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Petition for the Addition of DHA Algal Oil to the National List of Allowed and Prohibited Substances

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Respectfully Submitted:

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August 12, 2010

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APPENDICES

Introduction

Martek Biosciences Corporation ("Martek"), pursuant to 7 U.S.C. §6517-18, and 7 C.F.R. §205.600-07, respectfully submits this Petition to the National Organic Standards Board ("NOSB") and the National Organic Program ("NOP") *[See also* 72 Fed. Reg. 2167-69 Overview of Petition Review by the NOSB (January 18, 2007)]. This Petition seeks the placement of Docosahexaenoic Acid Algal Oil ("DHA Algal Oil") on the National List of Allowed and Prohibited Substances ("National List") under 7 C.F.R. § 205.605(a) or (b).[1]

The petitioned material has appeared as an ingredient in multi-ingredient organic food products for several years pursuant to an NOP letter ruling authorizing its use in handling as an allowed synthetic material falling under the "nutrient vitamin and minerals" category on the National List[2] [See 7 C.F.R. § 205.605(b)]. In April of 2010, the NOP revisited the issue of letter rulings on National List authorizations from a procedural perspective and determined that, "[T]he NOP will not be making policy decisions in letters."[3] Pursuant to the change in the letter ruling policy, materials that were previously recognized by letter ruling, such as DHA Algal Oil, are now procedurally required to be the subject of a Petition seeking NOSB review, and placement on the National List. The petitioned material is unchanged from that which was authorized previously.

Executive Summary

This petition covers DHA Algal Oils that are sourced from two different microalgae, *Schizochytrium* sp. and *Crypthecodinium cohnii.* Currently, Martek's DHA Algal Oils are included in various organic food products such as infant formulas, yogurts, baby foods, fluid milk, soy milk, and numerous other food products to bolster their DHA content.

DHA is an omega-3 long chain, polyunsaturated fatty acid. DHA is a primary structural component in the brain and retina and is recognized by experts worldwide as playing a nutritional role in optimizing cognitive, visual, and heart function, and other aspects of health. The inclusion of DHA (and arachidonic acid (ARA), which is covered by a separate petition) in infant formula is particularly important because studies have consistently demonstrated the role of dietary DHA in optimizing visual and cognitive development. These two important nutrients are included in essentially every commercially available infant formula marketed in the United States. The benefits of DHA are also recognized for children and adults given the important structural role DHA plays in the brain and retina, its benefits in supporting

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[1] Martek recognizes that the proper classification of a material, or class or category of materials, under the NOP is the subject of ongoing discussion. *See e.g.*; Classification of Materials--DRAFT Guidance document (Joint Materials and Handling Committee) (March 1, 2010)(hereinafter "Draft Guidance"); Addendum to November 6, 2009 Recommendation on Classification of Materials, (Joint Materials and Handling Committee)(March 1, 2010)(hereinafter "Recommendation"); Recommendation on Classification of Materials, (NOSB)(November 6, 2009); Recommendation on Classification of Materials (NOSB Joint Materials and Handling Committee)(September 9, 2009).

[2] *See* Appendix No. 1, Letter to Compliance Officer Amador from Assoc. Deputy Administrator Bradley (November 3, 2006)(approving DHA as an "accessory nutrient"); *see also* Appendix No. 2, The Use of Nutrient Supplementation in Organic Foods, National Organic Standards Board Recommendation, (October 31, 1995)(recognizing DHA as an "accessory nutrient")

[3] *See* Appendix No. 3, Action Memorandum for the Chairman of the National Organic Standards Board: Scope of Nutrient Vitamins and Minerals in Organic Food, (April 26, 2010).

heart health, and its benefits in improving cognitive function in the elderly. Numerous health organizations worldwide recommend inclusion of DHA and ARA in infant formula and have set recommended intake levels for DHA in the diets of pregnant women, children, and adults.

DHA is naturally found in abundance in marine-based organisms, predominately high fat fish and the marine microalgae (i.e., phytoplankton) they consume. Marine microalgae are the original source of omega-3 fatty acids in the aquatic food chain and are also used to create DHA Algal Oil. DHA Algal Oil is obtained from naturally occurring, non-genetically modified, sustainable, microalgal sources.

As will be explained in more detail in the following petition, the manufacturing process for DHA Algal Oil uses an aerobic fermentation process followed by oil recovery from the fermentation broth. The manufacturing process does not alter or chemically change the DHA Algal Oil. Because the DHA Algal Oil is formed naturally within the microalgae cell, oil from either of the two microalgae sources cannot be extracted using mere physical means such as that commonly used in the cold pressing of products such as olives, soy, and tree nuts. The two microalgae used as the sources for the Martek DHA Algal Oils have different physical structures that necessitate the use of different extraction procedures. The *Schizochytrium* sp. oil is extracted by first treating the microalgae with an enzyme that hydrolyzes the cell wall causing it to rupture and release the DHA Algal Oil from the cell. The oil is released into the aqueous broth and forms a water/oil emulsion. Isopropyl alcohol is added to break the oil and water emulsion. *C. cohnii* have a much more complex cell wall structure that cannot be hydrolyzed through enzymes that are currently available. The cell wall is ruptured through high pressure homogenization followed by solvent extraction, which is the only method, to date, that can effectively extract the DHA Algal Oil from the *C. cohnii* cell structure. These methods are common to the vegetable oil industry and no detectable residues of solvent remain in the extracted DHA Algal Oil. The manufacturing process also utilizes non-organic processing aids such as food acids and antioxidants that are needed to maintain the stability of these oils, which are prone to oxidation. At this time, Martek has not been able to identify a functional organic alternative to these processing aids.

The Food and Drug Administration (FDA) has authorized the use of the DHA Algal Oil from *C. cohnii* for use in infant formulas (DHA Algal Oil from *Schizochytrium* sp. was not developed for use in infant formula; as such, it has not been reviewed by FDA for that application). Unlike most foods, infant formulas are subject to FDA pre-market notification requirements prior to marketing, and must meet federal nutrient requirements and include minimum and maximum amounts of certain nutrients. The premarket notification typically must be supported by safety data and clinical studies demonstrating the new infant formula will support growth. FDA has authorized only one of the Martek microalgae sources of DHA for use in infant formulas (i.e., the DHA Algal Oil extracted from *C. cohnii)*[4]. Therefore, a company likely could not introduce into commerce in the United States an infant formula containing DHA Algal Oil extracted from *Schizochytrium* sp. without first conducting safety and clinical studies demonstrating the adequacy of this source of DHA in sustaining infant growth and development and receiving FDA authorization of an infant formula premarket notification—a process that could easily take five or more years. Moreover, a modification of the oil extraction process for *C. cohnii* similarly could trigger the filing of a new infant formula notification. Inclusion of the DHA Algal Oil extracted from *C. cohnii* on the National List will ensure infants receiving organic formulas will have the DHA that is needed to optimize visual and cognitive growth.

[4] As discussed elsewhere in this petition, the *Schizochytrium* sp. DHA Algal Oil Is not approved by FDA for use in infant formula because they have not been asked to review its use in that application. Rather, FDA has only reviewed and approved DHA obtained from *C. Cohnii* for use in infant formula products.

The components of DHA Algal Oil have a history of safe consumption. All ingredients used in the processing of DHA Algal Oil are either food grade or of higher quality. The entire process meets the current Good Manufacturing Practices for foods. DHA Algal Oil undergoes rigorous analytical and quality assurance testing and meets well-defined product specifications prior to release. Additionally, a large number of safety studies have been conducted using DHA Algal Oil and no scientifically valid reports (published or unpublished) have suggested any safety issues associated with the use of this product.

Martek believes that DHA Algal Oil is eligible under either category of allowed materials for handling under 7 C.F.R. § 205.605. DHA Algal Oil may be classified under either 7 C.F.R. § 205.605 (a) or (b), and additionally may fall under an existing category of approved material, such as "microorganisms" or "nutrient vitamins and minerals" if the boundaries of that category are clarified.

PETITION

Item A

Category for inclusion on, or removal from, the National List

Martek is petitioning for the inclusion of DHA Algal Oil on the National List under 7 C.F.R. § 205.605 (a) or (b) for handling of multi-ingredient food products.

Item B

1. Common name of the substance.

DHA Algal Oil
Algal Oil

Martek's DHA Algal Oil is currently marketed under the trade names *life'sDHA*™, DHA™-S, DHASCO®, DHASCO®-S , DHA™-HM, and DHA GOLD™.

2. Manufacturer's name, address and telephone number.

Martek Biosciences Corporation
6480 Dobbin Road
Columbia, MD 21045
PH: (443) 542-2395
FAX: (410) 997-7789

3. The intended or current uses of the substance.

DHA Algal Oil is intended to be used in organic handling operations as a source of DHA in infant formulas, foods, beverages and for use as a dietary supplement. As discussed in more detail in section 8.d, below, DHA is a valuable omega-3 fatty acid that is deficient in the diet of most Americans. DHA Algal Oil is typically used to increase the omega-3 fatty acid content of foodstuffs, and is approved by FDA for use in a variety of products, such as:

Cookies & Crackers	Breads & Rolls	Cakes & Pies
Cereals	Baked Goods & Baking Mixes	Fats & Oils
Yogurt	Milk (Liquid & Powder)	Cheese
Meat Products	Egg Products	Fish Products
Condiments	Soup Mixes	Snack Foods
Nut Products	Gravies & Sauces	Soy Protein Bars
Plant Protein Products	Beverages	Candy
Non-Dairy Products	Soy Milk	Jams & Jellies
Dairy Product Analogs	Flavored Milk & Milk Products	Nonalcoholic Beverages

Pastas	Poultry Products	Fruit Juices
Sugar	Chewing Gum	Gelatins & Puddings
Confections & Frosting	Sweet Sauces, toppings and syrups	Dietary Supplements
Infant Formulas		

4. Source of the substance and a detailed description of its manufacturing or processing procedures from the basic component(s) to the final product.

DHA Algal Oil is obtained from naturally occurring, non-genetically modified, microalgal sources, such as *Schizochytrium* sp. and *C. cohnii*. *Schizochytrium* sp. is a member of the Chromista kingdom (Stramenopilia), while *C. cohnii* is a member of the Dinophyta kingdom. Both *Schizochytrium* sp. and *C. cohnii* are single-celled organisms which are incapable of photosynthesis.

DHA Algal Oil is produced using traditional food fermentation techniques, followed by oil recovery and purification steps which utilize standard food-grade vegetable oil industry methods. As has been made clear in the recent descriptions of the National List evaluation processes, the use of synthetic solvents to facilitate the isolation or extraction of a component of an agricultural product or a product of a natural biological process, does not automatically render the extracted fraction of the product a "synthetic" substance as it is described in the OFPA. Here, the use of a common solvent does not change the original chemical compositions of the DHA Algal Oil that is naturally produced by the microalgae. In its March 2010 draft guidance, the NOSB noted that the use of an extraction solvent will not result in a material being classified as synthetic, "unless either the extraction resulted in a chemical change or the synthetic remained in the final product at a significant level,"[5] neither of which occurs here. The use of food acids and bases to adjust the pH during the manufacturing process similarly does not result in a chemical change to the DHA Algal Oil.[6] Moreover, the antioxidants in the finished DHA Algal Oil are not present at significant levels[7] and have no technical or functional effect in the finished foods that utilize DHA Algal Oil.

a) Fermentation – The microalgae are grown using an aerobic fermentation process followed by recovery from the fermentation broth. Fermentation media consists of a carbon source (e.g., glucose, fructose), a nitrogen source (e.g., yeast extract), bulk nutrients (e.g., sodium chloride), trace minerals (e.g., iron, copper), and vitamins (e.g., thiamin, biotin). Fermentation is monitored and controlled for physical conditions. The fermentation is performed under aseptic conditions. Post-fermentation, the broth is pasteurized and may be heated and pH adjusted, as necessary. Safe and suitable food-grade antioxidants, such as

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[5] *National Organic Standard Board—Joint Materials and Handling Committee Classification of Materials,"* Draft Guidance, Question3, pg. 6 (March 1, 2010).

[6] In its draft Guidance, NOSB recognized the use of an acidification and neutralization step in the isolation of soy protein from soybeans does not, standing alone, result in a chemical change determination under the National List analysis because the soy protein at the end of the process was restored to the same chemical identity as the soy proteins in the source soybeans. *Id.*

[7] *See, id,* Draft Guidance, Question 4, pg. 7 (*de minimis* presence is below the level of regulatory significance under the NOP).

tocopherols and ascorbyl palmitate, are added to the fermentation broth to protect any free oil that may be released from the microalgae during fermentation (long chain omega-3 fatty acids are easily oxidized and need to be protected from oxidation).

b) Oil Recovery – Following fermentation, oil is recovered from the microalgae utilizing a physical plus solvent process or an enzyme process depending on the microalgae source. The composition of the microalgae cell walls requires the use of different extraction processes for the DHA Algal Oil sourced from *C. cohnii* and *Schizochytrium* sp. DHA Algal Oil derived from *C. cohnii* is processed using high pressure physical homogenization to rupture the cell wall followed by extraction with hexane to release the oil from the cell. DHA Algal Oil derived from *Schizochytrium* sp. is processed using enzymes to rupture the cell wall and release the oil from the cells. Isopropyl alcohol is then added to break the oil and water emulsion that is formed after the cells are ruptured. The primary reason for the differences in processing lies in the morphology and composition of the cell walls of each microalgal source.

The cell wall of *Schizochytrium* sp. is composed predominantly of sugars and proteins. A protease enzyme "attacks" the proteins in the cell wall leading to a breakdown of the cell wall structure, releasing the oil from the cells into the aqueous fermentation broth and forming an oil and water emulsion. Isopropyl alcohol is added to break the emulsion and separate the oil phase for further processing.

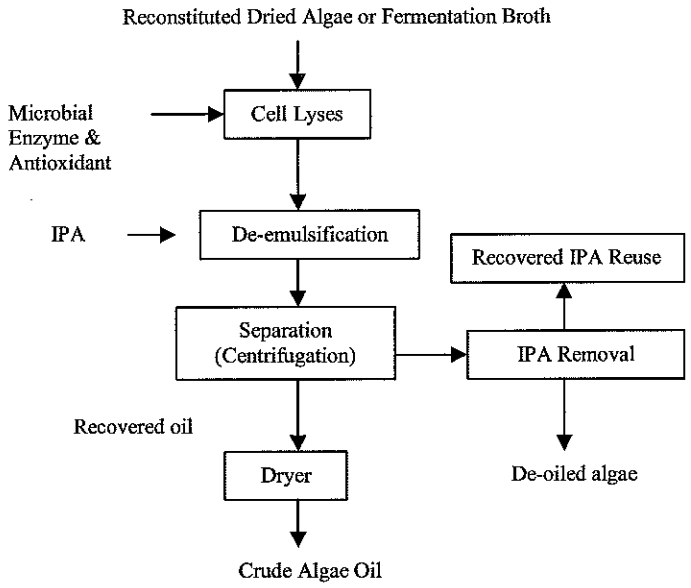
The cell wall of *C. cohnii* is unique in that its cell boundary (amphiesma) is delimited by three distinct layers: an outer membrane, the thecal layer, and an inner membrane. The outer and inner membranes are classic membranes in that they consist mainly of lipids and some proteins. The thecal layer is more similar to the cell wall of terrestrial plants and is comprised largely of cellulose arranged in plate-like structures. When observed microscopically, these plates give the cell an armored appearance, making the lysing of *C. cohnii* cell walls more difficult than *Schizochytrium* sp. Protease enzymes have no effect on the cellulosic thecal plates. Likewise, the outer membrane of *C. cohnii* cell walls protects the thecal layer from enzymes that are marketed for the digestion of cellulose. In-house research has not been able to identify an enzyme treatment that is effective in breaking down the multi-layered cell boundary, rupturing the cell and releasing the oil.

Below, we provide more details on the enzyme hydrolysis and solvent extraction processes.

i. ***Enzyme Hydrolysis*** - The fresh broth or reconstituted dried microalgae may be heated, pH adjusted as necessary, and treated with a non-genetically modified microbial enzyme to rupture the cell walls and release the oil from the cells. The oil is released into the aqueous broth and forms a water/oil emulsion. Isopropyl alcohol is added to break the oil and water emulsion. The broth-alcohol mixture is centrifuged, and the oil is collected as the top (light) phase and the spent broth and alcohol as the lower (heavy) phase. Alcohol is recovered from the spent broth by evaporation and distillation. The recovered alcohol is stored for re-use in subsequent batches. Prior to drying, additional antioxidants, such as tocopherols and ascorbyl palmitate, are added to the oil to protect the oil from oxidation. The oil is then dried under vacuum with a nitrogen purge. The dried oil is stored frozen until it undergoes further refining. No detectable residues of isopropyl alcohol

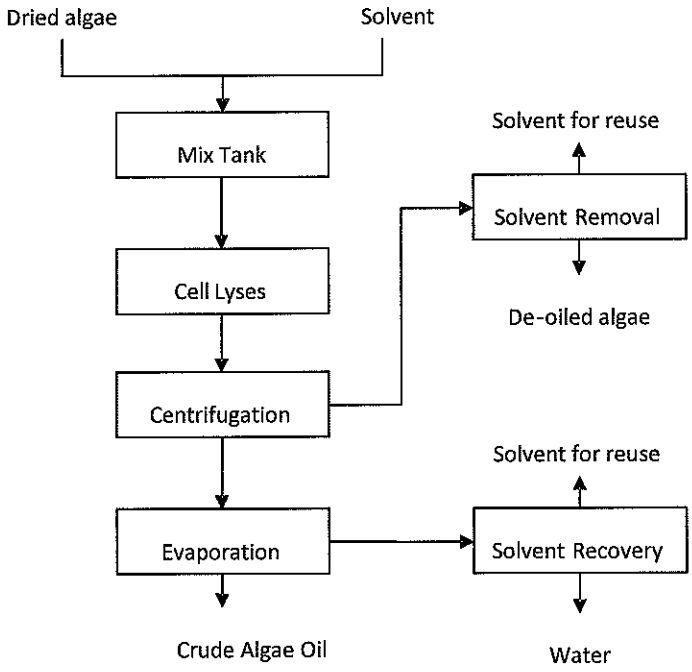
remain in the final product. Isopropyl alcohol is undetectable at a limit of detection of <1 ppm. See Figure 1 for overview of the DHA enzyme hydrolysis process.

