Nuts as an Ingredient—How Safe is Safe?

Due to differences in their physical characteristics and how various nuts are grown, handled and processed, a tailored approach to safety is necessary.

Daniel J. Zedan
Nature's Finest Foods, Ltd.

Since 2000, the U.S. consumer has been bombarded with what might seem to be a never-ending series of *Salmonella*- and/or *E. coli*-related product recalls. There have been major recalls involving lettuce, almonds, tomatoes (later determined to be peppers), spinach, peanuts and/or peanut butter, pistachios and, most recently, mayonnaise, cookie dough and milk, just to name a few. In some cases, the recalls were limited to certain regions of the country and resulted in little or no adverse health-related consequences, while in other cases whole industries were nearly bankrupted and hundreds of people sickened. While the costs attributed to the most recent peanut butter/peanut recall have yet to be fully tabulated, several major food processors have already reported losses exceeding tens of millions of dollars. As Congress considers what types of legislation might be needed to help protect the consumer, food processors are left to consider how best to protect not only their customers, but themselves.

Five of the aforementioned recalls involved nuts: two almond recalls, two peanut butter and/or peanut-related recalls and one pistachio recall. After the second almond recall, in an effort to minimize the chances of another such event, the USDA and the California Almond Board jointly developed validated 4-log-kill production processes to be utilized for all almonds shipped to North American markets. Because that industry is governed by a federal marketing order, the new processes, in effect, have the force of law. All almond processors must comply with the procedures or be subject to a variety of penalties, including fines and the possible suspension of operations. While it might be tempting to simply require that all nut processors follow the same procedures, due to the differences in physical characteristics and the way in which various nuts are grown, handled and processed, a one-size-fits-all approach is not only unnecessary, it can be counter productive.

When looking at the differences among various nuts, it is important to understand that there is a difference between the potential hazards associated with those grown domestically and those that are imported. Domestically grown nuts are subject to a number of federally mandated regulations ➤

Daniel Zedan is the founder of Nature's Finest Foods and has more than 26 years of experience in the tree nut industry. He is currently serving as the director of new market development for Navarro Pecan Co. and was formerly the vice president of NYM Marketing Co.

Making changes in the way a nut is grown, handled, processed and stored can decrease contamination hazards significantly.

covering everything from the types and amounts of pesticides that can be used in the orchards to the ways in which the nuts are handled and processed. Company records are subject to inspection by everyone from the EPA to the FDA, as are the processing plants and orchards. Penalties for noncompliance can be substantial, and while it is an acknowledged fact that there are simply not enough inspectors to adequately oversee the many food-safety-related issues associated with the various segments of the food industry, the overall record of the U.S. nut industry is very good.

The same is not necessarily true for imported nuts. Many countries have no regulations relative to the application of pesticides, the quality of processing water or the way in which nuts are handled, processed and stored. Further, while incoming nuts must pass through U.S. customs, at the moment there are no FDA regulations that address the testing of imported nuts. While this may change should the pending food-safety legislation become law, due to a lack of sufficient inspectors and the millions of containers entering the country each year, it may be some time before imported nuts actually meet the same standards as those currently required of the domestic nut industry.

Country of origin is just one of the factors that need to be understood when evaluating potential hazards associated with the use of nuts as an ingredient. The physical properties of the nut, how it is grown and the ways in which it is processed and handled should all be evaluated when developing a food-safety program. Of critical importance is the shelling process. Most dry-shelled tree nuts, depending on country of origin, should not be accepted in the raw state without having them tested for *E. coli* and *Salmonella* unless the process involves a valiated kill step of at least 4 logs.

It should also be noted that peanuts are not included in this overview. This is because peanuts are not a nut; they are a legume. As such, they need to be treated differently. Unlike tree nuts, they are grown in the soil, thereby increasing the chances of exposure to a myriad of pathogens including, but not limited to, *E. coli*, aflatoxin and *Salmonella*. Unlike many tree nuts, which have a heavy, thick shell that helps to protect the nut meat, peanuts have a very light, porous shell. Further, because peanuts are cleaned and shelled in a dry process, the chance of contaminating the nut meat during the shelling process is greatly increased. Blanching and roasting can help to minimize the chances of finished product leaving the plant carrying the aforementioned pathogens; however, the same is not true for product that is shipped in a raw state.

WHAT'S THE DIFFERENCE?

