HEALTH CONSULTATION

INDIAN MOUND HOME PESTICIDE CONTAMINATION

TENNESSEE DEPARTMENT OF AGRICULTURE
(PESTICIDE CONTAMINATION IN A HOME)
INDIAN MOUND, STEWART COUNTY, TENNESSEE 37079

FEBRUARY 23, 2005

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
PUBLIC HEALTH SERVICE
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
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Background and Statement of Issues

On October 7, 2004, the Tennessee Department of Health (TDH) Environmental Epidemiology Program (EEP) received a telephone call and fax from the Tennessee Department of Agriculture (TDA) asking if adverse health effects could occur from misapplication of pesticide in a West Tennessee home.

According to the TDA on October 22, 2003, homeowners hired a pest control company to treat their attic for insects. The pest control company placed a fogging machine in the attic just above the bathroom, with the intention of fogging the attic with 3 % Resmethrin, a Type I synthetic pyrethroid insecticide. The machine malfunctioned, sending the pesticide out as a stream, rather than as a fog. The next day the home owners complained to the pest control company about the odor. During the next three weeks, the company attempted to mask the odor. After three weeks, they used Kilz on the ceiling of the bathroom to eliminate the odor and then repainted. This did not solve the odor problem.

In August 2004, the homeowners learned that the TDA has legal authority for regulating pest control companies (Hanks, Carl, TDA, personal communication, October 8, 2004). The TDA collected wipe samples and samples of contaminated sheetrock and insulation at the residence on August 18, 2004, and the sample results were received on September 14, 2004.

As of October 2004, the homeowners have a seven-month old infant. The mother was pregnant at the time of the pesticide application. At a recent well-baby visit to the doctor, the infant was diagnosed with respiratory problems. The mother was given a nebulizer for use at home. The mother did not inform the physician of the pesticide problem at the home (personal communication with mother, October 11, 2004).

Discussion

Environmental Sampling

Wipe samples were collected in the residence from areas measuring 100 square centimeters in size. Wipe samples were taken from the vinyl ceiling of the front porch and from a vent pipe in the attic above the bathroom. Additional samples were collected from the insulation from the south end of the front porch near the living quarters of the house, the sheet rock in the ceiling of the bathroom, and of the insulation in the attic above the bathroom (see Table 1 below).

To determine whether persons are, have been, or are likely to be exposed to contaminants, TDH evaluates the environmental and human components that could lead to human exposure. An exposure pathway contains five elements: (1) a source of contamination, (2) contaminant transport through an environmental medium, (3) a point of exposure, (4) a route of human exposure, and (5) an exposed population. An exposure pathway is considered complete if there is evidence that all five of these elements are, have been, or will be present.

Exposure can occur through ingestion of contaminated water, ingestion of fish with which have accumulated chemicals in their flesh, incidental ingestion of contaminated soil, inhalation of chemicals in air, and dermal exposure to contaminated materials, soil, or surface water. Since the liquid pesticide soaked into the insulation and sheetrock, but did not run down the walls or puddle on the floor samples were taken only of the insulation and sheetrock in the attic and ceiling. These areas are not likely to be touched. Therefore, dermal exposure is unlikely for both children and adults. Inhalation exposure is possible, making that the only potentially complete exposure pathway. However, air samples have not been collected.

Table 1: Summary of pesticides sampling at the residence. Units in parts per million (ppm), unless otherwise noted. Samples taken August 18, 2004. Sample results received September 14, 2004.

