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Procedural Compliance Prevents Illnesses Caused by Microorganisms in Food

Hygienic practices and time-temperature awareness by cabin crews help reduce the risk of outbreaks of foodborne illnesses. Outbreaks involving airline meals have been rare, but complacency and errors weaken the defenses that keep food and water safe from invisible hazards.

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FSF Editorial Staff

Updated recommendations from several sources currently reflect a global consensus about appropriate training and duties of cabin crewmembers within the food-safety systems of airlines. Examples include guidelines for cabin crews in July 2002 from the International Air Transport Association (IATA), which said that "cabin crew should follow the same code of practice as food handlers on the ground."[1] Similarly, the International Flight Catering Association (IFCA) and the International Inflight Food Service Association (IFSA), which published guidelines for flight caterers in February 2003, have said that a strong interdependency exists between flight caterers and cabin crews. One IFCA book said that flight attendants provide the last safety link in the custody of food.[2]

Preparing and/or serving meals aboard aircraft sometimes has been perceived as a service issue that is separate from the cabin crew's primary responsibility for safety. As a result, differences in responsibilities between flight attendants and food workers — rather than their common interests — sometimes have been the focus of safety discussions. Both groups are essential to an airline's defense against the invisible hazards known as pathogenic (disease-causing) microorganisms or pathogens, which primarily include — in the context of airline meals — bacteria and viruses that have proven to cause specific illnesses in passengers and crewmembers.

"Although flight attendants' final preparation and presentation of a meal affects passenger perception of the airline … storing, reheating (rethermalizing/regenerating) and serving food require attention to safety issues," IFCA said.

Properly trained cabin crew will not conduct the meal service if they have any doubt about the quality of food — for example, abnormal odor, color or texture. Investigations of outbreaks of foodborne illness, however, show that contamination often is insidious because pathogens can be impossible to detect except by microbiological testing in a laboratory. Moreover, some outbreaks are not reported because this requires laboratory analysis of specimens that identify a causative agent and epidemiological analysis that implicates food as the source of the illness.[3]

"Microbiological hazards are the most prominent risk factors connected with [airline] food production," said Maija Hatakka, a researcher in Finland who conducted several studies of foodborne illness involving airlines during the 1990s. "They arise owing to the complexity of the operation in the flight kitchen, long food-production chains and on-board service with limited facilities. … Galley space and sanitary facilities on airplanes are very limited. … Microbiological hazards are associated with the raw ingredients, staff and processes, as well as serving [meals] on aircraft."[4]

Factors that affect microbial growth (i.e., increase in the quantity of pathogens) in food include time of exposure to environmental factors, temperature, water content, intrinsic saltiness or acidity of the food, and control of temperature during processing, distribution and storage.[5] In general, bacteria of concern cause two primary problems: If they increase to a sufficient quantity, they can infect people with specific illnesses, and in some time-temperature conditions, they can produce deadly toxins. Several viruses are of concern in food safety because very small quantities of viruses (infective doses) typically can infect people — especially those who have a weakened immune system — with specific illnesses.

"The temperature range between 41 degrees and 140 degrees Fahrenheit (F; 5 degrees and 60 degrees Celsius [C]) is considered a danger zone because bacteria that cause foodborne illness and bacteria that cause food spoilage multiply when food is held within this range," IFCA and IFSA said.[6]

Foodborne illness in air transport can have the following consequences:[7]

- During flight, one or more pilots or cabin crewmembers could collapse or otherwise become incapacitated suddenly. This could occur when food-storage conditions have enabled growth of hazardous microorganisms and bacterial toxins have formed;

- During flight, one or more pilots or cabin crewmembers could experience subtle incapacitation that affects ability to perform duties. This could occur before the onset of symptoms such as stomachache, nausea, diarrhea or headache;

- An in-flight outbreak of foodborne illness could require diversion of the flight; and,

- After a flight, from a public health standpoint, an outbreak of foodborne illness could be undetected if symptoms do not appear until after passengers and crewmembers have dispersed, possibly losing the opportunity to identify the source and take corrective action.

