Material	Info
Aluminum	*Aluminum is an acceptable material for use in packaging. Preference should be given to suppliers with the highest amount of post-consumer recycled material, although 100% recycled aluminum can be difficult to source.* **Background** About one half of all aluminum products are made from post-consumer aluminum which uses only 5% of the energy used to make the ingot from virgin materials, and it uses 10% of the capital equipment. Non-recycled aluminum originates as an oxide called alumina made from bauxite. Because aluminum itself does not occur in nature as a metal, the processing of aluminum took a giant leap forward with the advent of electricity. Deposits of bauxite ore are mined and refined into alumina—one of the feedstocks for aluminum metal. Then alumina and electricity are combined in a cell with molten electrolyte called cryolite. Direct-current electricity is passed from a consumable carbon anode into the cryolite, splitting the aluminum oxide into molten aluminum metal and carbon-dioxide. Between materials recovery and ongoing innovative research and development efforts, the industry is constantly searching for ways to reduce the amount of electricity used in aluminum production—and thus the related emissions and costs. The worldwide alumina industry produces more than 70 million dry metric tons of bauxite residue annually. Australia is the largest alumina refiner in the world, processing nearly one-third of the global total. During the smelting process perfluorocarbon (PFC) is released into the atmosphere. PFCs are potent greenhouse gases, characterized by strong infrared radiation absorption and relative inertness in the atmosphere. To combat this issue, the United States Environmental Protection Agency created the Voluntary Aluminum Industry Partnership (VAIP). VAIP partners work towards reduced PFC emissions. The following companies have signed up as a VAIP partner: Alcan Primary Metals Group, Sebree Works Alcoa Inc. Aluminum Association Century Aluminum Company of Kentucky Century Aluminum Company of West Virginia Columbia Falls Aluminum Company Golden Northwest Aluminum Kaiser Aluminum Noranda Aluminum Inc.
Aluminum Foil	*Aluminum Foil and Aluminum Laminate are acceptable materials for use in packaging. Preference should be given to suppliers with the highest amount of post-consumer recycled material.* **Background** Aluminum foil is a very versatile packaging material. It is relatively inexpensive and provides an absolute barrier to light, moisture, and oxygen. Laminated to paper or plastic films for strength, foil provides lighter, less-expensive protection to foods, medicines, and other products that would be damaged by the environment. Foil is produced by passing aluminum between rolls under pressure. Foil is less than 0.006 inch thick. It is produced from sheet coils that are heated and then passed through high-speed foil rolling mills. Foil is shiny on only one side because as it passes through the final foil mill, two thicknesses of foil are rolled together. The sides facing each other emerge with the dull finish, while the sides in contact with the foil mills come out shinier—due to the burnishing effect of the rollers.

Aseptic Containers	*Aseptic containers are acceptable packaging materials. However, due to the limited recyclability of these multi-laminate cartons, care should be taken to ensure that any claims are appropriate. General recyclability claims are not acceptable. However, "recyclable where facilities exist" is an acceptable claim, and preferable in markets where facilities do exist.* **Background** Tetra Pak is the name of the company whose president invented the multi-laminated, germ-free (aseptic) package. It is a 6-layer package consisting of three materials: 75% paper, 20% low-density poly- ethylene, and 5% aluminum held together by adhesives. The more complex the package, the more difficult to recycle. This package is very complex, and hence quite difficult to recycle. There are only a limited number facilities in the world with the capacity to recycle Tetra Pak. As of 2012, only about 30% of US households had curbside access to recycling for aseptic containers. See http://www.recyclecartons.com/ for local recyclability information For some applications, such as shelf-stable milk, this container is the only suitable option. Its use is of particular importance in developing countries where refrigeration is uncommon. The use of this package should be evaluated for individual scenarios, and in some cases an alternative may be more appropriate.
