

# Supporting environmental health officers in food premise inspections – A new field guide for ready-to-eat meats food safety considerations

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**Abstract:** Ready-to-eat (RTE) meats such as beef jerky, pepperoni, salami, prosciutto, bacon, ham, and smoked deli meats have been rising in popularity. Environmental Health Officers (EHOs) and other regulatory personnel have the responsibility to inspect and regulate small- and medium-sized food operations that may be producing these types of meat products. Many of these operators may have limited technical food safety knowledge of RTE meat products, with the responsibility of education falling on the shoulders of EHOs. This article will provide a brief overview of the new Ready-to-eat Meats Field Guide developed by the National Collaborating Centre for Environmental Health, which discusses general food safety considerations of RTE meat production.

**Key words:** ready-to-eat meats, food safety, risk assessment, meat inspections, inspections, meat production.

## Introduction

With the growing popularity of artisanal and locally produced meat products, small- and medium-sized food operations may be increasingly producing ready-to-eat (RTE) meat products such as beef jerky, pepperoni, salami, prosciutto, bacon, ham, and smoked deli meats. Regulatory personnel such as environmental health officers (EHOs) have the responsibility of inspecting facilities that produce foods including RTE meat products. The food safety of these products is particularly important because the consumer will not normally cook them. In general, smaller RTE meat production facilities are not licensed with the Canadian Food Inspection Agency (CFIA) but are inspected by EHOs from a provincial agency or local health department. Many of these operators have limited technical food safety knowledge of RTE meat products and have limited in-house capacity to conduct safety testing of ingredients and final products.

To support EHOs in their inspection and risk assessment roles, the National Collaborating Centre for Environmental Health (NCCEH) developed an online self-paced course in 2018 based on materials from in-person training delivered by the BC Centre for Disease Control. Since then, the applicable regulations have changed and other training content has been updated. EHOs now require current and more readily available information to support them in the field, which the online course could no longer provide. As such, the outdated online course has been retired and the essential content has been updated and modified into a field guide that can be easily referred to on demand. The field

guide (<https://ncceh.ca/resources/videos-tools/ready-to-eat-meats-field-guide-environmental-health-officers>) is designed specifically for EHOs and other regulatory personnel responsible for inspecting micro, small, and medium-sized RTE meat production operations—which include restaurants, butcher shops, and local meat processors that do not distribute products nationally. This guide serves as both a reference document and a field-ready inspection aid, offering general guidance on evaluating food safety risks in RTE meat production. This article provides a brief overview of the content covered in the new field guide.

## Conducting a food safety risk assessment

The field guide provides an overview of key considerations when conducting a risk assessment of a food processing facility, and the food safety risks and controls associated with RTE meat processing.

There are many known biological, chemical, and physical hazards associated with meat products. Pathogenic microorganisms are biological hazards; examples include *Escherichia coli*, *Salmonella* spp., *Listeria monocytogenes*, *Staphylococcus aureus*, *Clostridium perfringens*, *Trichinella spiralis* and *Clostridium botulinum*, which can lead to serious illnesses if not adequately controlled. Chemical hazards such as excess additives (curing agents and allergens), as well as physical hazards such as bone chips, metal, and glass may also exist. This section of the field guide describes important considerations when inspecting a

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food production facility and determining the risks associated with foods produced in the facility:

- Fundamental food safety programs such as food safety plans that incorporates Hazard Analysis Critical Control Point (HACCP) principles, sanitation procedures and records, equipment maintenance procedures and records, employee and product flow plans, availability of potable water, and recall plans.
- A complete list of RTE meat products produced at the facility, along with the food safety controls in place (critical control points [CCPs], critical limits [CLs], production records) for each of the products. Food safety controls could include cooking, fermenting, curing, drying, or combinations of these steps.

## Common critical control points in RTE meat production

There are limited primary CCPs in RTE meat production, and not all of them will apply to all products. Figure 1 highlights CCPs in green, and shows all combinations of processes that raw meat, also referred to as “fresh” meat or product, can go through to become RTE. The field guide discusses each of these steps in greater detail.

