

SECTION 7. FOOD AND LIGHT INDUSTRY TECHNOLOGY

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7.1 Management of production waste and garbage, their collection and disposal in catering establishments

Introduction. Every day, humanity generates hundreds of tons of waste, the majority of which ends up in landfills [268-270]. Food waste is defined as 'any by-product or waste resulting from the production, processing, distribution, and consumption of food products' [271]. Consequently, this poses a significant threat to the sustainability of the food system, particularly in light of the growing population and the finite nature of natural resources [272].

According to the Food and Agriculture Organization of the United Nations (FAO), it is estimated that globally, 1.3 billion tons of food are lost or wasted each year. This represents approximately one-third of all the food produced [273]. Food waste ranks as the third-largest emitter of carbon dioxide [274], contradicting the principles of rational use of natural resources and posing a threat to global food security.

The problem of food waste in public dining establishments, including restaurants and cafes, is especially concerning: these venues produce tons of food each day, a considerable amount of which eventually ends up in landfills. This results from both the overproduction of food and the substantial amount of leftovers from customers' plates. The growing volume of waste produced in these facilities, particularly from food preparation and processing, will considerably increase the environmental footprint of the restaurant industry if current waste management practices are not improved [275].

Considering the extensive problems (both in scale and global reach) and the increasing emphasis on producing and consuming healthy, sustainable food, the issue of food waste is attracting greater scientific and public attention [273]. Consequently, an increasing number of initiatives are being introduced to reduce the amount of waste at every stage of the supply chain, from production and storage to preparation and

consumption.

Materials and Methods. This article examines the methods and strategies for collecting, sorting, recycling, and disposing of waste in public dining establishments, taking into account their adverse effects on the environment and the public dining sector.

Additionally, it evaluates the regulatory documents [276-279] that outline the requirements for appropriate trash and waste management, specifically focusing on collection and disposal.

Results and Discussions. All business entities generate waste from their operations, including public dining establishments.

The HACCP team proactively develops action plans for each establishment to be immediately implemented if monitoring shows deviations from critical limits. These action plans must be documented in relevant procedures [276].

Special facilities are essential for storing garbage and inedible materials until they are removed from the public dining establishment. The design of these facilities must provide protection against pests and prevent contamination of food products, drinking water, equipment, premises, or pathways within the public dining establishment.

Enterprises must maintain an effective and orderly system for disposing of effluents and waste, ensuring it is in good working condition. All drain pipes (including sewage) must be designed to prevent contamination of drinking water. All drain pipes should be properly installed and lead to a drainage pipe [277].

Identifying the specific types of waste generated is necessary, which involves conducting an inventory, identification, and certification of the waste.

Inventory at the facility is conducted once. During the waste inventory, several important issues are addressed:

- 1) Whether there is a need to develop a register map for the waste generation facility on-site;
- 2) Whether the facility needs to obtain a permit for waste management operations or if it is sufficient to annually submit a declaration of waste generation.

An ecologist should conduct the inventory. After the inventory and certification

of the waste are completed, there will be an understanding of the specific types of waste generated at the facility, their quantity, their hazard class, whether they are hazardous, and where and how they can be temporarily stored, and what should be done with them subsequently.

In the kitchen and food preparation areas, waste must be collected in disposable waterproof bags or marked reusable containers. These containers should be sealed or closed and removed from the production areas as they fill up or after each shift, then placed or emptied into lockable waste bins, which should never be brought into the kitchen. Reusable containers must be cleaned and disinfected before being reused in the kitchen [277].

Waste containers should be situated separately from food storage areas in a dedicated closed area.

The temperature should be maintained as low as possible, and the area must be equipped with adequate ventilation, lighting, and protection against insects and rodents.

The area should be readily accessible for cleaning, washing, and disinfection. Waste containers must be cleaned and disinfected as necessary [278].

These containers should be clearly marked to indicate their purpose (Table 1), constructed from durable material that can be easily cleaned and sanitized, and positioned in designated areas. They should be kept closed when not in use and securely locked in locations where waste could pose a contamination risk to products (Figure 1).

All waste generated at the facility must be either utilized or removed.

Since public dining establishments lack the capability to dispose of waste independently, they are required to enter into waste disposal contracts with municipal enterprises.

Table 1.

Classification of Containers According to Category Division

No	Type of garbage	Color
1	Low-hazard waste or minor chemical waste: fluorescent lamps, cleaning agents, spent oils, etc	Red
2	PMD (Plastic or Metal and Drink Cartons) waste: packaging made of plastic or metal and beverage cartons are recycled to produce new packaging materials, textile fibers, etc	Orange
3	Cans from beverages and food	Yellow
4	Glass and glass cullet. In most places, clear glass and colored glass should be separated. New glass containers can be made from recycled glass	Green
5	Paper and cardboard: newspapers, magazines, boxes, and the like must be sufficiently clean to be recyclable	Blue
6	Organic waste: vegetables, fruits, garden waste, trimmings, grass, and leaves can be composted	Black



Figure 1. Classification of containers according to color coding

Contracts must encompass all types of waste as specified in the nomenclature. In other words, both the contract and its associated primary documentation should list the waste types as defined in their respective certificates.