IATA recommends that airlines establish and enforce policies that require all cabin crew to be medically screened before employment and require cabin crew to affirm that they are in good health when they report for duty. This practice is especially relevant to food safety if a flight attendant has had a gastrointestinal disease or other food-related illness.

Many airlines currently use the hazard-analysis critical control point (HACCP) system to manage the microbiological quality of food. This is a method of identifying the hazards in a process and then identifying critical control points where the hazard can be controlled. Preventive measures then focus on specific risks, and their effectiveness is determined by microbiological testing.[8]

Past Outbreaks of Illness Influence Current Practice

The U.S. Food and Drug Administration (FDA) says that the number of illnesses transmitted by people who prepare and serve food requires rigorous intervention measures, including exclusion of ill workers from the workplace, removal of pathogens from the hands and the use of barriers to prevent bare-hand contact with ready-to-eat foods.[9]

One review of scientific literature about outbreaks of foodborne illness that resulted from contamination by food workers from 1975 to 1998 — including those involving airline meal service — found that 93 percent involved food workers who were ill either prior to the outbreak or at the time of the outbreak. Two viral agents were the cause in 60 percent of outbreaks; in the United States, seven pathogens found in meat, fish and dairy products were estimated to cause annually approximately 3.3 million to 12.3 million cases of illness and 3,900 deaths.[10]

"Approximately 9,000 air passengers and crewmembers have been reported to have suffered from food poisoning [in scientific studies of outbreaks of foodborne illness associated with commercial passenger aircraft]," Hatakka said. "The number of reported deaths was 11. … Air crews have been involved in 11 outbreaks associated with aircraft meals."

Historically, outbreaks of foodborne illness associated with airline meals have been recognized infrequently and food-handling errors — especially improper food-holding temperatures — have been associated with most of the outbreaks that have been investigated. For example, investigators found after one outbreak that the flight-catering kitchen appeared to be of modern design, visibly clean and reportedly operated under current systems for prevention of foodborne illnesses. Nevertheless, their report said that although food workers had paid sick leave, some of them said that they had worked while experiencing a diarrheal illness. The report also said, "Cold food items were found at temperatures above 4 degrees C [39 degrees F], food handlers were not adhering to hand-washing policies, and food-contact surfaces of equipment were not being adequately cleaned and sanitized. … It was an apparent failure to adequately train and supervise food handlers on the production lines that led to the occurrence of this outbreak."[11]

Aboard the aircraft, cooking food from raw ingredients presents the greatest risk of foodborne illness because of the relative probability that food could be undercooked and/or safe time-temperature conditions for ready-to-eat foods could be exceeded, potentially resulting in a high severity of foodborne illness. Cooking on board essentially requires that raw food be cooked to safe core temperatures — according to scientific national standards — that will eliminate undesirable pathogens. Current guidelines of the flight-catering industry recommend searing of specified meats and fish in the flight-catering kitchen and reheating temperatures that do not require the flight attendant to measure — for food-safety purposes — the time that the core temperature has been maintained. Use of the probe on a calibrated temperature-measuring device enables the flight attendant to determine that each batch has met the temperature requirement; if not, the flight attendant must continue cooking that batch until the temperature requirement is met.[12]

Current practices to prevent foodborne illness associated with airline meals have evolved partly from investigations of outbreaks since 1947. A summary of 23 outbreaks that involved 120 commercial airline flights from 1947–1984 found that crewmembers were affected by foodborne illness in eight of 12 outbreaks for which information was available, and that no waterborne-illness outbreaks were reported. In some of these outbreaks, investigators found that crewmembers had consumed passenger meals that contained pathogens rather than special crew meals that did not contain pathogens. In another outbreak during this period, all 10 crewmembers and no passengers became ill because only the crew meals contained pathogens.[13]

Investigation of one outbreak involving an international flight in 1984 found that flight deck crewmembers and cabin crewmembers had eaten foods from the first-class passenger menu rather than crew meals that were provided as a defense against in-flight foodborne illness.[14] A summary of 30 outbreaks in civil aviation from 1961 to mid-1976 found that some had involved storing meals under time-and-temperature conditions that would not comply with current guidelines — and preparation activities by flight attendants sometimes were involved. In one outbreak, for example, pathogen-contaminated meals for one delayed flight had been stored at room temperature for six hours, then at 10 degrees C (50 degrees F) for 14.5 hours before transport to the aircraft, then stored at room temperature inside the aircraft for approximately eight hours. The resulting in-flight illness affected 196 of 344 passengers beginning about eight hours into the international flight; 143 passengers were hospitalized for as long as 10 days.[15]