### Cooking/smoking

Cooking is the application of heat to a product until it reaches a time-temperature combination sufficient to kill harmful microorganisms. Appendix B of the Canadian Food Service and Food Retail Code outlines minimum internal cooking temperatures for different meat types. The CFIA outlines time/temperature combinations for specific types of meat in their guidance on Preventive control recommendations for manufacturing cooked RTE meats (Canadian Food Inspection Agency, 2018b). It is very important to note that all temperature/time combinations refer to the minimum internal temperature of the product.

Smoking occurs when the product is exposed to smoke at some point in the process, either through combustion or friction using clean, untreated fruit woods or hardwoods. Wood used for smoking must not be scrap wood that has been exposed to chemicals, hydrocarbons, or wood preservatives, or any processed wood such as particle board, plywood, or paneling that contains glue. Liquid smoke may also be used during a smoking step or as a substitute for smoke.

- Hot smoking occurs at cooking temperatures and can serve as a lethality step.
- Cold smoking uses sub-lethal temperatures and does not kill pathogens—it is not considered a control step.

### Cooling

Some pathogens, such as spore-forming bacteria, may be able to survive the cooking/smoking process. Therefore, rapid and continuous cooling is critical. Generally, cooling rates should be similar to those required in other food service establishments.

- From 60°C to 20°C within 2 hours, and then
- From 20°C to 4°C within 4 hours.

The CFIA also outlines acceptable cooling processes in the guidance on “Preventive control recommendations for cooling heat processed meat products” (Canadian Food Inspection Agency, 2018a). Rapid cooling can be used for all cooked meat products, while slow cooling can only be used for products that meet specific criteria. The field guide discusses these cooling processes in greater detail.

### Curing

Curing is the addition of salt and nitrites ( $\text{NaNO}_2$ ) or nitrates ( $\text{NaNO}_3$ ) to meat to enhance flavor, extend shelf life, and most importantly, prevent the growth of harmful pathogens, especially *Clostridium botulinum* (Interior Health, 2016). Nitrates must be converted to nitrites by bacteria. In general, all RTE sausages and fermented RTE products MUST be cured. Nitrites also slow or stop other pathogens by reducing water activity and creating

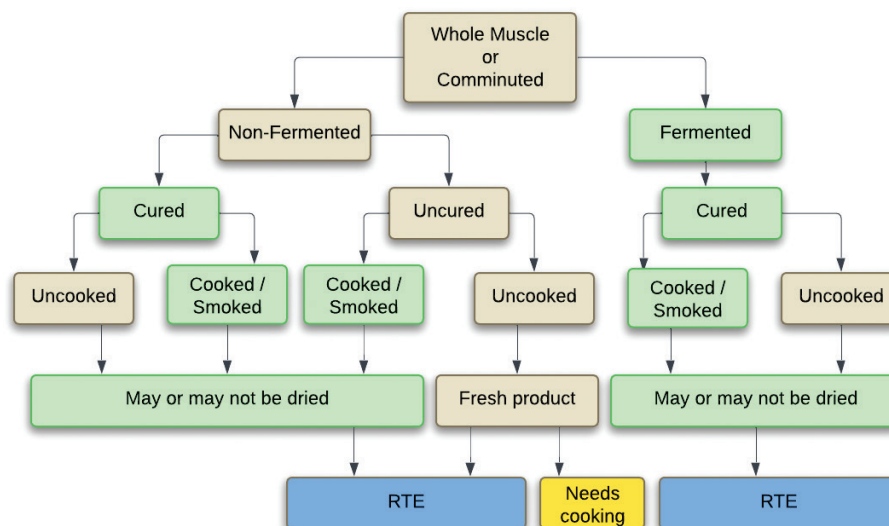


Figure 1: RTE meat processing methods, with critical control points shown in green.

hostile conditions inside the meat. Products such as jerky, hams, bacon, and many deli/sandwich type meats such as certain types of pepperonis are all examples of non-fermented meat products that have been cured. Many cured products produced today are either further cooked by the manufacturer or are meant to be cooked by the consumer. However, there are some cured products that are not further cooked prior to consumption.

