Attachment 3. Definition of Contributing Factors to Foodborne Illness Outbreaks

The following table contains guidance and definitions for factors that introduce or otherwise permit contamination, proliferation/amplification, and survival of pathogens into food. This is the newest contributing factor guidance (2022).

Contamination Factors	
C1	**Toxin or chemical agent naturally part of tissue in food** **Description** A natural toxin found in a plant, fungus, or animal; -OR- A chemical agent of biologic origin that occurs naturally in the plant, fungus, or animal or bioaccumulates in the plant, fungus, or animal before or soon after harvest or slaughter. **Examples** • Ciguatera fish poisoning due to consumption of tropical marine finfish which have bioaccumulated naturally-occurring ciguatera toxins through their diet • Scombroid fish poisoning due to consumption of fish containing elevated levels of histamine. (However, if there is environmental or traceback evidence of temperature abuse, then please also identify P4 or P5, as appropriate, in addition to C1.) • Mushroom poisoning due to consumption of toxic mushrooms
C2	**Poisonous substance or infectious agent intentionally added to food to cause illness (does not include injury)** **Description** A poisonous substance, chemical agent, or infectious agent was intentionally/deliberately added to the food in quantities sufficient to cause illness. Poisons added because of sabotage, mischievous acts, and attempts to cause panic or for blackmail fall into this category. This CF does not apply to physical objects (such as a sharp object) intentionally added to food to cause injury. **Examples** • Cyanide or phenolphthalein deliberately added to food to cause illness • Methomyl pesticide intentionally added to food to cause illness • *Salmonella* intentionally added to food to cause illness
C3	**Poisonous substance accidentally/inadvertently added to food** **Description** A poisonous substance or chemical agent was accidentally or inadvertently added to the food. This addition typically occurs at the time of preparation or packaging of the food. Misreading labels, resulting in either mistaking poisonous substances for foods or incorporating them into food mixtures, would also fall into this category. **Examples** • Sanitizer or cleaning compound accidentally added to food • Metallic ingredient accidentally added to food (e.g., copper in cake icing)
C4	**Ingredients toxic in large amounts accidentally added to food** **Description** An approved ingredient was accidentally added in excessive quantities to the food so as to make the food unacceptable for consumption. **Examples** • Excessive amount of niacin in bread • Excessive amount of nitrites in cured meat • Excessive amount of ginger powder in gingersnaps
C5	**Container or equipment used to hold or convey food was made with toxic substances**

	Description The container that held or conveyed the implicated food is made of toxic substances. The toxic substance either migrates into the food or leaches into the food through contact with highly acidic foods. **Examples** • Galvanized container used to store acidic food/beverage • Flour stored in a container that previously held toxic materials • Pre-made ice stored in a toxic container **Notable Exceptions** This factor should not be confused with contamination resulting in a waterborne outbreak, rather than foodborne. Waterborne outbreaks generally include contamination occurring in the source water or in the treatment or distribution of water to the end consumer. For example, in drink mix/soda machines, if the water enters a contaminated machine or if there is a problem with the internal plumbing of the machine resulting in contamination (e.g., cross-connections, backflow of carbonated water resulting in copper leaching), this is a waterborne outbreak. For ice, if ice is made with contaminated water, it is also a waterborne outbreak. However, if ice is already made and then it becomes contaminated because it was previously stored in a container made with toxic substances, it is a foodborne outbreak and it would be appropriate to list C5 as a CF. For more examples and details differentiating between foodborne and waterborne outbreaks, please see NORS Appendix A.
C6	**Food contaminated by animal or environmental source at point of final preparation/sale** **Description** The food was contaminated at point of final preparation/sale (e.g., restaurant, private home, etc.) by animal or environmental source(s), such as from dripping, flooding, airborne contamination, access of insects or rodents, and other situations conducive to contamination. **Examples** • Mouse feces in pantry contaminates food • A leaky roof permits water to seep into a walk-in refrigerator and contaminates stored food
C7	**Food contaminated by animal or environmental source before arriving at point of final preparation (pre or post-harvest)** **Description** The food was contaminated before arriving at the point of final preparation by animal or environmental sources, either pre-harvest (e.g., growing field, harvest area, irrigation water, etc.) or post-harvest (e.g., processing or distribution facility, in warehouse storage, during transit, etc.). Note: Traceback may implicate the identification of where the food was contaminated (pre-harvest versus post-harvest). If identified, please indicate this in the Point of Contamination question in the NORS interface; otherwise, please select “before point of final/preparation/sale: unknown”. **Examples** **Pre-Harvest:** • Shellfish from sewage polluted waters or closed beds • Crops watered by contaminated irrigation water • Produce grown in soil contaminated by geese • Live poultry contaminated with *Campylobacter* then slaughtered and poultry distributed to retailers • Eggs contaminated with *Salmonella* **Post-Harvest:** • Peanut butter contaminated by bird droppings in a processing plant • Cheese contaminated with *Listeria* in a cheese manufacturer plant
C8	**Cross-contamination of foods, excluding infectious food workers/handlers** **Description** The pathogen was transferred to the food source from contaminated surfaces, foods, and/or fomites to include, but not limited to, food worker’s hands, cutting boards, preparation tables, utensils, processing lines, etc. **Examples**