Figure 1. Overview of the enzyme hydrolysis process for DHA Algal Oil recovery



ii. **High Pressure Homogenization** – DHA Algal Oil may also be recovered from the microalgae utilizing established food-grade oil industry methods, such as solvent extraction. After fermentation, the dried algae are combined with hexane prior to undergoing cell disruption. The cells are physically ruptured using high pressure homogenization, releasing the oil into the solvent. The cell walls are removed through centrifugation and the oil and solvent mixture is sent through a series of evaporators to remove the solvent from the oil. No detectable residues of the extraction solvent remain in the final product. Hexane is undetectable at a detection limit of <0.3 ppm. The solvent is recovered for re-use through a series of condensers, separators, and an oil scrubber. See Figure 2 for an overview of the DHA solvent extraction process.

Figure 2. Overview of the solvent extraction process for DHA Algal Oil recovery



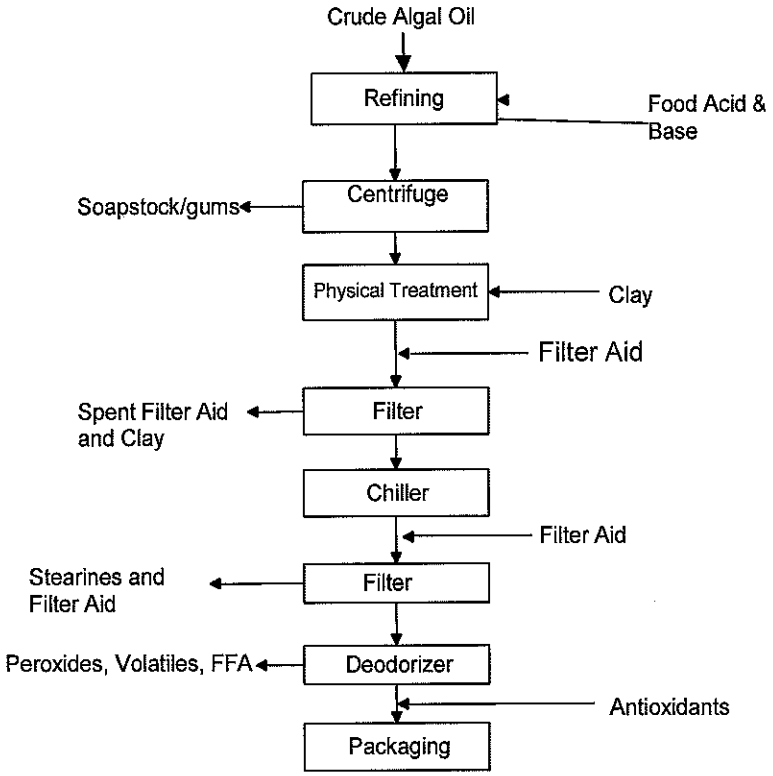
c) Oil Purification – The crude oil needs to be further purified to neutralize free fatty acids and naturally occurring trace metals (e.g., copper, iron and phosphorous). The purification is accomplished by adjusting the pH, which causes the formation and precipitation of the undesirable residues in the crude oil so they can be easily separated and removed. The crude oil is heated, followed by the addition of an acidulated solution (e.g., oleic or citric). After treatment, the pH of the oil is then raised through the addition of sodium hydroxide. These changes in the pH cause the formation of "soaps" and "gums," along with water that will be present in the "heavy phase". The oil is then reheated and centrifuged to separate the heavy phase from the refined oil. After alkali refining, the oil is treated with adsorbents and chelaters (e.g., citric acid, silica, clay, filtration) to remove through physical means the remaining residual levels of polar compounds (e.g., soaps), trace metals (e.g., copper, iron and phosphorus), and oxidation products from the refined oil.

The treated oil may then be chill filtered to further remove high melting point components (e.g. stearines and waxes) from the oil to achieve the desired level of clarity. The oil is heated and then cooled and held for a period of time causing the high melting triglycerides and waxes to crystallize. Filter aid (diatomaceous earth) is added to the chilled oil and the crystallized solids are removed by filtration.

After chill filtration, a deodorizer, operated under elevated temperature and vacuum, is used to remove peroxides and any remaining low molecular weight compounds naturally found in the oil (e.g., carbonyls and aldehydes) that may cause off-odors and flavors. The oil is cooled under a nitrogen blanket at the end of the deodorization cycle and safe and suitable ingredients, such as tocopherols, rosemary extract and ascorbyl palmitate, are added to the oil to provide oxidative stability and flavor. High oleic sunflower oil may be added to the oil to provide a

product with a consistent DHA potency. The finished oil is then packaged and stored. DHA Algal Oil may also be microencapsulated to provide a product in a powder form. Figure 3 provides an overview of the refining and downstream processing of the oil.

Figure 3. Overview of the refining process of DHA Algal Oil



d) Manufacturing Discussion - All processes are set up using a Hazard Analysis Critical Control Point (HACCP) approach. They are documented according to current Good Manufacturing Practices regulation (cGMP) for foods and the identified critical control points (CCPs) are monitored. Quality Control (QC) personnel record the results of laboratory tests as well as sterility checks. Production personnel record the continuous batch monitoring results within the batch records, according to cGMP. Quality Assurance personnel monitor the production records to ensure that batch process changes have been properly authorized, documented, and recorded in the records for each batch.

DHA Algal Oil has no detectable residues of extraction solvents, pesticide residues, PCB's or any heavy metals such as arsenic, mercury, cadmium and lead. Product information can be found in Appendix 4.

Food-grade oils with high amounts of long chain unsaturated fatty acids, such as DHA Algal Oil, are highly susceptible to oxidation without the addition of antioxidants. Antioxidants are therefore added during processing to delay the oxidation of the oil which results in palatability, functionality, shelf-life and nutritional quality issues. Tocopherols alone cannot be used to protect the oil from oxidation due to naturally present compounds, such as ketones and

aldehydes, and manufacturing processes that expose the oil to oxygen, heat, and light. As such, antioxidant mixtures are utilized which allow several compounds to work synergistically to delay the onset of oxidation.

Tocopherols and rosemary extract are added to remove free radicals from the oil and provide flavor. Food acids, such as citric and oleic, are added to remove the naturally-occurring trace metals from the oil, while ascorbyl palmitate, the fat soluble form of vitamin C, serves primarily as an oxygen scavenger. Alternatives to ascorbyl palmitate, such as ascorbic acid, have limited applicability in Martek's DHA Algal Oil due to the inability to uniformly disperse and solubilize in an oil matrix. Martek is continually evaluating the use of antioxidant mixtures to improve the quality and stability of our oil. At this time, we have not been able to identify an effective combination of alternative antioxidant blends. The antioxidants utilized by Martek are processing aids that scavenge oxygen that may be introduced during the manufacturing process and neutralize the trace minerals and other substances that can oxidize the oils. The antioxidants are used at the minimum level to accomplish their functional effect during the processing. These processing aids do not have any functional effect in the foods that are made with the DHA Algal Oil. In other words, while the processing aids promote stability during the manufacture of the DHA Algal Oil, they do not function as antioxidants in the foods that are formulated with the DHA Algal Oil.

High oleic sunflower oil is added to DHA Algal Oil to provide a product with a consistent DHA potency to customers. High oleic sunflower oil is used for its fatty acid profile, stability and sensory profile. The high oleic sunflower oil does not provide a functional or technical effect in foods that are formulated with DHA Algal Oil.

Outside of the processing methods utilized by Martek, a review of publicly available information (e.g., GRAS notifications and patent applications) indicates that other commercial sources of DHA Algal Oil utilize common food-grade solvents, such as hexane, to extract the oil from the microalgae.

Martek continues to investigate alternative food-grade extraction technologies. To date, an alternative, commercially feasible process, resulting in a stable, high-quality oil equivalent to the DHA Algal Oil offered today, has yet to be identified.

5. A summary of any previous reviews of the petitioned substance by State or private certification programs, or other programs.

- DHA Algal Oil has previously been considered an accessory nutrient and utilized in "organic" and "made with organic" products under the Nutrient Vitamins & Minerals category of the National List (7 C.F.R. § 205.605 (b)).
- Martek's DHA Algal Oil is certified Kosher by the Orthodox Union.
- Martek's DHA Algal Oil is certified Halal by the Islamic Food and Nutrition Council of America.

See Appendix 5 for a summary of regulatory approvals and market data for DHA Algal Oil.

6. Information regarding EPA, FDA, and State Regulatory authority registrations.

FDA

DHA Algal Oil from *C. cohnii* was the subject of a GRAS Notification (GRN000041) submitted by Martek Biosciences Corporation to the U.S. Food and Drug Administration (U.S. FDA) in 2000. The Agency responded with no objection regarding Martek's conclusion that DHA-rich Algal Oil from *C. cohnii* is GRAS when added to infant formulas at a level up to 1.25 percent of the total dietary fat and at a ratio of DHA to ARA of 1:1 to 1:2.
http://www.accessdata.fda.gov/scripts/fcn/fcnDetailNavigation.cfm?rpt=grasListing&id=41

DHA Algal Oil from *Schizochytrium* sp. was also the subject of a GRAS Notification (GRN 000137) submitted by Martek Biosciences Corporation to the U.S. FDA in 2003. The Agency responded with no objection regarding Martek's conclusion that DHA-rich Algal Oil from *Schizochytrium* sp. is GRAS when used as a direct food ingredient at approximately 1.5 grams DHA per day, equivalent to approximately 4 grams of oil per day.
http://www.accessdata.fda.gov/scripts/fcn/fcnDetailNavigation.cfm?rpt=grasListing&id=137

DHA Algal Oil from *Schizochytrium* sp. has been marketed as a dietary supplement and was the subject of a New Dietary Ingredient Premarket Notification to the U.S. FDA in 1997 for SeaGold™ DHA-rich oil.
http://www.regulations.gov/search/Regs/home.html#documentDetail?R=090000648055c314

EPA

The facilities where the extraction of DHA Algal Oil occurs are regulated by the Environmental Protection Agency (EPA) and each facility has existing operating approvals from the EPA.

7. The Chemical Abstract Service (CAS) number of the substance and labels of products that contain the petitioned substance.

There is no Chemical Abstract Service (CAS) registry number for DHA Algal Oil; however the CAS number for DHA, the primary component of this substance, is 25167-62-8.

Sample labels for products containing DHA Algal Oil can be found in Appendix 6.

8. Physical properties of the substance and chemical mode of action: including environmental impacts, interactions with other materials, toxicity and persistence, effects on human health, effects of soil organisms, crops or livestock:

a. Physical properties and mode of action

- DHA Algal Oil is derived from single celled, non-genetically modified microalgal sources.
- DHA Algal Oil is a yellow to light orange-colored semi-solid to liquid oil that is composed predominantly of triglycerides, and contains a minimum 35% DHA.
- Ingested long chain polyunsaturated fatty acids (LCPUFA) are found circulating in the blood either as a constituent of red blood cell (RBC) membranes, or in non-cellular forms either as triglyceride, plasma phospholipids, or steryl esters. Plasma phospholipid DHA increases in a dose and time dependent manner and reaches a new equilibrium level in two to three weeks following oral consumption of DHA (Arterburn et al., 2006).

b. Chemical interactions with other substances

No distinct chemical interactions are known to occur.

c. Toxicity and environmental persistence

DHA Algal Oil is fully biodegradable and does not persist in the environment. There are no environmental risks or toxicity associated with the use or disposal of Martek's DHA Algal Oil. See MSDS's in Appendix 7.

d. Effects on Human Health

DHA plays an important role in infant neural growth and development and is an essential fatty acid necessary to ensure proper function of the body and for the development and function of the brain and eyes. See Appendix 8 for a detailed discussion of the role of DHA in human health and recommendations of regulatory and expert organizations.

- The DHA content of human milk is directly influenced by the fatty acid content of the mother's diet. In the absence of DHA supplementation, the DHA level in human milk is often low, particularly in countries where fish consumption is low or variable. The lowest reported DHA levels (≤ 0.2% of total fatty acids) in human milk are consistently reported among women in the United States (Yuhas et al., 2006) and Canada (Innis et al., 1997; Ratnayake and Chen, 1996). The highest reported levels (>0.8% total fatty acids) are among populations with a tradition of consuming higher levels of marine foods, such as Japan (Yuhas et al., 2006; Wang et al., 2000).
- DHA is recognized as an essential fatty acid necessary to ensure proper function of the body, particularly the brain and eyes (FAO/WHO 2008; AFFSA 2010).
- DHA enrichment of foods fed to young children presents an excellent opportunity to assure that the developing child receives sufficient DHA during the important period,

from 6 months to 4 years old, when the brain growth spurt is occurring and neural development is at its peak.

- DHA has an important role in neural function beginning early in life, and recent evidence suggests a continued need throughout the lifespan.

- DHA is supportive of cardiovascular health throughout life, reducing cardiovascular mortality through reductions in sudden death and risk factors for heart disease such as hypertension, elevated heart rate, and triglycerides, for both the general population and those currently suffering from heart disease.

e. Environmental impacts from its use or manufacture

There are no known negative environmental impacts resulting from the use, or disposal of DHA Algal Oil as a food ingredient. DHA Algal Oil has no effect on soil organisms, crops or livestock. The source organisms for Martek's DHA Algal Oil are commonly found in marine environments throughout the world and are considered suitable for the production of microbial oils for use in foods. These organisms are not toxigenic, pathogenic, or genetically modified.

DHA Algal Oil is produced by fermentation under closed, aseptic conditions. DHA Algal Oil is extracted, refined, treated, and deodorized in a process that is similar to that used for other edible vegetable oils. DHA Algal Oil does not contain environmental contaminants and marine pollutants, and therefore, offers a viable and sustainable alternative to, or replacement for, fish and fish oils for increased intake of DHA.

Oil waste (e.g., cell debris, water) from the manufacturing process is treated on-site prior to being sent to a public wastewater treatment facility. Biomass residuals may also be sold as animal feed. Solvents used in processing are managed in a closed system, and captured utilizing oil scrubbers and condensers for subsequent re-use in production. The facilities where the extraction of DHA Algal Oil occurs are regulated by the Environmental Protection Agency (EPA) and each facility has existing operating approvals from the EPA.

FAO/WHO recently provided background on global trends in fish production, intake and composition which contributed to the recently released interim conclusions of an FAO/WHO expert consultation on total fat and fatty acid requirements (FAO/WHO 2009). The FAO/WHO report notes that changes in aquaculture practice to meet increased demand for fish are diminishing the EPA+DHA content of farm-raised fish. Specifically, "87% of all fish oil was used by the aquaculture industry to produce feed" in 2006. This is problematic as, "a sustainable utilization of fishery resources will not allow a permanent increase in the production of fish oils based on available fishery resources." As such the aquaculture industry is working continuously "to reduce the reliance on fish oils and is increasing the use of vegetable oils in aquaculture feeds" (Wolmarans, 2009). Fish are what they eat, however, and the composition of fish is a reflection of what they are fed. In studies of fish fed vegetable oil alternatives "fish given feeds low in fish oil had a low level of EPA and DHA in their fillets" thus diminishing the usefulness of certain farm-raised fish for achieving DHA intake recommendations.

9. Safety information about the substance.

The components of DHA Algal Oil have a history of safe consumption. The fatty acids present in DHA Algal Oil are components of a normal diet or normal metabolites of fatty acids. As noted in section 6, Martek submitted GRAS notifications for its DHA Algal Oils from *C. Cohnii* and *Schizochytrium* sp. and FDA completed favorable reviews of both notifications. FDA also completed a favorable review of the new dietary ingredient notification for *Schizochytrium* sp. The safety of the Martek DHA Algal Oils is established by the favorable reviews of the relevant safety data by FDA. In addition, see Appendix 7 for DHA Algal Oil MSDS's.

A number of studies have demonstrated safe use of Martek DHA Algal Oils, and confirm that the source organisms are nontoxic, further supporting the safety of DHA Algal Oil (Appendix 9). Clinical trials involving over 3,000 term and preterm infants, and over 2,100 healthy adult men, women, including pregnant and lactating women, and children, have been conducted using Martek's DHA Algal Oil with excellent tolerability and safety (Appendix 9).

10. Comprehensive research reviews and research bibliographies, including reviews and bibliographies which present contrasting positions.

See Appendix 9 (Research Bibliography).

11. A "Petition Justification Statement" which provides justification for inclusion of a non-organically produced nonagricultural substance onto the National List.

The nutritional need for the primary ingredient in DHA Algal Oil, DHA, is set forth in other sections of this petition, particularly Appendix 8.

Martek believes that DHA Algal Oil is eligible under either category of allowed materials for handling under 7 C.F.R. § 205.605. DHA Algal Oil may be classified under either 7 C.F.R. § 205.605 (a) or (b), and additionally may fall under an existing category of approved material, such as "microorganisms" or "nutrient vitamins and minerals" if the boundaries of that category are clarified.

DHA Algal Oil is used to increase the DHA content of foodstuffs. As discussed in the petition, a review of the available data demonstrates the importance of including DHA in the diets of all life stages from infancy through adulthood. DHA is essential for healthy functioning of the brain, eyes, and heart and is recognized as particularly important in the diet of infants and toddlers. Based on consumer demand for products that provide these benefits, food developers and manufacturers recognize the need to provide products containing DHA. Recent research from MamboTrack (2010) indicates that eight in 10 natural and organic consumers regularly read ingredient labels for health and nutrition content and express interest in purchasing functional foods with additional health, nutrition and dietary benefits.

Perhaps most notably, virtually all US infant formula products (both organic and non-organic) now contain DHA (and ARA) because of the well-established importance of DHA (and ARA) intake to support infant development and growth. DHA is naturally found in breast milk and is important for optimal infant brain and eye development and function. Although human milk represents the optimal form of infant nutrition, those parents who need or choose formula

should have access to the most nutritionally optimal formula available. If DHA Algal Oil is not added to the National List, organic infant formulas will be nutritionally inferior to conventional infant formulas and will not be able to maintain a competitive position in the market.

