BUG REPELLENT: *Chemicals of Concern*

A MADE SAFE® REPORT

Insect repellents are regulated as pesticides in the United States because the active ingredients in repellents *are* pesticides. According to the EPA website: "People often think of the term pesticide as referring only to something that kills insects, but 'pesticide' is a broad term and includes products that don't kill anything, such as insect repellents." Also, "Minimum Risk Pesticides" are exempted from regulation, and the essential oils we approve as botanical repellents are eligible for the minimum risk pesticide exemption.

Bug repellents are made up of two types of ingredients. Active ingredients are the active repelling chemicals and must appear on the label. Inert ingredients are everything else in the products and can range from solvents and preservatives to anti-caking or foaming agents and even fragrance. None of these inert ingredients are required to be listed on the label.

ACTIVE INGREDIENTS OF CONCERN

This list is not exhaustive, but a good place to start given their frequency in insect repellents. *None of these chemicals are permitted in MADE SAFE certified products.*

DEET

DEET, which is an acronym for N,N-Diethyl-meta-toluamide, is one of the most effective bug repellents and also repels ticks.

DEET and Health

Large doses of DEET have been linked to skin blisters, seizures, memory loss, headaches, stiffness in the joints, shortness of breath, and skin irritation. DEET is also linked to neurotoxicity that may lead to physiological and behavioral problems, especially with motor skills, and learning and memory dysfunction.

DEET is absorbed quickly through the skin: one study showed that 48% of the applied dose is

totally absorbed within six hours. When mixed with the sunscreen chemical oxybenzone, it was found to be absorbed even more quickly. DEET has been shown to cross the placenta: in animal studies, DEET was found in the fetus and in newborns up to three months old after exposing the mother to the chemical.

DEET and the Environment

DEET breaks down slowly in soil and has potential to contaminate groundwater; it has been detected in groundwater, surface water, and drinking water.

Cyfluthrin

Cyfluthrin structurally resembles DDT and has a similar mode of action. Also similarly to DDT, it accumulates in fatty tissues.

Cyfluthrin and Health

Cyfluthrin is linked to neurotoxicity, interfering with sodium and potassium ion channels in the nerves which may result in loss of coordination, muscle trembling, and behavior changes. Studies show harmful effects of cyfluthrin on blood, including decreased glucose and red blood cells; disruption of liver function; and behavior changes after exposure in the womb.

Cyfluthrin and the Environment

Cyfluthrin is harmful to aquatic invertebrates, fish, and honeybees.

Permethrin

Permethrin is a synthetic pesticide most frequently used to treat bug resistant clothing, mosquito netting and outdoor gear, although it's also often used in bug sprays and very commonly used worldwide as a pesticide for crops.

Permethrin and Health

Permethrin is linked to neurotoxicity, which acts on sodium ion channels, causing repeated nerve impulses. At high levels, it can affect the function of chloride channels, which may result in seizures. One study found that permethrin and DEET, either in combination or alone, were linked to the death of neural cells in various parts of the brain which may lead to many physiological and behavioral issues, including problems with motor skills, learning and memory. Another study found that newborn exposure to permethrin impaired working memory by interfering with neural processing in the frontal lobe of the brain.

Permethrin and the Environment

Permethrin is toxic to fish, aquatic life, and bees.

Pyrethroids

Pyrethroids are the most common chemical class for bug repellent chemicals. This class contains over 1,000 insecticides, including:

- Lambda-cyhalothrin
- Prallethrin Metofluthrin
- dl-allethrolone, d-trans chrysanthemate
- Tetramethrin
- Phenothrin
- dl-trans allethrin

Pyrethroids and Health

Pyrethroids are lipophilic, which means they love fat cells. They can easily cross the blood-brain-barrier and can thus become toxic to the central nervous system; the WHO has said that synthetic pyrethroids are neuropoisons. Acute reactions to pyrethroids include dermatitis and asthma-like reactions, nausea, incoordination, and burning and itching sensations. The most severe poisoning cases have been reported in infants, because their systems can't efficiently break down pyrethroids. Many pyrethroids have been linked to endocrine disruption like estrogen in the body, and some have been classified as possible carcinogens.

Pyrethroids and the Environment

Most of the chemicals in this class are toxic to fish and aquatic life.

NATURAL BUG REPELLENTS & PLANT BASED ALTERNATIVES

The MADE SAFE® screening process doesn't allow the inclusion of high risk pesticides in products. Therefore we only approve products made without these chemicals, usually focusing on those that take a natural approach to bug repellent. See more about natural bug repellent options at www.madesafe.org/bugrepellent. Natural repellent may work for casual settings to diminish bites, but it cannot prevent diseases. With the rise of Zika virus and concern for other mosquito-borne diseases, we recognize there is a time and place for the use of bug repellent products that would not pass our screening process.

We urge people to become informed and stay on top of advice from the Centers for Disease Control (CDC) and the World Health Organization (WHO).

ZIKA AND OTHER MOSQUITO-BORNE ILLNESSES

Knowing your area and if you are at risk for a mosquito-borne or tick-borne illness can help you make the right bug repellent choice for you and your family. Go to Consumer Reports' Guide to Mosquito and Tick Diseases for information for your area.

As of July 2016, there were more than 1600 confirmed cases in the United States of Zika virus (a condition that causes microcephaly, a condition in which babies are born with unusually small heads). While the vast majority of these cases were contracted from travel abroad, a growing number of cases were contracted in Florida. The CDC recommends avoiding travel abroad to countries with confirmed Zika cases and has issued warnings in Miami, FL as well. This list is changing and should be monitored as the Zika virus spreads. Note that the CDC recommends using EPA-approved insect repellents, which include DEET, IR3535, citronella, picaridin, and lemon eucalyptus oil.

Zika virus should be taken very seriously. Here is one recent article in the *New York Times* about the virus. We urge people to keep apprised of the changing information around this epidemic, the areas impacted and any changes in advice as it becomes available.

If you think you might be at risk or are experiencing symptoms of an insect-borne illness, heed the advice from the CDC, WHO, and your doctor.

For more on bug repellent, visit www.madesafe.org/bugrepellent