

## Insect Repellent Use and Safety

**Repellents are an important tool to assist people in protecting themselves from mosquito-borne diseases.**

CDC recommends the use of products containing active ingredients which have been registered by the U.S. Environmental Protection Agency (EPA) for use as repellents applied to skin and clothing. EPA registration of repellent active ingredients indicates the materials have been reviewed and approved for efficacy and human safety when applied according to the instructions on the label.

### General Questions

#### **Q. Why should I use insect repellent?**

**A.** Insect repellents can help reduce exposure to mosquito bites that may carry viruses such as West Nile virus that can cause serious illness and even death. Using insect repellent allows you to continue to play and work outdoors with a reduced risk of mosquito bites.

#### **Q. When should I use mosquito repellent?**

**A.** Apply repellent when you are going to be outdoors. Even if you don't notice mosquitoes there is a good chance that they are around. Many of the mosquitoes that carry West Nile virus bite between dusk and dawn. If you are outdoors around these times of the day, it is especially important to apply repellent. In many parts of the country, there are mosquitoes that also bite during the day, and some of these mosquitoes have also been found to carry West Nile virus.

#### **Q. How often should repellent be reapplied?**

**A.** In general you should re-apply repellent if you are being bitten by mosquitoes. Always follow the directions on the product you are using. Sweating, perspiration or getting wet may mean that you need to re-apply repellent more frequently.

Repellents containing a higher concentration (higher percentage) of active ingredient typically provide longer-lasting protection.

#### **Q. How does mosquito repellent work?**

**A.** Female mosquitoes bite people and animals because they need the protein found in blood to help develop their eggs. Mosquitoes are attracted to people by skin odors and carbon dioxide from breath. The active ingredients in repellents make the person unattractive for feeding. Repellents do not kill mosquitoes. Repellents are effective only at short distances from the treated surface, so you may still see mosquitoes flying nearby.

### Active Ingredients (Types of Insect Repellent)

#### **Q. Which mosquito repellents work best?**

**A.** CDC recommends using products that have been shown to work in scientific trials and that contain active ingredients which have been registered with the [US Environmental Protection Agency \(EPA\)](#) for use as insect repellents on skin or clothing. When EPA registers a repellent, they evaluate the product for efficacy and potential effects on human beings and the environment. EPA registration means that EPA does not expect a product, when used according to the instructions on the label, to cause unreasonable adverse effects to

human health or the environment.

Of the active ingredients registered with the EPA, CDC believes that two have demonstrated a higher degree of efficacy in the peer-reviewed, scientific literature (See [Publications](#) page). Products containing these active ingredients typically provide longer-lasting protection than others:

- DEET (N,N-diethyl-m-toluamide)
- Picaridin (KBR 3023)

Oil of lemon eucalyptus [active ingredient: p-menthane 3,8-diol (PMD)], a plant-based repellent, is also registered with EPA. In two recent scientific publications, when oil of lemon eucalyptus was tested against mosquitoes found in the US it provided protection similar to repellents with low concentrations of DEET.

**Q. How does the percentage of active ingredient in a product relate to the amount of protection it gives?**

**A.** Typically, the more active ingredient a product contains the longer it provides protection from mosquito bites. The concentration of different active ingredients cannot be directly compared (that is, 10% concentration of one product doesn't mean it works exactly the same as 10% concentration of another product.)

DEET is an effective active ingredient found in many repellent products and in a variety of formulations. Based on a 2002 study (Fradin and Day, 2002. See [Publications](#) page.):

- A product containing 23.8% DEET provided an average of 5 hours of protection from mosquito bites.
- A product containing 20% DEET provided almost 4 hours of protection
- A product with 6.65% DEET provided almost 2 hours of protection
- Products with 4.75% DEET were both able to provide roughly 1 and a half hour of protection.

These examples represent results from only one study and are only included to provide a general idea of how such products may work. Actual protection will vary widely based on conditions such as temperature, perspiration, and water exposure.

