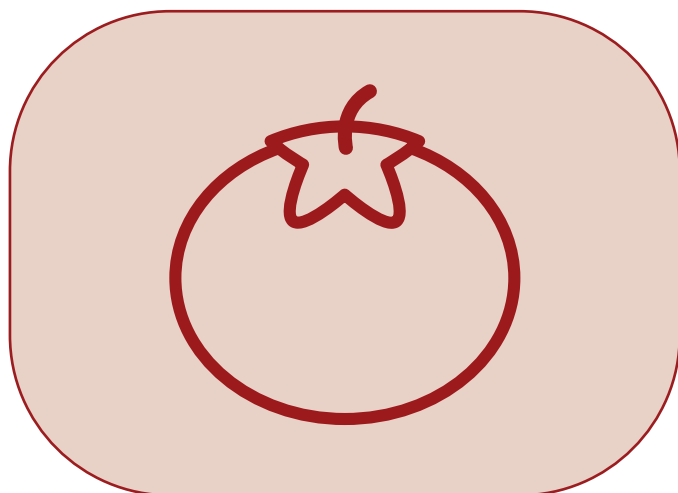
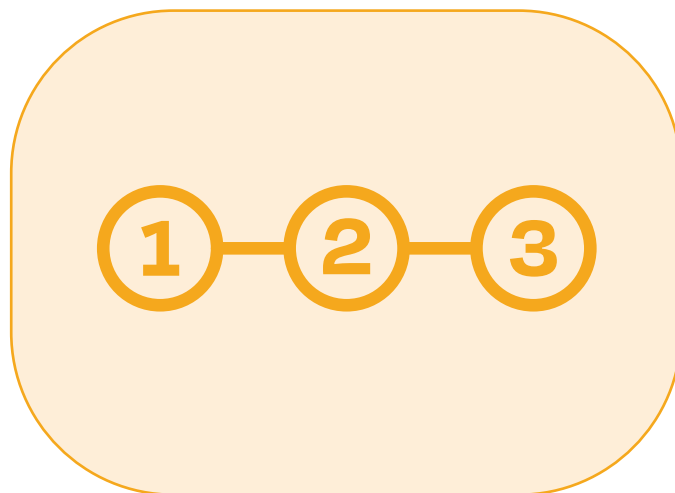
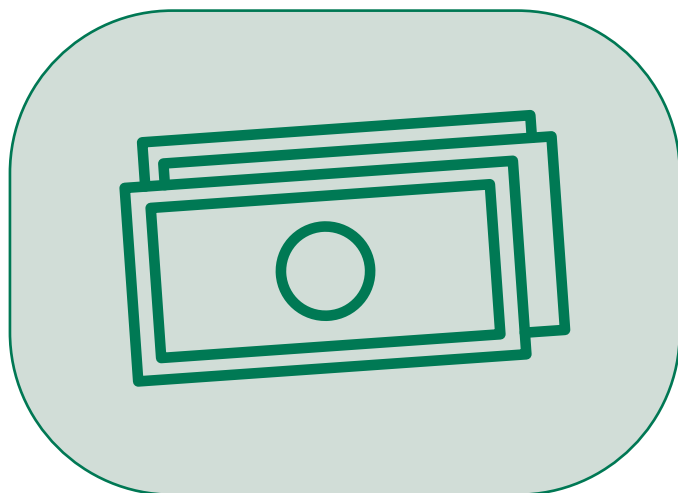
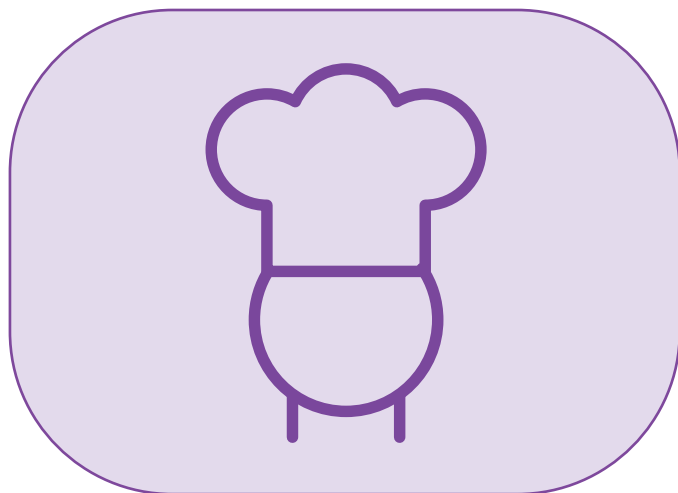