While there may be little anyone can do to change the physical properties of various nuts, making changes in the way a nut is grown, handled, processed and stored can decrease contamination hazards significantly. For example, little can be done to change the fact that there is a greater chance of contamination in almonds due to their physical differences from macadamias. However, by changing the way in which all almonds are processed (all almonds sold in North America must now be pasteurized before shipment), the industry has significantly reduced the chances of another *Salmonella*-related recall. So what are some of the differences? They can be summed up as follows:

Almonds A member of the peach family, almonds have a very thin, porous shell. ➤

Originally brought to this country from the Middle East, the trees are shallow rooted and are not self-pollinating. Therefore, honey bees are brought into the orchards during bloom, generally a 2- to 3-week period in February or early March, to pollinate the crop.

The almond crop is the largest agricultural crop in California and is one of the United States' largest export crops. California is by far the largest producer of almonds in the world (Spain is a distant second). At harvest time the trees are mechanically shaken, allowing the mature nuts to fall from the tree to the ground. The nuts are then mechanically swept into rows between the trees and collected by large sweepers. Once collected, they are transported to the huller where the thick, protective hulls (Figure 1), as well as the sticks, stones, dirt and other debris, are separated from the inshell nut. Both the hulling process and the shelling process are dry processes. In other words, no water is used during the process. As such, any micro-organism present on the incoming inshell prior to the hulling and shelling process has a very good chance of finding its way onto the shelled nut meat. Since 2001 there have been two *Salmonella*-related industry recalls. After the second recall, the California Almond Board, working with the FDA, developed an industry-wide standard requiring that all almonds sold into North American markets be pasteurized. As part of the program, the Almond Board even certified which types of pasteurization processes could be used to achieve the required 4-log kill. The only exception to this requirement applied to companies willing to subject their processing facilities to an industry-established, FDA-approved verification program to validate that their processes could achieve the required 4-log kill. Because almonds are a very hearty nut, they can be successfully pasteurized through a number of methods, including those that rely on exposure to either heat or steam. The almond industry is the only nut industry to have established such requirements.

Mature Almond with Open Hull

Figure 1

Because almonds are a very hearty nut, they can be successfully pasteurized.

English walnuts A member of the walnut family, walnuts have a hard, thick shell which naturally acts as a barrier to certain contaminants. Originally brought to this country from Europe and Asia, the trees are relatively deep rooted and are self-pollinating. California is the second-largest producer of walnuts in the world (China is the largest). Walnuts are grown throughout California's central valley and are harvested and processed in much the same way as almonds. At harvest time the trees are mechanically shaken, allowing the mature nuts to fall from the tree to the ground. The nuts are then mechanically swept into rows between the trees and collected by large sweepers. Once collected, they are transported to the huller where the thick, protective hulls, as well as the sticks, stones, dirt and other debris, are separated from the inshell nut. The one major difference occurs during the hulling process. Walnuts, unlike almonds, are sub- ➤

The inshell pecans are subjected to a chlorine bath, a hot sanitizing bath or a combination of the two.

jected to water during the hulling process to facilitate the removal of the hulls. However, the use of water in this process step, as well as the subsequent drying of the inshell, does not constitute a validated "kill step" relative to *E. coli*, aflatoxin or *Salmonella*. Once dried, the nuts are then shelled in a dry shelling process. As such, in many walnut-processing plants there is no validated process step to minimize the chance that a micro-organism present on the incoming inshell prior to the hulling and shelling process will find its way onto the shelled nut meat. Because walnuts are not as hearty as almonds, pasteurization options are limited (i.e., the physical characteristics of the walnut can be adversely affected when exposed to either heat or steam). At the moment, most walnut processors do not currently possess the capability to pasteurize their product. As such, if pasteurization is requested by the customer, the product is usually sent to a third party where the nuts are pasteurized, most often using propylene oxide.

Pecans A member of the hickory family, pecans are the only major tree nut indigenous to North America (Figure 2). Pecan trees are self-pollinating and are grown throughout the southern United States from the Atlantic to the Pacific. There are also substantial quantities grown in Mexico. (The United States is the largest producer of pecans in the world; Mexico is second.)