The addition of nitrites is a CCP with the amount added being the critical limit. There are health risks involved with adding too little or too much nitrite to meat products. Permitted levels of nitrites for cured products are outlined by the CFIA in their guidance “Preventive control recommendations on the use of nitrites in the curing of meat products” (Canadian Food Inspection Agency, 2021). An important point to note is that all prescribed levels are calculated at the time of formulation.

The primary values to remember for nitrite concentrations:

- Maximum level for most products is 200 ppm.
- Maximum level for side bacon only is 120 ppm.
- Minimum level of 100 ppm for all products that must be cured, which includes all RTE sausages (including fermented types), chopped ham, corned beef, bacon, back bacon, and Wiltshire bacon. For a full list of products that must be cured, please see CFIA Table 2 Standards for Specific Edible Meat Products (Canadian Food Inspection Agency, 2024).

Nitrites can be added to products in three different ways:

- Direct addition to the meat mixture/emulsion along with other ingredients.
- Dry rub spread over a measure amount of meat then allowed to penetrate over a period.
- Brine soaking/immersion or injection using specialized equipment.

As part of the risk assessment of the facility and products, the level of nitrites used in all products must be calculated manually. The field guide discusses these calculations in greater detail.

## Fermentation

Fermentation is the process of using specific bacterial cultures, usually lactic acid bacteria, to lower the pH of the product to a level that prevents the growth of harmful microorganisms (pH 5.3 or lower). Most lactic acid bacteria grow well between 20°C and 37°C, though some cultures will grow below and above this range (Walker et al., 2024). This process imparts some of the flavour that is characteristic of these products. These temperatures also permit pathogens such as *Clostridium botulinum*, *Staphylococcus aureus*, *Escherichia coli*, *Salmonella* spp., and *Trichinella spiralis* to grow; thus, there must be certain controls in place.

Backslopping is when a small portion of a previously fermented batch of product is used as the starter culture, instead of adding a commercial bacterial culture to start the fermentation. In general, backslopping is not recommended and is prohibited in some provinces.

To verify that critical limits in fermentation are being met, it is crucial that the pH of the product is accurately measured and recorded as well as the time required for the product to attain a pH of 5.3 or less. A primary concern in the production of fermented

products is growth of *Staphylococcus aureus* and subsequent production of its enterotoxin. It is critical that the pH is lowered at a rate that will sufficiently inhibit the production of the toxin to prevent human illness. This is accomplished by controlling the time and the temperature conditions before the pH reaches 5.3. This combination of time and temperature is referred to as degree-hours, and there are different acceptable limits depending on the temperature (or combination of temperatures) used during the fermentation process. The field guide describes the method to calculate degree-hours at constant and variable temperatures.

## Drying

Drying removes moisture from RTE meats under controlled conditions to improve shelf stability, texture, and flavor. The process is used for both whole muscle and comminuted products, fermented and non-fermented products, cured and uncured products, and products that may or may not be further cooked. Drying is often used along with other steps such as curing or fermenting to control pathogens but is not considered a pathogen lethality step on its own. Drying is particularly important for products that rely on water activity ( $a_w$ ) to meet shelf-stability requirements. If fermented products are dried to attain shelf stability, these products must meet the following requirements (Walker et al., 2024):

- Minimum of 100 ppm nitrites/nitrates AND
- Minimum of 2.5% salt AND
- The  $a_w$  of the finished product is 0.85 or less, regardless of pH, OR
- The pH of the finished product is of 4.6 or less, regardless of  $a_w$  OR
- The pH is 5.3 at the end of the fermentation period and the end product has an  $a_w$  of 0.90 or lower

Drying is used for both whole muscle and comminuted, fermented and non-fermented, cured and uncured products. If the product was properly fermented, any drying temperature may be used. The rate of drying is particularly important for fermented products. If the rate is too slow, mould growth and discoloration may occur. If the rate is too fast, surface hardening (case hardening) traps moisture inside and may promote pathogen growth. For non-fermented products, drying temperatures must be lower than 15.0°C or higher than 60°C to prevent pathogen growth. Drying rooms must be clean, designated areas with airflow, humidity, and temperature control, and monitored daily.

