



BUL 1079

# Does ChatGPT Get Food Safety?

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## Introduction

HAVE YOU HEARD ABOUT CHATBOTS on the internet?

A **chatbot** is a computer program that simulates human conversation. People rely on them for a variety of reasons, often to save time at work—as an aid to write program code more quickly or to shorten the time needed to develop a technical presentation. Unfortunately, others sometimes use them for more troubling purposes—to help someone pass a bar exam (Weiss 2023). Regardless of the end use, their operation is the same. A user inputs a question (verbally or typewritten) into the program, which processes a humanlike answer/response consisting of text, images, and/or sound (IBM n.d.).

Their use sounds convenient and simple, but beware. Like most new technologies, chatbots are not perfect. They're not oracles, though their seemingly effortless response may indicate otherwise. In early 2024, AP News reported that they provide "false and misleading information" about the voting process, thus potentially disenfranchising voters in an election year (Burke 2024). Even legal professionals have been tripped up. One group relied on ChatGPT (developed by OpenAI and launched in 2022) to look up case law. The chatbot, one of the most popular and successful, cited nonexistent cases. The lawyers' use of that ill-gotten research in court led to sanctions and fines (Merken 2023).

Used knowingly, however, chatbots can be a great time-saver for small businesses that are new to food manufacturing and required by regulators, customers, and third-party auditors to develop a food-safety program. Creating the plans and programs from scratch can be daunting even for a seasoned food-safety professional, but for a new small food entrepreneur it's especially challenging. To enhance the awareness of smaller operators who are interested in relying on chatbots to complete these requirements, this bulletin reports the results of an examination of the quality of chatbot responses

(outlined in green) in developing food-safety programs. Using ChatGPT 4, three scenarios were inputted and their outputs reviewed using specific grading criteria (see Table 1) to determine the chatbot's accuracy. As is the case with any search engine, precise word choice is key. Inputting the appropriate question likely produces a correct answer or more accurate or relevant response.

**Table 1.** Grading criteria.

Points	Category	Explanation
1.0	Correct	The information is correct, accurate, and currently aligns with industry and regulatory standards.
0.5	Potentially Misleading	The information is somewhat accurate, but provides incomplete data or conclusions or indicates some degree of misunderstanding.
0.0	Incorrect	The information is inaccurate and does not align with current industry or regulatory standards.

## Chatbot Scenarios

### Scenario #1: Hazard Analysis

Those of you who are familiar with food-safety plans understand the importance of a thorough **hazard analysis**. A hazard analysis is an examination of food ingredients and their processing that identifies potential biological, chemical, and physical dangers, prompting the development of strategies to reduce any identified hazards to acceptable levels or to eliminate them.

*Prompt: Food Safety HACCP plan Hazard Analysis of Raw Milk*

#### *Response:*

Creating a HACCP (Hazard Analysis and Critical Control Points) plan for handling raw milk involves identifying potential food safety hazards and implementing measures to control these risks. Here's a brief overview of the steps and considerations for a HACCP plan focused on raw milk:

1. **Hazard Analysis:** Identify biological, chemical, and physical hazards. For raw milk, common biological hazards include pathogens like Salmonella, E. coli, and Listeria. Chemical hazards could involve residues from cleaning

agents, or antibiotics, while physical hazards might include foreign objects like metal shards from equipment.

2. **Critical Control Points (CCPs):** Determine the points in the process where control can be applied and is where control can be applied and is essential to prevent or eliminate a food safety hazard or reduce to an acceptable level. For raw milk, potential CCPs include:
  - **Refrigeration:** Keeping milk at or below 4°C (39.2°F) to inhibit bacterial growth.
  - **Filtration and separation:** Removing physical contaminants and reducing microbial load.
  - **Hygiene practices:** Ensuring that milking equipment and facilities are properly sanitized.
3. **Critical Limits:** Establish maximum or minimum values to which biological, chemical, or physical parameters must be controlled at a CCP to prevent, eliminate, or reduce to an acceptable level the occurrence of a food safety hazard. For instance, setting a specific temperature and time for refrigeration.
4. **Monitoring Procedures:** Set up procedures to check critical limits at each CCP. This could involve regular temperature checks and logging results to ensure compliance.
5. **Corrective Actions:** Identify actions to take when monitoring indicates that a particular CCP is not under control. For raw milk, this might involve discarding milk if it's been held above the critical temperature limit for a certain period.
6. **Verification Procedures:** Implement methods, procedures, and tests, including random sampling and analysis, to ensure the HACCP system is working effectively.
7. **Record-Keeping and Documentation:** Maintain documentation including the hazard analysis, CCP identification, critical limits, monitoring system, corrective actions, verification activities, and all records associated with these processes.