Compostable/Tree Free Pulp Board	*Compostable board products made from tree-free alternatives such as plant fibers, especially waste fibers, are acceptable materials for use in packaging. These materials are preferable with BPI "Commercially Compostable" certification or "recyclable" certification.* **Background** Paper can be made from most any fibrous plant, not just from trees. The most common fiber feed-stocks are bagasse (sometimes spelled: bagasse), which is a byproduct of sugar cane processing, bulrush (cattails), and palm fiber or any fibrous waste such as from banana or lemon harvesting. Sugar cane yields about 30% usable fiber after it is processed to obtain sugars. The bagasse can be used for many purposes, but was most commonly burned for energy generation. It can also be turned into a paper product with high strength and water resistance. Currently, the 365 compostable picnic plates are made from this material. Bulrush is an aquatic grass-like plant that has been used for weaving baskets and rugs since the dawn of man. More recently it has been pulped, and the fibers can be converted into a heavy paper. It is the container currently used in many WFM salad bars. Palm fiber is similar to the other two materials, and all three, when sustainably harvested, are preferable to virgin or recycled paper. The paper does have high fiber content, and can be recycled or composted. It must be composted, however, when contaminated with food. It can be used in any paper or paperboard packaging application such as with cereal boxes, or overwrap for chocolate. It does cost slightly more, but can be positioned as tree-free which will appeal to the consumer.

Ethylene Vinyl Acetate (EVA)	*Ethylene Vinyl Acetate is not acceptable for use as a packaging material due to major concerns about the reactivity and safety of its base material. Substitutes include LDPE or HDPE.* **Background** Ethylene Vinyl Acetate (EVA) is the copolymer of ethylene and vinyl acetate. Vinyl acetate monomer (VAM) is an essential chemical building block used in a wide variety of industrial and consumer products. VAM is a key ingredient in emulsion polymers, resins, and intermediates used in paints, adhesives, coatings, textiles and packaging. Ethylene is a basic building block for the chemical industry, and it is one of the largest volume organic chemicals produced globally. Ethylene is produced commercially from petroleum and natural gas feedstocks. The major concerns around EVA relate to the use of VAM, which is considered to toxic to aquatic organisms. Animal studies also connect VAM to certain cancers. Given these concerns, and the availability of alternative materials, EVA packaging should be avoided.
Glass	*Glass is an acceptable packaging material which is minimally reactive and abundantly recyclable.* **Background** Glass is usually made from Silicon Dioxide (SiO2), along with several additives that make it melt more easily, or increase its strength. There are also ways to make silicon-free glass for use in different applications. Glass is very easily recyclable. Used glass packaging materials, usually bottles, can be turned back into bottles almost infinitely without quality issues. It is accepted in every curbside recycling program in the nation, and unlike plastic there is no consumer confusion about glass recycling like exists with plastics. One potential down side to glass is that it is heavier so it uses more fuel to transport. Although measures can be taken to offset the emissions, there may be some situations where plastic is a more sustainable material, but this is evaluated on a case-by-case basis. Generally, glass will be given preference to plastic due to its recyclability back into a useful product.

Nylon/Polyamide	*Nylon is acceptable but not preferred for use in packaging. It is most commonly found in lids for plastic (PET) bottles, as the principal material for certain hard and clear bottles, and as a film overwrap.* **Background** Nylon is a thermoplastic silky material, first used commercially in a nylon-bristled toothbrush (1938), followed more famously by women's "nylons" stockings (1940). It is made of repeating units linked by peptide bonds (another name for amide bonds) and is frequently referred to as polyamide (PA). Nylon was the first commercially successful polymer and the first synthetic fiber to be made entirely from coal, water and air. These are formed into monomers of intermediate molecular weight, which are then reacted to form long polymer chains. Nylon was intended to be a synthetic replacement for silk and substituted for it in many different products after silk became scarce during World War II. It replaced silk in military applications such as parachutes, flak vests, and was used in many types of vehicle tires. Nylon fibers are used in a great many applications, including fabrics, bridal veils, carpets, musical strings and rope. Solid nylon is used for mechanical parts such as gears and other low- to medium-stress components previously cast in metal. Engineering grade nylon is processed by extrusion, casting, and injection molding. Type 6/6 Nylon 101 is the most common commercial grade of nylon, and Nylon 6 is the most common commercial grade of cast nylon. Nylon is available in glass-filled and molybdenum sulfide-filled variants which increase structural and impact strength and rigidity or lubricity. Because nylon is synthetic fiber from a non-petroleum base, it is not accepted for recycling anywhere. Because suitable substitutes exist, it is preferable to find an alternative material for use in packaging.
