FRIED FOOD PRODUCTS

INTRODUCTION

Despite the health concerns of eating fried foods, they are still very popular. Potatoes are commonly prepared as french fries, and most of our favorite snack foods are fried.

This PRC Guideline describes the manufacturing of two fried snack foods: potato chips and corn chips. Other fried foods, such as french fries, fried dough, tortilla chips, and cheese curls, have different ingredients and product shapes, but are fried in a similar way.

This PRC Guideline also describes pretzel manufacturing. Pretzels are baked, but they are usually manufactured in the same facilities where fried snack foods are made. Other baked snack foods include crackers and some potato chips. Crackers may be produced in a facility that makes fried snack foods or in a cookie bakery.

Although doughnuts are fried, they are considered to be a bakery product. PRC.17.23.1.1 covers manufacturing of bakery products, including doughnuts.

The most serious hazard of frying foods is the heated oil used to fry them. Even at room temperature, the oil is combustible. The temperatures used to fry foods bring the oil near its flash point, making it much more hazardous. If the oil overheats or the oil level in the fryer drops too low, a serious fire is likely. And if oil residue has accumulated on cooking equipment, inside ducts, or on building surfaces, a fire can spread quickly and destroy an entire facility.

Loss prevention for facilities processing fried foods centers on controlling the oil temperature, oil level and residue accumulation. Vigilant housekeeping is necessary to reduce chances of having a serious fire.

PROCESSES AND HAZARDS

The process for making fried foods is to prepare the food or batter, then deep fry it in tanks of hot oil.

Potato Chips

Potatoes are stored in wooden boxes in small rooms with moisture and temperature control. The boxes are solid piled, usually to no more than 16 ft (5 m) high. Up to one year's supply of potatoes can be kept on hand. If stored in the same room, empty wooden boxes create an exposure to the potatoes.

Refrigeration systems for the potato storage rooms often use ammonia for a refrigerant. These systems present potential for fire, explosion and contamination.

Cooking oil is a Class IIIB liquid. Larger facilities store the oil in large steel tanks; smaller facilities store it in 55-gal (200-L) plastic drums. Oil storage is usually kept inside the building in a separate room. Loss exposures from oil storage include liquids damage, contamination and fire.

Potatoes are taken from storage, washed, peeled and sliced. They are soaked in a bicarbonate-rich water mixture to prevent them from sticking together. The treated potato slices are then fried in 350°F (180°C) oil for approximately 8 min. This is done either in continuous fryers or in direct fired batch kettles.

Continuous potato chip fryers are usually gas fired but may sometimes be oil fired. They usually hold approximately 1200 gal (4500 L) of oil.

Continuous fryers are of three types. The most common is the radiant tube type, in which six to eight radiant tubes run the length of the fryer tank bottom. Burners fire into the radiant tubes to heat the oil. The tubes are connected to a common header and exhaust stack.

The second type of fryer circulates the cooking oil through a tube bundle under the fryer. The tube bundle, similar to a coil, is heated by a fuel burner. The heated oil then returns to the fryer.

The third type of fryer uses a separate heat exchanger to heat the oil. The heat exchanger is usually located on the roof of the building. The fryer is not exposed to the heat exchanger in this arrangement, but oil must be piped to the exchanger. This exposes other parts of the facility to hot oil.

Potato chips made in batch kettles are called kettle chips. Kettles usually hold approximately 400 gal (1500 L) of oil. Sliced, prepared potatoes are dropped into the kettle and hand stirred. Special ladles are used to remove the chips from the kettle when the batch is done.

The primary hazard of cooking potato chips is the heated cooking oil. Fires occur when the oil is heated above its flash point. This can happen from defective heating controls or when the oil level drops too low. Another hazard is explosion from accumulation of unburned fuel. Loss of fryers or kettles can result in long down times.

After chips leave the fryer or kettle, excess oil is drained on stainless steel drainboards. Here the chips are also coated with salt and spices. Then they are automatically packaged in plastic bags and conveyed to shipping or storage areas.

Potato chips are usually stored in boxes on pallets. Height of storage is limited to 20 ft (6.1 m) to avoid crushing the product. Any fire in a storage area will contaminate all the product in that area.