Like walnuts, pecans have a very hard, thick shell which naturally acts as a barrier to certain contaminants. While the growing and harvesting of pecans is done in much the same manner as both almonds and walnuts, the hulling of pecans is usually done at a location different than that of the shelling plant. Further, once the inshell has been shipped to the various shellers, the product is almost universally stored in freezer storage. The shelling process is also significantly different. Unlike other tree nuts, most pecan meats are derived from a wet shelling process. After sizing, depending on the sheller, and after going through a water bath to remove stones, glass and other heavy objects, the inshell pecans are subjected to a chlorine bath, a hot sanitizing bath or a combination of the two. In the case of the sanitizing bath, the inshell is submersed in water maintained at temperatures above 190°F for a specific period of time to not only make cracking easier, but to minimize the chance of exposing the processed meats to any incoming micro-organisms. In the case of those shellers utilizing a chlorine bath, chlorine levels are monitored to maintain specific predetermined chlorine concentrations. Once taken out of the applicable bath and cracked, the pecan meats are then put through dryers at over 190°F until the moisture levels are brought back down to about 4.5 percent. Further, some processors also clean certain sizes of pieces in an alcohol solution. The combination of the aforementioned processes significantly minimizes the potential for aflatoxin, *E. coli* and *Salmonella* contamination. After the second almond recall, the National Pecan Shellers Association began

Pecans Nearing Maturity

Figure 2

looking at ways to validate a 4-log kill in the aforementioned processes. With the assistance of the University of Georgia, this process is expected to be completed later this year. In the meantime, most major pecan shellers are already going through the steps of having their specific processes validated. Initial testing has indicated that kills of 4 logs or better are being achieved with the use of a hot-water sanitizing bath. Should a customer still feel that it is necessary to use only pasteurized pecans, most shellers will generally have the meats sent to a third-party pasteurization facility utilizing propylene oxide.

Pistachios Originally brought to the United States from the Middle East, pistachio trees are self-pollinating and grow very well in arid climates (Figure 3). There is primarily only one variety of pistachios grown in the United States, with all of the production occurring in California and Arizona. While there are numerous processors involved in the handling of the other major U.S. tree nuts, the U.S. pistachio industry has only a few with the two largest processors accounting for approximately 90 percent of the domestic production. Because a mature pistachio will force open its outer shell, the nut is highly susceptible to *E. coli*, aflatoxin and *Salmonella*. For example, Iran, the world's largest producer of pistachios, has been unable to export the bulk of its crop to the West over the past several years because of continued problems with aflatoxin. To minimize the chances of product contamination in the United States, the pistachio industry has adopted very specific harvesting standards which forbid the sale of any pistachios that touch the ground during harvesting. As such, huge umbrella-like shakers are used to catch the pistachios as they fall from the trees.

Pistachios on the Tree

Figure 3

The nuts are then fed into conveyors which transport the nuts to waiting trailers. From there, the nuts are taken to the huller for further processing. Because water is used in the hulling process, it is necessary to dry the dehulled nuts to bring moisture levels back down to levels that will minimize the chances of mold development. As a result of the recent pistachio recall, the industry is in the process of evaluating whether this step can be considered to be a kill step. Prior to the recall, most pistachio processors felt that because the bulk of their products were sold in a roasted state, the chances of contamination were minimal. However, recent studies have shown that dry roasting may not be sufficient to achieve a verifiable 4-log kill.

Iran, the world's largest producer of pistachios, has been unable to export the bulk of its crop to the West over the past several years because of continued problems with aflatoxin.

Cashews originated in Brazil and are primarily processed in three countries: Brazil, India and Vietnam. India is currently the world's largest processor of cashews, although Vietnam may soon surpass them. Cashews have a very thick, hard shell and unlike most other tree nuts, they do not have a thick, protective husk. Instead, the cashew nut grows at the bottom of a large pear-shaped fruit/flower (Figure 4).

Harvesting is generally done by hand. Once harvested, the nut is separated from the flower for shelling. The flower is also edible, and once separated from the nut, it is dried ➤

U.S. hazelnuts are grown on trees in orchards similar to those of the other major North American tree nuts. Turkish hazelnuts are grown on bushes.

and processed for consumption. In Brazil, the nuts are prepared for mechanical shelling by subjecting the nuts to a water and steam bath which serves to rehydrate the nut prior to shelling. However, this has not been shown to constitute a kill step. In India and Vietnam, the nuts are still shelled by hand. Because the nuts are generally harvested by hand, aflatoxin contamination is generally not a problem. However, in all three exporting countries, poor storage and handling practices make the raw meats susceptible to both *E. coli* and *Salmonella*. Since testing of incoming raw meats is not mandated, importers should not accept raw product without having it tested for *E. coli* and *Salmonella*. There are several independent inspection services that can perform these inspections.