Identifying Root Causes:

A Reference for National Environmental Assessment Reporting System (NEARS) Users



About This Manual

This reference provides an overview of environmental antecedents (also known as root causes) with examples of questions and observations. Determining environmental antecedents can be challenging. However, it is essential for determining corrective actions to eliminate contributing factors and prevent future outbreaks. This reference is primarily for users of CDC's National Environmental Assessment Reporting System (NEARS).

Use this manual to

- help identify root causes (environmental antecedents) during foodborne illness outbreak investigations and
- report the appropriate environmental antecedents in NEARS.

This reference can help, but remember, each outbreak is unique

- The examples and antecedents included in this reference do not include everything that can happen in an outbreak. Rather, they are a starting point for considering questions, observations, and evidence to help identify environmental antecedents.
- When applicable, we list corresponding NEARS questions for environmental antecedents.
- We use the terms "facility" and "establishment" interchangeably. Both refer to a retail food establishment.

Things to keep in mind about investigating outbreaks

Use information from the following four sources to help identify the most applicable antecedents:

- Environmental assessment, especially the interviews with managers and food workers, observations, record reviews, and the establishment's policies and practices
- Epidemiological investigation
- Laboratory tests
- Your knowledge, experience, and professional judgment

Consider meeting with the outbreak team to discuss investigation findings and identify environmental antecedents together. This approach will include multiple perspectives and can help the group take a broad view of the outbreak.

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Environmental Antecedents: People Category



Lack of a food safety culture or attitude toward food safety

If you saw this	Then consider this	If yes, environmental antecedent could be this
Numerous breakdowns led to the outbreak.	Does this establishment have a well-documented history of poor compliance or association with foodborne outbreaks?	Lack of food safety culture
Staff members are involved in activities (contributing factors) linked to the outbreak.	Do observational or interview data indicate poor food safety attitudes, perceptions, or opinions?	Lack of food safety culture

Example: *The manager in the establishment knows the food safety requirement for cooking chicken livers is 165°F. However, the establishment has always served chicken livers undercooked, without anyone getting sick. Therefore, the manager encourages employees to undercook it. The investigator finds that this manager does not agree with recommended food safety requirements. As a result, the investigator determines the establishment does not have a positive food safety culture.*

Lack of training of employees on specific processes

If you saw this	Then consider this	If yes, environmental antecedent could be this
Appropriate equipment and policies are in place, but staff members are not following the establishment's procedure.	Do the employees lack training? See NEARS <ul style="list-style-type: none"> • Part III, question 16c • Part Va, question 5a 	Lack of employee training on specific processes

Example: *The establishment has a cooking procedure for a food item, but the employee was not trained on this procedure and is unsure of proper cooking temperatures or does not understand they are a critical control step to kill pathogens.*