	• A ready-to-eat (RTE) food was prepared on the same cutting board as contaminated raw poultry • A food worker handled contaminated raw foods without subsequently washing their hands, and afterward handled an RTE food • Materials used to clean equipment (e.g., cloths, sponges, etc.) that processed contaminated raw foods were subsequently used on surfaces that came in contact with RTE foods without first being disinfected • Contaminated raw foods touched or dripped onto foods that were not subsequently cooked • Contaminated raw foods were processed on shared lines with non-contaminated food items **Notable Exceptions** This CF only applies to foods that are cross-contaminated by other food or fomites, and *not* by an infectious food worker/handler (please indicate C9 instead).
C9	**Contamination from infectious food worker/handler through bare hand contact with food** **Description** A food worker/handler, who is suspected or confirmed to be infectious, used their bare hands to touch/prepare foods that are not subsequently cooked. If it is unknown whether the food worker was wearing gloves or not, then cite C11. If there is evidence for both bare hand contact and glove-hand contact with the food, both C9 and C10 should be cited. This is a typical situation that precedes outbreaks caused by norovirus or staphylococcal enterotoxins. Potential reasons to suspect or confirm that a food worker is "infectious" — an all-inclusive term used to describe all persons who are colonized by, infected with, a carrier of, or ill due to a pathogen: a) They recently displayed or admitted to common enteric disease symptoms (e.g., diarrhea, vomiting, nausea, fever) that may be similar to symptoms identified in those who are ill in the outbreak investigation b) Their household member exhibited similar symptoms directly preceding the outbreak c) They tested positive for an enteric pathogen d) Other epidemiologic or environmental evidence. **Example** • An infectious food worker/handler preparing deli meat without wearing gloves contaminated the food served to restaurant patrons
C10	**Contamination from infectious food worker/handler through glove-hand contact with food** **Description** A food worker/handler, who is suspected or confirmed to be infectious, used their glove-hands to touch/prepare foods that were not subsequently cooked. If it is unknown whether the food worker was wearing gloves or not, then cite C11. If there is evidence for both bare hand contact and glove-hand contact with the food, both C9 and C10 should be cited. This is a typical situation that precedes outbreaks caused by norovirus or staphylococcal enterotoxins. See C9 for a further description of reasons to suspect or confirm an infectious food worker/handler. **Example** • An infectious food worker/handler prepared deli meat while wearing gloves that were not changed after coughing into their hand, which contaminated the food served to restaurant patrons
C11	**Contamination from infectious food worker/handler through unknown type of hand contact with food or indirect contact with food** **Description** A food worker/handler, who is suspected or confirmed to be infectious, used their hands to touch/prepare foods that were not subsequently cooked, but the epidemiologic/environmental investigation was unable to determine whether or not the food worker was wearing gloves during food preparation. -OR- A food worker/handler, who is suspected or confirmed to be infectious, contaminated the food indirectly (no direct bare-hand or glove-hand contact with the food).

