State of California

Memorandum

HSM-96004

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To: Karen Fletcher, Registration Specialist
Pesticide Registration Branch

Date: March 27, 1996

Place: Sacramento

Phone： 445-4244

From: Department of Pesticide Regulation - Tareq A. Formoli, Associate Environmental Research Scientist
Worker Health and Safety Branch
[original signed by T. Formoli]

PRODUCT NAME: eco-fresh®
ACTIVE INGREDIENT: Orthoboric Acid
COMPANY NAME: eco-fresh Industries, Inc.
I.D. NUMBER: 159988-E
DOCUMENT NUMBER: 50366-124
EPA REGISTRATION NUMBER: 66480-1
TITLE: Evaluation of Human Exposure Potential to eco-fresh Carpet Treatment for Fleas

The subject product, eco-fresh®, is a powder that can be used in residential, institutional, and industrial areas as well as in boats, trucks, buses, upholstery, and sewers to control fleas, cockroaches, ants, and silverfish. It contains 64% orthoboric acid as the active ingredient. It is applied only when children and pets do not have access to treatment areas. The maximum application rate on carpets of residential areas is 1 lb/100 ft^2 (3.1 mg a.i./cm^2). The product must be applied to dry carpet surfaces only and worked deep into the fibers. Any powder visible after application must be brushed into the carpet fibers or removed. The use on upholstery is limited to the unexposed areas such as wells, crevices, and corners. This product can also be mixed with water at a rate of one cup of powder in one gallon of water to be used as a mop solution. Application to food areas is limited to cracks and crevices.

This data volume contains a study that evaluated the dislodgeable residues of a product that contained 100% orthoboric acid following application to carpet and linoleum to estimate human exposure. Carpet sections (4-year old nylon) at four separate rooms were treated at the application rate of 3 lb/100 ft^2 (14.7 a.i./cm^2 **(correction 9.3 mg a.i./cm^2)**) as a worst case condition. This application rate was approximately 5 times **(correction 3 times)** the maximum application rate for eco-fresh. The powder was worked into the carpet with a kitchen utility broom. Two uncarpeted sites that were covered with linoleum were treated with a sponge squeeze mop. The application rate for linoleum was one cup of the test material (197 grams) in one gallon of water for mop-on treatment. Pre-washed cotton dosimeters (3,932 cm) were used to collected dislodgeable residues. Dislodgeable residue samples were collected using the CDFA roller method (Ross *et al*., 1991). The carpet and pad were in fair condition with obvious wear in some areas.

All cotton dosimeters were extracted with water on an oscillating extraction apparatus. Samples were analyzed for total boron, using inductively coupled argon plasma/mass spectrometry. The detection limit for boron was 0.01 mg/L. The average (n = 4) recoveries for samples spiked at 505, 1010, and 2020 ug were 129, 114, and 95%, respectively. Linoleum and the carpet with more wear had higher dislodgeable residues compared to the open pile carpet with little wear, as shown in Table 1.

Table 1. Dislodgeable Boron (ug/cm^2) on Carpets and Linoleums Treated with Orthoboric Acid

	Carpet with open pile/little wear	Carpet with tight short pile/more wear	All carpets	Linoleum
Number of replicates	6	6	12	6
Dislodgeable residue	0.127 ± 0.081	0.850 ± 0.489	0.489 ± 0.487	0.815 ± 0.515

One method of estimating the exposure to treated surfaces is the Transfer Factor Model. Using a dermal transfer factor of 43,800 cm^2/hour for an adult human that was obtained in evaluation of an indoor occupant exposure study (Formoli, 1994) and the dislodgeable residue values in Table 1, absorbed daily dosages (ADD) are estimated in Table 2. We assume that one hour would be a reasonable estimate of aerobic contact of the full body with a carpet surface.