Paper/Paperboard	*Paper and paperboard are acceptable packaging materials.* **Background** Though paper can be made from virgin trees, recycled paper is now available in virtually all categories of packaging. The most important attributes to consider with regard to paper are the percentage of recycled content (this should be as high as possible, up to 100%) and whether the recycled content claim is certified by a third party, such as the Forest Stewardship Council (FSC). The virgin fiber content of recycled paper packages should come from FSC certified forests. Preferred materials will be those with the most post-consumer recycled content, striving for 100% overall recycled content and at least 40% post-consumer. Preference should be given to papers made from non-tree feedstocks. These include alternate fibers such as banana leaves, hemp, limestone and other agricultural waste. Some of these options will result in a cost increase from tree-based paper.

Poly Vinyl Acetate (PVA)	*Poly Vinyl Acetate is not acceptable for use as a packaging material due to major concerns about the reactivity and safety of its base material. Substitutes include LDPE or HDPE.* **Background** Poly Vinyl Acetate (PVA) is made from the monomer vinyl acetate. Vinyl acetate monomer (VAM) is an essential chemical building block used in a wide variety of industrial and consumer products. VAM is a key ingredient in emulsion polymers, resins, and intermediates used in paints, adhesives, coatings, textiles and packaging. Ethylene is a basic building block for the chemical industry, and it is one of the largest volume organic chemicals produced globally. Ethylene is produced commercially from petroleum and natural gas feedstocks. The major concerns around EVA relate to the use of VAM, which is considered to toxic to aquatic organisms. Animal studies also connect VAM to certain cancers. Given these concerns, and the availability of alternative materials, EVA packaging should be avoided.
Polycarbonate	*Polycarbonate plastic should be avoided unless no suitable alternatives exist.* **Background.** Polycarbonate plastics are generally made up of the monomer Bisphenol A (BPA). Research suggests that small amounts of BPA may leach into foods or beverages stored in polycarbonate containers, especially when the contents are acidic, high in fat, or heated. Research also suggests that, at certain levels, BPA acts as an endocrine disruptor, a substance which mimics natural human hormones. For the company's full position on BPA, see http://www.wholefoodsmarket.com/products/bisphenol-a.php and http://rock.wholefoods.com/?p=887 BPA (note that this is not technically polycarbonate, but a BPA-containing epoxy) remains the only suitable material for use in can linings for certain types of food. At this time BPA based epoxy lining is the industry standard in canned foods with very few exceptions. This is true of most aluminum cans in the US and does include our store brand (private label) products. In our store brands, our buyers are not currently accepting any new canned items with BPA in the lining material, and we have met with each of our suppliers and their can manufacturers to develop plans for their transition to non-BPA cans. Currently, 27% of the sales of our store brand canned good sales are of non-BPA cans, and that number continues to increase. BPA based epoxy liners work effectively to protect the integrity of food. The U.S. can market is dominated by a small number of very large companies. Whole Foods Market represents a very tiny slice of the overall canned good market, so our leverage is limited. Despite the uphill nature of this battle, we are working with a group of like-minded companies and socially responsible investors to continue to push for alternatives. Our hope is that with the recent updated guidance from the FDA, companies will be encouraged to find an alternative material that works just as effectively to protect the integrity of canned foods without the presence of BPA or any other substances of concern.

Polyethylene (HDPE, LDPE)	*All Polyethylene products (High Density, Low Density, Linear Low Density and Medium Density) are acceptable for use in packaging and tertiary overwrap.* **Background** Ethylene, the base material for polyethylene, is produced commercially from petroleum and natural gas feedstocks. Ethylene is primarily used as a reactive monomer (chemical building block) to make polyethylene, and as an intermediate in the production of other organic compounds, such as ethylene dichloride and ethylene oxide. Products produced from ethylene are used to make chemicals and plastics, and are used in other industrial processes and in consumer products such as detergents, automotive antifreeze, and plastic articles of many types. Ethylene is used industrially in the production of various plastics and chemicals used in industrial and consumer products. For example, plastic milk jugs and plastic bags are made from HDPE, which is a polymer made from ethylene. PE films can be recycled at any WFM location, but are not accepted by municipal recycling companies in most areas. Recycling information should be included on the label. HDPE (#2) containers, such as milk jugs and shampoo bottles, are accepted everywhere for recycling.
