Valentina Carpio-Téllez
Parabel Ltd.
7898 Headwaters Commerce Street
Fellsmere, FL 32948

Re: GRAS Notice No. GRN 000742

Dear Ms. Carpio-Téllez:

The Food and Drug Administration (FDA, we) completed our evaluation of GRN 000742. We received Parabel's notice on November 8, 2017 and filed it on December 19, 2017. Parabel submitted amendments to the notice on February 19, 2018; April 16, 2018; June 12, 2018; and August 1, 2018. The amendments included revisions to the dietary exposure assessment.

The subjects of the notice are duckweed powder (DWP) and degreened duckweed powder (DDWP) for use as a source of protein in food at levels ranging from 3-20%.[1] The notice informs us of Parabel's view that this use of DWP and DDWP is GRAS through scientific procedures.

Our use of the terms "duckweed powder" and "degreened duckweed powder" in this letter is not our recommendation of those terms as appropriate common or usual names for declaring the substances in accordance with FDA's labeling requirements. Under Title 21 of the United States Code of Federal Regulations (CFR) 101.4, each ingredient must be declared by its common or usual name. In addition, 21 CFR 102.5 outlines general principles to use when establishing common or usual names for nonstandardized foods. Issues associated with labeling and the common or usual name of a food ingredient are under the purview of the Office of Nutrition and Food Labeling (ONFL) in the Center for Food Safety and Applied Nutrition. The Office of Food Additive Safety (OFAS) did not consult with ONFL regarding the appropriate common or usual name for "duckweed powder" and "degreened duckweed powder."

Duckweeds are aquatic plants in the Lemnoideae subfamily of the plant family Araceae.[2] The notifier intends to use multiple species from the genera *Landoltia, Lemna, Wolffia,* and *Wolfiella*.[3] Although the products may derive from different duckweed species, the

[1] Excluding products regulated by the United States Department of Agriculture.
[2] Parabel describes duckweeds as members of the plant family Lemnaceae. However, FDA notes that current scientific literature generally considers the duckweeds to be a subfamily (Lemnoideae) within the family Araceae.
[3] Parabel states DWP and DDWP would derive from any the following species: *Landoltia punctata, Lemna gibba, Lemna minor, Lemna japonica, Lemna obscura, Lemna turionifera, Lemna valdiviana,*

notifier states that the species are similar in composition and that the resulting products are compositionally uniform.

Parabel describes the method of manufacture for DWP and DDWP. The company obtains duckweed from open field hydroponic growth areas. The duckweed is pre-screened to remove any foreign materials and fed to a thermal washing system to eliminate microbes and pathogens, deactivate enzymes, and remove undesirable components. The material is then dewatered, dried, and milled to obtain DWP. Parabel describes DWP as a free-flowing, green powder. To obtain DDWP, Parabel extracts fats and plant pigments from dewatered duckweed using 95% food-grade ethanol. The material is then dried and milled. Parabel states that both products are manufactured in accordance with current good manufacturing practice.

Parabel states that DWP and DDWP are similar in composition and consist primarily of protein, with lesser amounts of fiber, fat, ash, and moisture. The composition of DWP also includes various carotenoids, vitamins, and chlorophyll. Specifications for DWP include crude protein (39-55%), dietary fiber (30-45%), carbohydrates (≤12%), fat (≤12%), and limits on microorganisms. Specifications for DDWP include crude protein (39-55%), dietary fiber (35-50%), carbohydrates (≤10%), fat (≤10%), and limits on microorganisms. Parabel also includes specifications for lead, mercury, arsenic, and cadmium for both products and monitors levels of heavy metals in production water. Parabel presents the results of analyses of five non-consecutive batches of each product that demonstrate it can be made to conform with the specifications.

Parabel states that DWP and DDWP would be used as a general protein source in food. At the request of FDA, Parabel provided an estimate of exposure based on a budget-type analysis, where a portion of the protein added to the diet would be replaced by DWP or DDWP. The estimate assumes that 50% of protein in the diet is added, and that DWP or DDWP would account for 25-50% of the added protein in the diet. The budget-type analysis provides an estimate of dietary exposure of 27.8-55.6g per person per day.[4]

Parabel discusses published and unpublished data and information supporting the safety of DWP and DDWP. Parabel describes the protein fraction of DWP and DDWP as a source of essential amino acids and states that it is digested like other dietary proteins, by normal metabolic processes. Parabel corroborates the safety of duckweed protein with unpublished studies it conducted with a protein concentrate derived from DWP, consisting of 60-70% crude protein. No mortality or signs of toxicity were observed in an acute oral toxicity study in rats administered DWP protein concentrate by gavage at 2,000 mg/kg body weight (bw), the highest dose tested. No adverse toxicological effects were observed from a subchronic 90-day oral toxicity study in rats administered DWP protein concentrate by gavage, up to 1,000 mg/kg bw/day, the highest dose tested.

