9.10.2.2 Peanut Processing

9.10.2.2.1 General

Peanuts (*Arachis hypogaea*), also known as groundnuts or goobers, are an annual leguminous herb native to South America. The peanut peduncle, or peg (the stalk that holds the flower), elongates after flower fertilization and bends down into the ground, where the peanut seed matures. Peanuts have a growing period of approximately 5 months. Seeding typically occurs mid-April to mid-May, and harvesting during August in the United States.

Light, sandy loam soils are preferred for peanut production. Moderate rainfall of between 51 and 102 centimeters (cm) (20 and 40 inches [in.]) annually is also necessary. The leading peanut producing states are Georgia, Alabama, North Carolina, Texas, Virginia, Florida, and Oklahoma.

9.10.2.2.2 Process Description

The initial step in processing is harvesting, which typically begins with the mowing of mature peanut plants. Then the peanut plants are inverted by specialized machines, peanut inverters, that dig, shake, and place the peanut plants, with the peanut pods on top, into windrows for field curing. After open-air drying, mature peanuts are picked up from the windrow with combines that separate the peanut pods from the plant using various thrashing operations. The peanut plants are deposited back onto the fields and the pods are accumulated in hoppers. Some combines dig and separate the vines and stems from the peanut pods in 1 step, and peanuts harvested by this method are cured in storage. Some small producers still use traditional harvesting methods, plowing the plants from the ground and manually stacking them for field curing.

Harvesting is normally followed by mechanical drying. Moisture in peanuts is usually kept below 12 percent, to prevent aflatoxin molds from growing. This low moisture content is difficult to achieve under field conditions without overdrying vines and stems, which reduces combine efficiency (less foreign material is separated from the pods). On-farm dryers usually consist of either storage trailers with air channels along the floor or storage bins with air vents. Fans blow heated air (approximately 35°C [95°F]) through the air channels and up through the peanuts. Peanuts are dried to moistures of roughly 7 to 10 percent.

Local peanut mills take peanuts from the farm to be further cured (if necessary), cleaned, stored, and processed for various uses (oil production, roasting, peanut butter production, etc.). Major process steps include processing peanuts for in-shell consumption and shelling peanuts for other uses.

9.10.2.2.2.1 In-shell Processing -

Some peanuts are processed for in-shell roasting. Figure 9.10.2.2-1 presents a typical flow diagram for in-shell peanut processing. Processing begins with separating foreign material (primarily soil, vines, stems, and leaves) from the peanut pods using a series of screens and blowers. The pods are then washed in wet, coarse sand that removes stains and discoloration. The sand is then screened from the peanuts for reuse. The nuts are then dried and powdered with talc or kaolin to whiten the shells. Excess talc/kaolin is shaken from the peanut shells.