Polyethylene Terephthalate (PET)	*Polyethylene Terephthalate (PET) is acceptable as a material for use in packaging.* **Background** PET can exist both as an amorphous (transparent) and as a semi-crystalline (opaque and white) material. PET can be semi-rigid to rigid, depending on its thickness, and is very lightweight. It makes a good gas and fair moisture barrier, as well as a good barrier to alcohol (requires additional "Barrier" treatment) and solvents. It is strong and impact-resistant. It is naturally colorless with high transparency. While all thermoplastics are technically recyclable, PET bottle recycling is more practical than many other plastic applications. The primary reason is that plastic carbonated soft drink bottles and water bottles are almost exclusively PET which makes them more easily identifiable in a recycle stream. PET has a resin identification code of 1. PET, as with many plastics, is also an excellent candidate for thermal recycling (incineration) as it is composed of carbon, hydrogen and oxygen with only trace amounts of catalyst elements (no sulfur) and has the energy content of soft coal. One of the uses for a recycled PET bottle is for the manufacture of polar fleece material. It can also make fiber for polyester products. PET is universally accepted by recycling programs.

Polylactic Acid (PLA) and plant-derived plastics	*PLA, and other related plastics derived from plant starch, pose a complex and difficult set of issues. On one hand, they provide a plant-derived alternative to petroleum-derived plastics, but on the other, they are often sourced from energy-intensive and genetically modified corn or other food crops. With PLA, it's critical that you work with the Green Mission and QS teams to ensure that the claims being made are not misleading and do not misrepresent the environmental benefits of the material.* **Background** PLA is useful as a packaging material because it has properties similar to certain types of petroleum based plastics. It is clear, rigid, and can be formed on practically any machine that forms plastic leading to a vast array of applications. It tolerates cold and heat fairly well, and protects products from moisture and air. Despite its positive attributes, the feedstock of PLA is most often corn starch which raises several concerns. The first consideration is the issue of using genetically modified (GM) corn. PLA is generally made from GMO corn (although we are aware of a Chinese manufacturer using non-GMO corn), and the principal US supplier is not willing to create a non-GMO version. A second issue is that corn is a food crop. Removing edible product from the food supply raises ethical concerns. This process has also been demonstrated to raise prices for corn resulting in corn-based foods to be at such a high cost as to render them unattainable to low-income people, especially in developing countries. Additionally, corn is a high input crop and many question whether the impact of growing corn is actually worse than the petroleum source of a traditional plastic. For these reasons, as well as the lack of a composting infrastructure, PLA should be avoided until such a time that it can be made from waste products and not from an energy-intensive food and GMO food product.
Polypropylene (PP)	*Polypropylene (PP, #5), is accepted for use as a packaging material, but #1 PET and #2 HDPE may be suggested as alternatives.* **Background** Polypropylene is a thermoplastic polymer used in a wide variety of applications, including packaging, textiles (e.g., ropes, thermal underwear and carpets), stationery, plastic parts and reusable containers of various types, laboratory equipment, loudspeakers, automotive components, and polymer banknotes. An addition polymer made from the monomer propylene, it is rugged and unusually resistant to many chemical solvents, bases and acids. Melt processing of polypropylene can be achieved via extrusion and molding. Common extrusion methods include production of melt blown and spun bond fibers to form long rolls for future conversion into a wide range of useful products such as face masks, filters, diapers and wipes. The most common uses for PP in packaging come in dairy products such as yogurt and margarine tubs. It is also found in complex shapes such as bottle lids and some films like labels and bags. PP is accepted by municipal recycling facilities in many communities, and is relatively easy to recycle. PP can become clothing, bottles, tote bags or rigid products like toothbrush

	handles. Because #1 and #2 plastics are still more commonly accepted for recycling, PP should be evaluated on a case-by-case basis.