By systematically applying these steps, you can help ensure that raw milk is handled safely, reducing the risk of foodborne illness.

Source: ChatGPT, 29 April 2024

## Comments about the response:

The overview (the prompt) is correct (1 point).

**Hazard analysis.** Although the hazard categories are correct, the bot response fails to mention several potential hazards that need to be considered when a facility receives raw milk:

- Biological (0.5 points): *Salmonella*, *Escherichia coli*, and *Listeria* are all present in raw milk, but it can contain many other toxic substances. Most food-safety plans list some sort of category (for example, “various vegetative pathogens and toxins, including . . .”). The bot response needs to provide a more comprehensive list, including *Staphylococcus*, *Clostridium*, *Bacillus cereus*, etc.
- Chemical (1 point): Mentioning cleaning agents as problematic is correct. The milker or driver could have turned on the wrong tank during a cleaning cycle and contaminated the milk with chemicals at the dairy; or the milk-receiving truck might not have drained properly after its last wash and contaminated the milk.
- Chemical (1 point): Mentioning antibiotics is accurate. All milk, according to the Pasteurized Milk Ordinance (PMO), must be tested at a receiving facility for beta lactams (most of your penicillin-based antibiotics belong to this group) before unloading. Although its detection at milk-receiving plants have decreased over the years, lab technicians occasionally discover a positive sample. In 2023, out of nearly 3.7 million samples 345 tested positive for a drug residue (Joint Institute for Food Safety and Applied Nutrition 2023).
- Not discussed (0 points): Chemical (allergens). Milk is one of the Food and Drug Administration’s (FDA) “Big 9” allergens that must be declared in plain language on finished product labels, per the Federal Food, Drug, and Cosmetic Act 21 CFR 201(qq).
- Not discussed (0 points): Chemical (aflatoxins). The FDA, United States Department of Agriculture, and World Health Organization have declared aflatoxins as a growing food-safety hazard and milk has been found to contain aflatoxin from the feed that cows eat (Belson and

Tabucki 2011). Many large-scale milk-receiving facilities periodically test their milk for aflatoxin to prove whether it is low, medium, or high risk.

- Not discussed (0 points): Chemical (pesticides and herbicides). A cow’s milk reveals the animal’s diet, so a milk-receiving facility must acknowledge the potential presence of pesticides and herbicides in the milk. Normal processing does not deactivate those chemicals.
- Not discussed (0 points): Chemical (radiological) Many customers ask about your risk assessment for radiological hazards. As seen in testing after several nuclear disasters, including the Fukushima Daiichi nuclear power plant cooling system meltdown, milk is a food product that is extremely vulnerable to radioactive contamination (Belson and Tabucki 2011). A milk-receiving plant must understand the potential for contamination based on the location of the dairy, the feed, and any nearby nuclear facilities.
- Not discussed (0.5 points): Physical. Although the bot response mentions metal shavings, it did not mention the presence of rubber, plastic, various fibrous materials, and pests in raw milk, which are common contaminants.

Along with these aforementioned lapses, ChatGPT also omitted

- common supplemental paperwork, specifically tables headed by questions (Table 2) (0 points) and
- elaborative information. A food-safety team must also determine the severity of each contaminant and the likelihood of its occurrence and then justify that conclusion.

A hazard analysis is incomplete without all of this information.

Next, the bot response addressed CCPs, which refer to principle/item #2 in scenario #1 (0 point). Its definition of CCP is appropriate; however, raw milk does not contain CCPs. Either prerequisite programs (testing, filtration, visual inspection, and approved supplier programs) at the time of receipt or pasteurization (later in the process) control the hazards. It listed some control measures but none that would be a CCP and instead listed cooling the milk to 4°C as a control mechanism for bacteriological

**Table 2.** Typical hazard analysis form for an HACCP plan. SSOP, sanitation standard operating procedure; B, biological; C, chemical; P, physical.