The most recent outbreak described in medical journals occurred in 1992, when 75 of 336 U.S. passengers contracted cholera after consuming a cold seafood salad; one passenger died, and 10 passengers were hospitalized. Investigation by national health authorities did not reveal a mechanism of contamination in the non-U.S. flight-catering kitchen; and U.S. investigators could not determine how the salad became contaminated with the microorganism that caused cholera, the report said. Airlines and passengers were advised to use caution when providing/consuming cold-food airline meals prepared in any country that is experiencing a cholera epidemic.[16]

During the past five years, the most common food-safety deficiency identified on aircraft inspected by FDA in the United States has been inadequate temperature control. FDA inspectors found internal temperatures of entrees and other food items — including some crew meals — higher than allowed by food-safety standards. The improper holding temperatures were measured by FDA inspectors in first-class meals, business-class meals and coach-class meals. Examples of the foods cited include roast-beef sandwiches, chicken breasts, turkey sandwiches, chicken salad, salad dressing, scrambled-egg sandwiches, low-fat yogurt, cantaloupe salad and cream cheese.

Defensive Measures Begin in Flight-catering Kitchens

Although the scale of food preparation for airlines has evolved into computer-controlled mass-production processes, flight caterers must control the microbiological quality of food from the time they receive raw ingredients until trayed meals are delivered to the cabin crew for storage on the aircraft. First-class meals, business-class meals and crew meals may be prepared by chefs in a smaller flight kitchen, but the same microbiological standards apply. Flight caterers typically use cook-chill technology and other processes designed to deliver microbiologically safe food to the aircraft — using ingredients that will withstand processing, chilling, transportation and holding.

Delivery of preset trays and meals to the aircraft galley follows a long sequence of decisions and events, IFCA and IFSA said. In the HACCP system, the sequence begins when specialists conduct a risk assessment of both the probability and severity of foodborne illnesses that could occur under all conceivable scenarios. In some scenarios, if pathogens grow to a dangerous level, "no subsequent step — such as cooking or freezing — will reduce contamination to an acceptable level." The specialists' assessment influences the initial specification of foods for an airline menu and the ingredients of those foods. For example, raw alfalfa sprouts (and other sprouts and fresh herb garnishes that cannot be readily washed and sanitized) and some species of fish that have unacceptable risks of contamination with bacterial toxins can be high-risk ingredients for flight-catering.

Transportation and aircraft loading of meal trays and ready-to-eat food items by the flight caterer normally are considered to involve medium risk of pathogen growth and medium severity of foodborne illness, in part because of the procedures and relatively short times involved. Nevertheless, operations that depart from standard procedures and specified time frames increase the risk that pathogens will grow in food.

"Trolleys that contain food are loaded with dry ice in various forms to minimize temperature rise from the time they leave the flight caterer's refrigerated store and the time they are loaded into the aircraft galley," IFCA said. "The number of blocks used depends on the ambient temperature. Oven containers for meals which are to be reheated are kept in chilled storage until the last minute. Most caterers will supply foods at temperatures at or below 5 degrees C. The methods include solid carbon dioxide [dry ice] within a trolley or cart (blocks, foil capsules, or snow-type packing), fan-assisted chiller units, refrigerators or modified heat exchangers that use outside air."[17]

Responsibility of Cabin Crew Begins at Food Delivery

In simple terms, in-flight meal service involves two broad categories of foods: cook/chill meals and ready-to-eat food items. For example, a cook/chill entree might include meats that are browned and roasted but are not cooked thoroughly so that final cooking can be completed during reheating in an aircraft galley oven. Each flight has a predetermined routine of meal preparation and service for each passenger class.[18]

When the cabin crew accepts delivery of an airline catering order aboard the aircraft, they assume responsibility for the food, beverages and service. At this stage, monitoring storage of chilled food and frozen food is essential to manage temperatures, in addition to counting meals and ensuring that all provisions for the meal service have been delivered.[19]

IATA said that the cabin crewmember in charge should ensure that "food is well sealed and has been sufficiently protected against heat, dust and insects during loading; the time interval when food was taken out of the refrigerator and time loaded in the aircraft remains [within] the acceptable limits; and, in the event of a delay, those appropriate measures have been taken to prevent spoilage of food."