Polystyrene (PS)	*Polystyrene (#6, styrofoam) is unacceptable due to it's non-recyclability and questions about its safety.* **Background** Polystyrene is a polymer made from the monomer styrene, a liquid hydro-carbon that is derived from petroleum. Polystyrene's most common use is as expanded polystyrene (EPS, or styrofoam). Expanded polystyrene is produced from a mixture of about 90-95% polystyrene and 5-10% gaseous blowing agent, most commonly pentane or carbon dioxide. The solid plastic is expanded into a foam through the use of heat, usually steam. The resin identification code symbol for polystyrene is #6. However, the majority of polystyrene products are currently not recycled because of a lack of suitable recycling facilities. Furthermore, when it is "recycled," it is not a closed loop — polystyrene cups and other packaging materials are usually recycled into fillers in other plastics, or other items that cannot themselves be recycled and are thrown away. Expanded polystyrene is not easily recyclable because of its light weight and low scrap value. It is generally not accepted in curbside programs. Expanded polystyrene foam takes 900 years to decompose in the environment and has been documented to cause starvation in birds and other marine wildlife. According to the California Coastal Commission, it is a principal component of marine debris. A CIWMB (California Integrated Waste Management Board) report finds that "in the categories of energy consumption, greenhouse gas effect, and total environmental effect, EPS's environmental impacts were second highest, behind aluminum." Restricting the use of foamed polystyrene takeout food packaging is a priority of many solid waste environmentalist organizations, like Californians Against Waste. The city of Berkeley, California was one of the first cities in the world to ban polystyrene food packaging (called Styrofoam in the media announcements). It was also banned in Portland, OR, and Suffolk County, NY in 1990. Now, over 20 US cities have banned polystyrene food packaging, including Oakland, CA on Jan 1st 2007. San Francisco introduced a ban on the packaging on June 1st 2007. As of 2012, several dozen US cities and counties have banned polystyrene packaging.
Polyvinyl Chloride (PVC)	*PVC is only acceptable where no suitable alternatives exist, due to its limited recylability. For packaging, alternatives include other, recyclable plastics such as PET or HDPE, and for pallet overwrap, LDPE is an alternative. With plastic wraps for products such as cheese, PVC is the only material capable of sufficiently protecting and preserving the product.*

Steel/BPA	*Steel is acceptable as a material for packaging. BPA is acceptable in can linings but should be avoided where functional alternatives exist. Please note that while BPA-free can linings are a growing category, BPA epoxy remain the only suitable material for can linings for certain categories of food.* **Steel** Steel is an alloy consisting mostly of iron, with a carbon content between 0.2 and 2.04% by weight depending on grade. Carbon is the most cost-effective alloying material for iron, but various other alloying elements are used such as manganese, chromium, vanadium, and tungsten. Carbon and other elements act as a hardening agent, preventing dislocations in the iron atom crystal lattice from sliding past one another. **Bisphenol A** For the company's full position on BPA, see http://www.wholefoodsmarket.com/products/bisphenol-a.php and http://rock.wholefoods.com/?p=887 BPA (note that this is not technically polycarbonate, but a BPA-containing epoxy) remains the only suitable material for use in can linings for certain types of food. At this time BPA based epoxy lining is the industry standard in canned foods with very few exceptions. This is true of most aluminum cans in the US and does include our store brand (private label) products. In our store brands, our buyers are not currently accepting any new canned items with BPA in the lining material, and we have met with each of our suppliers and their can manufacturers to develop plans for their transition to non-BPA cans. Currently, 27% of the sales of our store brand canned good sales are of non-BPA cans, and that number continues to increase. BPA based epoxy liners work effectively to protect the integrity of food. The U.S. can market is dominated by a small number of very large companies. Whole Foods Market represents a very tiny slice of the overall canned good market, so our leverage is limited. Despite the uphill nature of this battle, we are working with a group of like-minded companies and socially responsible investors to continue to push for alternatives. Our hope is that with the recent updated guidance from the FDA, companies will be encouraged to find an alternative material that works just as effectively to protect the integrity of canned foods without the presence of BPA or any other substances of concern.