Lack of oversight of employee or enforcement of policies

If you saw this	Then consider this	If yes, environmental antecedent could be this
Appropriate equipment, policies, and training are in place, but staff members are not following the establishment's procedures.	<p>Is the manager (Certified Food Protection Manager or Certified Kitchen Manager) absent or not in the establishment during all hours of operation?</p> <p>See NEARS Part III, questions 14 and 14b.</p> <p>Is the manager aware of deficiency?</p>	<p>Lack of oversight</p> <p>Also consider these antecedents:</p> <ul style="list-style-type: none"> • Language barriers • Lack of staffing • Lack of training • Antecedents listed in the economics category
Appropriate equipment, policies, and training are in place, but staff members are not following the establishment's procedures.	Is a manager aware of the deficiency and disregarding it?	<p>Lack of oversight</p> <p>Also consider these antecedents:</p> <ul style="list-style-type: none"> • Lack of food safety culture
Appropriate equipment, policies, and training are in place, but staff members are not following the establishment's procedures.	Does the manager lack understanding of the importance of the hazard?	<p>Lack of oversight</p> <p>Also consider these antecedents:</p> <ul style="list-style-type: none"> • Lack of food safety culture • Lack of training

Example: Employees are trained by an owner or manager when they are hired, but a manager or supervisor typically is not present to ensure they are following the proper procedures. In some cases, the manager might always be present but does not provide adequate oversight to ensure employees are following proper procedures.

Language barrier between management and employees

If you saw this	Then consider this	If yes, environmental antecedent could be this
Management and employees are speaking different languages.	<p>Do managers and employees speak differing languages?</p> <p>See NEARS</p> <ul style="list-style-type: none"> • Part III, questions 11, 12, and 16 • Part IV, question 19b 	Language barrier

Example: The establishment manager speaks language X and employees speak language Y. The manager is unable to explain the establishment's processes because of the language barrier.

High turnover

If you saw this	Then consider this	If yes, environmental antecedent could be this
New staff members seem unfamiliar with practices, policies, or both and might be inexperienced.	<p>Have most staff members been there for less than a year? Are they frequently hiring new staff members?</p> <p>See NEARS Part III, questions 25 and 26.</p>	High turnover

Example: *The turnover rate is so high that the establishment employees lack institutional knowledge to provide on-the-job training, or there is a lack of training for new staff members. This results in new employees being unfamiliar with the restaurant's processes and might lead to unsafe food handling practices.*

Low or insufficient staffing

If you saw this	Then consider this	If yes, environmental antecedent could be this
Minimal staff members are present in the establishment during peak times, or staff members are juggling multiple duties (for example, dishwashing, taking orders, preparation, etc.).	<p>Does the establishment have staffing issues? Are they operating with a smaller staff than needed?</p> <p>See NEARS Part III, questions 16, 25, and 26.</p>	<p>Low or insufficient staffing</p> <p>Also consider antecedents in the economics category.</p>

Example: *During the environmental assessment, one employee is trying to prepare, cook, and serve the food. It's a busy day with lots to do, and the employee takes shortcuts (for example, not washing hands or not cleaning/sanitizing surfaces). These actions lead to contamination of a product.*



Environmental Antecedents: Equipment Category



Insufficient capacity of equipment (not enough equipment for the processes)

If you saw this	Then consider this	If yes, environmental antecedent could be this
A lack of necessary equipment in the establishment (for example, thermometer, hand sink, three-compartment sink).	Does the establishment need equipment that is not available onsite? See NEARS Part IV, questions 3, 4, 9, and 16.	Insufficient capacity of equipment
Some equipment is available but not in the quantities needed to ensure food safety (for example, not enough hand sinks or cold-holding units).	Is more equipment needed to operate successfully? See NEARS Part IV, questions 3, 4, and 6.	Insufficient capacity of equipment

Example: The investigator finds that the ambient temperature in the reach-in refrigerator is high. Overloading in the unit blocked all the condenser vents so that cold air couldn't circulate. After all the stacked containers are removed from the unit, the ambient temperature decreased to 41°F. The establishment says it is their only refrigeration unit and that is why it is always so full.