1. Ingredient or Process step.	2. Identify potential food-safety hazards introduced, controlled, or enhanced at this step.	3. Are any potential food-safety hazards significant (yes or no)?	4. Why (justification for decision made in previous column)?	5. Identify the prerequisite program, preventive control, SSOP, or procedure which reduces the likelihood or severity of the hazard to significantly minimize the food-safety hazard.	6. Is the control mechanism applied at this step (yes or no)?	7. Is this step a Preventive Control or a Critical Control Point (yes or no)? If yes, assign a number and a name for reference.
	B					
	C					
	P					

growth, which is a correct procedure, but not a CCP. According to the PMO, raw milk must be stored at less than 45°F for up to seventy-two hours before processing (United States Food and Drug Administration n.d.). So, although storing milk at colder temperatures complies with regulation, the ChatGPT response did not mention a cold-storage time, which might incline the facility to be unintentionally noncompliant. Yes, facilities implement filtration at milk receiving instead of at unloading and as part of their foreign material prerequisite program. However, filtration is not a CCP.

A last point, about hygienic milking-parlor practices, is covered in a milk-receiving, facilities-approved supplier program. Again, according to the PMO, dairies are inspected and must comply with basic standards or they cannot sell milk for human consumption. Ensuring products came from licensed and approved dairies is part of a facilities prerequisite program, not a CCP, as the bot would have it.

The ChatGPT response continues to discuss the rest of the seven HACCP principles and their definitions are accurate; however, the prompt merely asked about a raw milk hazard assessment, so any follow-up discussion of other principles would not be helpful (0.5 points). If the prompt was trying to provide comprehensive information, then the response should have also reviewed the five preliminary steps that are required in an HACCP plan.

Based on the experiment, ChatGPT’s submission of a raw-ingredient hazard assessment is unacceptable. It did not complete several important HACCP requirements and ignored several potential food-safety issues that a food manufacturer must manage as part of any food-safety and -quality program.

**Score: 4.5 out of 12 possible points = 37.5% accuracy**

## Scenario #2: Good Manufacturing Practices (GMPs) Policy

Every food facility must understand the GMPs found in the Code of Federal Regulations ([21 CFR 117 subpart B](#)). They identify the basic requirements to produce a safe and high-quality food product—the minimum basics for the FDA and the third-party inspection process. There are nine subsections in the GMPs: 117.10 Personnel; 117.20 Plant and Grounds; 117.35 Sanitary Operations; 117.37 Sanitary Facilities and Controls; 117.40 Equipment and Utensils; 117.80 Processes and Controls; 117.93 Warehousing and Distribution; 117.95 Holding and Distribution of Human Food By-Products for Use as Animal Food; and 117.110 Defect Action Levels (US FDA 2015).

Rather than have the chatbot create a policy for the entire GMPs, the chatbot was prompted to focus on the first subsection, Personnel. Humans can be a microbiological, chemical, and physical hazard to our food products; consequently, all personnel working with a product or its contact packaging must maintain a high degree of personal cleanliness.

**Prompt: Write a policy to comply with Good Manufacturing Practices Personnel subsection**

**Response:**

Certainly! Here's a draft policy for compliance with the Personnel section of Good Manufacturing Practices (GMP):

**GMP Compliance Policy: Personnel**

**Purpose:** To ensure that all personnel involved in the manufacturing, processing, packing or holding of food products adhere to the required hygiene, health, and cleanliness standards to prevent contamination of food products.

**Scope:** This policy applies to all employees, contractors, and temporary staff working in any production or handling area within the facility

**Policy Elements:**

1. **Health Screening:** All personnel must undergo a medical screening prior to employment and periodic health checks, thereafter, as specified by the company's occupational health program.

Any personnel showing signs of infectious diseases or open wounds must report to the facility health officer and will be restricted from entering production areas until deemed safe.

2. **Hygiene and Sanitation:** Personnel must practice good personal hygiene including, but not limited to, regular hand washing with soap and water for at least 10 seconds, especially after using the restroom, handling waste, and before entering production areas.

Hand sanitizing stations must be used upon entry to production areas where food is exposed.