	This is a typical situation that precedes outbreaks caused by norovirus or staphylococcal enterotoxins. See C9 for a further description of reasons to suspect an infectious food worker/handler. **Examples** • An infectious food worker/handler prepared deli meat, though it was unknown if gloves were worn, contaminated the food served to restaurant patrons • An infectious food worker/handler contaminated utensils that subsequently contaminated food served to restaurant patrons.
C12	**Contamination from infectious non-food worker/handler through direct or indirect contact with food** **Description** A person other than a food handler/worker who is suspected or confirmed to be infectious, contaminated ready-to-eat foods that were later consumed by other persons, resulting in spread of the illness. A "non-food handler/worker" is considered to be any person who is not directly involved in the handling or preparation of the food before service. Potential reasons to suspect or confirm that a non-food worker is "infectious" — an all-inclusive term used to describe all persons who are colonized by, infected with, a carrier of, or ill due to a pathogen: a) They recently displayed or admitted to common enteric disease symptoms (e.g., diarrhea, vomiting, nausea, fever, etc.) that may be similar to symptoms identified in those who are ill in the outbreak investigation b) Their household member exhibited similar symptoms directly preceding the outbreak c) They tested positive for an enteric pathogen d) Other epidemiologic or environmental evidence. **Examples** • An ill person attended an event and contaminated ready-to eat-foods in a buffet line by handling food before someone else consumed it. • Pizza was prepared by a healthy food worker and arrived pathogen-free. An ill non-food worker, such as a mother, rearranged pizza slices onto plates before serving the slices to a group of children at a birthday party, and these children subsequently developed foodborne illness. • An infectious non-food worker/handler contaminated utensils that subsequently contaminated food at a potluck. **Notable Exceptions** This factor should not be confused with contamination from person-to-person, rather than foodborne. For person-to-person outbreaks, there would be no association with any particular food(s).
C13	**Other source of contamination (specify)** **Description** A form of contamination that does not fit into the above categories.
Proliferation/Amplification Factors	
P1	**Allowing foods to remain out of temperature control for a prolonged period <u>during preparation</u>** **Description** During <u>food preparation</u>, food was kept out of temperature control for a prolonged period that allowed pathogenic bacteria and/or fungi to multiply to an amount sufficient to cause illness or to produce toxins if toxigenic. **Examples** • Improper thawing (such as allowing frozen food to thaw at room temperature or leaving frozen foods in standing water for prolonged periods) allowed pathogens to multiply • Prolonged preparation time (such as prolonging preparation time by preparing too many foods at the same time) allowed pathogens to multiply
P2	**Allowing foods to remain out of temperature control for a prolonged period <u>during food service or display</u>**