Martek is unaware of a commercially available, certified organic, source of algal derived DHA. While fish oils may appear as a likely alternative to algal sourced DHA, fish oil has disadvantages, such as non-sustainability and contribution to over-fishing, environmental contaminants, allergen concerns, and non-vegan status. In contrast, algal sourced DHA is produced in a controlled environment with no exposure to ocean-borne contaminants, and provides a consistent, sustainable, non-allergenic, vegetarian source of DHA to improve the nutritional quality of infant formulas, foods, beverages and dietary supplements.

DHA Algal Oil supports the organic philosophy because it is obtained from naturally occurring, non-genetically modified, sustainable, microalgal sources. Algal sourced DHA is made from the same marine microalgae (i.e., phytoplankton) that fish consume, which are the original source of omega-3 fatty acids in the food chain. This approach ensures environmental sustainability and purity. Furthermore, the availability of a renewable source of DHA is increasingly important as additional food products are fortified with DHA. Because DHA Algal Oil provides benefits distinct from fish oil, its addition to the National List will advance the organic movement by helping organic producers provide consumers with a wide variety of organic food and beverage products with this important nutrient.

12. Commercial Confidential Information Statement describing information that is considered to be confidential business or commercial information.

The analytical results contained in Appendix 4 are considered Confidential Business Information (CBI) that should not be disclosed. The information in Appendix 4 is considered a trade secret because it identifies the nature of the analytical procedures that we perform on the DHA Algal Oil. We have invested considerable time and resources ascertaining the testing that should be performed on the DHA Algal Oil. NOP has recognized that quality control test and data are examples of CBI. The analytical test data are (1) commercially valuable in that we have devoted considerable time and resources identifying the analytical procedures that should be performed on our DHA Algal Oil and would be placed at a competitive disadvantage if this information is released, (2) the analytical tests described in Appendix 4 continue to be used in our business, and (3) these data and test results are maintained in secrecy.

Consistent with the guidance provided by NOP, we are providing a copy of the petition, labeled "CBI Copy" in the upper right hand corner that identifies each page that contains CBI. We have bracketed the CBI information in the text and included "CBI" in the right hand margin next to the bracketed text. We also are providing a separate copy in which we have deleted the CBI. Each page with deleted CBI contains the statement, "CBI-Deleted," in the upper right hand corner and "CBI-Deleted" appears in the right hand margin next to the deleted text.

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APPENDIX 1

APPENDIX 1

United States Department of Agriculture
Agricultural Marketing Service
STOP 0268 – Room 4008-S
1400 Independence Avenue, SW.
Washington, D.C. 20250-0268

Date: November 3, 2006

To: Paul Amador
Compliance Officer
Compliance and Analysis

From: Mark A. Bradley
Associate Deputy Administrator
National Organic Program

Subject: NOP Complaint, PBM Nutritionals, LLC, Parent's Choice Infant Formula

This memorandum supersedes all earlier National Organic Program (NOP) correspondence on the PBM Nutritionals, LLC, Parent's Choice Infant Formula compliance case NOP-041-06.

Accessory nutrients, that are non-agricultural, are allowed in the production of products to be sold, labeled, or represented as organic under the NOP; provided, they are used in full compliance with Food and Drug Administration (FDA) rules and regulations. Non-agricultural accessory nutrients are covered under Section 205.605(b) *Synthetics allowed*, of the NOP National List (nutrient vitamins and minerals). Agricultural accessory nutrients must be organically produced unless listed as commercially unavailable in section 205.606 of the National List.

Section 205.605(b) "Nutrient vitamins and minerals, in accordance with 21 CFR 104.20, Nutritional Quality Guidelines For Foods" originates from the October 31, 1995, nutrient supplementation recommendation of the National Organic Standards Board (copy attached).

Nutrients allowed under section 205.605(b) are not limited to the nutrients listed in section 104.20(d)(3), because section 104.20(f) provides that nutrients may be added to foods as permitted or required by applicable regulations established elsewhere by FDA; for example, 21 CFR Part 107 Infant Formula.

The complaint that resulted in the opening of this case questioned use of the nutrients docosahexaenoic acid (DHA) and arachidonic acid (ARA) in an organic infant formula. The resulting investigation led to questions concerning the use of the nutrients nucleotides and taurine. FDA permits the use of all four in infant formulas. Accordingly, provided the nutrients in question are used in full compliance with FDA rules and regulations, they would comply with the NOP National List as currently written.

Please transmit this interpretation to Quality Assurance International and request that they inform PBM Nutritionals.

Attachment

APPENDIX 2

APPENDIX 2

National Organic Standards Board

NOSB

NOSB Administrative Information

NOSB Meetings

NOSB Recommendations

Executive Committee Conference Call Summaries

What's New?

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National List Recommendations -- 1995

NATIONAL ORGANIC STANDARDS BOARD FINAL RECOMMENDATION ADDENDUM NUMBER 13 THE USE OF NUTRIENT SUPPLEMENTATION IN ORGANIC FOODS

Date adopted: October 31 1995
Location: Austin Texas

Introduction:

The Committee has debated the issue of the inclusion of synthetic vitamins, minerals, and/or accessory nutrients in organic foods. Although it is generally considered that foods themselves are the best source of nutrients, in some cases, State regulations mandate the inclusion of vitamins and/or minerals to fortify foods. An example of this is enriched white flour pasta in which some States mandate the inclusion of thiamin riboflavin niacin and iron

The Committee also believes that recommendation by independent professional associations may also be taken into consideration An example of this is infant cereals in which fortification of iron is highly recommended by the American Dietetic Association and various associations dealing with pediatric care and nutrition as a baby's stored iron supply from before birth runs out after the birth weight doubles

In the recommendation listed below, the term "accessory nutrients" means nutrients not specifically classified as a vitamin or mineral but found to promote optimal health. Examples include omega-3 fatty acids, inositol, choline, carnitine, and taurine. Without this inclusion we believe we may be limiting ourselves given future nutritional discoveries. It is also a term used frequently throughout the food and supplement industries

Recommendation:

Upon implementation of the National Organic Program, the use of synthetic vitamins, minerals, and/or accessory nutrients in products labeled as organic must be limited to that which is required by regulation or recommended for enrichment and fortification by independent professional associations

APPENDIX 3

APPENDIX 3

USDA Agricultural Marketing Service

1400 Independence Avenue, SW.
Room 2646-S, STOP 0268
Washington, DC 20250-0201

April 26, 2010

ACTION MEMORANDUM FOR THE CHAIRMAN OF THE NATIONAL ORGANIC STANDARDS BOARD

FROM: Miles McEvoy
Deputy Administrator
National Organic Program

SUBJECT: Scope of Nutrient Vitamins and Minerals in Organic Food

ISSUE:

The National Organic Program (NOP) requests that the National Organic Standards Board (NOSB) reevaluate their recommendation for nutrient vitamins and minerals, currently codified in 7 CFR §205.605(b), in the sunset 2012 process and define the scope of permitted vitamins, minerals and nutrients. This evaluation is requested due to a clarification of scope of the current annotation for nutrient vitamins and minerals which references the Food and Drug Administration (FDA) fortification policy in 21 CFR §104.20.

DISCUSSION:

In November 1995, the NOSB voted to permit nutrient vitamins and minerals in organic food. Two technical advisory panel (TAP) reviews were conducted prior to the meeting. The TAP review for "nutrient minerals" covered calcium, phosphorus, magnesium, sulfur, copper, iodine, iron, manganese and zinc; the TAP review for "nutrient vitamins" included vitamins A, D, E, K C, B6, B12, folic acid, thiamin (B1), riboflavin (B2) and biotin. There was not a TAP review of substances identified as "accessory nutrients."

According to the record of the NOSB October 31 – November 4, 1995 meeting, the Board adopted a final recommendation titled *The Use of Nutrient Supplementation in Organic Foods*.[1]

This addendum includes reference to accessory nutrients, stating:

> In the recommendation listed below, the term accessory nutrients means nutrients not specifically classified as a vitamin or mineral but found to promote optimal health. Examples include omega-3 fatty acids, inositol, choline, camitine, [sic] and taurine. Without this inclusion, we believe we may be limiting ourselves given future nutritional discoveries. It is also a term used frequently throughout the food and supplement industries.

[1] Final Recommendation Addendum Number 13 available at http://www.ams.usda.gov/AMSv1.0/getfile?dDocName=stelprdc5058973

NOSB Recommendation:
Upon implementation of the National Organic Program, the use of synthetic vitamins, minerals, and/or accessory nutrients in products labeled as organic must be limited to that which is required by regulation or recommended for enrichment and fortification by independent professional associations.

Following the adoption of the above addendum, the NOSB vote on the listing of nutrient vitamins and minerals was recorded as follows:

Nutrient Vitamins and Minerals - Determined to be synthetic; Vote - Unanimous. The NOSB's decision is to allow this material for use in organic food processing; Vote: 10 aye / 4 opposed. Annotation: Accepted for use in organic foods for enrichment or fortification when required by regulation or recommended by an independent professional organization. [2]

The recommendation voted upon for nutrient vitamins and minerals did not include the term "accessory nutrients." The NOP proposed rule, published on March 13, 2000 (65 FR 13512), did not include the NOSB annotations "when required by regulation" or "when recommended by an independent professional organization." The NOP final rule, as published on December 21, 2000 (65 FR 80548), retained the reference to 21 CFR §104.20, and did not incorporate the term "accessory nutrients:"

§205.605(b) *Synthetics allowed:*
Nutrient vitamins and minerals, in accordance with 21 CFR §104.20, Nutritional Quality Guidelines for Food.

In 2006 the NOP received a complaint that substances such as arachidonic acid (ARA), docosahexaenoic acid (DHA), sterols, and taurine[3] were being added to infant formula and other organically labeled products. In a 2007 letter, the NOP clarified that DHA, ARA and other nutrients are allowed in organic foods because "[n]utrients allowed under section 205.605(b) are not limited to the nutrients listed in section 104.20(d)(3), because section 104.20(f) provided that nutrients may be added to foods as permitted or required by applicable regulations established elsewhere by FDA. Thus, for example, ARA and DHA are covered under section 205.605(b) of the National List because the FDA permits their use as nutrients that are GRAS."[4]

---

[2] FINAL MINUTES OF THE NATIONAL ORGANIC STANDARDS BOARD FULL BOARD MEETING AUSTIN, TEXAS, OCTOBER 31 - NOVEMBER 4, 1995

[3] ARA and DHA are omega-6 and omega-3 fatty acids, respectively; phytosterols are a type of organic compound naturally occurring in plants; taurine is an organic acid.

[4] Letter from USDA AMS Compliance to complainant, April 3, 2007.

FDA Clarification

The FDA fortification policy is established in 21 CFR §104.20. Section 104.20(d)(3) permits the following nutrients for fortification in accordance with its policy: protein, calcium, iron, thiamin, riboflavin, niacin, folate, biotin, pantothenic acid, phosphorus, magnesium, zinc, iodine, copper, potassium, and vitamins A, C, D, E, B_6, and B_{12}.

The NOP met with FDA staff from the Office of Nutrition, Labeling and Dietary Supplements for clarification of the scope of 21 CFR §104.20. The FDA explained that "nutrients" as referenced in 21 CFR §104.20(f) are intended to pertain only to those nutrients listed in §104.20(d)(3) and as specified in the standards of identity (21 CFR Parts 130-169) for a food or class of foods. The standards of identity for enriched cereal-flours and related products, for example, require fortification at specified levels with thiamin, riboflavin, niacin, iron and folic acid (21 CFR §137). The FDA noted that some foods have separate requirements and are not subject to 21 CFR §104.20, such as infant formula which is subject to comply with the nutrition requirements at 21 CFR §107.100.

In summary, 21 CFR §104.20(f) does not apply to the use of substances such as ARA, DHA, taurine, or sterols that have been added to products such as infant formula, milk, pet food, or energy bars as nutrients.

NOSB CONSIDERATION:

The NOP is requesting that the NOSB reevaluate their recommendation for nutrient vitamins and minerals during the 2012 sunset process, and provide specific recommendations regarding the scope of permitted vitamins, mineral and nutrients in organic food products.

The NOP requests that NOSB consider the following:

- Are the "nutrient vitamins and minerals" specified within 21 CFR §104.20 aligned with the 1995 NOSB recommendation? If not, are there substances that should be prohibited or additional substances that should be allowed?

SUMMARY

In conclusion, the NOP acknowledges that its previous interpretation of 21 CFR 104.20 was incorrect. The NOP recognizes that many certifiers and certified operations have made decisions based on the NOP's incorrect interpretation of the FDA guidelines.

In the future, the NOP will not be making policy decisions in letters. All policy decisions will be made through the federal register and in compliance with Executive Order 12866. Transparency is a core principle for the NOP, AMS and the USDA administration. We are committed to an open public process. All NOP guidance will be published through the federal register with public comment.

In regards to nutrient vitamins and minerals, the NOP plans to publish draft guidance later this year that will align with the FDA interpretation of 21 CFR 104.20. The draft guidance will provide a transition time for businesses to reformulate products to comply with the regulations as per the FDA guidelines. There will be a 60 day comment period for the draft guidance. Final guidance will be published after consideration of the comments received.

The NOP also notes that companies or interest groups may petition to add substances to the National List during this transition period. Specifically the pet food industry may want to consider petitioning to add substances to the National List in order to meet the nutritional requirements for pets.

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APPENDIX 4

NON-CBI COPY

APPENDIX 5

APPENDIX 5
Regulatory Approvals of DHA Algal Oil and Other Market Data

Australia and New Zealand
In 2002 and 2003, the Australia New Zealand Food Authority (ANZFA) approved the use of DHA Algal Oil when used as novel food ingredient in infant formulas, food and beverage products for DHA enrichment.

Brazil
In 2009, the National Health Surveillance Agency (ANVISA) approved the use of DHA-S™ as a new food ingredient in foods and dietary supplements.

Canada
In 2002, in response to a novel food application from Martek, Health Canada notified Martek Biosciences Corporation that it had no objections to the use of DHA Algal Oil (*C. cohnii*) for use in infant formulas.

In 2006, in response to a novel food application from Martek, Health Canada notified Martek Biosciences Corporation that it had no objections to the use of DHA Algal Oil (*Schizochytrium* sp. and *C. cohnii*) for use in foods.

In 2010 Health Canada notified Martek that DHA Algal Oil (*Schizochytrium* sp. and *C. cohnii*) is permitted for use in foods designed for children under 2 years of age including cereals and baby foods up to 20 mg per serving.

China
DHA Algal Oil (*C. cohnii*) is approved as a food additive and has been used as an ingredient in infant formulas and formula milk powders since 2000.

In August 2007 the Ministry of Health in China authorized the use DHA-S™ as a novel food ingredient. In 2010 the Ministry of Health reaffirmed the approval of DHA-S™ as a novel food ingredient.

European Union
DHA (*C. cohnii*) is considered to have been consumed in the community "to a significant degree" prior to May 15, 1997. As such, it is not considered a novel food or novel food ingredient and is permitted for use in infant formulas, foods and beverages, and dietary supplements.

In 2003, the European Union authorized the placing on the market DHA Algal Oil (*Schizochytrium* sp.) as a novel food ingredient under Regulation (EC) No. 258/97 of the European Parliament and of the Council.

In 2009 the European Union authorized additional uses of DHA Algal Oil (*Schizochytrium* sp.) as a novel food ingredient.

France
In 1996 the Ministry of Health approved the use of Martek's DHASCO® in infant formulas.

Israel
In 2008 the Ministry of Health in Israel approved DHA Algal Oil as a novel food ingredient.

Japan
DHA Algal Oil is considered a food in Japan and is used in foods and dietary supplements.

Mexico
DHA Algal Oil is allowed for use in foods and beverages, and is classified according to the Eleventh Title of the Regulation on Sanitary Control of Products and Services (Edible fats and oils, chapter I: Edible Oils).

Netherlands
In 1995 the Ministry of Health independently evaluated and approved Martek's DHASCO® as safe for use in infant formula.

South Korea
DHA Algal Oil is approved for use in foods and dietary supplements.

In addition to regulatory evaluations, Martek's DHA Algal Oil has an extensive worldwide history of use in both preterm and term infants. Martek's DHA and ARA Single-Cell Oil (see separate petition for listing ARA Single-Cell Oil on the National List) have been added to conventional infant formulas since 1994 and organic certified infant formulas since 2006.

United States sales of products known to contain Martek's DHA Algal Oil and ARA Single-Cell Oil account for 96.5% of all sales in the baby formula category (IRI, 2009). The remaining 3.5% of sales are made up of private label sales (2.9%), which are not tracked at the SKU level, and toddler milks, discontinued products and specialty medical formulas (0.6%). According to the largest manufacturer of private label infant formulas in the U.S., substantially all private label infant formulas in the U.S now contain Martek's DHA Algal Oil and ARA Single-Cell Oil.

Organic infant formulas containing Martek's DHA Algal Oil and ARA Single-Cell Oil account for 0.2% of IRI's total baby formula category. One other organic product, Baby's Only Organic is intended for babies one year of age and older and does not contain DHA and ARA, is included in the baby formula category and accounts for 0.004% of total category sales (IRI, 2009). In fact, Baby's Only recommends parents supplement their baby's diet with a DHA & ARA fatty acid supplement, derived from non-vegan, allergenic egg phospholipid, to ensure babies receive the proper amount of these nutrients in their diet.

Infant formula products containing Martek's DHA and ARA are commercially available in over 75 countries, including major markets such as:

United States	Canada	Mexico
Brazil	United Kingdom	France
Germany	Italy	Spain
Russia	Poland	Greece
Turkey	Egypt	Saudi Arabia
South Africa	China	Indonesia
Philippines	South Korea	Vietnam
Australia	New Zealand	

APPENDIX 6

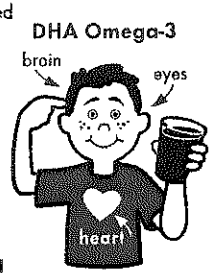
▲ SELL BY

HorizonOrganicDHA.com

HORIZON ORGANIC

A smart way to nurture YOUR FAMILY'S HEALTH

The great-tasting Horizon Organic® milk you trust is now an excellent source of **DHA Omega-3.**† Recognized by doctors and nutritionists as an important part of a healthy diet, DHA has been shown to help support **heart health,** and has also been recognized for its role in supporting **brain and eye function and development.** Our milk is fortified with a natural, 100% vegetarian and sustainable source of DHA, and is available in Whole, Reduced Fat 2% and Chocolate.