Protective clothing, such as gloves, hairnets, and face masks, must be worn at all times in production areas and changed regularly to prevent cross-contamination.

3. **Training:** All new hires must receive training on GMP standards relevant to their role prior to beginning work in production areas. Refresher training must be conducted annually or as regulations update.

Training will cover topics such as proper handwashing techniques, the importance of personal cleanliness, correct use of personal protective equipment, and recognizing symptoms of illness.

4. **Behavioral Standards:** Eating, drinking, smoking, or using tobacco or gum is prohibited in all production areas.

Personal belongings, such as jewelry, watches, and mobile phones, must not be carried or worn in production areas.

5. **Visitor Policy:** All visitors to production areas must be accompanied by a trained staff member and adhere to all personal hygiene and protective clothing requirements.

Visitors must be informed of and comply with all applicable GMP regulations during their visit.

6. **Enforcement:** Non-compliance with this policy will result in disciplinary action, which may include retraining, suspension, or termination, depending on the severity of the infraction.

7. **Review and Monitoring:** This policy will be reviewed annually by the compliance officer to ensure effectiveness and updated in response to any changes in GMP regulations or company operations.

This policy outlines the critical aspects needed to comply with GMP standards focusing on personnel hygiene and health. It should be customized to reflect specific operational practices and regulatory requirements applicable to your facility.

Source: ChatGPT, 29 April 2024

**Comments about the response:**

This one is much better. The purpose and scope are encompassing. On the policy elements of the first section of the GMPs personnel, the bot discusses disease control (0.5 points).

However, its handling of related policies is limited. A facility needs to make sure that a health officer is present if it wants employees to report incidents internally (usually, employees report to an onsite supervisor or quality-assurance [QA] technician about cleanliness issues). Furthermore, the response

doesn't describe how supervisors or QA techs should conduct these conversations. Indeed, the GMPs actually state that a person who has a disease that can be transmitted through food cannot handle any product or product contact packaging. So, based on the bot's incomplete response, the ill person could technically clean bathrooms or sort paperwork, etc.

Regarding hygiene and sanitation, there are a few inaccuracies. Proper handwashing time is twenty seconds, not ten (Centers for Disease Control Clean Hands 2024) (0.5 points). Also, a person needs to wash their hands more frequently, like when switching from a nonproduct contact surface to a product contact surface; after sneezing; after scratching their nose or head; picking up a pen from the floor, etc. The GMPs do not require that employees wear a face mask but many companies do anyway (0.5 points). Most policies also go into additional detail about how to wear a hairnet and when beard nets are required (0 points).

The sections on training and behavioral standards are acceptable (0.5 points). Although most policies go into additional detail about prohibiting the wearing of jewelry (including nose rings, tongue studs, etc.), the bot does not include discussion of fake fingernails, colored fingernails, false eyelashes, etc.

The section on visitor policy is correct (1 point). Visitors will be asked to review the facility's GMPs and sign a document certifying that their compliance with the policy, including being escorted until they meet other criteria.

The last three sections (enforcement, review and monitoring, and summary) are also correct (3 × 1 point). However, it's important to remember to update any reference to employees tasked with reviewing food-safety and -quality policies if your organization does not currently have a literal compliance officer.

**Score: 6 out of 9 possible points = 66.7% accuracy**

### **Scenario #3: Write a sanitation standard operating procedure (SSOP)**

An SSOP is a written set of directions on how to safely and properly clean the facility and its equipment to prevent adulteration, including when

and what product-contact and noncontact surfaces must be cleaned. In addition, it describes what to do when contamination occurs or is suspected, what documentation to complete, and how to determine and verify effective cleaning. An SSOP should be detailed enough that any person, even one who has never cleaned a particular surface before, should be able to perform the tasks acceptably after reading it.

***Prompt: Write a wet cleaning sanitation standard operating procedure for cleaning a Hobart mixer in a food manufacturing facility***

#### **Response:**

Sanitation Standard Operating Procedure (SSOP): Wet Cleaning of Hobart Mixer

Objective: To ensure the Hobart mixer is thoroughly cleaned and sanitized, reducing the risk of food contamination and maintaining compliance with food safety standards.

Scope: This procedure applies to the cleaning and sanitization of the Hobart mixer used in the production area of the food manufacturing facility.

