be covered with an inert material such as aluminum foil or a plastic sheet before they are pressed into the sample container. Disposable plastic bags must be sealed securely after filling so that they cannot leak or become contaminated during normal handling. It is a good practice to place one bag inside another (double thickness) to resist puncture.

2 *Instruments for opening food packages.* Sterile scissors, knives, can-openers, saws, as required, can be used to open food packages.

3 *Sampling devices.* Sterile scoops, spoons, triers, probes, drill bits, tongs, forks, cork-borers, pipettes, and swabs can be used for collecting sample units. Sterile scissors or knives may be needed to cut portions from large items of food.

4 *Labels or markers.* Containers can usually be labelled by marking them with a felt-point indelible marking pen. However, light-coloured waterproof cardboard tags with reinforced eyelet holes and wire or cord ties or gum-backed paper labels or adhesive-backed tape can be used to identify samples. Labels should be big enough to carry all relevant data (see (e) below).

5 *Sterilizing and disinfecting equipment.* In the laboratory, sampling containers or implements should be sterilized in either an autoclave or

an oven capable of reaching a temperature of 170°C. In the field, a pressure-cooker, a steam-chamber, or a hydrocarbon (propane or butane) torch or burner is necessary for sterilization. Disinfecting agents, such as alcohol (95% ethyl or isopropyl), which is subsequently flamed, or hypochlorite solution, which is not a sterilant (made up to 100 ppm and discarded when it falls below 50 ppm), may be used in the field when the above procedures are not practical.

6 *Storage and transport of samples.* A plastic-foam or other insulated container of sufficient capacity is needed for holding and transporting chilled or frozen sample units. Appropriate racks may be needed to secure sample units or prevent leakage or contamination of them during transit. Either ice or plastic or metal containers filled with refrigerant or water and frozen are needed to keep sample units cool. Dry ice is needed to keep frozen sample units frozen.

7 *Cold storage of samples.* In the field, sample units should be stored in either a refrigerator in the establishment from which the samples are being collected or an insulated container with ice or cold containers as described above. Sample units may be chilled first under running water or in ice- or water-baths. In the laboratory, a refrigerator capable of maintaining the sample units at 0–5°C is essential. A freezer or freezer compartment of a refrigerator, depending on the volume of frozen samples received, capable of maintaining samples at –10°C is also required.

8 *Temperature-measuring device.* A device such as a thermometer or thermocouple probe and potentiometer is needed to measure temperatures of food and storage units. Many varieties of digital or recording potentiometers with one or more thermocouple probes are available; these offer more flexibility than thermometers. Metal bayonet (at least 5 inches long), dial-faced (graduated at intervals of not less than 2°C and covering a range of –10°C to 110°C) thermometers have proved useful for measuring food temperatures in the field.

(b) *Sterilizing sampling containers and utensils*

1 Sterilize all sample containers and utensils that are to come in contact with a food. As a rule, sterilize beforehand in the laboratory by one of the following methods:

- a Autoclaving at 121°C for 15 minutes. Use this method for all materials containing water and materials likely to be damaged by dry heat (e.g., rubber).

- b* Exposing glassware, metal containers, and implements and similar materials to hot air (170°C) in an oven for at least 1 hour.
- 2 Try to bring enough pre-sterilized sampling utensils from the laboratory to collect the desired number of sample units. If additional samples are to be collected after the pre-sterilized utensils have been used, clean (wash, rinse, and dry) used ones at the site and sterilize or disinfect them by using one of the following methods:
 - a* Autoclave them in a small (20–30 litre) pressure-cooker at 121°C for 15 minutes.
 - b* Expose them in a chamber to steam at 100°C for 1 hour.
 - c* Heat them in a small, portable hot-air oven at 170°C for 1 hour (assuming power is available).
 - d* Flame the part of the utensil that will contact food thoroughly with a propane or butane torch or Bunsen burner (taking care not to overheat sampling equipment).
 - e* Immerse them in 95% ethyl or isopropyl alcohol for 3 or more seconds and flame to burn off the alcohol. Repeat this procedure twice more, making sure on each occasion that the flame is out before reimmersing the utensils in the alcohol.
 - f* Immerse them for at least 30 seconds in hypochlorite solution containing not less than 50 ppm of available chlorine or other acceptable halogen sanitizers which are of a concentration equivalent to at least 50 ppm hypochlorite (not a sterilant).