Kid-Friendly!

Kids' brains grow incredibly fast. In fact, the brain nearly quadruples in size in the first five years of life. **DHA is a key component of the brain,** yet most kids don't get their recommended DHA from common dietary sources like fish.* By making Horizon Organic Milk Plus DHA your family choice, you're bringing home **all the goodness of organic, plus an extra nutritional boost for growing minds and bodies.**

life'sDHA
HEALTHY BRAIN, EYES, HEART

life'sDHA™ is a trademark of Martek Biosciences Corporation

†Contains 32 mg of DHA per serving, which is 20% of the 160 mg Daily Value of DHA.

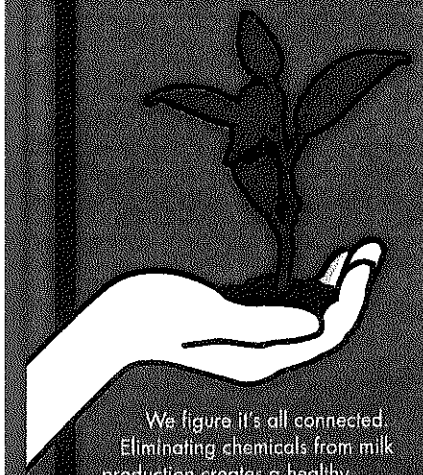
*Kris-Etherton P.M., et al. *Am J Clin Nutr.* Jan 2000; 71(1 Suppl): 179S–188S.

For more information visit HorizonOrganicDHA.com

Creating an Organic Connection

At Horizon Organic,® we believe in producing wholesome dairy without the use of antibiotics, added growth hormones, pesticides or cloning. Synthetic colors and artificial flavors are also off the list. So what do all those "No's" add up to?

A big "Yes" for your health and the health of the environment.



We figure it's all connected. Eliminating chemicals from milk production creates a healthy environment that supports **healthy cows, healthy family farms, healthy communities and a healthier planet.**

Above all, we think choosing organic leaves the world just a little better than how we found it. And it all starts with one creamy and delicious glass of milk.

Visit HorizonOrganic.com

▲ SELL BY

DHA OMEGA-3

NEW 1%

organic

CHOCOLATE LOWFAT MILK

Vitamins A & D Added · Ultra-Pasteurized

HORIZON ORGANIC

DHA OMEGA-3

helps support a healthy brain

DHA Omega-3 from 100% vegetarian algal oil

1%

organic

CHOCOLATE LOWFAT MILK

Vitamins A & D Added
Ultra-Pasteurized

USDA ORGANIC

Our farms produced this milk without antibiotics, added growth hormones, pesticides or cloning

ONE QUART (946 mL)

Date: 09/24/09 V# DM8

Designer: DM Job# 12348 CA

INGREDIENTS: Organic Grade A Lowfat Milk, Organic Evaporated Cane Juice, Organic Cocoa, Organic Vanilla Flavor, DHA Algal Oil, Carrageenan, Salt, Vitamin A Palmitate, Vitamin D3.

Nutrition Facts

Serving Size 1 Cup (240 mL)
Servings Per Container 4

Amount Per Serving	
Calories 170	Calories from Fat 30
	% Daily Value*
Total Fat 3 g	**5%**
Saturated Fat 2 g	**10%**
Trans Fat 0 g	
Cholesterol 15 mg	**5%**
Sodium 140 mg	**6%**
Total Carbohydrate 27 g	**9%**
Dietary Fiber 0 g	**0%**
Sugars 27 g	
Protein 8 g	

Vitamin A 10% • Vitamin C 0%
Calcium 30% • Iron 2%
Vitamin D 25% • Phosphorus 25%

*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:

	Calories:	2,000	2,500
Total Fat	Less than	65 g	80 g
Sat Fat	Less than	20 g	25 g
Cholesterol	Less than	300 mg	300 mg
Sodium	Less than	2,400 mg	2,400 mg
Potassium		3,500 mg	3,500 mg
Total Carbohydrate		300 g	375 g
Dietary Fiber		25 g	30 g

Calories per gram:
Fat 9 • Carbohydrate 4 • Protein 4

Distributed by HORIZON ORGANIC® Broomfield, CO 80021

Certified Organic by Quality Assurance International

MADE IN USA

1-888-494-3020 or visit HorizonOrganic.com

MFD at PLT # stamped above.

PERISHABLE KEEP REFRIGERATED

Best if opened by sell-by date and used within 7 days.

GRADE A

Fat reduced from 8 g to 3 g

00

The soy you can enjoy...ON THE GO. Our certified organic soy milk delivers superior taste plus health benefits for your entire family, including 32 mg of vegetarian Omega-3 DHA which is shown to help boost brain function.
- Lactose Free - Gluten Free - Vegetarian - Free of MSG, Eggs, & Casein -

Organically grown and processed in accordance with the organic standards of the U.S. Department of Agriculture

NO INTENTIONALLY ENGINEERED SOY BEANS

Certified Organic By: NOFA-NY Certified Organic LLC.

life'sDHA™

NOT FOR USE AS INFANT FORMULA.

Distributed By ZenSoy, 21 Empire Blvd. South Hackensack, NJ 07606

www.zensoy.com

Diets low in saturated fat and cholesterol that include 25 grams of soy protein a day may reduce the risk of heart disease. One serving of ZenSoy provides 7 grams of soy protein.

Calcium & Vitamin Enriched

Expandable Straw Instructions: Fully extend straw and hold into locking position. Then pierce Quality Seal with pointed end of straw and push straw all the way to bottom of container. Enjoy!

0 72050 10202 7

ZENSOY®

Soy on the Go

Vanilla

USDA ORGANIC

Omega 3 DHA

8.25 FL.OZ. (250ml)

Nutrition Facts
Serving Size 8.25 fl.oz. (250ml)
Servings 1 Container

Amount Per Serving	
Calories 110 Fat Cal [illegible]	
	% Daily Value*
Total Fat [illegible]	[illegible]
Saturated Fat 1g	[illegible]
Trans Fat 0g	
Cholesterol 0mg	[illegible]
Sodium [illegible]	[illegible]
Total Carbohydrate [illegible]	[illegible]
Dietary Fiber 1g	[illegible]
Sugars [illegible]	
Protein 7g	[illegible]
Vitamin A [illegible] • Vitamin C [illegible]	
Calcium [illegible] • Vitamin D [illegible]	
Iron [illegible] • Vitamin B12 [illegible]	
Riboflavin [illegible]	

* Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs.

Calories	[illegible]	[illegible]
Total Fat Less than	[illegible]	[illegible]
Sat Fat Less than	[illegible]	[illegible]
Cholesterol Less Than	[illegible]	[illegible]
Sodium Less Than	[illegible]	[illegible]
Total Carbohydrate	[illegible]	[illegible]
Dietary Fiber	[illegible]	[illegible]
Protein	[illegible]	[illegible]

Calories per gram:
Fat 9 • Carbohydrate 4 • Protein 4

Ingredients: Filtered Water, Organic Whole Soybeans, Organic Granulated Cane Juice, Natural Flavor, Organic Vanilla Extract, Calcium Carbonate, Sea Salt, DHA Algal Oil, Carrageenan, Vitamin A Palmitate, Vitamin D2, Riboflavin (B2), Vitamin B12. Refrigerate after opening and use within 7 days.

ZenSoy isn't your average company. We're family-owned and operated, which means we're passionately committed to producing the best tasting, healthiest soy products, and to protecting the environment by supporting international wildlife organizations.

DIE LINE→
5376341

NO UV VARNISH AREA

THIS LASER PROOF IS FOR COPY & COLOR BREAK ONLY. FOR ACTUAL PMS COLORS, CONSULT PANTONE COLOR GUIDE.

CLIENT: HAIN CELESTIAL GROUP
JOB#: 1130854
SIZE: 4.0 X 5.75
DATE: 04-22-08

INK COLORS:
- ☒ 4 COLOR PROCESS
- BEIGE MATCH STANDARD
- GOLD 872
- RED MATCH 1795
- ☐ PATTERNED UV

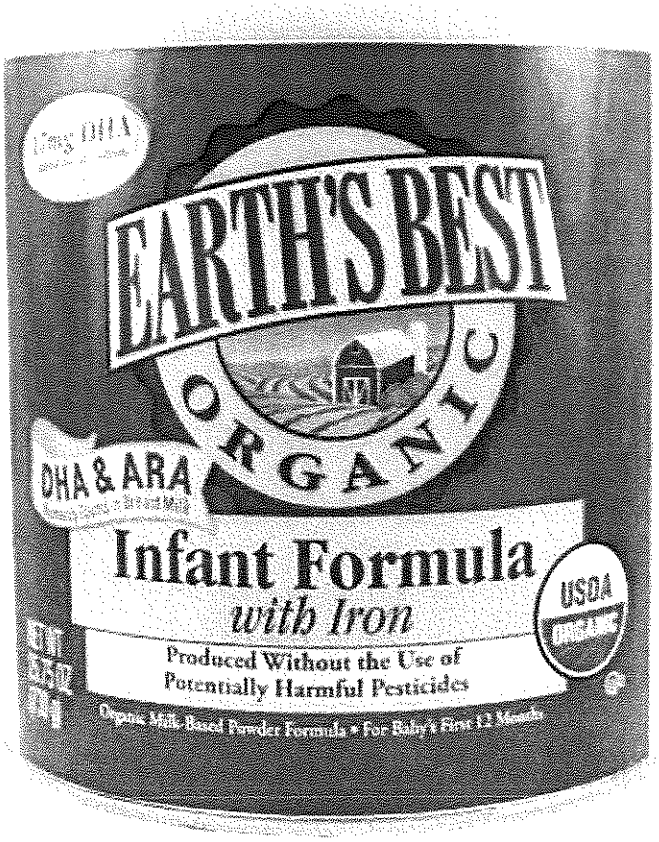
☐ APPROVED AS IS.
☐ APPROVED WITH REVISIONS LISTED.
☐ NOT APPROVED. REVISE & REPROOF.

I UNDERSTAND THAT ANY NET WT. DECLARATION, NUTRITION FACTS PANEL, AND/OR UPC CREATED AT MY REQUEST MAY NOT MEET FDA, USDA, AND/OR UCC SPECIFICATIONS, FOR WHICH I ASSUME FULL RESPONSIBILITY.

MPI® LABEL SYSTEMS
THE CUSTOMER COMMITTED COMPANY
2315 Station Dr. • Stockton, CA 95215
209.467.2470 • fax 209.467.2469 • 800.533.2076
www.mpilabels.com • pre-press: calprep@mpilabels.com

ROLL WIND
#3

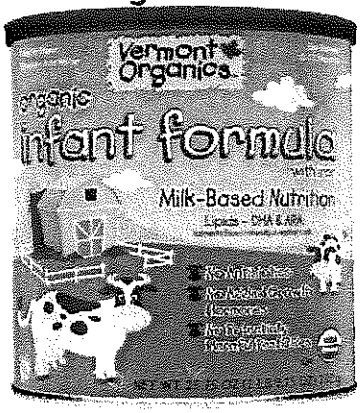
SIGNATURE DATE


EARTH'S BEST
ORGANIC
DHA & ARA
Infant Formula
with Iron
USDA
ORGANIC
Produced Without the Use of
Potentially Harmful Pesticides

Vermont Organics

Vermont Organics Formulas

Milk Organic Formula



Milk-Based Nutrition

Certified Organic Infant Formula

Lipids DHA and ARA

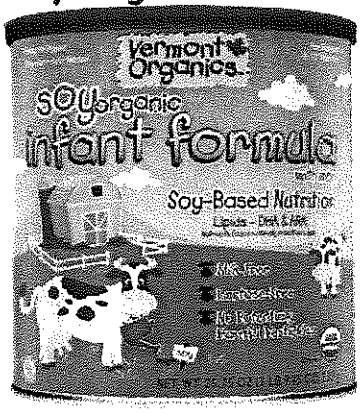
No Potentially Harmful Pesticides

No Added Growth Hormones

No Antibiotics

Gluten-Free

Soy Organic Formula



Soy-Based Nutrition

Certified Organic Infant Formula

Lipids DHA and ARA

No Potentially Harmful Pesticides

Lactose-Free

Milk-Free

Gluten-Free

Experts agree that mother's milk is best for babies.

www.VermontOrganicsFormula.com

USDA ORGANIC

BabyOrganic.com

APPENDIX 7

MATERIAL SAFETY DATA SHEET

MARTEK life enriched.™

Date Issued: 07/21/2008
MSDS No: O-20001
Date Revised: 07/01/2010
Revision No: 3

Martek DHA™-S

1. PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: Martek DHA™-S
PRODUCT CODE: 40200-XX, 40209-XX, and 40212-XX series

MANUFACTURER

Martek Biosciences Corporation
6480 Dobbin Road
Columbia MD 21045
Telephone: (843) 382-6221
Fax: (843) 382-6056

24 HR. EMERGENCY TELEPHONE NUMBERS

CHEMTREC: US Transport (800) 424-9300,
International Transport (703) 527-3887

COMMENTS: Use also for the following product codes: 40203-XX series, 40208-XX series, 40209-XX series, and 40213-XX series

2. HAZARDS IDENTIFICATION

POTENTIAL HEALTH EFFECTS

EYES: Mildly irritating to the eyes.

SKIN: May cause slight irritation.

INGESTION: Not considered hazardous; large amounts may irritate digestive tract.

INHALATION: Hazard is negligible unless heated to produce vapor or mist, which may cause irritation to mucous membranes and other symptoms.

PHYSICAL HAZARDS: Combustible with heat.

3. COMPOSITION / INFORMATION ON INGREDIENTS

Chemical Name	Wt.%	CAS
DHA Algal Oil	70 - 99	N/A
High Oleic Sunflower Oil	< 1 - 30	N/A
Proprietary Emulsifiers, Antioxidants, and Flavorings	< 8	N/A

4. FIRST AID MEASURES

EYES: Hold eyelids apart and flush eyes with plenty of water for at least 15 minutes.

SKIN: Wash with soap and water.

INGESTION: If ingested in large quantities and discomfort occurs, contact a physician.

INHALATION: Remove to fresh air. Contact a physician if symptoms persist.

5. FIRE FIGHTING MEASURES

FLASHPOINT AND METHOD: > 232°C (450°F) Pensky-Martens CC

EXTINGUISHING MEDIA: Dry chemical or CO2

FIRE FIGHTING EQUIPMENT: Firefighters should wear full fire-fighting turn out gear. Firefighters and others exposed to decomposition products should wear self-contained breathing apparatus.

HAZARDOUS DECOMPOSITION PRODUCTS: Carbon dioxide, carbon monoxide

6. ACCIDENTAL RELEASE MEASURES

SMALL SPILL: Absorb small spills or remaining material from large spills with an inert material. Flush residual spill area with soap and water.

LARGE SPILL: Contain large spills with dike of absorbent or impervious materials such as earth or clay.

HANDLING PRECAUTIONS: Spills of this material are very slippery. Porous material wetted with this product may undergo spontaneous combustion. Monitor closely until material can be disposed of properly.

SPECIAL PROTECTIVE EQUIPMENT: Use personal protective equipment recommended in Section 8.

7. HANDLING AND STORAGE

HANDLING: Handle in accordance with good industrial hygiene and safety practices.

STORAGE: Due to sensitivity to heat, frozen storage is recommended.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

ENGINEERING CONTROLS: If needed, ventilate area of use.

PERSONAL PROTECTIVE EQUIPMENT

EYES AND FACE: Wear safety glasses with side shields or chemical goggles.

SKIN: Wear gloves, protective shoes, long-sleeved shirt, long pants, and a head covering.

COMMENTS: No occupational exposure limits are known.

9. PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE: Liquid

ODOR: Marine

APPEARANCE: Light yellow to orange oil

pH: Not Applicable

FLASHPOINT AND METHOD: > 232°C (450°F) Pensky-Martens CC

SOLUBILITY IN WATER: Insoluble

SPECIFIC GRAVITY: 0.92

COMMENTS: Partly miscible with acetone, chloroform, hexane, and methanol.

10. STABILITY AND REACTIVITY

STABILITY: Stable under normal conditions.

CONDITIONS TO AVOID: Protect from heat.

HAZARDOUS DECOMPOSITION PRODUCTS: Carbon dioxide and carbon monoxide

INCOMPATIBLE MATERIALS: Oxidizing agents

11. TOXICOLOGICAL INFORMATION

COMMENTS: Not yet Determined

12. ECOLOGICAL INFORMATION

GENERAL COMMENTS: This material is readily biodegradable.

13. DISPOSAL CONSIDERATIONS

DISPOSAL METHOD: Dispose of in accordance with local, state, and federal regulations.

14. TRANSPORT INFORMATION

DOT (DEPARTMENT OF TRANSPORTATION)

OTHER SHIPPING INFORMATION: This product is not hazardous under the applicable DOT regulations.

15. REGULATORY INFORMATION

UNITED STATES

TSCA (TOXIC SUBSTANCE CONTROL ACT)

TSCA REGULATORY: Not Applicable

FIFRA (FEDERAL INSECTICIDE, FUNGICIDE, AND RODENTICIDE ACT): Not Applicable

16. OTHER INFORMATION

REVISION SUMMARY: Revision #: 3 This MSDS replaces the November 11, 2009 MSDS. Any changes in information are as follows: In Section 16 Comments

MANUFACTURER SUPPLEMENTAL NOTES: To request additional MSDS's, please email msds@martek.com.

ADDITIONAL MSDS INFORMATION: Legend: N/A = Not applicable

GENERAL STATEMENTS: To the best of our current knowledge, information contained herein is accurate and complete. However, nothing contained herein shall be construed to imply any warranty or guarantee.

COMMENTS: Do not use ingredient information and/or ingredient percentages in this MSDS as a product specification. For product specification information refer to a Product Specification Sheet and/or a Certificate of Analysis. These can be obtained from your Martek contact.