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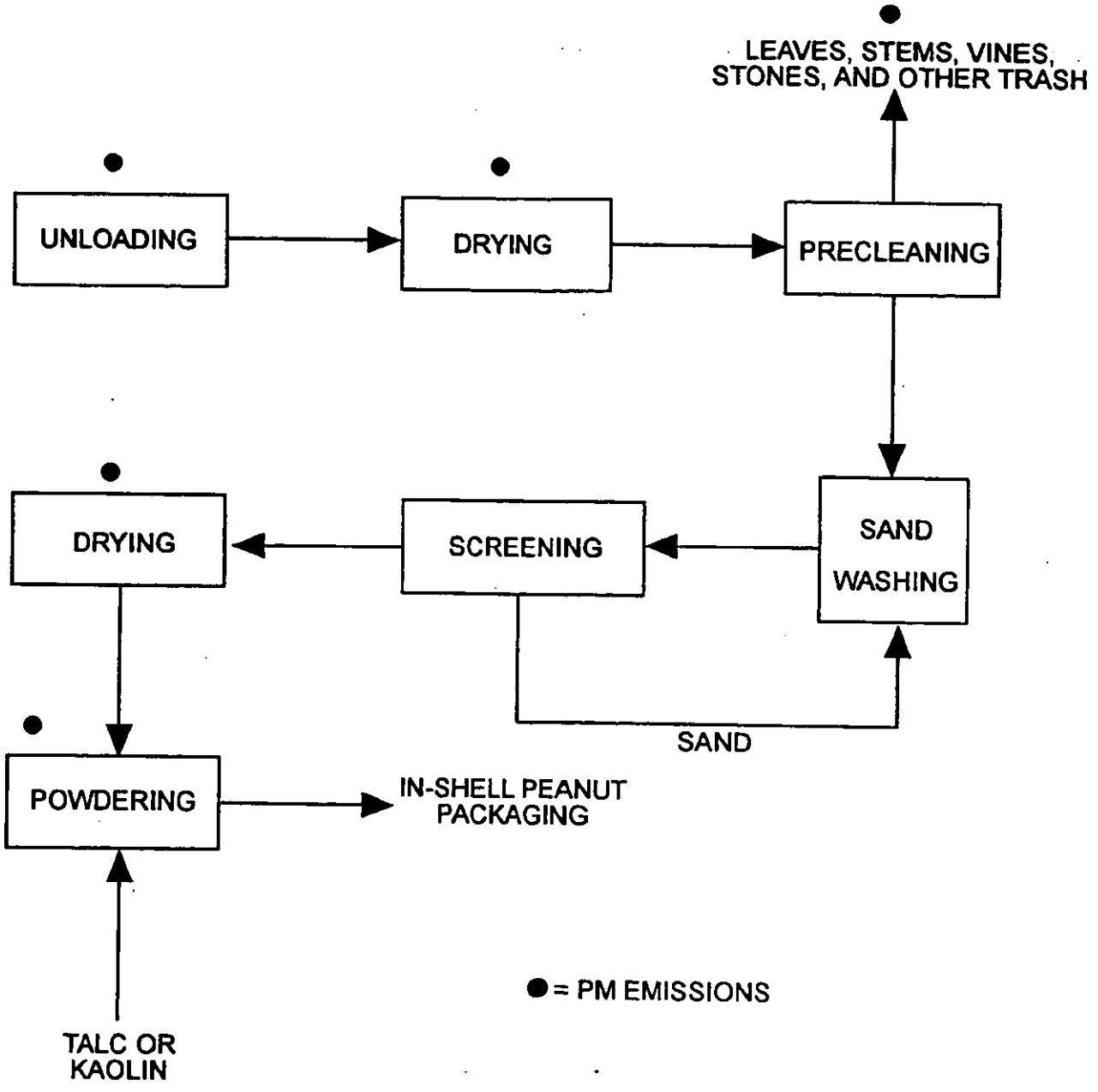

Figure 9.10.2.2-1. Typical in-shell peanut processing flow diagram.

9.10.2.2.2.2 Shelling -

A typical shelled peanut processing flow diagram is shown in Figure 9.10.2.2-2. Shelling begins with separating the foreign material with a series of screens, blowers, and magnets. The cleaned peanuts are then sized with screens (size graders). Sizing is required so that peanut pods can be crushed without also crushing the peanut kernels.

Next, shells of the sized peanuts are crushed, typically by passing the peanuts between rollers that have been adjusted for peanut size. The gap between rollers must be narrow enough to crack the peanut hulls, but wide enough to prevent damage to the kernels. A horizontal drum, with a perforated and ridged bottom and a rotating beater, is also used to hull peanuts. The rotating beater crushes the peanuts against the bottom ridges, pushing both the shells and peanuts through the perforations. The beater can be adjusted for different sizes of peanuts, to avoid damaging the peanut kernels. Shells are aspirated from the peanut kernels as they fall from the drum. The crushed shells and peanut kernels are then separated with oscillating shaker screens and air separators. The separation process also removes undersized kernels and split kernels.

Following crushing and hull/kernel separation, peanut kernels are sized and graded. Sizing and grading can be done by hand, but most mills use screens to size kernels and electric eye sorters for grading. Electric eye sorters can detect discoloration and can separate peanuts by color grades. The sized and graded peanuts are bagged in 45.4-kg (100-lb) bags for shipment to end users, such as peanut butter plants and nut roasters. Some peanuts are shipped in bulk in rail hopper cars.