Table 2. Estimates of Dermally and Orally Absorbed Doses of Boron Based on Transfer Factor Model

	Type of Floor Cover	Dislodgeable Residues (DR) (ug/cm^2)	Transfer Factor (TF) (cm^2/hr)	Dermal Dose[a] (mg/person)	Oral Dose[b] (mg/person)	Total ADD (mg/person)
Adult	carpet	0.489	43,800	0.21	0.15	0.36
Child	carpet	0.489	8,760[c]	0.04	0.30	0.34
Adult	linoleum	0.815	43,800	0.36	0.25	0.61
Child	linoleum	0.815	8,760[c]	0.07	0.50	0.57

a. Dermal Dose (mg/person/hour) = DR (ug/cm^2) x TF (cm^2/hour) x 0.01(dermal absorption)/1000
b. Oral dose (mg/person) = DR (ug/cm^2) x TF (cm^2/hour) x 0.14 (hand exposure of 14%) x 0.05 or 0.5 (hand residue ingestion of 5% or 50% by adults or children (Ross *et al*., 1992))/1000.
c. Corrected by a ratio of adults body surface area to that of children.

Durkin *et al*. (1995) used several studies to assess the relationship of dislodgeable residues on plants to residues on hands. They indicated that the transfer rate expressed as ug/cm^2/hour is approximately equal to the dislodgeable foliar residues expressed as ug/cm^2. This is consistent with the equilibrium model Worker Health and Safety Branch has historically been using to estimate daily dermal exposure from treated surfaces. Using the Equilibrium Model (Durkin *et al*., 1995) and the dislodgeable residue values in Table 1, the ADD could also be estimated as shown in Table 3.

Table 3. Estimates of Dermally and Orally Absorbed Doses of Boron Based on Equilibrium Model

	Body surface area (cm^2)	Dislodgeable Residues (DR) (ug/cm^2)	Transfer Rate (TR)[a] (ug/cm^2)	Dermal Dose[b] (mg/person)	Oral Dose[c] (mg/person)	Total ADD (mg/person)
Adult on carpet	19,400	0.489	0.55	0.11	0.08	0.19
Child on carpet	3,925	0.489	0.55	0.02	0.15	0.17
Adult on linoleum	19,400	0.815	0.90	0.17	0.12	0.29
Child on linoleum	3,925[d]	0.815	0.90	0.04	0.25	0.29

a. Log TR = 1.09 log DFR + 0.05 (Durkin *et al*., 1995)
b. Dermal dose (mg/person) = Body surface area (cm^2) x TR (ug/cm^2) x 0.01(Dermal absorption of 1%)/1000
c. Oral dose (ug/person) = Body surface area (cm^2) x TR (ug/cm^2) x 0.14 (hand exposure of 14%) x 0.5 or 0.05 (hand residue ingestion of 5% or 50% by children or adults)/1000.
d. Snyder *et al*., 1974

Conclusion:
The permissible exposure level (PEL) for borates and boron oxide dust is 10 mg/m^3 for occupational exposure. However, no significant exposure via inhalation is anticipated due to lack of vaporization of boric acid and the relatively large particle size and concomitant settling rate of the dust. The estimates of dermal exposure in Tables 2 and 3 are made for residential occupants wearing no clothing and based on 1% dermal absorption. These are conservative assumptions that would result in conservative estimates of dermally absorbed doses. Dermal absorption of boric acid may be much less than 1%. Studies have shown no or insignificant absorption of boric acid from intact skin (Draize and Kelley, 1958; Stuttgen, *et al*., 1982; Pfeiffer, *et al*., 1945), but boric acid is readily absorbed from broken or abraded skin (Stuttgen, *et al*., 1982; Pfeiffer, *et al*., 1945). In addition, clothing will provide significant dermal protection to the covered areas of the body and reduce dermal exposure (Thongsinthusak *et al*., 1993).

Boron is present in food, water, laundry and hand soaps, cosmetics, and pharmaceuticals. The daily intake of boron from water and food has been estimated to range between 0.5 to 20 mg/day for an adult human, with an average of 3 mg/day (Hunt, *et al*., 1991; Seiler and Sigel, 1988; WHO, 1973; Nielsen, 1991). A typical school lunch provides approximately 0.5 mg of boron (WHO, 1973). The estimates of boron ADD in Tables 2 and 3 for residential occupants exposed to treated carpets are below the average human daily boron intake from food and water.

Recommendation:
Based on the submitted data, human exposure to boric acid from the use of eco-fresh to carpets and linoleum as directed on the label is insignificant.

References:

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