Sampling area	Chlorpyrifos	Resmethrin	Permethrin
Wipe sample from vinyl ceiling of front porch	128 µg		37.8 µg
Insulation from attic at south end of front porch	24	1.2 – 1.5	56 – 75
Sheetrock, ceiling of bathroom	Not detected	3378	1172
Sheetrock backing, ceiling of bathroom	Not detected	2341 – 2521	692 – 824
Insulation in attic over bathroom	Not detected	2.3 – 5.8	3.2 – 3.6
Insulation backing, in attic over bathroom	Not detected	470 – 568	65 – 86
Wipe sample from vent pipe above bathroom	55 µg	Not detected	262 µg

Legend: $\mu g/cm^2$ = micrograms per square centimeter
ppm = parts per million

EEP staff talked with Michael Schwartz, M.D., medical toxicologist, and Andy Betz, both members of the Emergency Response Team of the Agency for Toxic Substances and Disease Registry (ATSDR), to quickly confirm conclusions about the situation and to gain additional knowledge of pyrethroid toxicology. Conclusions were reported to TDA via telephone.

The concentrations of Resmethrin found in the insulation in the attic over the bathroom are consistent with a spill of 3 percent product, but are not consistent with resmethrin residue left by fogging. Resmethrin and permethrin are both synthetic pyrethroids; therefore, the toxicologic discussion is for pyrethrins and synthetic pyrethroid compounds. It is unknown why some samples had detectable levels of chlorpyrifos.

Synthetic Pyrethroids

Pyrethrum is the natural extract that occurs of flowers of *Chrysanthemum cinerariaefolium* and *Chrysanthemum cineum*. Pyrethrum has long been recognized as possessing insecticidal properties. Pyrethrum has long been recognized as possessing insecticidal properties. While many pyrethroids have been developed, only about a dozen or so are frequently used in the United States. The individual pyrethroids are typically grouped into two general classes, called Type I and Type II, based on a combination of toxicological and physical properties. Resmethrin and permethrin are both Type I synthetic pyrethroids.

Both groups, the pyrethrins and the pyrethroids, are important insecticides because of their rapid paralysis of flying insects, relatively low mammalian toxicity, and rapid rate of degradation in the environment. It is likely that the insecticide residue found in the sheetrock and insulation above the bathroom has not degraded substantially because of the absence of light needed to enhance degradation.

The general population is primarily exposed to pyrethrins and pyrethroids from the ingestion of foods, particularly vegetables and fruits. Exposure due to inhalation of ambient air is also possible after these compounds have been used. Pyrethrins and pyrethroids are also employed in a variety of pet shampoos, lice treatments, household insecticide sprays, and aerosol bombs that can be used in or around the home. The use of these household products can lead to both dermal and inhalation exposure. Occupational exposure to agricultural workers who apply these compounds onto crops can be substantial, with dermal exposure considered the most important pathway.

Pyrethrins and pyrethroids are used extensively as effective insecticides. They pose relatively little hazard to mammals (including humans) by natural routes of exposure at levels likely to be encountered in the environment or resulting from the normal use of pyrethrin or pyrethroid containing substances. Neurological signs typically result from acute toxicity from exposure to larger amounts of pyrethrins and pyrethroids. Due to rapid metabolism and elimination of pyrethrins and pyrethroids, low level chronic exposures usually do not cause neurological signs in mammals. However, direct skin contact may cause temporary paresthesia (abnormal cutaneous sensations such as tingling, burning, stinging, numbness, and itching) that is limited to the area of contact (ATSDR). The Environmental Protection Agency (EPA) has not classified permethrins for carcinogenicity. Since the contaminated sheet rock and insulation in the West Tennessee residence are in the attic and ceiling, direct skin contact on a regular basis is not expected and these symptoms are not expected. Pyrethrins and pyrethroids may cause irritation of the nose, throat, and eyes, and may cause swelling of the mouth and throat (HSDB 2004). Air data is necessary to definitively evaluate the inhalation pathway at this house.

Chlorpyrifos

Chlorpyrifos is an organophosphorus insecticide that has been widely used in the home and on the farm. In the home, chlorpyrifos has been used to control cockroaches, fleas, and termites; it has also been an active ingredient in some pet flea and tick collars. On the farm, it is used to control ticks on cattle and as a spray to control crop pests. In 1997, chlorpyrifos was voluntarily withdrawn from most indoor and pet uses by the manufacturer, DowElanco. Chlorpyrifos is the active ingredient of various commercial insecticides including Dursban® and Lorsban®.