Lack of preventive maintenance on equipment

If you saw this	Then consider this	If yes, environmental antecedent could be this
Equipment is improperly maintained or dirty (for example, thermometers are not calibrated, deli slicer or other equipment is visibly dirty).	Is equipment improperly cleaned and sanitized or cleaned at insufficient frequencies? See NEARS <ul style="list-style-type: none"> Part III, question 17 Part IV, questions 17 and 18 	Lack of preventive maintenance
Equipment is broken (for example, cold-holding unit running hot or steam table not working).	Is equipment broken or not working correctly? See NEARS Part IV, questions 3a, 4a, 7a, and 14a.	Lack of preventive maintenance

Example: A refrigeration unit was running at high temperatures, which allowed pathogens to proliferate. When trying to determine the cause of the high temperatures, the investigator learned from the manager that the refrigeration unit had not been routinely maintained for a long time. Additionally, the investigator saw soiled condenser fans and filters and a missing gasket on the refrigerator door. These were the reasons for the unit's high temperatures.

Equipment is improperly used

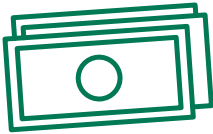
If you saw this	Then consider this	If yes, environmental antecedent could be this
Equipment is used incorrectly (for example, hand sinks are used for purposes other than handwashing, like dishwashing).	Are staff members unsure how to use equipment properly? Are staff members taking shortcuts rather than using the equipment as intended?	Equipment is improperly used Also consider these antecedents: • Lack of training
Equipment is used as an alternative for personal hygiene (for example, using a sanitizer bucket to dip hands in).	Are employees using equipment other than hand sinks to wash hands?	Equipment is improperly used Also consider these antecedents: • Lack of training
Improper equipment is used to wash or clean food contact surfaces (for example, mop sink used to wash large pots).	Are staff members washing and sanitizing dishes, utensils, or equipment outside of a dishwashing machine or three-compartment sink?	Equipment is improperly used Also consider these antecedents: • Lack of training

Example: When conducting the food flow, the investigator determines that soups are reheated in a hot holding unit. The unit does not get hot enough to reheat the soup to 165°F and it takes 3 hours to reach 135°F. The investigator informs the establishment that the hot holding unit is not designed to reheat food and that they should reheat the soup using a conventional cooking device before putting it in the hot holding unit.

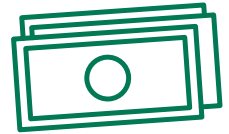
Poor facility layout

If you saw this	Then consider this	If yes, environmental antecedent could be this
<p>Layout promoted pathogen or chemical contamination of surfaces, hands, or ready-to-eat foods.</p> <p>Observe kitchen layout during food preparation practices of implicated food item. Assess:</p> <ul style="list-style-type: none"> • Physical flow: Clean vs. soiled or dirty areas • Food flow: Raw meats vs. ready-to-eat foods • Equipment location and accessibility (hand wash sinks; warewashing; holding) • Evidence of cross-contamination due to lack of space or poor design 	<p>Have changes to the menu (for example, added foods requiring complex preparation) resulted in layout issues or processes beyond the original intent or construction?</p> <p>See NEARS Part III, question 7.</p> <p>Does the establishment need more space to prepare foods safely (for example, store chemicals appropriately, adequate space between raw meat and ready-to-eat preparation areas)?</p> <p>See NEARS Part IV, questions 5 and 12. For handwashing sinks, see Part IV, questions 3 and 4.</p>	<p>Poor facility layout</p> <p>Also consider antecedents in the economics and processes categories.</p>

Example: The raw meat preparation area was next to the salad preparation area. During meat preparation, meat juices and debris splashed into the salad preparation area. The employee responsible for salad preparation did not clean and sanitize the counter before preparation, which caused meat juices to contaminate ready-to-eat salads.