MATERIAL SAFETY DATA SHEET

MARTEK
life enriched.™

Date Issued: 03/19/2008
MSDS No: O-20004
Date Revised: 04/02/2010
Revision No: 4

DHASCO®

1. PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: DHASCO®
PRODUCT DESCRIPTION: Algal Vegetable Oil containing Docosahexaenoic Acid
PRODUCT CODE: 40100-00, 40100-01, 40100-02, 40102-00, 40104-00

MANUFACTURER

Martek Biosciences Corporation
6480 Dobbin Road
Columbia MD 21045
Telephone: (843) 382-6221
Fax: (843) 382-6056

24 HR. EMERGENCY TELEPHONE NUMBERS

CHEMTREC: US Transport (800) 424-9300,
International Transport (703) 527-3887

2. HAZARDS IDENTIFICATION

POTENTIAL HEALTH EFFECTS

EYES: Mildly irritating to the eyes.

SKIN: May cause slight irritation.

INGESTION: Not considered hazardous; large amounts may irritate digestive tract.

INHALATION: Hazard is negligible unless heated to produce vapor or mist, which may cause irritation to mucous membranes and other symptoms.

PHYSICAL HAZARDS: Combustible with heat.

3. COMPOSITION / INFORMATION ON INGREDIENTS

Chemical Name	Wt.%	CAS
DHA Algal Oil	65 - 99	N/A
High Oleic Sunflower Oil	< 1 - 35	N/A
Proprietary Emulsifiers, Antioxidants, and Flavorings	< 0.1	N/A

4. FIRST AID MEASURES

EYES: Hold eyelids apart and flush eyes with plenty of water for at least 15 minutes.

SKIN: Wash with soap and water.

INGESTION: If ingested in large quantities and discomfort occurs, contact a physician.

INHALATION: Remove to fresh air. Contact a physician if symptoms persist.

5. FIRE FIGHTING MEASURES

FLASHPOINT AND METHOD: > 232°C (450°F) Pensky-Martens CC

EXTINGUISHING MEDIA: Dry chemical or CO2

FIRE FIGHTING EQUIPMENT: Firefighters should wear full fire-fighting turn out gear. Firefighters and others exposed to decomposition products should wear self-contained breathing apparatus.

HAZARDOUS DECOMPOSITION PRODUCTS: Carbon dioxide, carbon monoxide

6. ACCIDENTAL RELEASE MEASURES

SMALL SPILL: Absorb small spills or remaining material from large spills with an inert material. Flush residual spill area with soap and water.

LARGE SPILL: Contain large spills with dike of absorbent or impervious materials such as earth or clay.

HANDLING PRECAUTIONS: Spills of this material are very slippery. Porous material wetted with this product may undergo spontaneous combustion. Monitor closely until material can be disposed of properly.

SPECIAL PROTECTIVE EQUIPMENT: Use personal protective equipment recommended in Section 8.

7. HANDLING AND STORAGE

HANDLING: Handle in accordance with good industrial hygiene and safety practices.

STORAGE: Due to sensitivity to heat, frozen storage is recommended.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

ENGINEERING CONTROLS: If needed, ventilate area of use.

PERSONAL PROTECTIVE EQUIPMENT

EYES AND FACE: Wear safety glasses with side shields or chemical goggles.

SKIN: Wear gloves, protective shoes, long-sleeved shirt, long pants, and a head covering.

COMMENTS: No occupational exposure limits are known.

9. PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE: Liquid

ODOR: Marine

APPEARANCE: Free flowing, light yellow to dark orange liquid oil

pH: Not Applicable

FLASHPOINT AND METHOD: > 232°C (450°F) Pensky-Martens CC

SOLUBILITY IN WATER: Insoluble

SPECIFIC GRAVITY: 0.900

COMMENTS: Partly miscible with acetone, chloroform, hexane, and methanol.

10. STABILITY AND REACTIVITY

STABILITY: Stable under normal conditions.

CONDITIONS TO AVOID: Protect from heat.

HAZARDOUS DECOMPOSITION PRODUCTS: Carbon dioxide and carbon monoxide

INCOMPATIBLE MATERIALS: Oxidizing agents

11. TOXICOLOGICAL INFORMATION

COMMENTS: Not yet Determined

12. ECOLOGICAL INFORMATION

GENERAL COMMENTS: This material is readily biodegradable.

13. DISPOSAL CONSIDERATIONS

DISPOSAL METHOD: Dispose of in accordance with local, state, and federal regulations.

14. TRANSPORT INFORMATION

DOT (DEPARTMENT OF TRANSPORTATION)

OTHER SHIPPING INFORMATION: This product is not hazardous under the applicable DOT regulations.

15. REGULATORY INFORMATION

UNITED STATES

TSCA (TOXIC SUBSTANCE CONTROL ACT)

TSCA REGULATORY: Not Applicable

FIFRA (FEDERAL INSECTICIDE, FUNGICIDE, AND RODENTICIDE ACT): Not Applicable

16. OTHER INFORMATION

REVISION SUMMARY: Revision #: 4 This MSDS replaces the January 27, 2010 MSDS. Any changes in information are as follows: In Section 9 Appearance

MANUFACTURER SUPPLEMENTAL NOTES: To request additional MSDS's, please email msds@martek.com.

ADDITIONAL MSDS INFORMATION: Legend: N/A = Not applicable

GENERAL STATEMENTS: To the best of our current knowledge, information contained herein is

accurate and complete. However, nothing contained herein shall be construed to imply any warranty or guarantee.

COMMENTS: Do not use ingredient information and/or ingredient percentages in this MSDS as a product specification. For product specification information refer to a Product Specification Sheet and/or a Certificate of Analysis. These can be obtained from your Martek contact.

APPENDIX 8

APPENDIX 8

The Role of DHA Algal Oil in Human Health and Recommendations of Expert Organizations

Overview

DHA is an omega-3 long-chain polyunsaturated fatty acid (n-3 LCPUFA) naturally found in abundance in marine-based organisms, predominately high fat fish and the marine microalgae they consume. DHA is a structural and functional fatty acid found in numerous tissues throughout the human body. DHA is abundant in neural tissue and readily incorporated into the brain and eyes during the period known as the brain growth spurt, which begins in late gestation and continues up to 4 years of age (*Dobbing and Sands*, 1973; *Martinez*, 1992).

The DHA content of human milk is directly influenced by the fatty acid content of the mother's diet. In the absence of DHA supplementation, the DHA level in human milk is often low, particularly in countries where fish consumption is low or variable. The lowest reported DHA levels (≤ 0.2% of total fatty acids) in human milk are consistently reported among women in the United States (*Yuhas et al.*, 2006) and Canada (*Innis et al.*, 1997; *Ratnayake and Chen*, 1996). The highest reported levels (>0.8% total fatty acids) are among populations with a tradition of consuming higher levels of marine foods, such as Japan (*Yuhas et al.*, 2006; *Wang et al.*, 2000).

DHA represents 97% of all the n-3 polyunsaturated fatty acids (PUFA) in the brain and 93% of all the n-3 LCPUFA in the retina of the eye (*Lauritzen et al.*, 2001). DHA is recognized as an essential fatty acid necessary to ensure proper function of the body, particularly the brain and eyes (AFFSA 2010).

DHA's shorter chain counterpart typically found in fish oil, eicosapentaenoic acid (EPA), is considered non-essential based on insufficient evidence to demonstrate its necessity in the diet (AFFSA 2010). As such, DHA is important for brain and eye development in infants. Randomized controlled clinical trials of the effects of DHA supplementation on visual and cognitive maturation in preterm and term infants were the basis for the addition of DHA and ARA to infant formula. Those clinical trials supplementing higher levels of DHA for longer durations of time have consistently demonstrated visual and cognitive benefits (*Birch et al.*, 2010a). DHA has been shown to support brain and eye health in children by speeding maturation of early visual acuity and other measures of neural development when provided during gestation (*Cohen et al.*, 2005) or infancy via breast milk (*Jensen et al.*, 2005), DHA-enriched infant formula (*Morale et al.*, 2005), and complementary foods (*Hoffman et al.*, 2004).

DHA and ARA are also incorporated into the cell membranes of immune cells where they serve as precursors of eicosanoids and docosanoids, which modulate immune cell function and inflammatory response. Infants supplemented with DHA and ARA formula during infancy experienced delayed and reduced incidence of common respiratory illnesses and allergic diseases, wheezing and asthma up to three years of age compared to infants fed non-supplemented formula during the first year of life (*Birch et al.*, 2010b).

Dietary Requirements for DHA

DHA is recognized as an essential fatty acid necessary to ensure proper function of the body, particularly the brain and eyes (AFFSA, 2010). DHA can be synthesized, in very limited amounts, from its metabolic precursor alpha-linolenic acid (ALA). Isotropic tracer studies support the minimal conversion of ALA to DHA in humans, however only preformed DHA effectively increases blood and tissue DHA levels (*Brenna et al.*, 2009). Sources of preformed DHA include algae and fatty fish.

Studies of increased dietary ALA, as an alternative to preformed DHA, in the diets of nursing women, and infants fed formula, have met with limited, if any, success. For example, Francois and co-workers (2003) fed nursing women 10 times the normal amount of ALA in the diet as flaxseed oil for 4 weeks. While significant increases in breast milk ALA and EPA were observed, there was no effect of dietary ALA on breast milk DHA. In contrast, studies of preformed DHA supplementation during nursing have reported corresponding significant increases in breast milk DHA (*Makrides et al.*, 1996; *Jensen et al.*, 2000) and direct impacts on infant DHA status (*Gibson et al., 1997*).

Most recently, *Hoffman et al.* (2006) examined the role of varying levels of precursor ALA, in combination with preformed DHA+ARA, from infant formula on infant LCPUFA status. Healthy term infants (n=78) were fed one of two infant formulas containing either 2.1% ALA along with 0.15% DHA+0.40 ARA (high-ALA/low-DHA) or 1.6% ALA along with 0.32% DHA+0.64 ARA (low-ALA/high-DHA) for the first 4 months of life. Despite higher ALA intake, infants fed the high-ALA/low-DHA formula exhibited significantly lower percentages of DHA in all four blood lipid fractions studied at the end of the supplementation period. While tissue levels were suggestive of some conversion of ALA to DHA among the high-ALA/low-DHA infants, this conversion was not adequate to yield blood DHA percentages comparable with those of infants fed the higher DHA formula. The authors suggested that inadequate conversion of ALA to DHA not only fails to support tissue DHA status but enhances tissue deposition of conversion intermediaries and this, together with limited preformed DHA, may account for failure to find visual and cognitive benefits in some studies of infants fed formula with lower levels of DHA and ARA (*Auestad et al.*, 1997; *Scott et al.*, 1998; *Auestad et al.*, 2001).

Infants

DHA, including DHA derived from algal oil, plays an important role in infant neural growth and development and is an essential fatty acid necessary for the development and function of the brain and eyes (EFSA 2009). Human milk represents the optimal form of infant nutrition and Martek agrees breastfeeding is the best method of feeding infants. However, those parents who need or choose formula should be able to choose the most nutritionally optimal formula available, including organic versions of infant formulas.

More consistent visual and neurocognitive benefits in infants are associated with higher and longer duration of DHA supplementation. Global recommendations also address the need for associated ARA supplementation to avoid a deficit. A review of the most current literature prompted AFSSA (2010) to establish an ANC, the equivalent of the U.S.'s recommended dietary allowance, of 0.32% DHA and 0.5% ARA for term infants 0 –6 months of age. These findings are consistent with the WHO/FAO 2010 interim report recommending infant formula contain 0.2 – 0.36% DHA and 0.4 – 0.6% ARA, while a higher level of supplementation, 0.32 – 0.64% DHA and 0.64% ARA has been shown to promote visual acuity in term infants (*Birch et al.*, 2010). Table 2 summarizes current global recommendations for DHA, and ARA, levels in infant formula.

These data also suggest a minimum effective duration of supplementation between 4-6 months dependent upon gestational age at birth, although continued supplementation at least throughout the first year of life may be optimal. Failure to provide both DHA and ARA supplementation during the first 8 months of life, or until ARA from complimentary feeding is well-established, may contribute to neural developmental detriment (ESPGHAN, 2008).

Table 1. Summary of Expert Recommendations for DHA and ARA Levels in Infant Formulas

Organization	LCPUFA (% of total fatty acids)	
	Term Formula DHA/ARA	**Preterm Formula DHA/ARA**
British Nutrition Foundation 1992	0.4%/0.4%	20mg/kg DHA
FAO/WHO-expert panel 1994	0.35%/0.7%	40mg/kg DHA; 60mg/kg ARA
FAO/WHO-expert panel 2010	0.2-0.36%/0.4-0.6%	
Child Health Foundation, Koletzko 2001	0.2%/≥0.35%	≥0.35% DHA; ≥0.4% ARA
American Dietetic Association and Dietitians of Canada	≥0.2%/≥0.2%	
World Association Of Perinatal Medicine/Early Nutrition Academy/Child Health Foundation, Koletzko 2008	0.2-0.5%/≥0.2%	
Expert panel ISSFAL 2008	0.35%/0.5%	
Codex (2007) Codex Stan 72 198	≤0.5%/ARA required to meet or exceed added DHA	
Health Council of the Netherlands 2001	20 mg/kg DHA	
Commission of the European Communities 2006	≥0.2/ n-6 2% of total fat maximum 0.1% as ARA	
ESPGHAN, Agostini 2009		DHA: 12-30mg/kg/day or 11- 27mg/100kcals ARA: 18-42mg/kg/day or 16-39mg/100kcal. The ratio of AA to DHA should be in the range of 1-2:1 (Wt/Wt) EPA supply should not exceed 30% of DHA supply.
Agence Français de Sécurité Sanitaire des Aliments (AFSSA) 2010	0.32% DHA/0.5% ARA	

Pregnancy & Nursing

Given the critical importance of DHA in the maternal diet and in early life, the European Food Safety Authority has finalized dietary reference values for DHA during pregnancy and nursing of up to 450 mg/day (EFSA, 2010). Additionally, national authorities (*Belgium Superior Health Council*, 2004; *AFSSA*, France, 2003; *Australia New Zealand National Health and Medical Research Council*, 2005) and expert groups in Europe (*Koletzko et al.*, 2005; *Koletzko et al.*, 2007) have endorsed the supplementation of this vital nutrient during pregnancy and throughout early life. Specifically, current recommendations on behalf of the European Commission indicate that pregnant and lactating women "should aim to achieve a dietary intake of n-3 LCPUFA that supplies a DHA intake of at least 200 mg/d" (*Koletzko et al.*, 2007). This recommendation is made in recognition of the fact that "the n-3 LCPUFA, DHA, must be deposited in adequate amounts in the brain during fetal and early postnatal life" (*Koletzko et al.*, 2007).

Children

DHA enrichment of foods fed to young children presents an excellent opportunity to assure that the developing child receives sufficient DHA during the important period, from 6 months to 4 years old, when the brain growth spurt is occurring and neural development is at its peak. In fact, the European Society for Pediatric Gastroenterology, Hepatology, and Nutrition (ESPGHAN) has stressed the importance of DHA during the complementary feeding period noting that "the Committee considers it advisable" to include good sources of DHA in the complementary feeding diet (ESPGHAN Committee on Nutrition, 2008). The Committee further noted that delaying the introduction of n-3 fatty acid rich foods such as fish until the age of 3 to reduce the risk of allergy "could potentially have consequences for cognitive outcome".

As DHA is recognized as an essential fatty acid necessary to ensure proper function of the body, particularly the brain and eyes (AFFSA, 2010), EFSA has recently endorsed health claims related to DHA and the visual development of infants and the EU has adopted a minimum intake level of 100 mg DHA/day for infants and children ages 7-24 months (EFSA, 2009; EFSA, 2010). Similarly, the Superior Health Council (SHC) of Belgium has recently recommended 45-175 mg DHA/day and 45-110 mg ARA/day for children 12-36 months of age. Recognizing the importance of DHA throughout life, EFSA supports even higher intake levels beyond 2 years of age recommending 250 mg n-3 LCPUFA/d for children between 2-18 years (EFSA, 2010). The period between the ages 2 and 18 years represents a period of rapid DHA accumulation by the brain frontal cortex (*Carver et al.*, 2001).

DHA supplementation after the early post-natal period is also effective for improving cognitive function. For example, children supplemented with DHA for the first time beginning at 4 years of age have been reported to exhibit increased memory and vocabulary skills consistent with increased school readiness (*Ryan and Nelson*, 2008). Healthy young boys supplemented with DHA for the first time between the ages of 8 and 10 years have exhibited significantly enhanced functional activity in the frontal cortex during tests of sustained attention indicating DHA is a "robust modulator of functional cortical activity" in the brain of older children (*McNamara et al.*, 2010).

Obtaining adequate DHA for children beyond 2 years of age is also a challenge with parental fears of allergic reaction to fish-derived DHA, concerns with exposure to environmental contaminants, cultural practice, child and parental food likes and dislikes, and geographic availability of fish all limiting the availability of DHA-rich foods to this age group. DHA enrichment of foods, or the recommended use of DHA dietary supplements, represents a viable means to increase the availability of DHA throughout childhood. Table 2 summarizes current global DHA intake recommendations for women, infants and

young children.