	Description During food service or display, food was kept out of temperature control for a prolonged period that allowed pathogenic bacteria and/or fungi to multiply to an amount sufficient to cause illness or to produce toxins if toxigenic. **Examples** • Left foods out at ambient temperature for a prolonged time at a church supper • No time or temperature control measures on a buffet line
P3	**Inadequate cold holding temperature due to malfunctioning refrigeration equipment** **Description** Malfunctioning refrigeration equipment caused foods to be held at an inadequate cold holding temperature. **Examples** • Walk-in cooler malfunctioned causing inadequate cold holding temperature of food • A broken or torn door gasket caused air leakage in a reach-in refrigerator resulting in inadequate cold holding temperature of food
P4	**Inadequate cold holding temperature due to an improper practice** **Description** Inadequate cold holding temperature occurred due to an improper practice. **Examples** • Overloaded refrigerator resulting in poor air circulation • Inadequately iced salad bar • Time/Temperature Control for Safety (TCS) foods, such as tuna or egg salad, were stacked above the fill line of the cold holding wells in a deli cold holding unit
P5	**Inadequate hot holding temperature due to malfunctioning equipment** **Description** Malfunctioning hot-holding equipment caused foods to be held at an inadequate hot holding temperature. **Examples** • A steam table or crockpot broke and caused food to be held at inadequate hot holding temperatures
P6	**Inadequate hot holding temperature due to an improper practice** **Description** Inadequate hot holding temperature occurred due to an improper practice. **Examples** • A steam table or crockpot was not turned on or properly maintained and caused food to be held at inadequate hot holding temperatures • A crockpot being used to heat or reheat food was overloaded and caused food to be held at inadequate hot holding temperatures
P7	**Improper cooling of food** **Description** Foods were refrigerated in large quantities or stored in devices where the temperature was poorly controlled and allowed pathogens to multiply. **Examples** • Foods were refrigerated in large masses or as large volumes of foods in containers, which did not allow proper cooling • Foods were stored in containers with tight-fitting lids, pans were stacked on top of others, or crowded storage in a refrigerator, all of which led to inadequate air circulation during cooling process
P8	**Extended refrigeration of food for an unsafe amount of time, relative to the food product and pathogen** **Description** This situation is a concern for psychrotrophic pathogenic bacteria (e.g., *Listeria monocytogenes*, *Clostridium botulinum* type E, *Yersinia enterocolitica*, *Aeromonas hydrophila*) that can multiply over sufficient time at

	ordinary refrigerator temperatures and grow to an amount sufficient to cause illness or produce toxins if toxigenic (e.g., *C. botulinum*). **Examples** • *Listeria* growth after refrigeration of deli meat for more than 7 days • Kept containers of commercially prepared foods for several weeks after they were opened
P9	**Inadequate Reduced Oxygen Packaging (ROP) of food** **Description** Food was sealed using inadequate Reduced Oxygen Packaging (ROP) methods, which provided conditions conducive to growth of anaerobic or facultative bacteria in foods. ROP includes processing and packaging techniques that prevent the entry of oxygen into the container, such as vacuum packaging, modified or controlled atmosphere packaging, cook chill packaging, sous vide packaging, hermetically sealed containers (double seams/glass jar with lid), deep containers from which air is expressed, and products packed in oil. **Examples** • Inadequate process applied to vacuum-packed fish • Insufficient process applied to salad in gas-flushed bag • Ineffective hermetically seal on can • Garlic packaged in oil with unsatisfactory process • Lack of controlled atmosphere packaging of beef jerky
P10	**Inadequate non-temperature dependent processes (e.g., acidification, water activity, fermentation) applied to a food to prevent pathogens from multiplying** **Description** Non-temperature-dependent processes (e.g., acidification, water activity, fermentation) failed and allowed pathogens to multiply to an amount sufficient to cause illness. This situation is a concern for growth of preformed heat-stable toxins or bacterial spores (e.g., *Clostridium perfringens*, *Clostridium botulinum*, *Bacillus cereus*, *Staphylococcus aureus)*. **Examples** • Insufficient acidification (low concentration of acidic ingredients) in home canned foods • Insufficiently low water activity (low concentration of salt) in smoked/salted fish • Inadequate fermentation (starter culture failure or improper fermentation conditions) in processed meat or processed cheese **Notable Exceptions** Outbreaks caused by pathogenic bacteria, including *E. coli*, *Listeria monocytogenes*, and *Salmonella* species do not usually *grow* in high-acid food, but may be able to *survive* for extended periods of time. In these cases, please cite S4.
P11	**Other situations that promoted or allowed microbial growth or toxic production (specify)** **Description** A factor that promoted growth, proliferation, amplification, or concentration of bacterial agents but that did not fit into any of the other defined categories.
Survival Factors	
S1	**Inadequate time and temperature control during <u>initial cooking/thermal processing</u> of food** **Description** The time and temperature during <u>initial cooking/thermal processing</u> (e.g., pasteurizing, blanching, drying, dry roasting, frying, infrared, microwave, oil roasting, steaming) was inadequate to kill or reduce the pathogen population to below an infectious dose. In reference to cooking, but not retorting, it refers to the destruction of vegetative forms of bacteria, viruses, and parasites, but not bacterial spores. If the food under investigation was retorted, then spore-forming bacteria would be included. **Examples** • Inadequate cooking of meats/poultry before service • Inadequate pasteurization of milk **Notable Exceptions**