In general, foods that are the most microbiologically sensitive must be stored so that their internal temperatures — not the surrounding air temperature — remain at 5 degrees C (41 degrees F) or colder, IFCA and IFSA said. Other foods that are microbiologically sensitive must be stored so that their internal temperature is 8 degrees C (46 degrees F) or colder. Frozen foods must be stored so that their internal temperature remains at minus 18 degrees C (0 degrees F) or colder.[20]

Correct final reheating of chilled meals and frozen meals to be served as hot meals will render harmless all bacteria or viruses of concern that have survived earlier stages of food processing or have been introduced by contamination. The core temperature of foods must attain 72 degrees C (162 degrees F) for this to occur.[21] For some viruses, however, the most effective method of preventing foodborne illness is to exclude ill food workers from food-related duties for 48 hours to 72 hours after the end of diarrhea and vomiting.[22]

As in the catering environment, final cooking/reheating temperatures must be checked by a specific method. "Unless [otherwise] specified, the core temperature of food should be measured immediately after cooking using a probe thermometer at the slowest heating point of the food item," IFCA and IFSA said. "In addition, where there is a large batch of food in trays on a trolley, the food in the tray at the slowest heating point should be monitored. The temperature probe must be sanitized before and after use to prevent cross-contamination."[23]

Correct training for preparation and service of cook/chill meal trays — including reheating for immediate service in some galley procedures — reduces the probability that flight attendants would either contaminate food or accelerate the growth of pathogens. IFCA and IFSA said that this relatively low risk, however, depends on the following practices (reheating in the galley will not destroy some toxins if they have been produced by bacterial pathogens at an earlier stage):

- Avoiding bare-hand contact with food;

- Managing work so that preparation is completed within time-temperature standards;

- Keeping raw foods, ready-to-eat foods and cook/chill foods separate in the aircraft galley to minimize microbial cross-contamination;

- Complying with personal hygiene standards and requirements of crew health and fitness for duty; and,

- Following procedures for galley cleaning, equipment sanitizing and pest management.

Other issues that require attention by the cabin crewmember in charge include long departure delays, failures of the aircraft environmental-control system that result in cabin temperatures that are higher than normal and malfunctioning galley ovens.

Significant Delays Prompt Food-safety Reassessment

The guidelines by IFCA and IFSA include processes to safely address situations in which the aircraft departure has been delayed. In general, these detailed processes depend on whether meals have been loaded into the aircraft galley, and whether hot meals, chilled meals or both are involved.

For example, corrective action typically can be taken aboard the aircraft (e.g., by adding dry ice to trolleys) to rapidly rechill foods that inadvertently have warmed to a temperature range of 10 degrees to 15 degrees C (50 degrees to 59 degrees F) and to rapidly rechill and serve within two hours foods that inadvertently have warmed to a temperature range of 15 degrees C to 25 degrees C (59 degrees to 77 degrees F). Similarly, corrective action typically can be taken aboard the aircraft (e.g., by reheating one time) to serve hot meals within two hours when the core temperature inadvertently has cooled to less than 60 degrees C (140 degrees F).

If the delay has exceeded four hours and the temperature of chilled food has increased to more than 10 degrees C or the temperature of hot meals has decreased to less than 60 degrees C, consultation by the caterer and the airline's specialists is required to take case-by-case decisions under the specific circumstances — which could include corrective action, discarding the food and/or recatering the food based on the exact circumstances and the applicable policies.