Corn Chips

Dry ingredients for making corn chips are stored in bags, bins or silos. Conveying and mixing these materials presents an explosion hazard.

Corn chips are prepared by batch mixing cornmeal, vegetable oil, corn flour, water and other ingredients. This mix passes through a roller that cuts out the chips. The uncooked chips are heat set in a gas-fired broiler, which can be subject to fires and explosions.

After heat setting, the corn chips are conveyed through fryers similar to those used for potato chips. The remainder of the process and hazards is the same as that for potato chips.

Pretzels

Storing and handling the dry ingredients for making pretzels presents the same hazards as for making corn chips.

Pretzels are prepared by mixing approximately 300 lb (140 kg) batches of flour, vegetable oil, yeast and water. The mixture is placed in extruders, where a wheeled template forms the pretzels and places them on a proof belt. The pretzels then pass through a mixture of water and sodium hydroxide.

The pretzels are baked in 480°F – 550°F (250°C – 290°C) ovens, depending on the type of pretzel and its thickness. The pretzels are then dried in a drying kiln at 250°F (120°C).

The primary hazard of baking pretzels is fire or explosion in the ovens. Fires in baking ovens can be caused by faulty oven controls, conveyor slowdown or incorrect dispensing of batter. Explosions can be caused by accumulation of unburned fuel.

LOSS PREVENTION AND CONTROL

Since very small amounts of combustion products can be judged to damage 100% of the food products in a fire area, preventing fires is of primary importance. To keep combustion products from spreading to other areas, well designed protective systems are also needed.

Management Programs

Implement management programs in all the areas discussed in *OVERVIEW*, AXA XL Risk Consulting's total management program for loss prevention and control. Tailor these programs to the food manufacturing process, paying particular attention to the following areas:

Hazard Evaluation

Evaluate the hazards of all parts of the facility, including raw materials storage, food product preparation, frying and baking processes, product packaging, and finished product storage. Take into consideration the possible extent of contamination from incidents starting in each of these areas. Design and protect the facility to minimize the overall exposure to contamination.

Evaluate the importance of heating and refrigeration systems. Either install duplicate systems, design systems to meet capacity with multiple combinations of smaller units, or keep spare components for these systems so that loss of one system will not spoil a large amount of product.

Re-evaluate hazards when considering any process changes. Include such changes as increasing frying temperature or time, making a new type of product, modifying the ventilation system, or using a different oil. Also re-evaluate hazards when changing the storage configuration or amount of any raw material or finished product.

Hazardous Materials

Analyze the hazards of all materials used in the facility. Classify gases and liquids and the areas containing them in accordance with NFPA 497. Classify ground and powdered solid materials and the areas containing them in accordance with NFPA 499. Also analyze the hazards of solid materials that can melt and burn, such as butter and margarine.

Housekeeping

Regularly clean oil residue from fryers, conveyors, drainboards and drainboard collection areas, and from the insides of hoods and ducts. Arrange processes so that under normal operating conditions, as little excess oil residue as possible collects on equipment and building surfaces. A typical cleaning schedule for fryers should include a daily scrubdown of the fryer area and monthly cleaning of hoods and ducts.

Regularly clean oil and product residues from ovens, conveyors, and oil collection pans, and from the insides of hoods and ducts. Base the cleaning schedule on the rate of residue accumulation. A typical cleaning schedule for baking ovens should include a daily wiping and weekly scrubdown of the oven area and monthly cleaning of hoods and ducts.

Maintenance

Implement preventive maintenance for the following equipment:

- Fuel fired equipment, in accordance with NFPA 86, PRC.4.0.1 and PRC.7.1.0.5.
- Conveyors, in accordance with PRC.9.3.1.
- Ordinary motors and electrical equipment, in accordance with PRC.1.3.1.
- Hazardous location electrical equipment, in accordance with NFPA 70B.

Also implement preventive maintenance programs for equipment for weighing, measuring and refrigeration.

Pre-Emergency Planning

Form contingency plans for making up production in the event of adverse circumstances. Take into account 3-shift operations, custom equipment that cannot handle other products, equipment that is hard to replace, and refrigeration equipment. When possible, make arrangements for outside assistance. Keep contingency plans up to date.