9.10.2.2.2.3 Roasting -

Roasting imparts the typical flavor many people associate with peanuts. During roasting, amino acids and carbohydrates react to produce tetrahydrofuran derivatives. Roasting also dries the peanuts further and causes them to turn brown as peanut oil stains the peanut cell walls. Following roasting, peanuts are prepared for packaging or for further processing into candies or peanut butter. Typical peanut roasting processes are shown in Figure 9.10-2.2-3. There are 2 primary methods for roasting peanuts, dry roasting and oil roasting.

Dry Roasting -

Dry roasting is either a batch or continuous process. Batch roasters offer the advantage of adjusting for different moisture contents of peanut lots from storage. Batch roasters are typically natural gas-fired revolving ovens (drum-shaped). The rotation of the oven continuously stirs the peanuts to produce an even roast. Oven temperatures are approximately 430°C (800°F), and peanut temperature is raised to approximately 160°C (320°F) for 40 to 60 min. Actual roasting temperatures and times vary with the condition of the peanut batch and the desired end characteristics.

Continuous dry roasters vary considerably in type. Continuous roasting reduces labor, ensures a steady flow of peanuts for other processes (packaging, candy production, peanut butter production, etc.), and decreases spillage. Continuous roasters may move peanuts through an oven on a conveyor or by gravity feed. In one type of roaster, peanuts are fed by a conveyor into a stream of countercurrent hot air that roasts the peanuts. In this system, the peanuts are agitated to ensure that air passes around the individual kernels to promote an even roast.

Dry roasted peanuts are cooled and blanched. Cooling occurs in cooling boxes or on conveyors where large quantities of air are blown over the peanuts immediately following roasting. Cooling is necessary to stop the roasting process and maintain a uniform quality. Blanching removes the skin of the peanut as well as dust, molds, and other foreign material. There are several blanching methods including dry, water, spin, and air impact.