Critical Control Points Include Hygienic Issues

Leadership and oversight by the cabin crewmember in charge reminds other cabin crewmembers to observe airline procedures for food safety, personal hygiene, and cleaning and sanitizing galley equipment.[24] Recommended hygienic practices for cabin crew include the following measures:

- Keeping clean the galley, equipment and working utensils;
- Cleaning and organizing counter surfaces and drawers used for stowing foods and supplies;
- Keeping used items separate from clean items at all times;
- Handling cups and glasses by exterior surfaces, and touching only the handles of cutlery items;
- Avoiding viral contamination of galley working surfaces, food, beverages and utensils by covering the mouth and nose or otherwise preventing contact during coughs and sneezes; and,
- Covering visible breaks in the skin with a waterproof bandage that is replaced regularly and kept clean.

Airline trays and carts are not considered food-contact surfaces unless food is placed directly on the trays or trolleys without a dish or liner, said IFCA and IFSA. Food-contact surfaces must be visibly clean and sanitized; non-food-contact surfaces such as walls and floors must be visibly clean.[25] Similar food-safety measures apply to any ice that is intended for consumption.

"Only ice cubes manufactured from potable water and delivered to the aircraft in sealed polyethylene bags should be put into drinks," IATA said. "Broken block ice must only be used for chilling bottles and cans. Ice should be served by proper tongs and never handled by hand."[26]

Hand Washing Reduces Transfer of Microorganisms

Specialists in prevention of foodborne illness also focus on the role of hands in microbiological contamination of food. Some microorganisms normally are found deep within pores of the skin where they cannot be removed by hand washing and hand drying. Only one type — *Staphylococcus aureus* bacteria — causes food-safety concern when found on the surface of the skin, however. Therefore, the primary purpose of washing hands before beginning galley duties or food service is to remove transient organisms (that is, pathogens in the environment that become attached loosely to the outer layer of skin). Hands, arms and fingers may become contaminated with fecal microorganisms after using the toilet, for example. This concern has a direct application to recommended practices for cabin crews.

In one scientific report of an outbreak of foodborne illness associated with airline meals, investigators noted that proper hand washing aboard the aircraft can require a special effort by cabin crew.

"Although flight attendants frequently handle food, ice and beverages, the hand-washing sinks on aircraft do not facilitate hand washing because of the spring-loaded faucet design," the report said. "This type of faucet requires one hand to hold the faucet open while the other one is rinsed."[27]

Effective hand washing for food safety requires three elements: an appropriate protocol (i.e., instructions on when and how to wash and dry hands), an appropriate hand-washing/cleansing product and compliance. The following recommendations are found among various U.S. guidelines on effective hand-washing techniques before working around food: wetting the hands under comfortably warm water (about 100 degrees F [38 degrees C]); dispensing the recommended amount of a liquid hand-wash product onto the hands; rubbing the hand-wash product vigorously over all hand surfaces (concentrating on spaces between fingers and nail beds); applying a small amount of water and lathering for about 15 seconds; rinsing off the lather for about 30 seconds; and thoroughly drying the hands with a clean paper towel.

Washing hands for a longer time or under hot water typically will not remove the transient pathogens of concern and may increase the transfer of microorganisms from deep within the pores to the skin surface. Studies also have found that washing hands more than 25 times per day is counterproductive because skin irritation, dry skin, chapping and cracking cause problems that increase risk of shedding skin cells and releasing microorganisms on food.

Because bacteria are transferred much more easily from wet hands or moist hands than dry hands, adequate drying with paper towels is important. No normal method of drying hands is perfectly sanitary, but friction during rubbing hands with clean paper towels complements hand washing by removing additional microorganisms. A dry paper towel also can be used to avoid touching faucets, lavatory door handles and towel-dispensers with cleaned hands.

Any use of vinyl gloves or latex gloves — which typically is required for anyone who touches food in a flight-catering kitchen — depends on airline policies and procedures. In general, specific training and procedures are required for the correct use of gloves in conjunction with hand washing in the aircraft galley environment; otherwise, contamination of food can occur readily. Without training and procedures, misunderstandings are common about how gloves can provide protection, and improper use of gloves can increase risk of food contamination or cross contamination.

Maintenance, Replenishment Practices Help Protect Water

No outbreaks of waterborne illness associated with potable-water systems on civil transport aircraft were found during a search of medical literature in 2003. One summary of the medical literature about foodborne illnesses associated with airline meals also said that no cases of waterborne illness had been documented.[28] Nevertheless, public concerns about microbiological hazards in potable-water systems recently have increased educational efforts by some authorities and their enforcement of regulations.