Table 2. World-wide LCPUFA Intake Recommendations and Guidelines Women and Children		
Organization	**Amount of DHA or DHA+EPA**	**Reference**
Agence Français de Sécurité Sanitaire des Aliments	250 mg DHA/d for pregnant women 250 mg DHA/day for breastfeeding women	AFSSA Opinion Regarding the Update of the Recommended Dietary Intake for Fatty Acids. AFSSA-Hearing n2006-SA-0359. 2010.
Agence Français de Sécurité Sanitaire des Aliments	70 mg DHA/d for children 1-3 years 125 mg DHA/d for children 3-9 years 250 mg DHA/day for children 10-18 years	AFSSA Opinion Regarding the Update of the Recommended Dietary Intake for Fatty Acids. AFSSA-Hearing n2006-SA-0359. 2010.
Belgian Superior Health Council	40-175 mg DHA/d for children ages 12-36 months 45-110 mg ARA/d for children ages 12-36 months	Superior Health Council. Recommendations Nutritionnelles Pour La Belgique. CSS No. 8309. Revision 2009.
European Food Safety Authority (EFSA)	250 mg DHA+EPA/d for all women plus an additional 100-200 mg DHA/d for pregnant and nursing women	Opinion of the Scientific Panel on Dietetic Products, Nutrition and Allergies on a request from the Commission related to dietary reference values for fats, including saturated fatty acids, polyunsaturated fatty acids, monounsaturated fatty acids, *trans* fatty acids, and cholesterol. 2010.
EFSA	100 mg DHA/d for children ages 7-24 months 250 mg DHA+EPA/d for children 2-18 years	Opinion of the Scientific Panel on Dietetic Products, Nutrition and Allergies on a request from the Commission related to dietary reference values for fats, including saturated fatty acids, polyunsaturated fatty acids, monounsaturated fatty acids, *trans* fatty acids, and cholesterol. 2010.
International Society for the Study of Fats and Lipids	At least 200 mg DHA/d during pregnancy and nursing	ISSFAL Policy Statement 4: Recommendations for intake of polyunsaturated fatty acids by pregnant and lactating women. 2009.
March of Dimes	At least 200 mg DHA/d during pregnancy and nursing	http://www.marchofdimes.com/pnhec/159_55030.asp , 2009.
FAO/WHO Expert Consultation	At least 200 mg DHA/d toward total 300 mg n-3 EPA+DHA for pregnant and nursing women	From the Joint FAO/WHO Expert Consultation on Fats and Fatty Acids in Human Nutrition, November 10-14, 2008. WHO HQ, Geneva. *Interim Summary of Conclusions and Recommendations on Total Fat and Fatty Acids, 2010.*
FAO/WHO Expert Consultation	80-150 mg DHA/d for children 6-24 months	From the Joint FAO/WHO Expert Consultation on Fats and Fatty Acids in Human Nutrition, November 10-14, 2008. WHO HQ, Geneva. *Interim Summary of Conclusions and Recommendations on Total Fat and Fatty Acids, 2010.*
Perinatal Lipid Intake Working Group	At least 200 mg DHA/d during pregnancy and nursing	Koletzko B, Cetin I, and Brenna TJ. Perinatal Lipid Intake Working Group Consensus Statement: *Dietary fat intakes for pregnant and lactating women.* Brit J Nutr 98:873-7, 2007.
Australia New Zealand National Health and Medical Research Council	Pregnancy 110- 115 mg/day DHA+EPA+DPAn-3 Lactation 140-145 mg/day DHA+EPA+DPAn-3	Nutrient reference values for Australia and New Zealand including recommended dietary intakes. 2005. www.nhmrc.gov.au/publications/synopses/_files/n35.pdf

Adults

DHA has an important role in neural function beginning early in life, and recent evidence suggests a continued need throughout the lifespan. Decreases in plasma DHA are associated with cognitive decline in healthy elderly adults and in patients with Alzheimer's disease (AD). Higher DHA intake is inversely correlated with relative risk of AD (*Yurko-Mauro et al.*, 2010). DHA supplementation (900 mg DHA/day) of adults > 55 years of age with mild memory complaints resulted in increased blood levels of DHA and significant improvement in tests of memory and learning. Only higher DHA was related to better performance on tests of non-verbal reasoning, mental flexibility, working memory and vocabulary in non-patient adults 35 – 54 years of age (*Muldoon et al.*, 2010).

DHA is also supportive of cardiovascular health throughout life, reducing cardiovascular mortality through reductions in sudden death and risk factors for heart disease such as hypertension, elevated heart rate, and triglycerides, for both the general population and those currently suffering from heart disease.

Labeling reference values for DHA, along with EPA, were recently adopted by the EU at a level of 250 mg/day for the general population (Commission Regulation (EU) No 116/2010) reflecting EFSA's most recent opinion on omega-3 fatty acids and cardiovascular health, *"most recent evidence derived from meta-analysis of randomized trials and large prospective studies shows that, when only healthy subjects are considered, the intake of EPA plus DHA is negatively related to cardiovascular disease risk in a dose-dependent way..."*. Similar draft conclusions have been reached by the current U.S. Dietary Guidelines Advisory Committee (DGAC). In recent meetings the following has been proposed as dietary guidance for Americans "Consumption of 2 seafood meals/week (3-5 oz/serving) for an average of 250 mg/d of EPA and DHA is recommended for individuals without CVD." Similar advice was indicated for those with cardiovascular disease (CVD).

Additionally, the recent report of the DGAC recommends "consuming two servings of seafood per week (4 oz. cooked, edible seafood per serving) that provide an average of 250 mg/day of *n*-3 fatty acids from marine sources (i.e., docosahexaenoic acid [DHA] and eicosapentaenoic acid [EPA])." The report also states: "Ensuring maternal dietary intake of long chain *n*-3 fatty acids, in particular DHA, during pregnancy and lactation through two or more servings of seafood per week also has benefits for the infant, especially when women emphasize types of seafood high in *n*-3 fatty acids and with low methyl mercury content."

A recent systematic review provides evidence that low-dose DHA enriched foods favorably modify plasma lipids in a manner similar to that achieved with high dose fish oil supplementation (*Muso-Velosa et.al*, 2010). Recent expert opinion also recognizes evidence that only marine-based omega-3 fatty acids (i.e., DHA and EPA) provide protection against cardiovascular disease development or mortality. The shorter chain omega-3 fatty acid, ALA, derived from oilseeds and nuts are much less biopotent than those derived from marine sources and offer little in the way of cardiovascular protection (ISSFAL, FAO/WHO). World-wide recommendations for DHA and/or EPA for the promotion of cardiovascular and general health are provided in Table 4.

Unfortunately, due to limited availability and consumption of fish in some geographic areas, traditional and cultural dislikes of marine foods, concerns with exposure to environmental contaminants from fish, allergy concerns and vegan diet preference, DHA intake is often lower than recommended. Therefore, in an effort to sustainably broaden the availability and intake of DHA, alternative food ingredients are needed.

Table 3. Adult Cardiovascular and General Health		
Agence Français de Sécurité Sanitaire des Aliments	500 mg DHA+EPA; 250 mg of each respectively for adult men and women	AFSSA Opinion Regarding the Update of the Recommended Dietary Intake for Fatty Acids. AFSSA-Hearing n2006-SA-0359. 2010
European Food Safety Authority	250 mg DHA+EPA/d	Draft Opinion of the Scientific Panel on Dietetic Products, Nutrition and Allergies on a request from the Commission related to dietary reference values for fats, including saturated fatty acids, polyunsaturated fatty acids, monounsaturated fatty acids, *trans* fatty acids, and cholesterol. 2009. http://www.efsa.europa.eu/en/calls/documents/nda_op_drv_fat_draft_en_released%20for%20consultation,0.pdf
Heart Foundation of Australia	500 mg DHA+EPA/day for primary prevention of cardiovascular disease; 1000 mg/day for secondary prevention	Position Statement: Fish, fish oils, n-3 polyunsaturated fatty acids and cardiovascular health. 2008. www.heartfoundation.org.au
American Dietetic Association/ Dietitians of Canada	Fish twice/wk, both oily or 500 mg DHA+EPA/d	Kris-Etherton PM, Innis S; American Dietetic Association; Dietitians of Canada. Position of the American Dietetic Association and Dietitians of Canada: dietary fatty acids. J Am Diet Assoc. 2007;107:1599-611.
UK Scientific Advisory Committee on Nutrition	Fish twice/wk, one of which should be oily, minimum intake 450 mg DHA+EPA+DPA n-3/day	Scientific Advisory Committee on Nutrition. Advice on fish consumption. ISBN 0 11 243083. The Stationary Office. London. 2004. http://www.sacn.gov.uk/pdfs/fics_sacn_advice_fish.pdf
Superior Health Council of Belgium	An almost daily serving of fatty fish of varied species or alternatively, capsules of fatty fish oil (EPA+DHA) to the amount of 1 g per day	Hoge Gezondheidsraad Superior Health Council, Advisory Report, Recommendations and claims made on omega-3 fatty Acids (SHC 7945). 2004. https://portal.health.fgov.be/pls/portal/docs/PAGE/INTERNET_PG/HOMEPAGE_MENU/ABOUTUS1_MENU/INSTITUTIONSAPPARENTEES1_MENU/HOGEGEZONDHEIDSRAAD1_MENU/ADVIEZENENAANBEVELINGEN1_MENU/ADVIEZENENAANBEVELINGEN1_DOCS/OMEGA-3%20ENGLISH.PDF
International Society for the Study of Fats and Lipids	500 mg DHA+EPA	International Society for the Study of Fats and Lipids (ISSFAL). ISSFAL Policy Statement 3: Recommendations for intake of polyunsaturated fatty acids in healthy adults. 2004. Available from: http://www.issfal.org.uk/lipid-matters/issfal-policy-statements/issfal-policy-statement-3-2.html
American Heart Association	2 servings per week of fish for primary prevention; 1 g DHA+EPA per day for secondary prevention; 2-4 g per day for serum triglyceride reduction	American Heart Association Scientific Statement. Kris-Etherton PM, Harris, WS, Appel LJ and for the Nutrition Committee. Fish consumption, fish oil, omega-3 fatty acids, and cardiovascular disease. 2002. 106:2747-2757. http://circ.ahajournals.org/cgi/content/full/106/21/2747
U.S. Institute of Medicine	Up to 160 mg DHA+EPA/d	Dietary reference intakes for energy, carbohydrate, fiber, fat, fatty acids, cholesterol, protein, and amino acids (Macronutrients). The National Academy of Sciences Press, Washington DC, Chapter 8, 2005. http://www.nap.edu/openbook.php?isbn=0309085373.

FAO/WHO recently provided background on global trends in fish production, intake and composition which contributed to the recently released interim conclusions of an FAO/WHO expert consultation on total fat and fatty acid requirements (FAO/WHO 2009). The FAO/WHO report notes that changes in aquaculture practice to meet increased demand for fish are diminishing the EPA+DHA content of farm-raised fish. Specifically, "87% of all fish oil was used by the aquaculture industry to produce feed" in 2006. This is problematic as, "a sustainable utilization of fishery resources will not allow a permanent increase in the production of fish oils based on available fishery resources." As such the aquaculture industry is working continuously "to reduce the reliance on fish oils and is increasing the use of vegetable oils in aquaculture feeds" (*Wolmarans*, 2009). Fish are what they eat, however, and the composition of fish is a reflection of what they are fed. In studies of fish fed vegetable oil alternatives "fish given feeds low in fish oil had a low level of EPA and DHA in their fillets"[2] thus diminishing the usefulness of certain farm-raised fish for achieving DHA intake recommendations.

In addition, foods enriched with alternatives to fish oil, such as marine microalgae, were recognized as a way to provide meaningful levels of DHA and/or EPA to the diet of consumers who avoid fish for various reasons without threatening the available fish supply. In the FAO/WHO proceedings, it is noted that "...new technologies might allow the production of these fatty acids from other sources such as algae" further noting that DHA+EPA enriched foods achieved by feeding omega-3 fatty acids to laying hens and broiler chickens can effectively increase these nutrients in these popular foods (*Wolmarans,* 2009). Specifically, "these n-3 fatty acid-enriched foods could further contribute to meeting the recommendations for n-3 fatty acid intake..." In fact, eggs rich in DHA from feeding hens marine microalgae provide at least 150 mg DHA per egg and have been available throughout the U.S. and Europe for more than 10 years.

APPENDIX 9

DHA —BIBLIOGRAPHY

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NOTE: Bibliography obtained from searches conducted by NERAC (BIOSIS, MEDLINE, and TOXNET) at http://www.nerac.com/ in Oct. 2009 and updated in May 2010

SEARCH STRATEGIES:

NERAC (MEDLINE & BIOSIS)

(DHA; 6217-54-5; DHASCO; DHA GOLD; DHA LIP NS; DHA 45; DHA-S; Doconexent; Docosahexaenoic acid\AL\RN) and (Schizochytrium; ATCC 20888; Ulkenia\AL) and (clinical; multicenter; patient; hospital; double blind; randomized; multi-center; phase*; clinical-trial; prospective; retrospective; consectutive; ADME; bioavailability; metabolism; excretion; absorption; distribution; blood; plasma; brain; liver; hepatic; SAE; adverse; safety; efficac*; toxic*; poison*; neurotox*; death; mutag*; genet*; carcin*; *oma; clastogen*; terrato*; terato*; geno*; immun*; allerg*; inflamm*\AL) and (human; homo sapiens; sapiens; men; women; man; woman\TD).

NERAC (TOXNET)

Examples of Search Strategies in TOXNET:

DHA AND Ulkenia
Docosahexaenoic AND Ulkenia
DHA-S AND Ulkenia
Schizochytrium AND DHA, etc.

DHA — FOOD PRODUCING ANIMALS BIBLIOGRAPHY

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NOTE: Bibliography obtained from searches conducted by NERAC (BIOSIS, MEDLINE, and TOXNET) at http://www.nerac.com/ in Oct. 2009 and updated in May 2010

SEARCH STRATEGIES:

NERAC (MEDLINE & BIOSIS)

(DHA; 6217-54-5; DHASCO; DHA GOLD; DHA LIP NS; DHA 45; DHA-S; Doconexent; Docosahexaenoic acid\AL\RN) and (Schizochytrium; ATCC 20888; Ulkenia\AL) and (food-producing<3>animal; swine; pig*; sheep; poultry; chicken*; hen*; beef; steer; bovine; cow; cattle; dairy; lamb; ovine; porcine; pork; mutton; ostrich; turkey; rabbit; leporidae; suidae; venison; deer; cervidae; horse; equine; equidae; goat; capra; duck; geese; goose; calves; calf; buffalo; veal; eggs; aquaculture; shrimp; fish; mackeral; tuna; salmon; cod; roughy; mussels \AL).

NERAC (TOXNET)

Examples of Search Strategies in TOXNET:

DHA AND Ulkenia

Docosahexaenoic AND Ulkenia

DHA-S AND Crypthecodinium

Schizochytrium AND DHA, etc.

APPENDIX 10

Martek DHA™-S

General Characteristics

Description:	Nutritional oil derived from the marine alga, *Schizochytrium* sp., a rich source of Omega-3 docosahexaenoic acid (DHA).
Appearance:	Light yellow to orange colored oil
Aroma:	Characteristic
DHA Content, mg/g oil	min. 350 mg/g
Peroxide Value	max. 5.0 meq/kg
Unsaponifiable Matter	max. 4.5 %

Ingredients

DHA Algal Oil; High Oleic Sunflower Oil; Contains less than 2% of; Sunflower Lecithin; Rosemary Extract; Mixed Tocopherols and Ascorbyl Palmitate (as antioxidants).

Product Storage and Stability

Martek DHA™-S is guaranteed to meet all product specifications when stored in the unopened, original container for up to 1 month at room temperature (~25°C), up to 6 months at refrigerated temperature (~4°C), and up to 2 years under frozen storage conditions (~-20°C). For extended storage, and for best sensory performance, frozen storage is recommended.

Martek DHA™-S oil is derived from a natural fermentation process, and due to the nature of the oil, some variability in the clarity of the product has been observed. Upon prolonged storage at room temperature or refrigerated conditions, some semi-solid material may appear in the oil. This is not expected to negatively impact the quality of the product, but the product should be well mixed to re-suspend this material prior to use.

Martek DHASCO® Algal Oil

General Characteristics

Description:	Nutritional oil derived from the marine alga, *Crypthecodinium cohnii*, a rich source of Omega-3 docosahexaenoic acid (DHA).
Appearance:	Light yellow to dark orange colored oil
Aroma:	Characteristic

Docosahexaenoic Acid (DHA)	min. 350 mg/g
Peroxide Value	max. 5.0 meq/kg
Unsaponifiable Matter	max. 3.5 %

Ingredients

Algal Oil; High Oleic Sunflower Oil; Tocopherols and Ascorbyl Palmitate (as antioxidants).

Product Storage and Stability

Maximum stability of DHASCO® is achieved by shipping and storing the product frozen in the original, unopened container at minus 20 degrees centigrade until thawed for use. The oil should be protected from exposure to oxygen and elevated temperatures (> 30°C). Shipping and storage under frozen conditions provides stability for DHASCO® for up to three years if product is kept frozen and unopened.

Once a container is thawed and opened, use entire contents immediately. However, if it is not possible to use the entire amount at one time, the remainder may be nitrogen purged and refrozen at minus 20 degrees centigrade.

MARTEK
life enriched.™

Comparison of *life'sDHA™* from algae vs. DHA/EPA from fish oil

life'sDHA™: algae

- 35-40% DHA
- Acceptable & well tolerated
- Allergy-free
- Authoritative recommendations for DHA alone exist
- DHA alone benefits exist for:
  - Brain development
  - Retina development
  - Pregnancy
  - Lactation
  - Infant neurodevelopment
  - Cardiovascular health
- Sustainable and carbon footprint sensitive
- Only DHA is recommended for pregnancy, lactation, and infancy (PeriLip, 2007)
- Vegetarian source of DHA omega-3
- 1.0 to 1.5 g per day needed to decrease triglycerides
- Anti-inflammatory effects

DHA and EPA: fish oil

- Variation in DHA content; only salmon, tuna, mackerel oils are high in DHA
- Potential for "fish burps" & intolerance
- Risk of fish allergy
- Authoritative recommendations exist for DHA alone and DHA and EPA (LC n-3) only
- EPA alone benefits exist for:
  - Cardiovascular health
  - Mental health
  - Depression
  - Schizophrenia
  - Bipolar Disorder
- Not sustainable; contributes to over-fishing
- No EPA recommended intake for pregnancy, lactation, or infancy
- Not a vegetarian source of omega-3
- Higher levels needed to decrease triglycerides
- Anti-inflammatory effects

MARTEK
life enriched.™

Feature	Algal Oil	Fish Oil
Heath benefit		
Cardiovascular health	✓	✓
Eye health	✓	✓
Cognition (development)	✓	✓
Cognition (maintenance)	✓	✓
Maternal health	✓	✓
Inflammation	✓	✓
Infant health & development	✓	
Bone health	✓	
Lack of allergy	✓	
Sustainability	✓	
Free from contaminants/pollutants	✓	
Economically viable (long-term)	✓	
Consumer acceptability	✓	**variable**
Taste/sensory	✓	✓
Vegetarian	✓	

Organic Shoppers Want Functional Foods: Survey

May 20, 2010

Eight in 10 natural and organic consumers regularly read ingredient labels for health and nutrition content and express interest in purchasing functional foods with additional health, nutrition and dietary benefits, with four in 10, or 39 percent "very interested" in these kinds of foods, according to MamboTrack research from Collingswood, N.J.-based Mambo Sprouts Marketing.