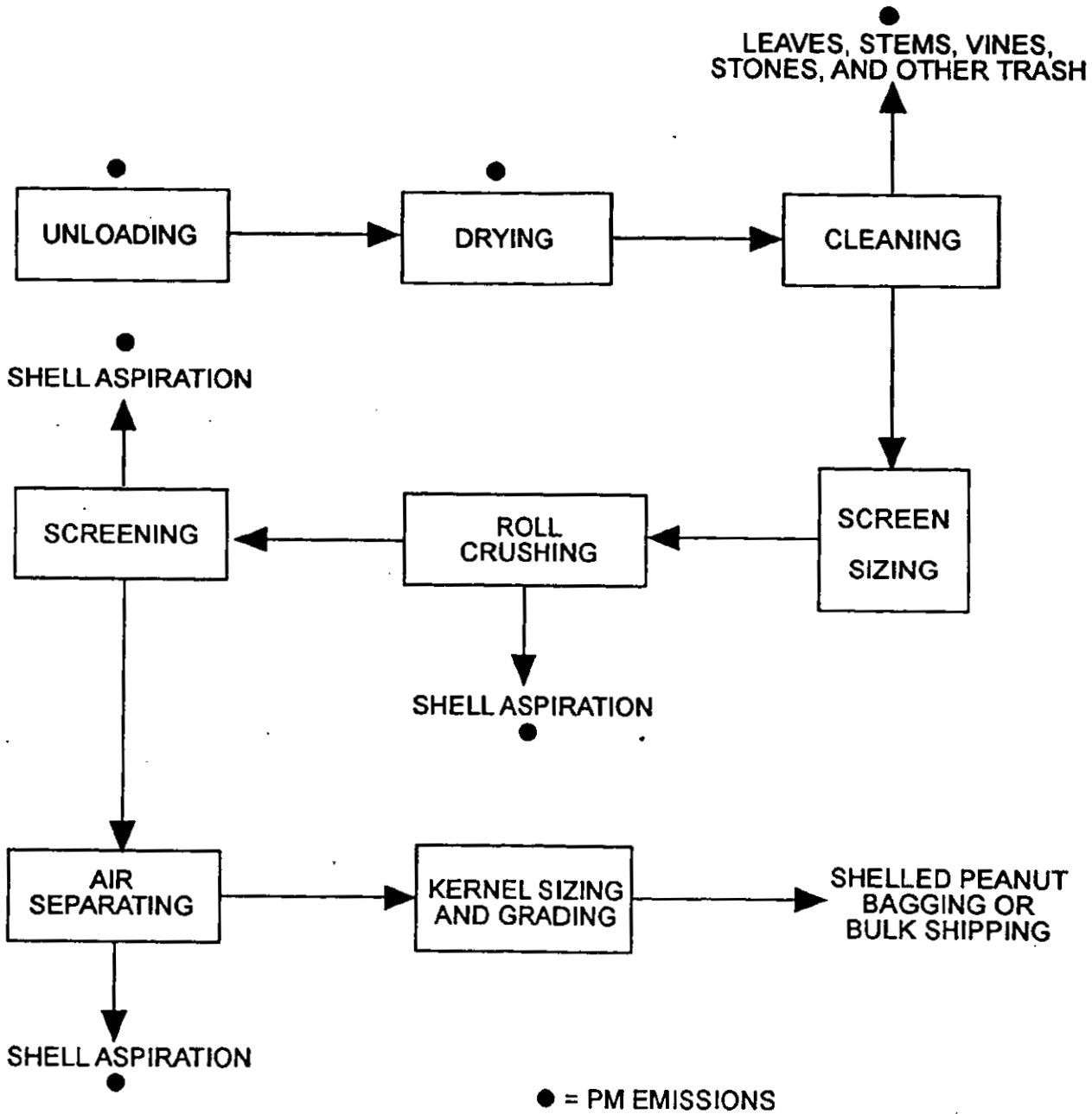

Figure 9.10.2.2-2. Typical shelled peanut processing flow diagram.