	• Citation of S1 does not include inactivation of preformed heat-stable toxins or destruction of bacterial spores, such as *Clostridium botulinum*, unless the food underwent a retort process. If this retort process was determined to be inadequate to kill the pathogen, please cite S1. Otherwise, please cite the appropriate proliferation factor. Norovirus in food cannot be inactivated by moderate heat treatments, such as pasteurization. However, it can be effectively inactivated with cooking or other heat processes, such as roasting.
S2	**Inadequate time and temperature during reheating of food** **Description** The time and temperature during reheating or heat processing of a previously cooked food (which may have been cooled overnight) was inadequate to kill or reduce the pathogen population to below an infectious dose. **Examples** • Reheating of sauces or roasts to a temperature insufficient to reduce the level of contamination to below an infectious dose **Notable Exceptions** Citation of S2 does not include inactivation of preformed heat-stable toxins, such as *Bacillus cereus*. Please cite the appropriate proliferation factor instead.
S3	**Inadequate time and temperature control during freezing of food designed for pathogen destruction** **Description** The time and temperature during freezing was inadequate to kill or reduce the pathogen population to below an infectious dose. A freezing process may be used in order to ensure the destruction of certain parasites before raw service of some foods, such as fish. **Examples** • Pacific red snapper was not sufficiently frozen before served in raw sushi, or an investigation revealed that the time and temperature requirements to kill parasites were not achieved. **Notable Exceptions** • Some species of tuna do not harbor parasites of concern and thus freezing is not necessary. Care should be taken in determining if freezing would have been an appropriate pathogen destruction process for the fish in question before this factor is cited. Norovirus in food cannot be inactivated by freezing.
S4	**Inadequate non-temperature dependent processes (e.g., acidification, water activity, fermentation) applied to a food to prevent pathogens from surviving** **Description** Non-temperature depending processes (e.g., acidification, water activity, fermentation) designed to kill or reduce the pathogen population to below an infectious dose were inadequate or improperly used, allowing pathogens to survive. This situation is more of a concern for pathogenic bacteria with low infectious doses, making pathogen survival more often the cause for illness rather than pathogen proliferation. Please note: 1) Though chemicals may be added to foods to inhibit bacterial growth, at normal levels of use, most chemicals cause inhibition rather inactivation. 2) Though pH is considered primarily a means of growth inhibition and not a method of destruction of existing pathogens, at low pH values, many bacterial pathogens will be destroyed if held at that pH for a significant amount of time, even if their growth is already inhibited. If the acidification procedures are inadequate, pathogenic bacteria can survive. *E. coli* O157:H7 and *Listeria monocytogenes*, in particular, are able to survive acidic conditions. **Examples** • Inadequate acidification of seafood when preparing ceviche, allowing for pathogen survival • Inadequate acidification of unpasteurized juice, in which the inappropriately high pH allowed survival of *E. coli* • Inadequate salting of fresh water fish, allowing for parasite survival • Inadequate fermentation of sauerkraut, allowing for survival of *Listeria monocytogenes* • Inadequate chlorine concentration used for washing lettuce, allowing for survival of *E. coli*. **Notable Exceptions** Norovirus in food cannot be inactivated by acidification.

Attachment 3. Definition of Contributing Factors to Foodborne Illness Outbreaks

S5	**No attempt was made to inactivate the contaminant through initial cooking/thermal processing, freezing, or chemical processes** **Description** No attempt was made to inactivate the contaminant through initial cooking/thermal processing, freezing, or chemical processes. **Examples** • Unpasteurized milk or cider • Oysters served raw
S6	**Other process failures that permit pathogen survival (specify)** **Description** **A form of survival that does not fit into the above categories.**