Dried beef products such as jerky, biltong, and similar products pose a hazard associated with *E. coli* O157:H7, and these products must be submitted to a heat treatment before the drying process. CFIA has outlined appropriate options for heat treatments in their guidance on Control of *E. coli* O157 in dried beef products (Canadian Food Inspection Agency, 2020). For whole-muscle dry-cured products such as prosciutto, bresaola, or coppa, the CFIA does not have specific prescriptive guidance, therefore it is recommended to reach out to CFIA the validate the production processes or use a previously validated process.

## Raw RTE meat products

RTE fresh products are made from raw meat that is not cooked, cured, fermented, or dried, yet is consumed without further

preparation. Examples include steak tartare, beef carpaccio, and some types of Metwurst sausage. These products do not undergo a kill step. Key control measures to reduce the food safety risks include:

- Use fresh, whole muscle cuts (not ground or tenderized).
- Searing the exterior can reduce surface contamination.
- Ensure the product is consumed shortly after preparation (within 3–4 days).
- Maintain strict refrigeration and sanitation during processing and storage.

## Controlling *Trichinella* in RTE meat products

*Trichinella spiralis* is a parasitic roundworm that can cause trichinellosis in humans. It must be controlled when processing at-risk meats, specifically pork, into RTE products. The CFIA conducts *Trichinella* control and surveillance programs, which are responsible for surveillance, regulation, and testing of commercially distributed pork in Canada. Approximately 18,000 slaughtered swine are tested annually, and 16,000 sows are tested every 3–5 years. CFIA inspectors enforce meat processing regulations at federally inspected meat plants to ensure destruction of *Trichinella* larvae (Canadian Food Inspection Agency, 2013).

*Trichinella* control methods are outlined in CFIA's preventive control guidance "Control recommendations for the inactivation of *Trichinella spiralis* in pork products" (Canadian Food Inspection Agency, 2022). There are three primary control methods for *Trichinella*:

- Heating the product to specific time and temperature combinations, OR
- Freezing the product to specific time, temperature, and thickness of product combinations, OR
- Using specific curing methods.

Other processes are available but require special approval before being used. It is important to note that wild game species (e.g. bear) are high-risk and often carry freeze-resistant *Trichinella*. Therefore, this meat must be thoroughly cooked.

## Uninspected meat

Some provinces allow uninspected meat—including game kills and farm-slaughtered animals—to be processed in licensed facilities under specific conditions. However, this meat has not undergone inspection for disease or sanitation, making it higher risk for contamination. If this meat is processed alongside inspected meat, there's a risk of cross-contamination. Another consideration is the risk of Chronic Wasting Disease (CWD) in venison from deer, elk, and related species in CWD zones. No cooking methods are able to inactivate prions. Some provinces permit the processing of uninspected meat in licensed meat processing facilities provided that certain steps are taken, and various conditions are met (see BC's Guideline for Cutting and Wrapping of Carcasses that are Not Government Inspected) (B. C. Centre for Disease Control, 2021).

## Conclusion

The production of RTE meats in small- to medium-sized operations presents unique challenges that require careful attention

to food safety principles, appropriate sanitation and hygiene practices, validated processing methods, and regulatory oversight. The new NCCEH field guide for RTE meats is intended to support EHOs in conducting evidence-informed inspections and risk assessments. Through effective inspection, education, and enforcement, EHOs play a vital role in reducing the risk of foodborne illness in food producing facilities. The RTE Meat Field Guide for EHOs is available on the NCCEH website.

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