Choose a repellent that provides protection for the amount of time that you will be outdoors. A product with a higher percentage of active ingredient is a good choice if you will be outdoors for several hours while a product with a lower concentration can be used if time outdoors will be limited. Simply re-apply repellent (following label instructions) if you are outdoors for a longer time than expected and start to be bitten by mosquitoes.

**Q. Why does CDC recommend certain types of insect repellent?**

**A.** CDC recommends products containing active ingredients which have been registered with [US Environmental Protection Agency \(EPA\)](#) for use as insect repellents on skin or clothing.

All of the EPA-registered active ingredients have demonstrated repellency however some provide more longerlasting protection than others. Additional research reviewed by CDC suggests that repellents containing DEET (N,N-diethyl-m-toluamide) or picaridin (KBR 3023) typically provide longer-lasting protection than the other products and oil of lemon eucalyptus (p-menthane-3,8-diol) provides longer lasting protection than other plant-based repellents. Permethrin is another long-lasting repellent that is intended for application to

clothing and gear, but not directly to skin. In general, the more active ingredient (higher concentration) a repellent contains, the longer time it protects against mosquito bites.

People who are concerned about using repellents may wish to consult their health care provider for advice. The National Pesticide Information Center (NPIC) can also provide information through a toll-free number, 1-800-858-7378 or [npic.orst.edu](http://npic.orst.edu)

**Q. How can you know which active ingredient a product contains?**

**A.** Check the product label if you have questions--repellents must specify their active ingredients. In some cases you will note the chemical name in addition to/instead of the "common" name:

- DEET is N,N-diethyl-m-toluamide
- Picaridin is KBR 3023, sometimes known as "Bayrepel" outside the US
- The active ingredient in oil of lemon eucalyptus is p-menthane 3,8-diol (PMD)

**Q. What is permethrin?**

**A.** Certain products which contain permethrin are recommended for use on clothing, shoes, bed nets, and camping gear, and are registered with EPA for this use. Permethrin is highly effective as an insecticide and as a repellent. Permethrin-treated clothing repels and kills ticks, mosquitoes, and other arthropods and retains this effect after repeated laundering. The permethrin insecticide should be reapplied following the label instructions. Some commercial products are available pretreated with permethrin.

**Q. Where can I find these repellents?**

**A.** Most of these repellents are sold at multiple retail, discount and drug stores. A wider selection may be available at "outdoor" stores or in hunting and camping sections. At this time picaridin is not yet registered with the state pesticide programs in NY and CA, and thus is not available in those areas.

**Q. Where can I find more information about picaridin?**

**A.** More information is available from EPA ([Environmental Protection Agency \(EPA\)](http://www.epa.gov)).

## Using Repellents Properly

**Q. What are some general considerations to remember when using insect repellents?**

**A.** Always follow the recommendations appearing on the product label.

- Use enough repellent to cover exposed skin or clothing. Don't apply repellent to skin that is under clothing. Heavy application is not necessary to achieve protection.
- Do not apply repellent to cuts, wounds, or irritated skin.
- After returning indoors, wash treated skin with soap and water. (This may vary depending on the product. Check the label.)
- Do not spray aerosol or pump products in enclosed areas.
- Do not spray aerosol or pump products directly to your face. Spray your hands and then rub them carefully over the face, avoiding eyes and mouth.

**Q. What are some reactions to be aware of when using insect repellents?**

**A.** Use of repellents products may cause skin reactions in rare cases. Most products also note that eye irritation can occur if product gets in the eye. If you suspect a reaction to a product, discontinue use, wash the treated skin, and call a poison control center. If product

gets in the eyes flush with water and consult health care provider or poison control center. If you go to a doctor, take the product with you.

There is a national number to reach a Poison Control Center near you: 1-800-222-1222.

## Children

### **Q. Can insect repellents be used on children?**

**A.** Repellent products must state any age restriction. If there is none, EPA has not required a restriction on the use of the product.

According to the label, oil of lemon eucalyptus products should NOT be used on CHILDREN UNDER 3 YEARS.

