Pesticides

INTRODUCTION

Pesticide use in agriculture is a very broad and complex subject. This Bulletin is presented to inform you of some of the findings and controls pertaining to the absorption of pesticides through the skin. Although machine injuries remain the primary cause of reported work-related injuries in agriculture, public concern about pesticide usage has reached national headlines.

PESTICIDE HAZARDS

Broadly speaking, pesticides present a hazard to agriculture employees in three forms: concentrates, diluted sprays or dusts, and as residues in the environment. Pesticide exposure can occur in many situations. Potential exposures can occur to the mixer, loader, applicator and field employee.

Usually, the mixing, loading and application is done by a full time employee, unless this activity is contracted out. This employee will have had some training in storage, transportation and handling procedures, along with availability of personal protective equipment, such as synthetic rubber gloves, boots, overalls, respirators and eye protection.

It has been found that skin exposures are greater, than respiratory exposures. Shortly after the introduction of organophosphates and carbamates it was found that it was possible to obtain a sufficient skin exposure from residues in the environment to become acutely intoxicated. Numerous studies of pesticide exposures have been concerned with the casual field employee. The casual field employee generally runs the greatest risk of dermal exposure and acute illness as a result. Workers are often unaware of the exposure. The population affected is largely made up of migratory employees, who move from one worksite to another. Field employees often don't know what pesticides have been used or when they were applied.

Residue poisoning can occur accidentally when employees or their children are exposed to highly contaminated soil, refuse or improperly clean equipment. These situations can be controlled by proper housekeeping.

Personal hygiene is, or course, important in minimizing exposure, particularly exposure through the skin. However, there is evidence that even thorough washing can be relatively ineffective in removing those pesticides that quickly penetrate the skin, particularly if an hour elapses between exposure and washing. As a consequence, prevention of exposure is much preferred over decontamination, although good personal hygiene is essential.

One of the most common ways that field employees are exposed to residues involves dislodging of pesticide-laden dust, principally from foliage, and the subsequent depositing of that dust on clothing and exposed skin.

At times the work requires direct contact with foliage and significant skin exposure is in many cases unavoidable. Changes in the work practices are not normally an option. Further, the physical nature of the work, combined with the temperatures typically encountered, have made protective clothing an unrealistic approach to control.

CONTROLLING HAZARDS

Several decades of research points to the conclusion that the only practical means of minimizing exposure is to make certain that toxic levels of residues have degraded before employees are allowed into the fields.

Field worker re-entry intervals have been established for various pesticide-crop combinations. The idea is simply to wait until the residues have decayed to a point where the exposure is insufficient to cause adverse health effects.

From the standpoint of hazard recognition, there are two types of residue poisoning: short-term and long-term, based on the time after application when they characteristically occur, and on the composition of the residue at that time. It was for this reason that re-entry periods were established for pesticides.

In the short-term re-entry, it is usually assumed that there has been insufficient time for chemical changes to occur in the pesticides in the environment, and exposure is usually to the parent pesticide alone.

The long-term re-entry problems reported involve the organophosphates. It appears the long-term re-entry problem arises from a curious interaction of some thiophosphate pesticides. After the thiophosphates are converted they differ from the parent chemical. They are direct cholinesterase inhibitors which affect the nervous system and usually are considerably more toxic than the parent compound. After formation they can persist at high levels for weeks.

The control of both long-term and short-term residue exposure problems is the same, and is based on the relative non persistence of the organophosphate pesticide. The strategy is simply to wait until the residue has decayed to a non hazardous level before allowing workers to enter the grove or vineyard for any work involving substantial contact with the foliage or soil.

There is a weakness in the re-entry concept as it applies to the long-term problem. Environmental chemistry and conditions arising from its application to different crops has proven it difficult to interpret factors accurately to set specific reentry intervals. A second weakness is that the reentry concept presumes a relatively predictable relationship between the degree of hazard and the post-application time. It appears that such a relationship does not exist. Unusual weather patterns can affect both the formation and persistence of toxic decay products or parent pesticides in ways that are difficult to predict.

Preventing contact with pesticide-laden dust, principally from foliage and the subsequent depositing of dust on clothing and exposed skin is also of primary importance. The extent that a compound can be absorbed through the skin depends on many factors, including the nature of the chemical, its physical form or solvent, the duration of exposure, part of body exposed and condition of skin, and whether or not the exposed area is sealed off from the air. Solvents in pesticides, such a xylene, enhance absorption. Certain areas of the body absorb better than others. The forehead, the ear canal, the back of the hand, and despite its thickness, the palm, absorb far more than the forearm. The skin of the armpit is highly permeable and, for some compounds, the scrotum provides no barrier and allows total absorption. Skin that is sweaty, irritated or abraded, or has been washed with solvents, allows increased absorption.

To minimize dermal contact of pesticides it has been found that closure of garment openings at the neck, sleeves and legs reduces dermal exposures substantially, although such designs can increase heat stress potential. Cotton/polyester 65/35 work shirts provide substantially less protection than heavier weight coveralls of 65/35 cotton/polyester fabric. Layering clothing can also protect the skin from residue contact. Ensuring that the field employees wear clothing that minimizes pesticide dermal contact and practice good personal hygiene is difficult, to say the least, but should be stressed.

SUMMARY

The on-going study of pesticide exposure and its short- and long-term health effects qualify this topic to be a valid safety and health concern. Employers can minimize employee exposure potential by adhering to the recommendations of the experts regarding re-entry intervals and other means of employee protection coupled with a conservative approach whenever doubt exists regarding the appropriate re-entry interval. Employers should also be sure to stay abreast of new developments and recommendations that result from current research. Although there are no easy means of eliminating this risk completely, consistent efforts to minimize these exposures will help agricultural employers maintain a healthy and productive workforce.