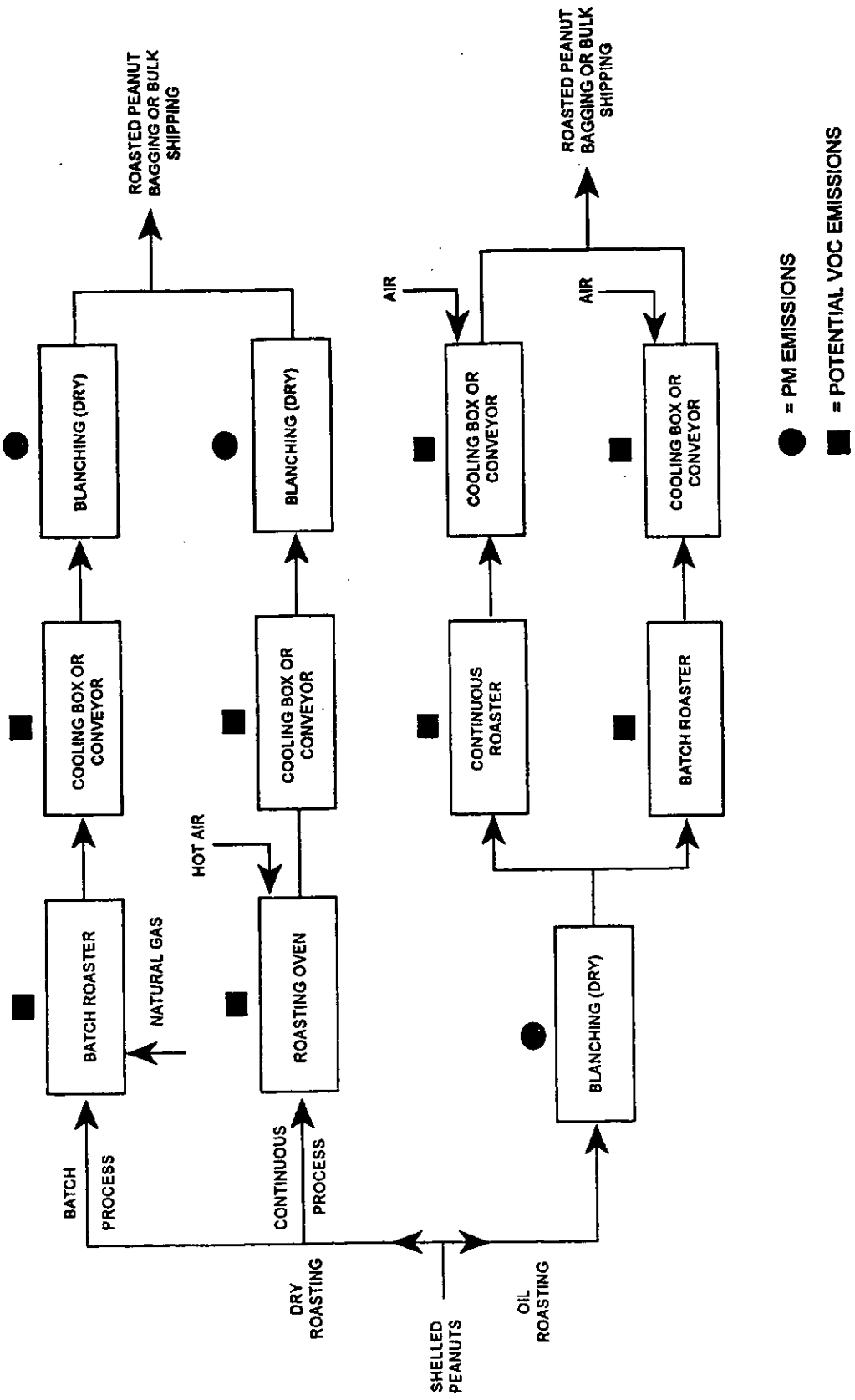

Figure 9.10.2.2-3. Typical shelled peanut roasting processing flow diagram.

Dry blanching is used primarily in peanut butter production, because it removes the kernel hearts which affect peanut butter flavor. Dry blanching heats the peanuts to approximately138°C (280°F) for 25 minutes to crack and loosen the skins. The heated peanuts are then cooled and passed through either brushes or ribbed rubber belting to rub off the skins. Screening is used to separate the hearts from the cotyledons (peanut halves).

Water blanching passes the peanuts on conveyors through stationary blades that slit the peanut skins. The skins are then loosened with hot water sprayers and removed by passing the peanuts under oscillating canvas-covered pads on knobbed conveyor belts. Water blanching requires drying the peanuts back to a moisture content of 6 to 12 percent.

Spin blanching uses steam to loosen the skins of the peanuts. Steaming is followed by spinning the peanuts on revolving spindles as the peanuts move, single file, down a grooved conveyor. The spinning unwraps the peanut skins.

Air impact blanching uses a horizontal drum (cylinder) in which the peanuts are placed and rotated. The inner surface of the drum has an abrasive surface that aids in the removal of the skins as the drum rotates. Inside the drum are air jets that blow the peanuts counter to the rotation of the drum creating air impact which loosens the skin. The combination of air impacts and the abrasive surface of the drum results in skin removal. Either batch or continuous air impact blanching can be conducted.

Oil Roasting -

Oil roasting is also done on a batch or continuous basis. Before roasting, the peanuts are blanched to remove the skins. Continuous roasters move the peanuts on a conveyor through a long tank of heated oil. In both batch and continuous roasters, oil is heated to temperatures of 138 to 143°C (280 to 290°F), and roasting times vary from 3 to 10 minutes depending on desired characteristics and peanut quality. Oil roaster tanks have heating elements on the sides to prevent charring the peanuts on the bottom. Oil is constantly monitored for quality, and frequent filtration, neutralization, and replacement are necessary to maintain quality. Coconut oil is preferred, but oils such as peanut and cottonseed are frequently used.

Cooling also follows oil roasting, so that a uniform roast can be achieved. Cooling is achieved by blowing large quantities of air over the peanuts either on conveyors or in cooling boxes.

9.10.2.2.3 Emissions And Controls

No information is currently available on emissions or emission control devices for the peanut processing industry. However, the similarities of some of the processes to those in the almond processing industry make it is reasonable to assume that emissions would be comparable. No data are available, however, to make any comparisons about relative quantities of these emissions.

Reference For Section 9.10.2.2

1. Jasper Guy Woodroof, *Peanuts: Production, Processing, Products*, 3rd Edition, Avi Publishing Company, Westport, CT, 1983.