The general population can be exposed to chlorpyrifos in many places because of its wide range of uses. People can be exposed to it in homes or offices if chlorpyrifos has recently been used to control household pests such as fleas or cockroaches. Exposure can also occur outside the home if chlorpyrifos has been applied to the ground around the foundation to control termites. Chlorpyrifos degrades rapidly in the environment; however, low levels may persist for long periods of time after it has been applied either inside or outside the home.

In people, short-term oral exposure (one day) to low (milligrams) levels of chlorpyrifos can cause dizziness, fatigue, runny nose or eyes, salivation, nausea, intestinal discomfort, sweating, and changes in heart rate (central nervous system effects). These same symptoms may follow inhalation exposure. The EPA has not classified chlorpyrifos for carcinogenicity. Chlorpyrifos is rapidly eliminated from the body; only trace amounts of chlorpyrifos metabolites can usually be found in the blood or urine 48 hours after a single exposure (ATSDR 1997).

There are many populations at potentially greater risk to chlorpyrifos-induced toxicity. Populations at risk include the elderly, persons with pre-existing medical conditions, infants and children, and women. The elderly are considered at risk for increased toxicity because of the general decline in health that accompanies aging. Persons with chronic respiratory ailments such as asthma, emphysema, and bronchitis would be at greater risk for respiratory distress following chlorpyrifos exposure. Air data is necessary to further evaluate the inhalation pathway at this house.

Child Health Considerations

An infant lives in the house discussed in this document, therefore special consideration was taken of the possibility of greater toxic effects on the infant than on the parents. Children sometimes differ from adults in their susceptibility to hazardous chemicals, depending on the chemical. Children may be more or less susceptible than adults to health effects, and the relationship may change with developmental age. Differences between children and adults regarding the absorption, distribution and elimination of pyrethroid compounds have not been investigated in humans, and sufficient information from studies conducted in immature laboratory animals is not available to allow for prediction of particular sensitivities in children (ATSDR 2003).

It is difficult to determine whether the increased susceptibility of children to chlorpyrifos toxicity is due to physiological or behavioral characteristics. Results from an animal study conducted in piglets suggest that chlorpyrifos more easily penetrates the skin of young animals, compared to adults. Very young children and infants also have a decreased metabolic capacity to eliminate toxicants and are more susceptible to central nervous system toxicants, thus lowering the exposure levels needed to cause chlorpyrifos toxicity in that population.

Conclusions

- No apparent public health hazard exists for adults or children in the household from dermal exposure to either pyrethroids or chlorpyrifos.
- An indeterminant health hazard exists for inhalation exposure to pyrethroids and chlorpyrifos, especially for the infant.

Recommendations

- Discuss the home pesticide situation with the infant's physician. The physician can refer the infant to the medical toxicologist at Vanderbilt University Medical Center, if needed.

- As a matter of prudent public health practice and to alleviate the persistent odor, remove contaminated insulation, sheetrock, and other contaminated porous materials and replace with new materials.
- Have the non-porous contaminated materials cleaned in accordance with applicable standards to aid in alleviating the persistent odor.
- If the contaminated material is not removed or cleaned, perform air sampling to determine concentrations of pesticides in the indoor air of the home.

Public Health Action Plan

1. TDH EEP will provide copies of this health consultation to state personnel in TDA who have assisted the effected homeowners.
2. TDH EEP will talk with the homeowners, as needed.
3. TDH EEP is available to review additional data or provide additional assistance.

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Certification

This Health Consultation: Department of Agriculture (Pesticide Contamination in a Home), Indian Mound, Stewart County, Tennessee, was prepared by the Tennessee Department of Health Environmental Epidemiology under a Cooperative Agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It was prepared in accordance with the approved methodology and procedures that existed at the time the health consultation was begun.

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The Division of Health Assessment and Consultation, ATSDR, has reviewed this public health consultation and concurs with the findings.

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