Environmental Antecedents: Economics Category



Lack of sick leave or other financial incentives to adhere to good employee health practices

If you saw this	Then consider this	If yes, environmental antecedent could be this
<p>Poor employee hygiene (for example, bare hand contact with ready-to-eat foods, not washing hands, soiled or dirty aprons or wiping cloths, etc.) is contributing to contamination.</p> <p>OR</p> <p>Conditions indicate potential contamination from a sick employee (based on incubation period, etymologic agent, suspected food, etc.).</p> <p>Examine records of employees requesting sick time or when employees called in sick.</p>	<p>Do employees avoid taking off work when sick because they cannot afford to take off a shift? Is sick leave unavailable or inconsistently provided?</p> <p>Were employees sick during the time of exposure? Ask employees what they do when they feel too sick to work (for example, do they tell their manager their symptoms, etc.) Ask employees how they decide to come to work if they are not feeling well (probe for types of symptoms, barriers to staying home).</p> <p>See NEARS Part III, questions 25 and 26.</p>	<p>Lack of sick leave if</p> <ul style="list-style-type: none"> employees worked while ill and reported economics played a role in their decision AND sick leave is not provided or is inconsistently provided. <p>Also consider these antecedents:</p> <ul style="list-style-type: none"> Lack of training Lack of oversight

Example: Employees have been working while symptomatic with vomiting, diarrhea, or both. During interviews it is determined that they worked while sick because they could not afford to take time off work and the establishment does not offer paid sick time or the ability to make up hours when they return to work.

Lack of supplies needed for operating the restaurant

If you saw this	Then consider this	If yes, environmental antecedent could be this
<p>Staff members do not have the supplies needed to do their work.</p>	<p>Are supplies missing? Are more supplies needed for the establishment's operation (for example, gloves, sanitizing agents, soap, etc.)?</p> <p>See NEARS Part IV, questions 3, 4, 9, 16, 17, 18b2, and 18d.</p>	<p>Lack of needed supplies</p> <p>Also consider these antecedents:</p> <ul style="list-style-type: none"> Lack of training Antecedents listed in the economics category.

Example: Employees touch ready-to-eat foods with their bare hands. When interviewed, the employees explain that the establishment frequently runs out of gloves.

Environmental Antecedents: Processes Category

Insufficient process to mitigate the hazard

If you saw this	Then consider this	If yes, environmental antecedent could be this
No attempt was made to control the hazard.	Were necessary policies missing to control hazard? See NEARS Part III, questions 17-24.	Insufficient process to mitigate the hazard
Staff members were following the procedure correctly, but there was an issue with the procedure itself.	Was the procedure unverified and never proven to control the food safety risk? Consider reviewing records as appropriate (for example, lab testing or temperature logs).	Insufficient process to mitigate the hazard

Example: An establishment has a specific written process that requires cooking rotisserie chickens for 25 minutes at 350°F. All the cooks follow this process, but do not measure temperatures for each batch. During the investigation, the investigator checks the temperature of the rotisserie chicken after 25 minutes, and finds that the internal temperatures for the larger chickens are less than 165°F. This process was therefore insufficient to eliminate the pathogens of concern for chicken.

Employees or managers are not following the facility's process

If you saw this	Then consider this	If yes, environmental antecedent could be this
<p>Written procedures (for example, recipe cards) were different than those observed in the food flow.</p>	<p>Are employees deviating from their usual or standard operating procedures?</p> <p>Ask employees to recreate the past event. This might require them to prepare a food item (conduct a food flow) or explain steps they took and how they cleaned, sanitized, stored, prepped, etc. Reviewing menu cards, written procedures, and employee training manuals can be helpful.</p> <p>See NEARS Part III, questions 16c, 17-23, and 26.</p>	<p>Employees or managers not following the facility's process</p> <p>Also consider these antecedents:</p> <ul style="list-style-type: none"> • Lack of training • Lack of oversight
<p>A unique event or situation on the day in question made the establishment deviate from normal procedures (for example, loss of power).</p>	<p>Could anything have been different when the establishment prepared the food on the day in question? For example, did the establishment need to make a larger batch than the recipe called for? Was the establishment short on time and had to speed up the process? Was any equipment not working that day?</p> <p>See NEARS Part IV, questions 20 and 21.</p>	<p>Employees or managers not following the facility's process</p> <p>Also consider antecedents in the economics and processes categories.</p>

