**DEET Toxicity**

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**Introduction**

N,N-diethyl-m-toluamide (DEET) is an effective and commonly used mosquito repellent. DEET was first developed by the US Department of Agriculture for use by military personnel in 1946, and was later registered for use in the general population in 1957. DEET is regulated by the Environmental Protection Agency (EPA). It is now widely used, with up to 30% of the US population using DEET every year. 1 DEET is the most common active ingredient found in commercially available insect repellents, with concentrations ranging from 5% to 100%. 2 Product forms include pressurized aerosols, aerosol pump sprays, lotions and creams, liquids, roll-ons and towelettes. It is theorized that mosquitoes have a sense of smell and are able to detect DEET, which initiates avoidance behavior. 3

**Human Pharmacokinetics**

Despite its widespread use, information about the pharmacokinetics of DEET in humans is lacking. Human studies have shown that between 5-17% of the applied dose of DEET is absorbed through the skin. 4 Therefore, the majority of DEET remains on the skin and can be recovered from the skin upon washing. Of the DEET that is absorbed through the skin, the majority is excreted in the urine. 5

Generally, insect repellent efficacy increases in proportion to DEET concentration; however, controversy remains regarding the safety of increasing DEET concentrations. 6 Although serum DEET concentrations can be measured by some commercial laboratories, serum concentrations are rarely obtained in suspected poisonings, and therefore toxic serum concentrations are not well established.

**Human Toxicity**

The mechanism of action of DEET toxicity in humans has not yet been fully elucidated. In the past, the majority of information regarding DEET toxicity came from animal studies. More recent information on toxicity in humans includes case reports, information from poison control centers (PCC), as well as information gathered from the DEET registry.

Despite extensive topical use in the United States, reported DEET toxicity is rare. Toxicity after topical use has been reported most often in children usually following excessive application. 7 Toxicity primarily involves the central nervous system (CNS), cardiovascular system as well as the skin (cutaneous/allergic reactions). Several deaths have been reported in children who developed CNS toxicity following excessive use of DEET as well as following intentional ingestion. 2,7-11 A study analyzing 20,764 DEET exposures reported to the American Association of Poison Control Centers between the years of 1993-1997 indicated that a majority of the cases (70%) reported no symptoms related to the exposure. 12 The occurrence of symptoms was related to the route of exposure, with the highest rates associated with ocular exposure, followed by inhalation, multiple exposure routes, dermal and ingestion. The majority of exposures involved infants and children, but this group also experienced lower rates of adverse effects compared to teens or adults. Additionally, there was not a correlation between concentration of DEET in the product and the occurrence of adverse effects. There were two deaths reported in this study, one in a 26-year-old male and one in a 34-year-old female, both following dermal exposure.

The DEET Registry was a post-marketing surveillance system designed to document adverse effects associated with the use of DEET containing products. The registry was (cont. on pg. 3)
M-44 SODIUM CYANIDE

The United States Department of Agriculture, Animal and Plant Health Inspection Service, Bureau of Wildlife Services would like us to remind you that the M-44 sodium cyanide device is used in Utah. The ejector device contains a capsule of sodium cyanide and is baited with meat and placed in the ground. This device is used in specific situations to control coyotes, red fox, gray fox and wild dogs in order to protect livestock and endangered species and to prevent the spread of disease. This device is primarily used on private lands but may also be used on federal land in any county in the state. Areas where the M-44 sodium cyanide device is used are marked with signs. While human exposure to this device is extremely unlikely, be aware this device contains 91% sodium cyanide for which there is an antidote. Please report any exposure to this device to the Utah Poison Control Center at (800) 222-1222.

FAST FAXES

UPCC now offers Fast Faxes, which are concise management guidelines for potentially complicated exposures and useful recommendations for the administration of various antidotes. Please call the UPCC at (800) 222-1222 to request a faxed copy if desired.

Titles Include:
- Arsenic
- Beta blockers
- Calcium channel blockers
- Digoxin-specific FAB fragment therapy
- High dose insulin euglycemia therapy
- Hydrofluoric acid and topical calcium therapy
- Intralipid therapy
- Lithium
- IV and oral N-acetylcysteine therapy
- Salicylates
- Radiation exposures including cesium-137, cobalt-60 and technetium-99
- Tricyclic antidepressants

UTAH POISON CONTROL CENTER MOVES TO NEW FACILITY

The Utah Poison Control Center, a program of the College of Pharmacy, relocated March 19-20, 2013 to our new home in the L. S. Skaggs Pharmacy Institute. This is the first time the UPCC has been physically located in the College of Pharmacy.

The L. S. Skaggs Pharmacy Institute was formally dedicated on April 12, 2013. The new institute connects with the old College of Pharmacy building (L.S. Skaggs Hall) to bring the entire College community under one roof. The L.S. Skaggs Pharmacy Institute is a state of the art facility encompassing 150,000 square feet and was designed with lots of shared spaces to encourage creativity and collaboration.