Responsibility:

- Production staff are responsible for performing the cleaning.
- Supervisors are responsible for ensuring compliance with this SSOP.
- Quality Assurance (QA) staff are responsible for periodic verification of the procedure.

Frequency: The Hobart mixer should be cleaned and sanitized after each production batch or at least once daily if used continuously.

Materials Needed:

- Food grade detergent
- Sanitizer solution approved for food contact surfaces.
- Soft bristled brushes or pads
- Non-abrasive sponges
- Clean, hot water (at least 171F)
- Protective gloves and goggles
- Sanitary hair nets and aprons

#### Procedure:

- 1. Preparation:** Ensure the mixer is turned off and unplugged  
  
Remove any large debris or residue from the mixer bowl and attachments manually.
- 2. Disassembly:** Carefully dismantle the mixer to remove the bowl, dough hook, beater, and whisk attachments. Consult the Hobart mixer's manual to ensure proper removal and handling of each component.
- 3. Cleaning:** Rinse all removed parts and the mixer itself with hot water to remove loose particles.  
  
Apply a food-grade detergent to a soft-bristled brush or non-abrasive sponge and scrub all surfaces of the mixer and its components thoroughly.  
  
Pay special attention to areas where food residue may accumulate, such as under the blades and around the mixing arms.
- 4. Rinsing:** Rinse all parts and the mixer thoroughly with clean, hot water to remove all traces of detergent.
- 5. Sanitizing:** Apply an approved sanitizer solution to all surfaces following the manufacturers recommendations for concentration and contact time.  
  
Ensure complete coverage without pooling of the sanitizing solution.
- 6. Air Drying:** Allow all parts and the mixer to air dry completely on a clean, sanitized surface or a drying rack. Do not use towels or cloths to dry to avoid recontamination.
- 7. Reassembly:** Once dry, reassemble the mixer according to the manufacturer's instruction.  
  
Ensure that all components are correctly and securely fitted.
- 8. Inspection and Verification:** Conduct a visual inspection to ensure the mixer and its components are clean, dry, and properly assembled.  
  
Document the cleaning process in the cleaning log, including the date, time, and personnel responsible.

- 9. Corrective Action:** If residue or debris is found during the inspection, repeat the cleaning and sanitizing procedure.  
  
Report any malfunction or damage of the mixer to the maintenance department immediately.
- 10. Documentation:** Maintain records of each cleaning session in the cleaning logs, which should be reviewed and signed by a supervisor.

This SSOP ensures that the Hobart mixer is maintained in a hygienic and operational state, ready for safe food production. Regular audits and training should be conducted to ensure adherence to the procedure.

Source: ChatGPT, 29 April 2024

#### *Comments about the response:*

The response from ChatGPT was quite good. It refers to the typical categories (see headings in green-colored sidebar of scenario #3) and includes pertinent information (5 out of 5 points possible). It provided some inaccuracies, however, preferring generic detergents and incorrect concentrations (0.5 points). Also, personnel would benefit from the inclusion of procedural photographs to ensure that they understand how to take apart the mixer unit. Other than these minor critiques though, the ChatGPT response was very accurate and provided the facility with a good start.

**Score: 5.5 points out of 6 possible points = 91.7% accuracy**

## Final Thoughts

Chatbots have existed since the 1960s, but only in the past couple of years have they been developed for use in the workplace. In food safety, their promise as content creators is attractive to food-safety professionals, who are often required to generate complicated policies in the proper formats in tight time frames. However, after testing and analyzing how well ChatGPT (one of the most popular work bots) applied industry-best standard and regulatory requirements to three different prompts, bot use merits only a highly qualified endorsement—particularly for early career professionals. Indeed, **a chatbot is not an effective substitute for training and knowledge.** It tends to leave out crucial

information (see Table 3), the kind that could cause a major food-safety issue or potential recall. Hence, when using one to develop a food-safety program, review its responses very carefully. Make sure they are accurate to industry-best practices and regulatory requirements.

**Table 3.** Score summary. GMPs, good manufacturing practices; SSOP, sanitation standard operating procedure.

Prompt	Score
Ingredient Hazard Analysis – Raw Milk	37.5%
GMPs – Personnel – Policy	66.7%
SSOP on Cleaning a Hobart Mixer	91.7%

## Further Reading

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