In addition to EPA's decisions about use of products on children, many consumers also look to the opinion of the [American Academy of Pediatrics](#) (AAP). The AAP does have an opinion on the use of DEET in children (see below). AAP has not yet issued specific recommendations or opinion concerning the use of picaridin or oil of lemon eucalyptus for children. CDC will post a link to such information from the Academy when/if it becomes available.

Since it is the most widely available repellent, many people ask about the use of products containing DEET on children. No definitive studies exist in the scientific literature about what concentration of DEET is safe for children. No serious illness has been linked to the use of DEET in children when used according to manufacturer's recommendations.

The [American Academy of Pediatrics](#) (AAP) Committee on Environmental Health has updated their recommendation for use of DEET products on children in 2003, citing: "Insect repellents containing DEET (N,N-diethyl-m-toluamide, also known as N,N-diethyl-3-methylbenzamide) with a concentration of 10% appear to be as safe as products with a concentration of 30% when used according to the directions on the product labels." AAP recommends that repellents with DEET should not be used on infants less than 2 months old.

Parents should choose the type and concentration of repellent to be used by taking into account the amount of time that a child will be outdoors, exposure to mosquitoes, and the risk of mosquito-transmitted disease in the area.

If you are concerned about using repellent products on children you may wish to consult a health care provider for advice or contact the National Pesticide Information Center (NPIC) through their toll-free number, 1-800-858-7378 or [npic.orst.edu](http://npic.orst.edu)

### **Q. What guidelines are available for using a repellent on children?**

**A.** Always follow the recommendations appearing on the product label when using repellent:

- When using repellent on a child, apply it to your own hands and then rub them on your child. Avoid children's eyes and mouth and use it sparingly around their ears.
- Do not apply repellent to children's hands. (Children may tend to put their hands in their mouths.)
- Do not allow young children to apply insect repellent to themselves; have an adult do it for them.
- Keep repellents out of reach of children.
- Do not apply repellent under clothing. If repellent is applied to clothing, wash treated clothing before wearing again. (May vary by product, check label for specific instructions.)

**Q. How else can I protect children from mosquito bites?**

**A.** Using repellents on the skin is not the only way to avoid mosquito bites. Children (and adults) can wear clothing with long pants and long sleeves while outdoors. DEET or other repellents such as permethrin can also be applied to clothing (but is not registered for use on skin), as mosquitoes may bite through thin fabric.

Mosquito netting can be used over infant carriers.

Finally, it may be possible to reduce the number of mosquitoes in the area by getting rid of containers with standing water that provide breeding places for mosquitoes.

**Q. Can insect repellents be used by pregnant or nursing women?**

**A.** Other than the routine precautions noted earlier, EPA does not recommend any additional precautions for using registered repellents on pregnant or lactating women. Consult your health care provider if you have questions.

**Insect Repellents containing DEET and Sunscreen**

**Q. Can I use an insect repellent and a product containing sunscreen at the same time? What are the recommendations for combination sunscreen/insect repellent products ?**

**A.** Yes. People can, and should, use both a sunscreen and an insect repellent when they are outdoors. Follow the instructions on the package for proper application of each product. In general, the recommendation is to apply sunscreen first, followed by repellent.

It is recommended NOT to use a single product that combines insect repellent containing DEET and sunscreen, because the instructions for use of insect repellents and use of sunscreen are different. In most situations, insect repellent does not need to be reapplied as frequently as sunscreen. While no recommendations are available at this time regarding products that combine other active ingredients and sunscreen, it is important to always follow the label on whatever product you are using.

To protect from sun exposure and insect bites, you can also wear long sleeves and long pants. You can also apply insect repellent to your clothing, rather than directly to your skin.

**More Information**

**Q. Where can I get more information about repellents?**

**A.** For more information about using repellents, please consult the [Environmental Protection Agency \(EPA\) Web site](#) or consult the National Pesticide Information Center (NPIC), which is cooperatively sponsored by Oregon State University and the U.S. EPA. NPIC can be reached at: [npic.orst.edu](http://npic.orst.edu) or 1-800-858-7378.

Some additional references are provided on our [Publications](#) page.