Smoking Regulations

Develop and strictly enforce smoking regulations that prohibit smoking in areas containing food or packaging materials. Be particularly watchful of storage areas.

Construction

Use noncombustible construction materials for buildings, insulation and interior finishes. Stainless steel is preferred for surfaces with cleanability requirements. Where plastic materials must be used, select materials that have a flame spread and smoke contributed ratings of 25 or less.

Cut off cooking oil tank storage rooms with fire walls having 4 h fire resistance rating. Provide two 3 h rated fire doors at wall openings. Cut off warehouses and truck garages with fire walls having a 3 h fire resistance rating. Provide 3 h rated fire doors at wall openings. Design fire walls in accordance with PRC.2.2.1. Protect conveyor openings in accordance with PRC.9.3.1.

Building Protection

Provide sprinkler protection throughout the facility. Design the sprinkler systems in accordance with Table 1.

TABLE 1
Sprinklers In Food Frying Facilities

Area	Sprinkler Design Guidance
Storage areas	
Oil storage	NFPA 30 and PRC.8.1.0
All Other storage	NFPA 13 and PRC.12.1.1.0
Areas using flammable or combustible liquids	NFPA 30 and PRC.8.1.0
Other processing areas	NFPA 13, Ordinary Hazard, Group 2 and PRC.12.1.1.0
All other areas	NFPA 13 and PRC.12.1.1.0

Raw Materials

Protect cooking oil storage tanks against overfill. Provide drainage or containment for oil storage rooms designed for 100% capacity of the largest tank.

Arrange systems for filling bins containing powdered raw materials in accordance with NFPA 61. Install and protect pneumatic conveying systems for powdered raw materials in accordance with NFPA 91.

Protect silos against accumulation of static electricity in accordance with NFPA 77. Equip bins and silos with venting for deflagrations in accordance with NFPA 68, or install explosion suppression systems in accordance with NFPA 69 and PRC.13.5.1.

Provide dust collection at points where powder can escape. Protect dust collectors in accordance with NFPA 68, or in accordance with NFPA 69 and PRC.13.5.1.

Arrange systems storing and dispensing flammable and combustible liquids in accordance with NFPA 30 and PRC.8.1.0.

Install electrical equipment classified for the hazard in that area. Use equipment listed for Class II, Group G in areas handling powders.

Use electrical equipment listed for Class I, Groups C and D, or equivalent, in areas handling flammable liquids or liquids heated above their flash points. See PRC.5.12.0.1 for equivalent classifications.

Batter Mixing

Control dust accumulation from loading dry materials into mixers.

Arrange and protect computers controlling the weighing and mixing processes in accordance with PRC.17.10.1.

Frying

Protect the fryers and kettles, drainboards, exhaust hoods and ductwork in accordance with NFPA 96 and PRC.9.2.7. Stop the conveyor, product flow and heat source upon actuation of the protection system.

Provide safeguards for fuel fired equipment heating cooking oil in accordance with NFPA 86 and PRC.4.0.1.

Baking

Provide safeguards for boilers providing steam to heat ovens in accordance with NFPA 85 and PRC.4.0.1. Provide safeguards for fuel fired baking ovens in accordance with NFPA 86 and PRC.4.0.1.

Interlock the power supply on electric ovens to shut down on high oven temperature. Interlock all ovens to shut down the heat source and batter flow if the conveyor stops.

Protect the inside of baking ovens with automatic total flooding CO_2 systems. Design and install the system in accordance with NFPA 12 and PRC.13.3.1. Interlock the CO_2 system to shut down oven ventilation.

Packaging

Keep the amount of packaging materials in the production area to a minimum. Store the bulk of packaging materials in an area cut off by 3 h rated fire walls and doors.

Protect storage of packaging materials in accordance with Table 1.

Finished Goods

Protect storage of finished goods in accordance with Table 1. Provide inside hose connections arranged so that two hose streams can reach any part of the storage area.

Refrigeration Systems

Arrange refrigeration systems in accordance with ANSI/ASHRAE 15. Design and install ammonia refrigeration systems in accordance with ANSI/IIAR 2. For more information on protecting these systems, refer to the NFPA *Fire Protection Handbook*.