Waste must be categorized as per Ukrainian legislation and, depending on the anticipated disposal method, isolated and collected in specific specialized containers.

Contracts should be made not only for the collection and removal of waste. The

contract must clearly specify the final waste management operation – whether recycling, disposal, or placement.

The removal and disposal of waste from the facility, as outlined in respective agreements, must be conducted. The cleaning, washing, and disinfection of containers and receptacles for external waste storage should be conducted separately from other containers. Containers for internal waste storage can be disposable or returned to the premises after cleaning, washing, and disinfection [276].

Vehicles designated for transporting containers and waste collectors are strictly prohibited from being used for the transport of food raw materials or finished products.

Schedules and methods for removing waste from premises where food products are handled must be determined to avoid accumulation. This should take into account the possibility of cross-contamination of products during their removal [276].

To prevent the spread of infections during the preparation of meals, which can cause food poisoning, it is extremely important in the kitchens of restaurant establishments to schematize the flows (Figures 2-3). This ensures a distinct separation between clean and dirty areas, thereby preventing dangerous cross-contamination [280].



Figure 2. Designation on the restaurant flow route diagram

The list of restaurant premises, along with the schematization of the movement of raw materials and staff analyzed for efficiency, is presented in Table 2. This mainly includes storage rooms for products, preparation workshops (vegetable, and meat-fish workshops), finishing workshops (hot and cold), as well as dishwashing areas for tableware and kitchen utensils, among others. Analyzing existing flow diagrams will

allow for the assessment of cross-contamination risks and the development of recommendations for optimizing these flows.