Consumers said they're most interested foods containing organic ingredients (65 percent) and low-sodium grocery products (47 percent), followed by low-fat/cholesterol (39 percent) and vegetarian items (31 percent). Functional food products with added calcium (44 percent), omega-3 (44 percent), antioxidants (43 percent), probiotics/prebiotics (38 percent), and vitamin D (30 percent) were also popular choices.

The study also revealed interest in specific ingredient-free foods, with one in three natural product consumers looking to buy allergen-free foods. Shoppers were most likely to report purchasing gluten-free/wheat-free items (25 percent), followed by dairy-free products (9 percent). Fewer eschewed soy (6 percent) or peanuts (4 percent). Among the gluten-free products, bread (59 percent), cereal (56 percent), chips and snacks (54 percent), and pasta (46 percent) were the most sought after.

Shoppers are turning to such items for a range of reasons. More than four in 10 gluten-free buyers believe these products are healthier for their family (43 percent), while another one in three (34 percent) had a household member with celiac disease or wheat intolerance, or noted that their favorite brands were already free of gluten (36 percent).

Packaging plays a key role in deciding which brands to buy, the research found. Four in 10 (40 percent) recently tried a new brand or switched brands specifically because of more earth-friendly packaging. Two in three purchased products with recyclable packaging or packaging made of recycled materials (66 percent), and 44 percent bought products with compostable/biodegradable packaging. Among the new eco-packaging options with the most appeal among one in two were compostable/biodegradable, reusable and refillable product packaging.

The study was based on the results of the online Mambo Sprouts Marketing Quick Poll, which surveyed 600 MamboTrack health and natural product consumers between April 19 and April 26, 2010.

Links referenced within this article

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http://www.progressivegrocer.com/progressivegrocer/content_display/features/e3i6bdd9c879228ff511a59c01568adbdac

Pregnant & Breastfeeding Women

Research Highlights: The Benefits of DHA During Pregnancy and While Breastfeeding

Docosahexaenoic acid, DHA, is a long chain omega-3 fatty acid that is found throughout the body. More specifically, it is a major structural fat in the brain and the retina of the eye and is a key component of the heart. A growing body of research continues to support the important role that DHA plays for both mother and baby. Specifically, DHA is important for optimal infant brain, eye and nervous system development, and has been shown to support a healthy pregnancy. Below are research highlights from studies examining the role of DHA in health and development during pregnancy and while nursing. (Please refer to the list of references.)

- DHA is the most abundant fatty acid in the brain and eyes (retina). DHA represents about 97% and 93% of all omega-3 fatty acids in the brain and eyes, respectively.[1-2]
- DHA is important for healthy visual and mental development of the infant in utero and throughout infancy. [1-4]
- Breast milk is the optimal method for infant feeding. DHA is always present in human breast milk. [5]
- The developing infant receives DHA from the mother through the placenta during pregnancy and in breast milk after birth.[5-7]
- Expert panels recommend that DHA intake be 200-300mg per day for pregnant and nursing women.[8-9]
- On average, pregnant and nursing women in North America consume 60-80mg of DHA a day, only 20-40% of the recommended intake.[10-11]
- Breast milk DHA levels are dependent on the mother's diet.[12-24] Because of a low DHA dietary intake, American women reportedly have lower DHA levels in their breast milk than their international counterparts.[5]
- Maternal DHA supplementation was shown to increase the mother's blood and breast milk DHA levels. This, in turn, elevated the blood DHA levels of both the fetus and breast-feeding infant. [12-13, 24-30]
- Higher levels of DHA in breast milk were associated with an infant's ability to easily adjust to changes in surroundings (measured using Brazelton Neonatal Behavioral Assessment scale).[31]
- Maternal DHA supplementation during lactation resulted in mental development advantages in children [32-35] including:
  - Improved psychomotor development (such as eye-hand coordination) at 2.5 years of age.[34]
  - Improved attention skills at 5 years of age.[35]
- A study using a statistical model of risk-benefit analysis, designed by Harvard Center for Risk Analysis, estimated that increasing maternal DHA intake by 1 g/day increases child IQ by 1.3 points.[36]
- Supplementation with DHA during pregnancy benefits both mother and baby by extending the length of gestational age. Meta-analyses of studies conducted to date show that maternal DHA supplementation was associated with a greater length of pregnancy averaging 1.6 to 2.6 days closer to term. [37-39] One study demonstrated a 6 day increase in the length of gestational age.[39]

life'sDHA™
HEALTHY • BRAIN • EYES • HEART

For more information, please call
1-800-662-6339 or visit www.lifesdha.com

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Infants

Research Highlights: The Importance of DHA in Infant Development

Docosahexaenoic acid, DHA, is a long chain omega-3 fatty acid that is found throughout the body. More specifically, DHA is an important structural fat in the brain and eyes and is a key component of the heart. DHA, a natural component of breast milk, is important for brain and eye development and function. Below are research highlights from studies examining the role of DHA in infant health and development. (Please refer to the list of references.)

- DHA is the most abundant omega-3 fatty acid in the brain and the retina of the eye, representing about 97% and 93% of all omega-3 fatty acids in the brain and eyes, respectively, and is important for healthy visual and mental development throughout infancy.[1-4]

- The brain grows rapidly during the last months of gestation and throughout the first years of life. This growth spurt is a time of rapid DHA accumulation in the brain. [5-7]

- An infant's ability to produce DHA may be inconsistent and inefficient. Infant blood DHA levels decrease significantly following birth unless the infant receives DHA either through breast milk or supplemented infant formula. [8-15]

- Breast milk is the optimal method for infant feeding. Breast milk always contains the long chain polyunsaturated fatty acids, DHA and arachidonic acid (ARA*).[16] Recommendations have been made by several expert groups for infant formulas containing DHA and ARA.[17-22]

- Infants rapidly accumulate DHA from their mother during the last months of gestation. Infants born prematurely do not have time to accumulate DHA to the same level as their full-term counterparts. When fed formula supplemented with DHA and ARA, preterm infants achieved normal growth in terms of weight, length and head circumference,[23-26] and showed improved visual and mental development compared to the infants fed formula not supplemented with DHA and ARA.[26]

- Many studies have demonstrated improved mental development for infants fed DHA- and ARA-supplemented formula compared to those receiving unsupplemented formula. These benefits extend well beyond the period of supplementation and continue into childhood. [27-29]

- Term infants fed DHA(0.36%)- and ARA (0.72%)- supplemented formula scored 7 points higher on the Bayley Mental Development Index at 18 months than those fed unsupplemented formula.[27] In a follow-up study of those same children at age 4, visual acuity and verbal IQ scores were higher in those children who had received supplemented formula compared with those who received formula lacking DHA and ARA. [29]

- Infants who were breastfed and then weaned to formula supplemented with DHA and ARA demonstrated more mature visual acuity than those breast-fed infants weaned to non-supplemented formula.[30-31]

- Infants fed DHA-supplemented formula exhibited better visual acuity than that of the non-supplemented infants (equivalent to 1.5 lines on the eye chart), and similar to that of breast-fed infants.[32-34]

- One study showed that infants fed formula supplemented with DHA (0.36%) and ARA (0.72%) had fewer episodes of bronchiolitis and bronchitis at age 5, 7, and 9 months compared to infants fed non-supplemented formula.[35]

- Infants fed formula supplemented with DHA and ARA had significantly lower blood pressure compared to infants fed non-supplemented formula, similar to that of breast-fed infants. Because blood pressure tends to track from childhood into adult life, it has been suggested that early intake of DHA and ARA may reduce the risk of cardiovascular disease later in life.[36]

** Arachidonic acid (ARA) is an omega-6 fatty acid that is added with DHA to infant formulas.*

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Children

Research Highlights: The Importance of DHA Beyond Infancy

Docosahexaenoic acid, DHA, is an omega-3 fatty acid that is found throughout the body. More specifically, it is an important structural fat in the brain and eyes and a key component of the heart. A growing body of research continues to support the role that DHA plays in maintaining good health throughout life. DHA is important for brain and eye development and function throughout the lifecycle, but is particularly important during the first years of life and early childhood. Below are research highlights from studies examining the role of DHA in health and development in early life. (Please refer to the list of references.)

- DHA is the predominant omega-3 fatty acid found in the brain. DHA represents about 97% of all omega-3 fatty acids in the brain and 93% of all the omega-3 fatty acids in the eye (retina).[1-3]
    - Uptake of preformed DHA by the brain is significant between ages 2 and 5 and supports the substantial accumulation of DHA by the brain during this critical growth period.[4]
- One-year-old infants who received DHA-supplemented baby food since weaning showed improved vision, equivalent to 1.5 lines on the eye chart, compared to those who received baby food that did not contain DHA.[5]
- The body's production of DHA from alpha-linolenic acid (ALA) is limited.[6,7]
    - Including DHA in the diet is the most reliable way to ensure that DHA is available to support optimal brain and eye development and function.[8]
- DHA supplementation has been shown to improve blood lipid profiles and restore endothelial function in children with high cholesterol levels.[9,10]
- Children ages 1-5 years were shown to have low DHA intakes ranging from 30-50 mg/day.[11,12]
    - This is because the primary dietary sources of DHA are fatty fish and organ meats which are not popular food choices for young children and DHA-fortified foods geared toward toddlers are limited.

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Adults

Research Highlights: Benefits of DHA in Adult Health

Docosahexaenoic acid, DHA, is an omega-3 fatty acid that is found throughout the body. More specifically, it is a major structural fat in the brain and eyes and a key component of the heart. A growing body of research continues to support the role that DHA plays in maintaining good health throughout every stage of life. Below are research highlights from studies examining the role of DHA in adult health. (Please refer to the list of references.)

- DHA is the predominant omega-3 fatty acid found in the brain, representing about 97% of all omega-3 fatty acids in the brain. It is especially concentrated in the region of the brain that is responsible for complex thinking skills.[1-2]
- DHA is concentrated in the retina and membranes of the eye. It represents 93% of all omega-3 fatty acids in the eye.[2]
- Low levels of DHA in red blood cells have been associated with cognitive decline in healthy elderly people.[3]
- Findings from a large observational study indicate that intake of the omega-3 fatty acid, DHA, and especially the ratio of omega-3 to omega-6 fatty acids, independent of childhood IQ, is important in the retention of cognitive function later in life. [4]
- Observational studies indicate that a high intake of fish, a good source of DHA, may be associated with a reduced risk for developing Alzheimer's dementia[5] and a slowing of normal, age-related, cognitive decline.[6]
- One study showed that people with the highest levels of plasma DHA (the top 20% of those in the study) had a significant (47%) reduction in the risk of developing dementia from any cause. After 9 years of follow-up, subjects with the highest levels of plasma DHA were less likely to develop Alzheimer's disease.[7]
- Results of a Swedish cohort study suggest that n-3 fatty acid, especially DHA, are positively associated with peak bone mineral density in the total body and spine in healthy, young men.[8]
- DHA is important for cardiovascular health. There does not appear to be significant differences in triglyceride-lowering benefits between DHA only and DHA + EPA combination products when dosing is based on DHA.[9]
- Evidence from observational and randomized controlled trials suggests a possible role of dietary long-chain omega-3 fatty acids, including DHA, in protection against ischemic stroke, the most common type of stroke in the U.S. and leading cause of long-term disability.[10,11]

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APPENDIX 11

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June 30, 2010

Mr. Miles McEvoy
Deputy Administrator
National Organic Program
Agricultural Marketing Service
1400 Independence Avenue, SW
Room 2646-S, STOP 0268
Washington, DC 20250-0201

Re: Overview of Accessory/Voluntary Nutrients, 5 February, 2010.

Dear Mr. McEvoy:

Martek Biosciences Corporation is a leader in the innovation and development of vegetarian sources of the omega-3 fatty acid *life'sDHA*™ (docosahexaenoic acid) for use in infant formula, foods, and dietary supplements, and *life'sARA*™ (arachidonic acid), an omega-6 fatty acid, for use in infant formula and growing-up milks. Martek's products promote health and wellness through every stage of life and have been used in products certified "organic" and "made with organic" since 2006.

Martek has reviewed the draft Technical Advisory Panel (TAP) report entitled "Overview of Accessory/Voluntary Nutrients", dated 5 February 2010, available on the National Organic Program (NOP) website. NOP made this draft TAP report publicly available on 26 April 2010. We commend the TAP on its comprehensive review of the available information on the role of the omega-3 fatty acids DHA and EPA and the omega-6 fatty acid, ARA, in diet and in health. However, we have identified several inaccuracies in the report that we would like to bring to the TAP's attention. This information should be corrected before the TAP finalizes the report. For example, although the TAP report states DHA and ARA have not been authorized for use in European infant formulas, in fact they have indeed been authorized for use in Europe and have been used in some European countries for over a decade.

We request that NOP provide this comment to the TAP so they will have the most current information available when preparing the final report. Martek also would like to take this opportunity to provide additional information on DHA and ARA that we believe the TAP will find valuable as they finalize the report.

Statement: "Omega-3 Fatty Acids are Not Considered Essential to the Diet"

In the discussion of accessory nutrients, the draft TAP report states "omega-3 fatty acids are not considered essential to the diet."[1] Two pages later, the draft report notes that at least one omega-3 fatty acid, alpha-linolenic acid or ALA cannot be synthesized by the body and is essential.[2] The draft

[1] Overview of Accessory/Voluntary Nutrients Pg. 2, Paragraph 1.
[2] Overview of Accessory/Voluntary Nutrients Pgs. 4-5.

report then also summarizes the various studies that have established the importance of providing DHA in the diet, particularly the diets of infants and young children.

The omega-3 fatty acid ALA is an essential nutrient. Recognition of ALA as essential has been confirmed by the U.S. Institute of Medicine (2007)[3] and recently reaffirmed by FAO/WHO experts.[4] ALA is the parent precursor to DHA in the body. The ability of the body to synthesize DHA from ALA may lead to the assumption that DHA is non-essential. However, the inability of ALA to provide sufficient DHA[5] during critical periods of life has led to the recognition by many experts of the essentiality of DHA during pregnancy, nursing, infancy and childhood[5,6,7] and, most recently, for the general population as a whole.[8] Indeed, the draft TAP report recognizes synthesis of DHA by the newborn infant is "limited" and that "LCPUFA status remains diet dependent in infants and young children."[9] We encourage the TAP to revise the sentence which presently states that "omega-3 fatty acids are not considered essential to the diet."

The omega-3 example provides an excellent case study of the ambiguities that would be introduced by defining accessory nutrients as "nutrients that are not considered essential nutrients."[10] Such a definition would place NOP in the unenviable position of trying to determine whether a particular nutrient is or is not essential. Moreover, it would exclude from this category those nutrients that are considered essential, such as the omega-3 ALA. We believe the 1995 Final Board Recommendation (FBR) by the National Organic Standards Board (NOSB)[11] best captured the accessory nutrient definition. The NOSB defined accessory nutrients as "nutrients not specifically classified as a vitamin or mineral but found to promote optimal health." We encourage the TAP to consider the 1995 definition, which in our view best captures the nature of these nutrients, the importance of including them in the diet, and avoids the ambiguity introduced by trying to determine whether a nutrient is "essential."

Statement: DHA and ARA are not Permitted in Infant Formula in the EU

The draft report states DHA and ARA are not permitted in infant formula in the EU.[12] Both DHA and ARA are authorized for use in infant formulas in Europe and have been used in various countries in Europe for well over a decade. The chart below identifies the minimum levels of DHA and ARA that have been authorized by regulatory authorities or expert groups in Europe and other countries outside of the United States.

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[3] Institute of Medicine, National Academy of Science. Dietary reference intakes for energy, carbohydrate, fiber, fat, fatty acids, cholesterol, protein, and amino acids (Macronutrients). The National Academy of Sciences Press, Washington DC, Chapter 8. http://www.nap.edu/openbook.php?isbn=0309085373

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[9] Overview of Accessory/Voluntary Nutrients Pg. 5, Paragraph 1.

[10] Overview of Accessory/Voluntary Nutrients Pg. 2, Paragraph 1.

[11] Final Board Recommendation Addendum Number 13, "The Use of Nutrient Supplementation in Organic Foods" ("the FBR"), 1995.

[12] Overview of Accessory/Voluntary Nutrients Pg. 5, Paragraph 3..

Regulatory Body	Long-chain omega-3/DHA Levels	Long-chain omega-6/ARA Levels
Codex *Codex Stan 72-1981 Standard for Infant Formula and Formulas for Special Medical Purposes. Rev. 2007*	DHA Upper limit 0.5% total fat content EPA should not exceed DHA Minimum level not specified	ARA Upper limit not specified ARA required to meet or exceed added DHA Minimum level not specified
EU Commission *Commission Directive 2006/141/EC of 22 December 2006 on infant formulae and follow-on formulae and amending Directive 1999/21/EC*	Upper limit 1% of total fat content for n-3 LCP[2] DHA shall not exceed ARA EPA shall not exceed DHA 0.2% minimum for DHA/if LCP nutrition claim is made	Upper limit of 1% of total fat content for ARA Minimum level not specified ARA ≥ DHA
Australia/New Zealand *Standard 2.9.1 Infant Formula Products*	Upper limit 1% of total fat content for LC omega-3[3] Total long chain omega 3:long-chain omega-6 ratio that is not less than 1	Upper limit of 1% of total fat content for ARA Total long chain omega 3:long-chain omega-6 ratio that is not less than 1
Indonesian National Agency for Food and Drug Control *Regulation of Head of Indonesian National Agency for Drug and Food Control Number HK.00.05.1.52.3920 on Infant Formula and Infant Formula for Special Medical Purposes*	0.2% minimum DHA Upper limit 0.5% DHA addition must be accompanied by addition of ARA according to the ratio of 1-2:1 EPA must not exceed DHA	ARA Upper limit not specified

Statement: DHA and ARA are not Permitted for Use in European Health Claims

The draft TAP report states DHA and ARA are not permitted for use in European health claims referencing children's development and health.[13] In fact, the European Food Safety Authority (EFSA) has determined that claims referencing children's development and health, specifically claims regarding the role of DHA in visual development of infants up to 1 year of age, are adequately substantiated.[14] The adoption and addition of the following claim, "DHA contributes to the visual development of infants," to the approved list of claims designated by EU Regulation 1994/2006 is currently under way.

