Evaluation of

Dill Oil

For Use as an Ingredient in Tobacco Products

February 2009

INTRODUCTION

Dill oil (CAS # 8006-75-5) is currently used worldwide at levels below **5 ppm** in selected brands of tobacco products manufactured and/or distributed by Philip Morris International, including cigarettes and fine-cut tobacco. This document is a review of the published toxicology information on dill oil abstracted from online toxicity databases.

Overview[a]

The following information was generated from the MICROMEDEX database system http://csi.micromedex.com on February 17th 2009, unless otherwise indicated.

Dill oil is pale-yellow liquid which can be obtained from *Anethum graveolens* (Dill weed oil) or from *Anethum sowa* (Dill seed oil). The both are obtained from stream distillation of the fresh herb and fruits respectively. The dill seed oil has a caraway-like odour and flavour because of the higher carvone content as compared to dill weed oil. Dill oil is widely used in food such as in cheese, baked goods, meat product and many others[1].

As a food flavouring additive, the material has been assessed under the provisions of the *Federal Food, Drug and Cosmetic Act, section 201 (s)*, by the Expert Committee of the USA Flavour and Extract Manufacturers Association (FEMA), to be generally recognised as safe (GRAS) under current conditions of use.

The use of dill oil on tobacco products is regulated in several countries worldwide. It is approved for use in tobacco products as an additive or flavouring in several countries with Tobacco Product Regulations, including e.g., Belgium, Croatia, Czech Republic, Egypt, Finland, France, Germany, Great Britain, Hungary, Lithuania, Macedonia, Romania, Slovak Republic, Spain and Switzerland. Apart from countries that approve its use, there is no country, regardless of the extent to which tobacco products are regulated therein, that affirmatively prohibits the use of this ingredient on tobacco products.

[a] Note: Philip Morris International shares the concerns of regulators and the public health community about the proliferation of certain cigarette brands that have a predominantly candy-like or fruity flavour and are particularly appealing to minors, and we support legislation that would ban such cigarettes. However, there is currently no consistent terminology used by regulators and the public health community to describe such cigarettes. This can lead to confusion and potential for misinterpretation. In this document, any references to flavours or "smoke aroma" or flavour perceptions such as "sweet", "fruity", etc. are not meant to describe a flavour, taste or aroma that would dominate the taste of the final product, let alone dominate it in a way that is appealing to minors. Rather, such references are only used to explain the differences and nuances between the various flavours described in this and related documents.

TOXICITY DATA ON UNBURNT MATERIAL

Health Hazard Data

The following information was generated from the RTECS – Registry of Toxic Effects of Chemical Substances (last revision December 1999), a database of MICROMEDEX Systems (http://csi.micromedex.com) on February 17th 2009.

Acute toxicity

LDLO/LCLO - LOWEST PUBLISHED LETHAL DOSE/CONC

Mouse

LDLo - ROUTE: Oral; DOSE: 3 gm/kg [Indian Journal of Pharmacy. (Bombay, India) V.1-40(1), 1939-78. For publisher information, see IJSIDW. (34,69,1972)]

LD50/LC50 - LETHAL DOSE/CONC 50% KILL

Rat

LD50 - ROUTE: Oral; DOSE: 4040 mg/kg [Food and Cosmetics Toxicology. (London, UK) V.1-19, 1963-81. For publisher information, see FCTOD7. (14,747,1976)]

Mouse

LD50 - ROUTE: Subcutaneous; DOSE: 1350 mg/kg [Veterinary Medical Journal Giza. (Cairo University, Faculty of Veterinary Medicine, Giza, Egypt) V.37- 1989- (43,167,1995)]

Rabbit

LD50 - ROUTE: Skin; DOSE: >5 gm/kg [Food and Chemical Toxicology. (Pergamon Press Inc., Maxwell House, Fairview Park, Elmsford, NY 10523) V.20- 1982- (20,673,1982)]

Irritation

SKIN - STANDARD DRAIZE TEST

Rabbit

ROUTE: Skin; DOSE: 500 mg/24H; REACTION: Moderate [Food and Chemical Toxicology. (Pergamon Press Inc., Maxwell House, Fairview Park, Elmsford, NY 10523) V.20- 1982- (20,673,1982)]

Genetic effects

MUTATIONS IN MICROORGANISMS

Bacteria - S Typhimurium

DOSE: 1 mg/plate (-S9) [Journal of Pharmacobio-Dynamics. (Japan Pub. Trading Co. (USA), 1255 Howard St., San Francisco, CA 94103) V.1- 1978- (3,236,1980)]

Other multiple dose toxicity data

Rat

TDLo - ROUTE: Subcutaneous; DOSE: 70 mg/kg/4W intermittent [Hormone and Metabolic Research. (Georg Thieme Verlag, Postfach 732, D-7000 Stuttgart 1, Fed. Rep. Ger.) V.1- 1969- (30,730,1998)]

TOXIC EFFECTS:

Blood - Changes in serum composition (e.g., TP, bilirubin, cholesterol)

Others - Changes in prostate weight

Others - Changes in testicular weight

TOXICITY DATA ON BURNT MATERIAL

Data on the toxicity of dill oil as a cigarette ingredient has been evaluated in a series of studies. The results of these studies may be found in the following references:

Baker R.R. *et al*. 2004, "An overview of the effects of tobacco ingredients on smoke chemistry and toxicity", Food and Chemical Toxicology, 42S:53-83. **PEER REVIEWED**

Carmines E.L., 2002, "Evaluation of the Potential Effects of Ingredients Added to Cigarettes. Part I: Cigarette Design, Testing Approach and Review of Results," Food and Chemical Toxicology, 40:77-91. **PEER REVIEWED**

Rustemeier K. *et al.* 2002, "Evaluation of the Potential Effects of Ingredients Added to Cigarettes Part II. Chemical Smoke Composition," Food and Chemical Toxicology, 40:93-104. **PEER REVIEWED**

Roemer E. *et al.* 2002, "Evaluation of the Potential Effects of Flavor Ingredients Added to Cigarettes. Part 3. In Vitro Genotoxicity and Cytotoxicity," Food and Chemical Toxicology, 40:105-111. **PEER REVIEWED**

Vanscheeuwijck P.M. *et al.* 2002, "Toxicological Evaluation of Cigarettes without and with the Addition of Flavor Ingredients to the Tobacco. Part 4. Subchronic Inhalation Toxicity," Food and Chemical Toxicology, 40:113-131. **PEER REVIEWED**

CONCLUSION

Smoking causes lung cancer, heart disease, emphysema and other serious diseases in smokers. Smokers are far more likely to develop serious diseases, like lung cancer, than non-smokers. There is no "safe" cigarette. Government health warnings about smoking apply to all cigarettes, regardless of the ingredients added, including those containing only tobacco and paper.

While Philip Morris International has not conducted human studies on the health effects of ingredients used in cigarette manufacture, studies have been conducted by Philip Morris International and/or others using scientifically accepted *in vitro* and *in vivo* toxicity assays with various ingredient mixtures. These studies show there is no meaningful difference in the composition or toxicity of smoke when the smoke from cigarettes with the added ingredient is compared to the smoke from cigarettes without this added ingredient. Based on a review of current published toxicological information, it is our scientific judgement that the addition of dill oil as an ingredient, at the levels used in our brands, does not increase the overall toxicity of tobacco smoke.

References

1. Burdock, G. A. *Fernaroli's Handbook of Flavor Ingredients, 5th Edition*. **2005**. CRC Press.