Cashew Nut and Flower/Fruit

Figure 4

Turkish Hazelnut Bush and North American Hazelnut Tree

Figure 5

Hazelnuts/Filberts Originally brought to North America from Europe and Asia, hazelnuts have a relatively hard shell. Turkey is by far the largest grower of hazelnuts in the world, producing as many as 700 million inshell pounds per year. By comparison, the U.S. Pacific Northwest growing region produces around 30 million pounds per year. There are significant differences between the varieties grown in the Pacific Northwest and those grown in Turkey. For instance, North American hazelnuts are generally not blanched (blanching is a process whereby the natural brown skin surrounding the nut kernel is removed). This is because the oil content of the variety grown in the Pacific Northwest is not high enough to assist in the blanching process. As such, the bulk of the blanchable hazelnuts sold around the world comes from certain growing regions in Turkey. However, the biggest difference has to do with how the nuts are grown. U.S. hazelnuts are grown on trees in orchards similar to those of the other major North American tree nuts. Turkish hazelnuts are grown on bushes (Figure 5).

As such, harvesting of the nuts is also different. Turkish hazelnuts are generally harvested by hand while North American hazelnuts are harvested mechanically in much the same manner as almonds, walnuts and pecans. The trees are mechanically shaken, allowing the mature nuts to fall from the tree to the ground. The nuts are then mechanically swept into rows between the trees and collected by large sweepers. Once collected, they are transported to the huller where the thick, protective hulls, as well as the sticks, stones, dirt and other debris, are separated from the inshell nut. Whether ➤

using imported or domestic hazelnuts, unless the processor has gone through the effort of validating the various processes within their plant, hazelnut users should not accept raw product without having it tested for *E. coli* and *Salmonella*.

Brazils As their name would indicate, the bulk of the world's Brazil nuts come from Brazil (Figure 6). Like many other tree nuts, the trees are self-pollinating and grow primarily in the rain forests of the Amazon River basin. The trees grow extremely tall and produce a coconut-type outer shell that houses the individual Brazil nuts within, each of which has an extremely thick, hard, protective shell.

While the combination of the thick outer coconut-type shell and the thick individual kernel shells makes an excellent barrier against contamination, the handling, processing and storage of the nuts do not. After the nut reaches maturity it falls from the tree to the jungle floor below, where it sits until it is picked up by the local processor. Upon arrival at the processing plant, the outer shells are washed to remove mud and other debris. As there are no specific requirements relative to the water used in the washing process, or that regulate how the raw meats are processed, handled and stored after shelling, the meats are highly susceptible to contamination by a number of microorganisms including *Salmonella* and *E. coli*. As with most other imported tree nuts, since testing of incoming raw meats and inshell is not mandated, importers should not accept either without having them tested for *E. coli* and *Salmonella*.

Brazil Nuts

Figure 6

Macadamia Nuts

Figure 7

Macadamias While many people think of Hawaii when asked about macadamias, the nut actually originated in Australia. Producing an extremely hard-shelled nut (Figure 7), macadamia trees are self-pollinating and grow well in many regions around the world. Australia produces approximately 40 percent of the world's macadamias, followed closely by Hawaii and South Africa. Together they account for approximately 75 percent of the world's macadamia production. Other producing countries include, but are not limited to, Kenya, Guatemala, Malawi, Brazil and Zimbabwe.

Like most other nuts, whether they are hand or machine harvested, macadamias are shelled in a dry process. Unlike other imported nuts, and excluding the Hawaiian macadamia industry which must comply with U.S. environmental and food-safety standards, when it comes to macadamias, country of origin can make a huge difference because the environmental and food-safety laws vary greatly.

Producing an extremely hard-shelled nut, macadamia trees are self-pollinating and grow well in many regions around the world.

Simply having a third-party audit performed at your facility does not guarantee a Salmonella-free processing environment.

HOW SAFE IS SAFE?

After the recent peanut butter recall, the FDA published several documents relative to the production of foods containing peanuts and/or peanut-derived ingredients. In the document Guidance on Production of Foods Containing Peanut Derived Ingredients (published on March 9, 2009), the FDA recommended that food processors "obtain … ingredients only from suppliers who use production processes that have been demonstrated to adequately reduce the presence of *Salmonella*, or that ensure that their own manufacturing process would adequately reduce the presence of *Salmonella*." No one can guarantee that your company won't get swept up in an industry recall; however, there are a number of strategies that can be followed to minimize the risk. At a minimum, every company should do the following: visit and become familiar with your vendor facilities, require third-party audits, perform your own periodic vendor-plant audits and test incoming product.

