THE PRACTITIONER'S TOOL KIT

Complexities and Strategies for Controlling Contamination

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Editor's Note: The National Environmental Health Association (NEHA) strives to provide relevant and useful information for environmental health practitioners. In a recent membership survey, we heard your request for information in the *Journal* that is more applicable to your daily work. We listened and are pleased to feature this column from a cadre of environmental health luminaries with over 300 years of combined experience in the environmental health field. This group will share their tricks of the trade to help you create a tool kit of resources for your daily work.

The conclusions of this column are those of the authors and do not necessarily represent the official position of NEHA, nor does it imply endorsement of any products, services, or resources mentioned.

Most of our activities involve some form of contamination control. Most situations in which contamination control is of concern—and particularly its subset, cross-contamination—involve food and food preparation. Interestingly, however, the Food and Drug Administration's model *Food Code* does not define cross-contamination or the newly introduced term: cross-contact. Yet, frequent and repetitive occurrences are found during our food safety inspections. We are trained to easily recognize both conditions when we see them. We respond in kind, by citing the *Food Code*, the details and many risk factors involved in both cross- and contact-contamination conditions.

Let us start by defining the current use of these two terms. Cross-contamination is the transfer of harmful bacteria, viruses, or other biological hazards (as well as chemical and physical contaminants) from one surface or food to another. The newest term in our lexicon, cross-contact, although similar to cross-contamination, is the transfer of a food allergen rather than a pathogen from one surface or food item to another. "Potato" versus "potahto." In either situation, developing straightforward strategies to prevent any form of cross-contamination is not easy.

In our collective experiences, we never found any situation that had a single causation. Rather, each cross-contamination condition we encountered required a multifactorial response that involved three tiers: people, places, and things. This challenge means that simply using the word "don't" does not work. Unlike straightforward time and temperature controls, comprehensive contamination control requires programmed responses that follow a hierarchy of prevention strategies. To achieve this goal, there are two distinct approaches to contamination control: 1) intervention and 2) prevention. They overlap. Here is how it works.

We start by identifying problems (intervention) relating to contamination through applied epidemiology, such as a response to a foodborne illness along with inspecting, auditing, sampling, and process monitoring. Simple and straightforward.

Next, we need to define the problem or problems that we find. Ideally, we do this step by using first-principle thinking. This form of reasoning is where the problem or situation is identified and understood. Instead of relying on conventional wisdom, this approach encourages us to start with what we know to be true—good science—and reason up from there. By dissecting problems into their most basic components, we can devise new insights and solutions. In short, this process is the best way to reverse-engineer complicated situations and separate underlying ideas or facts from any assumptions based on them. Simply stated, this process is Occam's razor (also known as the principle of parsimony)!

Following this step, we need to correct or alter the situation that we have identified. The best approach is to use second-order thinking. Second-order thinking requires us to consider our actions and their immediate consequences and the subsequent effects of those actions. All too often, what we think is a reasonable solution can create another problem. For example, in trying to eliminate *Listeria* from a food production environment, we all too often rely exclusively on disinfectants. Remember, these products can be potentially deleterious to things downstream, including destroying the biome of a sewage disposal plant. While the solution is effective in destroying *Listeria*, it is not so good for the environment.

Finally, we need to apply contamination control strategies that follow a general hierarchy of efficacy. Most of this application is directed at preventing future contamination occurrences. It starts with a simple concept: Keep the contaminants out. Ideally, if we can accomplish this goal, our job is done. Like integrated pest management, keeping pests

out of an establishment is the easiest way to prevent contamination due to their presence. Likewise, purchasing foods that were pretreated to destroy pathogens through pasteurization, irradiation, or acidification will negate the threat of foodborne illness at its source. Examples include milk, pasteurized eggs, fruit juices, packaged ready-to-eat foods, and vegetable products, just to name a few.

There is, however, no such thing as keeping everything out. Through necessity or oversight, something will always sneak by. So, the next stratagem is to destroy those contaminants that we could not prevent from getting in. This strategy includes applying the entirety of food safety practices, which is where most contamination of concern occurs. It is here that demand for the best of our knowledge, skills, and ability as environmental health professionals comes into play. Raw foods, soiled hands and equipment, and the occasional mouse dropping and urine are primary targets for the destruction of contaminants that are introduced into critical areas and onto critical surfaces. This strategy of contamination control focuses on traffic patterns, separation during preparation, cooking, personal hygiene, and in particular, frequent handwashing. Also included are thorough cleaning and sanitizing of processing equipment and utensils, as well as a comprehensive back-of-the-house integrated pest management program. The goal is to significantly reduce the risk of disease, as far as possible and as early as possible.

Realistically we also know that we cannot eliminate all risks of contamination. Therefore, our next aim is to keep unwanted microbes from growing and any other environmental contaminants from creating harmful conditions. To this end, we use time and temperature and apply all of the control requirements listed in chapter 3 of the 2022 *Food Code* (Food and Drug Administration, 2024). It is all about preventing contamination from direct and indirect human contact, vectors, vehicles, and fomites.

Finally, to ensure that we have achieved minimal risk of contamination, we apply our last strategy—to minimize the movement of all remaining contaminants within the environment. The food industry embraced the concept of hygienic zoning from biosafety (Runkle & Phillips, 1969). Through zoning, we can separate any operation into four basic risk groups. These include: 1) nonproduction zones (e.g., office, storage, building exterior), 2) low-risk zones (e.g., raw materials), 3) medium-risk zones (e.g., post microbial reduction), and 4) high-risk zones. The highest risk of contamination is assigned to those areas in which food that might support the survival and growth of pathogens or spoilage microorganisms are kept (e.g., ready-to-eat,, soft cheeses, lunch meat).

The objective of zoning is to prevent traffic and movement of products, people, and things between these areas. And yes, it can be done in retail food facilities. We accomplish this objective by using passive barriers, with active hurdles in high-risk zones; control of visitors, contractors, and employees; and training everyone within the facility.

While it takes a bit of imagination, materials can flow in one direction through zoning. Products should flow from low-risk to high-risk zones by passing through a microbial reduction step. Packaging material and eating utensils should be received and stored close to the high-risk area. Waste should be transported from the area where it is generated to a nonproduction zone (i.e., a low-risk zone). Ideally, the wastewater line for low-risk products should not be connected to the wastewater line from high-risk products. Utensils and tools used in a high-risk zone should remain within that zone. All tools introduced into a high-risk zone should be cleaned and sanitized before use. Ensure adequate space is planned for storage and cleaning. And finally, when inspecting and monitoring any operation, your movement should be from high to low risk, clean to soiled, and you should ensure that people activity and material movement go from high- to low-risk zones.

While contamination control is not easy, it is the most challenging thing we do in our profession. Learn, enjoy!

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References

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