Parabel summarizes several published studies of various duckweed preparations as a

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Lemna aequinoctialis, Lemna minuta, Wolfiella gladiata, Wolffia globosa, Wolffia arrhiza, Wolffia brasilensis, and Wolffia columbiana.

[4] FDA also conducted an independent budget-type exposure estimate using the same method and obtained the same values.

nutrient source for cattle, sheep, swine, poultry, fish, and shrimp. Growth was normal, and no adverse effects were observed. Parabel notes that duckweed has a history of safe consumption by humans in Southeast Asia. Parabel states that it has found no evidence of allergic reactions in humans to duckweed protein.

Parabel provides data showing that levels of oxalic acid, which has been reported in the literature to be present in duckweed, are significantly lower in DWP and DDWP than in other plant-based foods. Similarly, levels of other anti-nutritional factors including tannins, phytate, protease inhibitors, and biogenic amines are lower in DWP and DDWP than in other plant-based foods.

Based on the data and information described above, Parabel concludes that the intended use of DWP and DDWP is GRAS.

Standards of Identity

In the notice, Parabel states its intention to use DWP and DDWP in several food categories, including foods for which standards of identity exist, located in Title 21 of the CFR. We note that an ingredient that is lawfully added to food products may be used in a standardized food only if it is permitted by the applicable standard of identity.

Potential Requirement for a Color Additive Petition

There is no GRAS provision for color additives. In the notice, Parabel describes DWP as green. As such, the use of DWP in food products may constitute a color additive use under section 201(t)(1) of the Federal Food Drug and Cosmetic Act (FD&C Act) and FDA's implementing regulations in 21 CFR Part 70. Under section 201(t)(1) and 21 CFR 70.3(f), a color additive is a material that is a dye, pigment, or other substance made by a synthetic process or similar artifice, or is extracted, isolated, or otherwise derived from a vegetable, animal, mineral, or other source. Under 21 CFR 70.3(g), a material that otherwise meets the definition of a color additive can be exempt from that definition if it is used (or is intended to be used) solely for a purpose or purposes other than coloring. Our response to GRN 000742 is not an approval for use as a color additive nor is it a finding of the Secretary of the Department of Health and Human Services within the meaning of section 721(b)(4) of the FD&C Act. Questions about color additives should be directed to the Division of Petition Review in OFAS.

Section 301(ll) of the FD&C Act

Section 301(ll) of the FD&C Act prohibits the introduction or delivery for introduction into interstate commerce of any food that contains a drug approved under section 505 of the FD&C Act, a biological product licensed under section 351 of the Public Health Service Act, or a drug or a biological product for which substantial clinical investigations have been instituted and their existence made public, unless one of the exemptions in section 301(ll)(1)-(4) applies. In our evaluation of Parabel's notice concluding that DWP and DDWP are GRAS under their intended conditions of use, we did not consider whether section 301(ll) or any of its exemptions apply to foods containing DWP or

DDWP. Accordingly, our response should not be construed to be a statement that foods containing DWP or DDWP, if introduced or delivered for introduction into interstate commerce, would not violate section 301(ll).

Conclusions

Based on the information that Parabel provided, as well as other information available to FDA, we have no questions at this time regarding Parabel's conclusion that DWP and DDWP are GRAS under their intended conditions of use. This letter is not an affirmation that either DWP or DDWP is GRAS under 21 CFR 170.35. Unless noted above, our review did not address other provisions of the FD&C Act. Food ingredient manufacturers and food producers are responsible for ensuring that marketed products are safe and compliant with all applicable legal and regulatory requirements.

In accordance with 21 CFR 170.275(b)(2), the text of this letter responding to GRN 000742 is accessible to the public at www.fda.gov/grasnoticeinventory.

Sincerely,

Dennis M. Keefe -S

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