

Reduced Oxygen Packaging (ROP) of meats and other foods may offer some benefits to retail food establishments. However, it is important to understand the food safety concerns and know the regulations tied to this type of packaging.

Benefits of ROP

- » Reduction or removal of oxygen in a package limits growth of some spoilage organisms.
- » Reduces oxidation of foods and retards rancidity and color deterioration.
- » Reduced oxygen packaging may extend shelf life of cold-stored foods.

Types of Reduced Oxygen Packaging include¹:

- » Vacuum packaging: air is removed from a package of food and the package is hermetically sealed, so that a vacuum remains inside the package.
- » Modified atmosphere packaging: the atmosphere inside the package is modified so that the level of oxygen is different from outside air (21% oxygen). The composition of the atmosphere in the package may change over time due to permeability of the packaging material or respiration of the food.

What are the food safety concerns with vacuum packaging?

A dangerous bacterium called *Clostridium botulinum*, which is not detectable by sight or smell, can grow in the absence of oxygen such as in vacuum packaged or canned foods. *C. botulinum* forms spores that, under the right conditions, may germinate and grow, producing a deadly nerve toxin. While types of botulinal spores associated with seafood may grow slowly in the refrigerator, the vast majority of *C. botulinum* spores grow only in foods with high pH (above 4.6) and high moisture (water activity above 0.85), and in an oxygen-free environment at room temperature. Because it is present everywhere, any food can be contaminated with it.

Further, the extended shelf life possible with vacuum packaged products allows pathogens, such as *C. botulinum* and *Listeria monocytogenes*, that may be present to grow slowly over longer periods of time, even at refrigeration

¹ Cook-chill and sous vide are types of vacuum packaging processes not covered in this fact sheet.



temperatures. This can be particularly problematic because it is difficult to ensure that foods will always stay below safe refrigeration temperatures (<41°F) in transit, in stores, and in consumer homes. Because spoilage bacteria are less likely to grow under reduced oxygen conditions, the product may appear to be safe (no off odors or appearance), even when it may not be safe any longer. *C. botulinum* and *L. monocytogenes* also grow better when they do not need to compete with spoilage organism growth.

List of acceptable barriers to ensure ROP product safety:

In all ROP foods, at least two (2) barriers must be in place to control *C. botulinum* growth and toxin formation. These barriers include the following:

- » Refrigeration carefully maintained at <41°F with clearly labeled “use by” date (of less than 30 days after production). The product must also be labeled with: “Important – must be kept refrigerated at <41°F.”
- » pH at or below 4.6 (example foods: most fruit products²).
- » Water activity³ at or below 0.91 (example foods: hard cheese).
- » Presence of high levels of competing organisms such as raw meat or raw poultry.
- » Freezing. Note that all ROP frozen foods from a retail food establishment must be clearly labeled with

² List of pH of many foods: <https://extension.okstate.edu/fact-sheets/the-importance-of-food-ph-in-commercial-canning-operations.html>

³ More information on water activity: <https://www.clemson.edu/extension/food/canning/canning-tips/39available-moisture.html>

the statement: “Important- Keep Frozen Until Use”. Also note that seafood (including frogs and alligators) MUST be frozen before, during, and after ROP.

- » Inspected, properly cured meat or poultry product⁴.

In addition to utilizing at least two of these barriers, operations must ensure that employees are properly trained on ROP.

Regulations for safe vacuum packaging for Retail Food Establishments:

Retail food establishments planning to utilize any type of reduced oxygen packaging should always consult the food safety regulations in their area to determine the specific requirements for them to sell ROP food items. In general, most jurisdictions will require food businesses such as restaurants, caterers, delis in retail stores, etc. to utilize at least two (2) of the barriers listed above AND to have a HACCP plan in place which specifies the following:

- » Identification of the food to be packaged.
- » Specifies the method for maintaining the food at 41°F or below.
- » Describes how the packages will be prominently labeled with instructions to:
 - » Maintain food at 41°F or below.

4 The product must contain salt (brine concentration > 3.5%) AND nitrates or nitrites (120 ppm of sodium nitrite). The cured product must be produced following these regulations: 9 CFR 318.7 and 9 CFR 381.147

- » Discard the food within 30 calendar days if not already consumed.⁵
- » That the shelf life will be limited to no more than 14 calendar days from packaging to consumption.
- » Operational procedures that a) prohibit bare hand contact with the food, b) specify methods of separation of raw foods and ready-to-eat foods, and c) cleaning and sanitizing procedures for food contact surfaces.
- » Procedures to restrict access to ROP equipment to responsible trained personnel.
- » The training program to ensure that the person responsible for ROP understands all the necessary safety precautions.

Other useful resources:

- » FDA Food Code 2022: <https://www.fda.gov/media/164194/download>
- » Schneider, Keith, W. Steve Otwell, Victor Garrido, and Ray Mobley. Guidance for Processing Reduced Oxygen Packaging (ROP) of Raw, Frozen Seafood in Retail Operations. 2019. Available from: <https://edis.ifas.ufl.edu/publication/FS112> Accessed on June 8, 2023.

5 According to the Kansas Food Code. For other states, check your local regulations

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