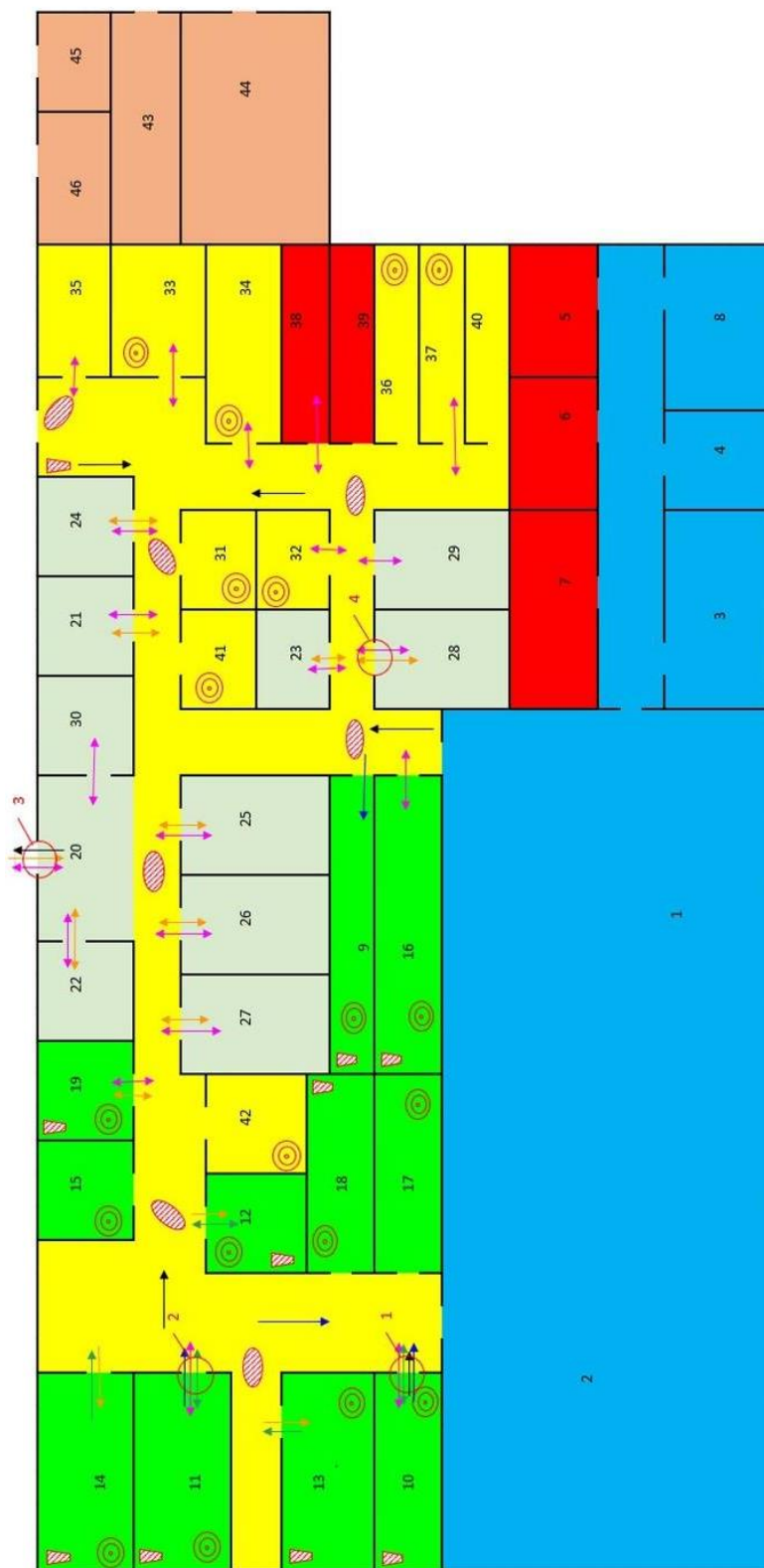


Figure 3. Traffic pattern in the restaurant

Table 2.

The names of the restaurant premises

№	Name	№	Name
	Premises for visitors	24	Grocery Pantry
1	Dining room	25	Cooling chamber for meat and fish
2	Zone of musical atoms, audio and video reproducing, etc.	26	Cooling chamber for dairy and fat products and gastronomy
3	Lobby	27	Cooling chamber for fruits, herbs, vegetables and drinks
4	Wardrobe	28	Pantry for daily supply of raw materials
5	Women's toilet (restroom)	29	Logistics storeroom
6	Men's toilet (restroom)	30	Pantry for washing containers and household packaging goods
7	Toilet (restroom) for people with limited mobility		Service premises
8	Smoking room	31	Director's office
	Production premises	32	Accounting
9	Buffet	33	Waiters and bartenders' quarters
10	Hot shop	34	Staff quarters
11	Cold shop	35	Staff wardrobe
12	Bread cutting room	36	Showers for women
13	Meat and fish workshop	37	Showers for men
14	Vegetable shop	38	Women's toilet (restroom)
15	Production Manager's Office	39	Men's toilet (restroom)
16	Room for washing tableware	40	Storekeeper's room
17	Room for storing and dispensing dishes	41	Cleaning equipment storage room
18	Room for washing kitchen utensils	42	Linen storage room
19	Egg processing room		Technical premises
	Warehouses	43	Electrical panel room
20	Loading room	44	Heating point room
21	Dry food pantry	45	Room for fresh air ventilation
22	Pantry of vegetables and pickles	46	Exhaust ventilation room
23	Wine and vodka pantry		

Monitoring and implementing corrective actions in case of detected non-conformities. The responsible chef [277] is in charge of organizing a comprehensive set of measures for handling production waste and garbage, including their collection and removal, as well as ensuring safe collection and disposal of waste in the kitchen.

The head of the establishment organizes the signing of a contract with a company that handles waste removal and disposal and oversees the sanitary condition of the premises and containers.

Monitoring is conducted continuously or periodically.

For periodic monitoring, the frequency should be set in a way that ensures the reliability of information and, at a minimum, facilitates corrective actions in case deviations are detected during monitoring. It should also ensure that potentially hazardous food products, produced since the last positive monitoring result, do not leave the market operator's control.

Monitoring should enable the timely detection of loss of control at critical control points (CCPs) for the prompt application of corrective actions.

In case of inadequate control and deviations from critical limits, a hazardous food product may be produced. Considering that the consequences of critical deviations at CCPs lead to the release of hazardous food products, monitoring procedures must be effective. If monitoring reveals trends indicating a loss of control at CCPs, preventive actions are implemented [276].

Completed work is documented in a report of work performed.

Verification of the basic program. Methods for verifying the prerequisite program include classifying waste by origin, adhering to the frequency of waste removal, and disinfecting waste bins.

Verification of the basic program is carried out by the HACCP team according to the 'Verification Plan'. The verification activity should confirm that:

- a) prerequisite programs are implemented and effective;
- b) the hazard management plan is implemented and effective;
- c) hazard levels are within acceptable limits;
- d) input data for hazard analysis are updated;
- e) other actions determined by the organization are implemented and effective.

If verification is based on testing of final product samples or direct sampling from the process, and the tests reveal non-conformity of the samples to acceptable levels of food hazards, then the organization must treat the questionable part of the production

as potentially hazardous and undertake corrective actions [279].

Staff training. Staff must have knowledge of the HACCP system commensurate with their job responsibilities [276].

The manager of the establishment conducts briefings for the production and administrative staff:

- initial briefing – after the document comes into effect;
- periodic briefing – once a year;
- extraordinary briefing – in cases of changes to the documents or when instances of employee non-compliance with the program requirements are detected.

Conclusions. In summary, the research on waste and garbage handling, as well as their collection and removal, indicates that effective waste management requires a comprehensive approach and systematic measures. The analysis demonstrated that optimizing these processes with modern methods of sorting, recycling, and disposal helps reduce waste, improve environmental conditions, and foster a more sustainable environment for future generations. This highlights the necessity of continually improving waste management strategies to attain a more sustainable and eco-friendly production environment in public dining establishments.