The UPCC sits administratively in the Department of Pharmacotherapy and occupies a beautiful spot on the top floor of the building in a secure suite surrounded by other members of the Department. With vistas of the mountains to the East, the entire staff is in awe of our surroundings inside and outside of the building. The call center has state-of-the-art workstations. Each workstation is hydraulically controlled to allow for standing or sitting, and has a fan, heating panel, and white noise control for individual comfort.

If you would like to visit our new space, call Marty C. Malheiro at 801-587-0603 to schedule a tour or shadow experience.

2012 ANNUAL REPORT

We are pleased to present the Utah Poison Control Center 2012 Annual Report. This report summarizes activities of the UPCC and includes highlights of the over 45,000 calls the UPCC responded to in 2012. It is available at: www.utahpoisoncontrol.org/about/report.htm
established to collect information about adverse effects to DEET soon after DEET exposures. The registry was also able to evaluate a possible temporal relationship between DEET exposure and adverse outcomes. Out of 296 cases reported to the DEET registry between 1995 and 2001, 36 (12.2%) were deemed to be probably and 157 (53%) possibly related to DEET exposure. A majority of the cases were adults (55.4%). There were 100 (41%) children 19 years of age and younger and 87 (36%) under the age of 13. A total of 59 cases with seizures were reported and 58 cases of other neurological symptoms of moderate or major severity. Seizures were a more common in children than adults.

Information gathered from both PCC data and the DEET Registry is useful as an indicator of potential safety issues associated with DEET-containing products. However, these data sources suffer from other limitations of passive reporting systems. Taking into account the high number of exposures in the general population, the risk of serious neurological events following the use of DEET is likely quite low. Overall, proper use of DEET-containing products according to package instructions is not associated with significant toxicity.

Special Populations

DEET-containing products should be used with caution in young children. The American Academy of Pediatrics currently recommends using insect repellents with concentrations of DEET less than 30% on children over 2 months of age to repel mosquitoes and ticks. The safety of daily applications of DEET in 897 women in their second and third trimesters of pregnancy was evaluated as part of a double-blind, randomized, therapeutic trial of insect repellents for the prevention of malaria. No adverse neurologic, gastrointestinal, or dermatologic effects were observed. DEET did cross the placenta and was detected in 8% of cord blood samples from a randomly selected subgroup of DEET users. No adverse effects on survival, growth, or development at birth, or at one year, were found. Currently the CDC recommends insect repellents be used sparingly in pregnant patients, and only when traveling to areas of the world where malaria is endemic.

DEET Regulations and Recommendations

In 1998, after completing a comprehensive re-assessment of DEET, the EPA concluded that DEET containing products pose little health concern as long as they are used as directed. The majority of exposures to DEET-containing products are most likely to be brief as opposed to long-term. Based on available data, the EPA believes that the normal use of DEET does not present a health concern to the general population.

Required labeling on DEET-containing products:

- Read and follow all directions and precautions on this product label.
- Do not apply over cuts, wounds, or irritated skin.
- Do not apply near eyes and mouth. Apply sparingly around ears.
- Do not apply to children’s hands.
- Do not allow children to handle this product.
- When using on children, apply to your own hands and then put it on the child.
- Use just enough repellent to cover exposed skin and/or clothing.
- Do not use under clothing.
- Avoid overapplication of this product.
- After returning indoors, wash treated skin with soap and water.
- Wash treated clothing before wearing it again.
- Use of this product may cause skin reactions in rare cases.
- If you suspect a reaction to this product, discontinue use, wash treated skin, and call your local poison control center.
- If you go to a doctor, take this product with you.

Conclusion

DEET is an effective mosquito repellent and the majority of studies indicate that the risks associated with DEET when used appropriately are low, while compared to the risk of insect-borne diseases in the United States. The Utah Poison Control Center is available to consult on any exposure to a DEET-containing product.
It’s spring and bugs are in the air. One toxicologic related controversy this year is the use of a common household insecticide group known as neonicotinoids, that act at acetylcholine receptors, of which imidacloprid is the most used. Growing concern has been raised by studies that it may be associated with colony collapse disorder in bees. A recent meta-analysis shows that these chemicals accumulate in bees, and may reduce their pollen seeking behaviors. A clear link to lethality has not yet been established, although exposed hives produce fewer queen bees and may be negatively impacted this way. The EPA will continue to review the science of this product.

FDA ANNOUNCES BeSafeRx PROGRAM

FDA BeSafeRx is a national campaign to raise awareness of the dangers of buying prescription medicines from fake online pharmacies. This campaign provides the resources to help consumers: know the risks of buying from a fake online pharmacy, know the signs to identify a fake online pharmacy, and know how to find a safe online pharmacy. The main focus is to help current and potential online pharmacy consumers make informed purchasing decisions. For further information, call 1-888-463-6332 or email druginfo@fda.hhs.gov.

THANK YOU

The Utah Poison Control Center expresses its sincere thanks to the health care professionals, public health officials and toxicology colleagues that work together to treat and prevent poisonings.

Know the risks: Before buying prescription medicine online, visit www.FDA.gov/BeSafeRx.