Visit and become familiar with your vendor and their production facilities While the current economic climate has forced many companies to make across-the-board cost reductions, when it comes to food safety, travel should not be one of them. It is critical that both buyers and quality control personnel be allowed to get out of their office to visit their suppliers. While it might be easier to simply ask for a copy of a vendor's third-party audit or HACCP plan, no amount of paper can replace the knowledge gained through a supplier visit. As was demonstrated during the congressional hearings into the latest peanut butter recall, simply having a third-party audit performed at your facility does not guarantee a *Salmonella*-free processing environment. It's one thing to be told that a plant is clean; it's another to see that it is clean. Take the time to meet the plant manager, process control personnel, quality control staff, etc. During the visit, don't be afraid to ask questions. Find out how long the vendor has been in business. How old is the facility? What challenges are currently facing the industry? If allowed, take pictures. While it is not reasonable to expect your staff to become experts on the various processes, it certainly is reasonable to expect that they understand how the products are procured, handled, processed and stored. Find out where a supplier gets their raw materials. Are they procured from domestic or foreign sources? Review their vendor approval process as well as the accompanying documentation. Does the facility process more than one item? Is this done in the same building? If so, what are the items and do they pose a cross-contamination issue? Take the time to review the company's HACCP plan, statistical process control (SPC) program, process flow diagrams, etc., and ask for a copy for your files. This information-gathering plant visit can be separate from, or done in conjunction with, a company vendor audit program. Regardless of how it is done, it should be done on a regular basis.

Require third-party audits by accredited and reputable organizations Annual audits, performed by knowledgeable auditors, benefit everyone involved. It is an opportunity for the vendor to improve training, review processes and to get confirmation that various implemented programs are achieving the desired results. For buyers, it provides an independent evaluation of a vendor's facility while affording the opportunity to work with one's vendors to achieve mutually beneficial goals. As such, they should be ➤

viewed as a joint cooperative effort. Understand, though, that simply requiring an audit doesn't guarantee that there aren't going to be problems. Many third-party audits do nothing more than review the paperwork generated by the plant staff during the course of normal operations and are only reviewing the cleanliness of the facility at a particular moment in time. Generally, the auditor has no way to verify when the paperwork was actually generated or when entries were actually made in the various production, process-monitoring and sampling logs. Further, many third-party audits don't include environmental or product sampling. As such, many audits are no more than a statement of what the company purports to be doing. Therefore, it is not unreasonable for a company to require that specific third-party auditors be used or that certain protocols are adhered to.

Become familiar with the procedures followed by various auditors. Develop an understanding of what they are looking for. Ask how they try to verify the veracity of the information provided to them. Ask if the auditor is able to take environmental, process and product samples. If so, require that they do so. If not, have the samples taken and analyzed by an independent third party or lab. If the vendor has an in-house lab, ask if they routinely send samples out to an independent lab to verify in-house results and don't be afraid to ask for copies of the results. Regardless of who performs the audit, it is important to remember that third-party audits are not an end-all but simply one of the many tools to be utilized in the food-safety process.

If possible, perform your own audit This audit should be performed in addition to any required independent third-party audits and need not be as extensive as the required third-party audit. It should be viewed as an opportunity for both parties to refamiliarize themselves with the vendor's operation, key staff, sanitation and cleaning procedures, training programs, record systems, ingredient traceability, recall procedures, etc. Make sure to discuss what has been done to minimize the risk of *Salmonella* contamination and what the vendor has done to validate a 4-log kill in any of their processes. If the equipment has been validated, ask for copies of the validation certificates.

Finally, never fail to take random samples of all incoming food items Even if the shipment is accompanied by a Certificate of Analysis (COA), remember that the COA only reflects what was found on the tested sample. The truck may arrive with its seal secure and intact but there is no way to know what the product was exposed to or how it was handled after the samples were taken and analyzed. Obviously, it is physically impossible to test every last kernel on every incoming shipment, but a new set of random samples is the best way to show that everything has been done to ensure that the ingredients used in your products meet the highest possible standards. □

It is important to remember that third-party audits are not an end-all but simply one of the many tools to be utilized in the food-safety process.