Public health regulations and/or environmental regulations of many countries require that water dispensed from aircraft potable-water systems comply with standards for drinking water set by the World Health Organization (WHO). By complying with microbiological quality standards for drinking water — regardless of the use of bottled waters in cabin service — airlines can ensure that water from the potable-water systems will be satisfactory for beverages and cabin crew hygiene, including hand washing.[29]

Drinking water standards do not require absolute purity; rather, they help to ensure that pathogens have been removed or treated so that they cannot cause illness in healthy people.

"Microorganisms will normally grow in water, and on surfaces in contact with water as biofilms," said a 2002 WHO report. "The principal determinants of [microbial growth after drinking-water treatment] are temperature, availability of nutrients, and lack of residual disinfectant. … Water systems on conveyances such as ships and aircraft present specific challenges to water safety management. These include both the physical characteristics (extensive complex piping in confined space, physical movement) as well as organization issues, such as multiple responsible parties in different locations and at different stages of delivery. … [A microbiological] test may indicate the need to examine procedures for taking on water, maintenance of the system and disinfection."[30]

Some microbial hazards may be more difficult to manage in bottled water than in tap water, said WHO. Neither type of water is sterile; both must meet microbiological quality standards.

"Bottled water is stored for longer periods and at higher temperatures than water distributed in piped distribution systems," WHO said. "Control of materials used in containers and closures for bottled waters is, therefore, of special concern. In addition, some microorganisms, which are normally of little or no public health significance, may grow to higher levels in bottled waters. This growth appears to occur less frequently in gasified water and in water bottled in glass containers compared to still water and water bottled in plastic containers. However, the public health significance of this remains little understood, especially for vulnerable individuals, such as infants and children, pregnant women, immunocompromised individuals and the elderly. In regard to infants, bottled water is not sterile; it should be disinfected — for example, by boiling for one minute — prior to its use in the preparation of infant formula."[31]

Various types of potable-water systems are used on transport aircraft, and several new technologies have been approved. Whichever technology is used, correct operation and maintenance are the keys to acceptable microbiological quality.

"The water supply on a modern aircraft is stored in large stainless steel [tanks] or reinforced fiberglass tanks [or composite tanks] built into the aircraft structure, from which the water is fed by gravity or pump to all outlets, including galleys, sink taps, wash hand basins and drinking points," said one British report about airline microbiological safety. "The water is supplied to the aircraft via a fill point on the belly of the aircraft, and is fed either directly from the [water-main] supply by hose pipe, or more often, via a self-propelled tanker or water bowser [tank cart]."[32]

The most widely used potable-water systems on transport aircraft require careful selection of sources of microbiologically tested potable water; applying hygienic methods to fill systems only from these sources; preventing/removing microbiological contamination of the aircraft system by various technologies; filtering the water to remove odors, tastes and visible particles; and distributing water to aircraft galleys and lavatories. Some technologies approved relatively recently by environmental authorities and civil aviation authorities are designed to provide continuous in-flight treatment of water. For example, microfiltration filters currently used on some transport airplanes remove microorganisms without chemical treatment.[33] Some use disposable filter-cartridge systems designed to prevent problems in galley coffee makers.[34] Some airlines have redesigned their potable-water systems to eliminate the need for onboard filtration by monitoring the microbiological quality of water at the source before replenishment.[35] One system being designed for the Airbus A380 will provide on-board mixed-oxidant disinfection of water — based on technology using water, salt and an electrolytic cell — enabling airlines to rely entirely on the aircraft system to produce drinking water.[36] Another example is a system approved by civil aviation authorities in the United States and Canada, which currently is used on some business jets and some privately registered transport jets, to circulate water through a prefiltration device then through a chamber where ultraviolet light inactivates the bacteria and viruses of concern without chemical treatment.[37]

To protect the potable-water system from microbiological hazards and prevent flight cancellations or delays caused by a failed inspection of the potable-water system, maintenance practices and replenishment practices must comply with airline procedures and applicable regulations. When U.S. authorities have inspected aircraft potable-water systems in recent years, reported regulatory warnings typically have involved the replenishment equipment at the gate — water carts, hoses, nozzles, valves and fittings — rather than the storage and distribution equipment on the aircraft.