Statement: "In Addition to the Potential Danger of Bleeding"

The "Adverse Effects" section of the report contains a quote from Medline Plus that states high intakes of omega-3 fatty acids have been associated with an increased risk of bleeding. The draft report identifies the source of this information as "NIH Medline-DHA." We could not find a Medline Plus report on DHA, although we did find a Medline Plus monograph with the title, "Omega-3 fatty acids, fish oil, alpha-linolenic acid" that covers the content mentioned in the draft.[15] By identifying the source of the information as a monograph on DHA, the draft TAP report creates the impression the data are limited to only DHA while the monograph covers the category of omega-3 fatty acids. We would recommend identifying the source of the information with the name used by Medline Plus (i.e., "Omega-3 fatty acids, fish oil, alpha-linolenic acid').

[13] Overview of Accessory/Voluntary Nutrients, Pg. 7, Paragraph 2.
[14] DHA and ARA and visual development, Scientific substantiation of a health claim related to docosahexaenoic acid (DHA) and arachidonic acid (ARA) and visual development pursuant to Article 14 of Regulation (EC) No 1924/2006. Question No EFSA-Q-2008-211. Adopted 22 January 09. The EFSA Journal 941:1-14.
[15] http://www.nlm.nih.gov/medlineplus/druginfo/natural/patient-fishoil.html. Accessed 5-11-2010.

The draft TAP report uses this NIH reference to support the observation that consumption of omega-3 fatty acids presents a potential danger from bleeding.[16] The draft TAP report, however, fails to mention the high level of omega-3 fatty acid intake that is associated with an increased risk of bleeding. Competent authorities world-wide, including the U.S. FDA, recognize DHA and EPA intake must exceed three grams before there could be any potential issues with increased bleeding. When establishing the levels of use of various sources of DHA and EPA, FDA placed restrictions on the maximum amount of DHA and EPA that could be formulated into each food category to ensure that total dietary intake of these two omega-3 fatty acids from all sources would not exceed three grams for the 90th percentile of consumers of the products.[17] FDA first adopted this approach when issuing the GRAS affirmation regulation for menhaden oil in 1997 and again when adjusting the allowance assigned to various food groups in 2005.[18] The submitters of the GRAS notifications for various other sources of DHA and EPA have maintained the same restrictions. Importantly, the addition of nearly a decade of additional research for safety evaluation did not change FDA's conclusions with regard to the safety of DHA+EPA for the general population or persons treated for various medical conditions.

The level of omega-3 fatty acids associated with increased bleeding times is magnitudes higher than the levels currently added to many foods, with many foods containing between 16 and 50 mg of added DHA and EPA per serving. By failing to provide information on the very high levels of omega-3 fatty acids that have been associated with increased bleeding times and the restrictions in place to ensure foods do not approach those levels, the draft report could be construed as implying there is a potential safety issue with increased bleeding times through the consumption of foods containing added omega-3 fatty acids. The potential confusion could be mitigated by removing the draft TAP report's reference to increased bleeding times or disclosing the very high levels that must be consumed (i.e., greater than 3 grams) and the restrictions in place to ensure foods do not exceed those levels.

Separately, we found confusing the discussion of the various beneficial effects associated with omega-3 fatty acid consumption under the "Adverse Effects" section. A summary of the beneficial effects would seem more appropriate in a section distinct from one dedicated to adverse events. We also found confusing the conclusion that "merely three uses, out of potentially thirty-six, are supported by strong data." It should be noted that there currently appears to be no DHA specific entry, but rather, an omega-3 fatty acid/fish oil entry specifying the thirty six health relationships. Medline Plus uses a grading scale to evaluate the various health benefits that ranges from "A to F." The "A" designation is used to identify strong scientific support and "B" denotes good support. A "C" designation is used when the scientific evidence is "unclear" while "D and F" are reserved in instances when there is "fair" or "strong," respectively, evidence against the use. The appropriate focus seemingly should not be on the total number of purported health benefits associated with omega-3 fatty acid consumption, but the strength of the data that exists for a particular health benefit. We believe the reader of the TAP report would find more beneficial a discussion of those health benefits found by NIH to be associated with "strong" or "good" data rather than focusing on the total number of health effects falling in the A, B, C, D, or F categories.

Statement: Vegetable Oil (e.g. soybean, safflower, and corn oil) are sources of Omega-6 Fatty Acids such as ARA

The draft report contains a chart that identifies potential sources of omega-6 fatty acids, such as ARA as soybean, safflower, and corn oil.[19] These vegetable oils supply linoleic acid from which the body can produce ARA. Food containing preformed ARA is limited to eggs, meat, and certain farm raised

[16] Overview of Accessory/Voluntary Nutrients Pg. 7.
[17] Menhaden oil GRAS, U.S. FDA 1997.
[18] Menhaden oil GRAS amendment, U.S. FDA, 2005
[19] Overview of Accessory/Voluntary Nutrients Pg. 5, Paragraph 3.

fish, with no one dietary source supplying an abundance of ARA[20,21] other than human breast milk.[22] We would recommend revising the chart by eliminating vegetable oils as a source for ARA.

While ARA is sufficient in the diets of most adults, the current medical position of the European Society for Pediatric Gastroenterology, Hepatology and Nutrition (ESPGHAN) indicates that ARA is important in the complementary diet, noting that "ARA is the major LCPUFA of the n-6 series and is well represented in the brain."[23] Although breast milk and DHA/ARA supplemented formulas are good sources of ARA, the cessation of exclusive breastfeeding and introduction of complementary foods, which are typically low in ARA, adversely impacts the availability of ARA to infants and children greater than 6 months of age.[24] Without adequate ARA from an abundant source such as breast milk, ARA declines in infants fed formula without added ARA. ARA is believed to contribute to neurologic development during this critical period.[25,26]

Summary of Dietary Reference Intakes

The draft TAP report contains a summary of various articles that have identified the dietary reference intakes that have been recommended by scientific authorities in various countries regarding DHA and EPA intake. Interestingly, since 2006 at least 10 U.S and international authorities have issued DHA and DHA+EPA intake recommendations for infants, children, pregnant and nursing women, adults at risk for heart disease, as well as the general population. The TAP may find the chart below of interest.

World-wide LCPUFA Intake Recommendations and Guidelines **Women and Children**		
Organization	**Amount of DHA or DHA+EPA**	**Reference**
Agence Français de Sécurité Sanitaire des Aliments	250 mg DHA/d for pregnant women 250 mg DHA/day for breastfeeding women	AFSSA Opinion Regarding the Update of the Recommended Dietary Intake for Fatty Acids. AFSSA-Hearing n2006-SA-0359. 2010.
Agence Français de Sécurité Sanitaire des Aliments	70 mg DHA/d for children 1-3 years 125 mg DHA/d for children 3-9 years 250 mg DHA/day for children 10-18 years	AFSSA Opinion Regarding the Update of the Recommended Dietary Intake for Fatty Acids. AFSSA-Hearing n2006-SA-0359. 2010.

[20] Brenna JT and Lapillonne A, 2009. Background paper on fat and fatty acid requirement during pregnancy and lactation. Ann Nutr Metab 55:97-122.
[21] Calder P, 2007. Invited Commentary: Dietary arachidonic acid: harmful, harmless or helpful? Br J Nutr 98:451-453.
[22] Yuhas R, et al. Human milk fatty acid composition from nine countries varies most in DHA. Lipids 41:851-858.
[23] ESPGHAN Committee on Nutrition, 2008. Complementary feeding: A commentary by the ESPGHAN Committee on Nutrition. JPGN 46:99-110.
[24] Luukkainen P, Salo MK, Visakorpi JK, et al. 1996. Impact of solid food on plasma arachidonic and docosahexaenoic acid status of term infants at 8 months of age. J Pediatr Gastroenterol Nutr 23:229-34.
[25] Hoffman et al., 2000. Impact of early dietary intake and blood lipid composition of long-chain polyunsaturated fatty acids on later visual development. JPGN 31:540-553.
[26] Makrides et al., 1996. Effect of maternal docosahexaenoic acid (DHA) supplementation on breast milk composition. EJCN 50:352-357.

Belgian Superior Health Council	40-175 mg DHA/d for children ages 12-36 months 45-110 mg ARA/d for children ages 12-36 months	Superior Health Council. Recommendations Nutritionnelles Pour La Belgique. CSS No. 8309. Revision 2009.
European Food Safety Authority (EFSA)	250 mg DHA+EPA/d for all women plus an additional 100-200 mg DHA/d for pregnant and nursing women	Draft Opinion of the Scientific Panel on Dietetic Products, Nutrition and Allergies on a request from the Commission related to dietary reference values for fats, including saturated fatty acids, polyunsaturated fatty acids, monounsaturated fatty acids, *trans* fatty acids, and cholesterol. 2009. http://www.efsa.europa.eu/en/calls/documents/nda_op_drv_fat_draft_en_released%20for%20consultation,0.pdf
EFSA	100 mg DHA/d for children ages 7-24 months 250 mg DHA+EPA/d for children 2-18 years	Draft Opinion of the Scientific Panel on Dietetic Products, Nutrition and Allergies on a request from the Commission related to dietary reference values for fats, including saturated fatty acids, polyunsaturated fatty acids, monounsaturated fatty acids, *trans* fatty acids, and cholesterol. 2009. http://www.efsa.europa.eu/en/calls/documents/nda_op_drv_fat_draft_en_released%20for%20consultation,0.pdf
International Society for the Study of Fats and Lipids	At least 200 mg DHA/d during pregnancy and nursing	ISSFAL Policy Statement 4: Recommendations for intake of polyunsaturated fatty acids by pregnant and lactating women. 2009.
March of Dimes	At least 200 mg DHA/d during pregnancy and nursing	http://www.marchofdimes.com/pnhec/159_55030.asp , 2009.
FAO/WHO Expert Consultation	At least 200 mg DHA/d toward total 300 mg n-3 EPA+DHA for pregnant and nursing women	From the Joint FAO/WHO Expert Consultation on Fats and Fatty Acids in Human Nutrition, November 10-14, 2008. WHO HQ, Geneva.
FAO/WHO Expert Consultation	80-150 mg DHA/d for children 6-24 months	From the Joint FAO/WHO Expert Consultation on Fats and Fatty Acids in Human Nutrition, November 10-14, 2008. WHO HQ, Geneva.
Perinatal Lipid Intake Working Group	At least 200 mg DHA/d during pregnancy and nursing	Koletzko B, Cetin I, and Brenna TJ. Perinatal Lipid Intake Working Group Consensus Statement: *Dietary fat intakes for pregnant and lactating women*. Brit J Nutr 98:873-7, 2007.
Australia New Zealand National Health and Medical Research Council	Pregnancy 110- 115 mg/day DHA+EPA+DPAn-3 Lactation 140-145 mg/day DHA+EPA+DPAn-3	Nutrient reference values for Australia and New Zealand including recommended dietary intakes. 2005. www.nhmrc.gov.au/publications/synopses/_files/n35.pdf

Adult Cardiovascular Health		
Agence Français de Sécurité Sanitaire des Aliments	500 mg EPA+DHA for cardiovascular disease risk reduction	AFSSA Opinion Regarding the Update of the Recommended Dietary Intake for Fatty Acids. AFSSA-Hearing n2006-SA-0359. 2010.
European Food Safety Authority	250 mg DHA+EPA/d	Draft Opinion of the Scientific Panel on Dietetic Products, Nutrition and Allergies on a request from the Commission related to dietary reference values for fats, including saturated fatty acids, polyunsaturated fatty acids, monounsaturated fatty acids, *trans* fatty acids, and cholesterol. 2009. http://www.efsa.europa.eu/en/calls/documents/nda_op_drv_fat_draft_en_released%20for%20consultation.0.pdf
Heart Foundation of Australia	500 mg DHA+EPA/day for primary prevention of cardiovascular disease; 1000 mg/day for secondary prevention	Position Statement: Fish, fish oils, n-3 polyunsaturated fatty acids and cardiovascular health. 2008. www.heartfoundation.org.au
American Dietetic Association/ Dietitians of Canada	Fish twice/wk, both oily or 500 mg DHA+EPA/d	Kris-Etherton PM, Innis S; American Dietetic Association; Dietitians of Canada. Position of the American Dietetic Association and Dietitians of Canada: dietary fatty acids. J Am Diet Assoc. 2007;107:1599-611.
ANZ National Health and Medical Research Council	610 mg/d for men; 430 mg/d for women as DHA+EPA+DPAn3 for chronic disease risk reduction, primarily based on cardio	National Health and Medical Research Council. Nutrient reference values for Australia and New Zealand including recommended dietary intakes. www.nhmrc.gov.au/publications/synopses/_files/n35.pdf
UK Scientific Advisory Committee on Nutrition	Fish twice/wk, one of which should be oily, minimum intake 450 mg DHA+EPA+DPA n-3/day	Scientific Advisory Committee on Nutrition. Advice on fish consumption. ISBN 0 11 243083. The Stationary Office. London. 2004. http://www.sacn.gov.uk/pdfs/fics_sacn_advice_fish.pdf
Superior Health Council of Belgium	An almost daily serving of fatty fish of varied species or alternatively, capsules of fatty fish oil (EPA+DHA) to the amount of 1 g per day	Hoge Gezondheidsraad Superior Health Council, Advisory Report, Recommendations and claims made on omega-3 fatty Acids (SHC 7945). 2004. https://portal.health.fgov.be/pls/portal/docs/PAGE/INTERNET_PG/HOMEPAGE_MENU/ABOUTUS1_MENU/INSTITUTIONSAPPARENTEES1_MENU/HOGEGEZONDHEIDSRAAD1_MENU/ADVIEZENENAANBEVELINGEN1_MENU/ADVIEZENENAANBEVELINGEN1_DOCS/OMEGA-3%20ENGLISH.PDF
International Society for the Study of Fats and	500 mg DHA+EPA	International Society for the Study of Fats and Lipids (ISSFAL). ISSFAL Policy Statement 3: Recommendations for intake of polyunsaturated fatty

Lipids		acids in healthy adults. 2004. Available from: http://www.issfal.org.uk/lipid-matters/issfal-policy-statements/issfal-policy-statement-3-2.html
American Heart Association	2 servings per week of fish for primary prevention; 1 g DHA+EPA per day for secondary prevention; 2-4 g per day for serum triglyceride reduction	American Heart Association Scientific Statement. Kris-Etherton PM, Harris, WS, Appel LJ and for the Nutrition Committee. Fish consumption, fish oil, omega-3 fatty acids, and cardiovascular disease. 2002. 106:2747-2757. http://circ.ahajournals.org/cgi/content/full/106/21/2747
Adult General Health		
Agence Français de Sécurité Sanitaire des Aliments	Adult man – 250 mg DHA/day Adult woman- 250 mg DHA/day	AFSSA Opinion Regarding the Update of the Recommended Dietary Intake for Fatty Acids. AFSSA-Hearing n2006-SA-0359. 2010.
Health Council of the Netherlands	450 mg n-3 fatty acids from fish	English translation, Health Council of the Netherlands. Guidelines for a healthy diet 2006. The Hauge: Health Council of the Netherlands, 2006; publication no. 2006/21E. http://www.gr.nl/pdf.php?ID=1481&p=1
U.S. Institute of Medicine	Up to 160 mg DHA+EPA/d	Dietary reference intakes for energy, carbohydrate, fiber, fat, fatty acids, cholesterol, protein, and amino acids (Macronutrients). The National Academy of Sciences Press, Washington DC, Chapter 8, 2005. http://www.nap.edu/openbook.php?isbn=0309085373.

Statement: Excerpt from Cornucopia Institute

Lastly, the draft TAP report contains an excerpt quoted directly from a report prepared by the Cornucopia Institute. As disclosed in the draft report, Cornucopia is an advocacy group that is strongly against the inclusion of DHA and ARA in infant formula. The draft TAP report contains a four paragraph excerpt that sets forth Cornucopia's basis for concern. The excerpt from the Cornucopia report contains numerous statements that are lacking in scientific support, including, but not limited to, the following:

> "processed utilizing a toxic chemical, hexane" [hexane is one of the most commonly used solvents to extract food-grade vegetable oils and is considered safe for this use by FDA; furthermore, not all DHA Algal Oil produced by Martek utilizes hexane];
>
> "these algal and fungal oils provide DHA and ARA in forms that are structurally different from those naturally found in human milk" [the ARA and DHA in the Martek oils are on a triglyceride, which is the same structural form as that found in breast milk]; and
>
> "scientists have conducted numerous studies that show little or no benefit to an infant's development from adding DHASCO and ARASCO to infant formula" [the statement ignores the extensive studies that have demonstrated a benefit and the recommendations from

independent experts around the world, summarized in this letter and the draft TAP report, on the importance of including pre-formed DHA and ARA in the diets of infants].

The inclusion of these excerpts in the draft report confers an element of legitimacy to the Cornucopia report that is not supported by an objective review of the underlying data. The Cornucopia excerpt appears in the draft document after excerpts quoted from journal articles that have survived the scrutiny of the peer review process. Martek is concerned the reader could be left with the impression the Cornucopia report is based on the same critical review of the underlying literature and has survived the same rigorous vetting process as the quoted publications authored by Harris et al (2009) and Kris-Etherton et al. (2009). Martek also is concerned that by quoting the Cornucopia report, the TAP could be creating the unintentional impression that it has reviewed the underlying data and believes there is some legitimacy to the positions advanced by Cornucopia.

We question whether it is appropriate for a critical scientific assessment of the underlying literature to include an advocacy piece from either industry or a consumer group. To the extent the TAP considers it appropriate to keep the reference to the Cornucopia report, we believe there should be a qualifying statement making it clear the TAP has not reviewed the underlying data and has not attempted to determine whether there is any scientific support for the statements made in the Cornucopia report.

Martek appreciates the opportunity to provide the National Organic Program information to support the development of an accurate, science-based technical review of accessory nutrients as they relate to DHA and ARA. If you, or any member of your staff, has any questions or would like additional supporting information, do not hesitate to contact us.

Sincerely,

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