Do not use method *d* or *e* if there is danger of fire or explosion. Methods *b* through *f* may not kill all spores.

(c) Collecting sample units

- 1 Only an authorized person properly trained in the appropriate techniques should collect sample units. This person may be assisted by other persons under his or her supervision.
- 2 If possible, collect sample units during unloading of a cargo of food (from a ship, truck, airplane) randomly from all parts of the load. Otherwise, collect samples randomly from the 'frame' (see Chapter 3, Section D).
- 3 If all individual packages are accessible, choose those to be sampled by use of random numbers (see Chapter 3, Section C).
- 4 When sampling large cartons containing smaller packages, choose the desired number of cartons at random, and from each of these, again

at random, take the desired number of smaller packages. At each stage, use random numbers (see Chapter 3, Section C).

5 Submit sample units to the laboratory in original unopened containers whenever practicable. This will reveal the condition of the product as prepared or altered by subsequent storage and, in the case of samples taken at the retail level, as offered to the public.

6 Take at least twice the amount required for analysis in the laboratory (i.e., in most situations, about 200 grams) to provide a reserve portion in case of accident or later enquiry. Store the reserve under conditions in which its microbial condition will not change appreciably.

7 If the product is in containers too large to be easily transported to the laboratory, transfer representative sample units to separate sterile containers under aseptic conditions. Remove surface contamination on appropriate areas of the food package and the sample container by wiping with 70% alcohol, after removing gross dirt by washing or sponging with 70% alcohol or, in the case of paper containers, by removing the outer ply. Open sealed food packages carefully with a sterile cutting instrument such as scissors or a knife, as appropriate. Use a separately sterilized instrument for each package to avoid cross-contamination. Exercise special care where the risk of cross-contamination is high (e.g., with light powders or pressurized packages). Do not open hermetically sealed cans under field conditions. Submit such cans to the laboratory as sample units.

8 If the food is in bulk, sample consistently from various places within the container(s) rather than, say, just from the top or bottom (unless experience assures complete mixing, or unless sampling from some particular place(s) has become accepted as a result of long experience), or choose the sampling site randomly.

9 When sampling from an outlet or sampling port of a bulk container, allow some material to pass through to 'flush' the port before collecting the sample.

10 Avoid contamination when taking a sample unit from bulk or from a food package and when transferring the material to the sample container.

11 Use an instrument appropriate to the physical state of the food for collecting sample units. For example, triers may be useful for sampling blocks of hard cheese, a drill and bit for frozen products, scoops or hollow probes for dried foods, pipettes or dippers for liquids, and spoons for mixed foods (see recommendations for particular foods in Chapters 11-26).

12 Strive always to obtain a representative sample. Where possible,

agitate liquid, free-flowing, or suspended materials until the product is homogeneous. If feasible, unwieldy brittle material, such as certain frozen liquids, may be placed in a large sterile container (e.g., a strong plastic bag) and broken into smaller pieces with a blunt instrument. If this procedure is not feasible, lay the material on a sterile surface and aseptically break it into smaller fragments using a suitable instrument such as a sterile hammer and sterile chisel. Take sample units from the crushed material.

13 Measure the air temperature of the storage room or shipping vehicle as well as the temperature of the food from which the sample is drawn. Do not insert a thermometer into the food until after the sample has been taken. Disinfect the thermometer or thermocouple between measurements to avoid cross-contamination. In instances where small packages are sent unopened to the laboratory, record the temperature of the food in an adjacent package in the same case or carton. The temperature of boneless moist food or dried foods collected in plastic bags can be taken by folding the filled bag around the stem of the thermometer or sensor of a thermocouple and waiting until the temperature reading stabilizes.

(d) *Number of sample units*

Draw the number of sample units specified in the sampling plan used. See Chapters 11–26 for recommendations for individual foods and cases; also Chapter 3, Sections B and C, for what constitutes a representative sample and recommendations on random sampling, and Section B of this chapter for recommendations on the amount of food to take for each sample unit.

(e) *Labelling sample containers*

- 1 Label all sample unit containers immediately before or after the sample unit is taken. Fix the label to prevent accidental removal during subsequent handling.
- 2 Number the sample unit container or write the number on the label. Make a related record including all the information necessary to identify the sample (see (j) below).
- 3 When the sample unit is taken from a larger container such as a bag or carton, identify this container with the corresponding number of the sample unit, in the event a subsequent examination is required.