One example of regulatory oversight is Canadian regulations that require commercial air carriers to use the following procedures to maintain potable-water systems on aircraft:

- "At least once a month, clean the system, use live steam or chlorine solution to sanitize the system and rinse the system with potable water; and;

- "At least once every two weeks, empty the water coolers and other chilling devices in the potable water system, clean them, sterilize them with live steam or chlorine solution [i.e., leave the solution in the system for a specified period], and rinse them with potable water."[38]

In the United States, FDA publishes information about problems related to inspection of aircraft potable-water systems. FDA documents from 1998–2003 contained the following examples of problems: absence of the required backflow-prevention device at the potable-water hydrant; absence of the required "drinking water only" label of correct size on potable-water carts; absence of caps or guards on hose nozzles; absence of signs instructing personnel to wash their hands before returning to work; absence of documentation to show that the mobile tank, hoses and auxiliary devices regularly were cleaned and sanitized as required; failure to store potable-water equipment in locations separate from other aircraft-servicing equipment; misuse of potable-water hoses for other maintenance purposes; conduct of potable-water-replenishment duties and waste-disposal duties by the same personnel; failure to protect overflow devices on mobile water carts from environmental sources of contamination; use of garden-grade hoses rather than required food-grade hoses; unsanitary conditions in potable-water cabinets; and aircraft panels mislabeled for "water servicing" rather than "potable-water filling."

Reports From Cabin Crews Influence Corrective Actions

In summary, IATA said in 2002 that food-safety training for cabin crews should cover at least "company regulations and procedures; essentials of food hygiene; risks and precautions; health requirements of cabin crew; cabin galley features and use of all equipment; use of protective clothing; code of practice in handling food, cooking times, chilling, etc.; personal hygiene; special meals; airline catering orders; acceptance of the delivery of food on the aircraft; [and,] how to deal with cases of food poisoning."

Part of the flight attendant's role as the last safety link in the custody of food is to document in-flight concerns and occurrences, and to report problems and anomalies to the cabin crewmember in charge or others as required by policy. A medical incident report form should be completed whenever a passenger or crewmember becomes ill during flight and foodborne illness is suspected. Comments from passengers or crewmembers regarding food items also should be reported to enable the airline to quickly review and resolve the problem with the flight caterer. If complaints are received, they should be documented and samples of the suspect food should be kept for investigation at the arrival station. For cabin crews, reporting discrepancies such as incorrect storage or substandard quality of catering products is essential not only to complete meal service but to avoid non-routine scenarios that could result in compromised microbiological safety.[39] ♦

Notes

1. International Air Transport Association (IATA). *Inflight Management Manual.* Second edition. 1 July 2002–30 June 2003.
2. International Flight Catering Association (IFCA); International Inflight Food Service Association (IFSA). *IFCA and IFSA World Food Safety Guidelines.* February 2003. The guidelines were developed by specialist representatives from international flight caterers, airlines, suppliers and the World Health Organization.
3. IATA; IFCA and IFSA.
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17. Jones and Kipps.

18. Jones and Kipps.

19. Jones and Kipps.

20. Jones and Kipps.

21. Hatakka, M.; Asplund, K. "The Occurrence of Salmonella in Airline Meals." *Acta Veterinaria Scandinavica.* Volume 34, 1993, 391–396.

22. Guzewich and Ross.

23. IFCA said that cross-contamination means direct transfer or indirect transfer of microorganisms from raw foods, food handlers, food-contact surfaces and equipment to ready-to-eat foods. Direct transfer takes place primarily by direct contact between the source and the ready-to-eat food; indirect contact occurs when the source has contaminated a surface, utensils, temperature probe or flight attendant's hands and microorganisms then are transferred when ready-to-eat food contacts the same surface, utensil, probe or hands.

24. IFCA guidelines said that sanitizing means "removing dirt and microbial contamination from a food-contact surface or object so that they will be safe to use in terms of public health requirements."

25. IFCA and IFSA.

26. IATA.

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