Example: An establishment has written procedures for how to properly clean up after a vomiting event. The investigator determines that a sick guest vomiting caused a norovirus outbreak. The investigator asks whether the restaurant has a clean-up policy and whether it seems to be effective against norovirus. Then the investigator asks the manager to describe how they cleaned up after the event. The manager says they brought the cleaning equipment (the bucket and mop head) into the dish area and sprayed it with the spray hose, which was adjacent to the clean dish rack, to clean it before they stored it away. The policy says to use disposable mop heads and discard them after use, but the establishment does not follow this practice. This shows that they do not follow their own process for cleaning.



Environmental Antecedents: Food Category



Food not treated as TCS (time-temperature control for food safety)

TCS refers to a food that requires time and temperature control to reduce illness-causing germs and toxins. In some jurisdictions, these foods are referred to as potentially hazardous foods.

If you saw this	Then consider this	If yes, environmental antecedent could be this
<p>Food is improperly sourced or obtained from an unapproved source (for example, required inspection or regulatory oversight is missing, product label is missing or inadequate).</p>	<p>Was food improperly sourced? See NEARS Part Va, question 5a.</p> <p>Was product label missing or inadequate? See NEARS Part Vb, question 2.</p>	<p>Food not treated as TCS</p> <p>Also consider antecedents in the people and processes categories.</p>
<p>Food is mishandled or improperly (for example, in cooking, cooling, holding).</p> <p>OR</p> <p>Food is used or served beyond its discard date.</p>	<p>Is food mishandled, stored, or prepared improperly? Ask the specific food employees who handled the implicated food how they prepared it.</p> <p>Is there a recipe or standard operating procedure for how the food item is prepared or handled in the establishment? If not, why not? See NEARS Part IV, questions 7-16.</p>	<p>Food not treated as TCS</p> <p>Also consider antecedents in the people and processes categories.</p>

Example: A restaurant cans its own garlic-stuffed cherry peppers made in oil and sells them as shelf-stable products. A *Clostridium botulinum* outbreak occurs. During the investigation, lab testing determines the product is not shelf-stable, and the restaurant did not recognize the hazard. Other examples of food not treated as TCS might include cut leafy greens, cut tomatoes, sprouts for smoothies, and cooked vegetables.

Important Definitions

Contributing Factors: The factors and practices that led to the outbreak. Contributing factors fall into three categories: contamination, proliferation, and survival factors. These three categories refer to the type of food safety failures that most likely occurred before the outbreak.

Environmental Antecedents (root causes): The reasons outbreaks occur. They are also known as the root causes of outbreaks. These reasons can relate to people, equipment, food processes, food type, economics, or other issues. For example, in an outbreak of Salmonella linked to raw chicken, investigators determine that a new worker did not wash their hands after touching raw chicken. The worker then prepared a salad. In this scenario, the contributing factor would be cross-contamination. The root causes could be lack of training for food workers and high staff turnover.

Environmental Assessment (of a foodborne illness outbreak): The part of the outbreak investigation that determines how and why pathogens got into the environment and spread to make people sick.

Additional Resources

Environmental Assessment Training Series (EATS)

Practice skills in an interactive virtual environment and learn to conduct environmental assessments as part of outbreak investigations.

<https://www.cdc.gov/nceh/ehs/elearn/eats/index.html>

National Environmental Assessment Reporting System (NEARS)

Capture environmental assessment data from foodborne illness outbreaks to help prevent outbreaks associated with restaurants and other food venues.

<https://www.cdc.gov/nceh/ehs/nears/index.htm>

- Overview of Environmental Assessments
<https://www.cdc.gov/nceh/ehs/nears/environmental-assessment.htm>
- Overview of Contributing Factors
<https://www.cdc.gov/nceh/ehs/nears/what-are-contributing-factors.htm>

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