

WORKER AND ENVIRONMENTAL SAFETY

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Your previous speaker, Jim Vaccaro, has discussed several points that I had included in my presentation which allows me an opportunity to digress briefly.

What is the greatest safety risk for lawn care workers? No, it is not pesticides. The greatest risk is driving a truck which occupies about 50% of his work time. What are the most common types of injuries leading to lost work time? No, they are not pesticide related. They are traumatic injuries to the hands, knees and back.

We emphasize pesticide safety because it is an issue visible to our customers and the general community as well as employees. Too often this leaves little attention to driving and safety in the warehouse.

It is generally agreed that the most important source of pesticide exposure in workers in the agricultural sector, including lawn care, is due to skin contamination. An estimate of the sources of absorbed pesticides are: skin - 97%; inhalation - 2.5%; and ingestion - 0.5%.

How much pesticide is absorbed and can it be monitored? The herbicide 2,4,-D is a good model for evaluating herbicide absorption because 2,4,-D is quantitatively excreted in urine. Since the rate of 2,4-D excretion in humans is known, we can use urinary excretion data to estimate absorption of 2,4-D when the amount excreted is equal to the amount absorbed. This is known as the steady-state. We collected 24 urine specimens from lawn specialists spraying 2,4-D and found that the amounts they excreted was an average of .0032 mg/kg in one group of employees and .0065 mg/kg in another group in a different location. These values may be compared with the WHO/FAO acceptable daily intake for 2,4-D in foods, which is 0.3 mg/kg. This indicates a safety factor for long term health effects of 50-100.

The herbicide 2,4-D has been incriminated as a hazardous chemical in Michigan and elsewhere with incorrect allegations that it contains a toxic dioxin. These claims arise from the fact that 2,4-D was a part of the herbicide "Agent Orange" used as a defoliant in Vietnam. Agent Orange was a 50-50 mixture of 2,4-D and 2,4,5-T. Agent Orange was contaminated with a toxic dioxin known as 2,3,7,8 tetrachlorodibenzo-p-dioxin (2,3,7,8 TCDD). This contaminant is a highly toxic substance that was present in the 2,4,5-T. But the highly toxic 2,3,7,8 TCDD does not occur in 2,4-D due to differences in the manufacturing process and raw materials.

The term dioxin refers to a family of chemicals and there are 75 possible chlorinated dioxins. They differ remarkably in toxicity, although not all 75 have been studied in detail. It is important to repeat that 2,4-D does not contain 2,3,7,8 TCDD, the one known to be toxic. The ester forms of 2,4-D may contain other dioxins including: 2,7 dichlorodibenzo-p-dioxin; 1,2,4 trichlorodibenzo-p-dioxin; 1,3,6,8 tetrachlorodibenzo-p-dioxin; and 1,3,7,9 tetrachlorodibenzo-p-dioxin.

These are not known to be toxic. For example, 2,3,7,8 TCDD was more toxic in rodents fed 2 ppb in their diet than when the 2,7 form was fed at 10,000,000 ppb. Furthermore, the amine formulation of 2,4-D which is the formulation used in lawn care, usually does not contain any detectable dioxin.

Jim Vaccaro discussed cholinesterase, an enzyme in the body that is affected by certain insecticides. Measurement of cholinesterase in blood is a

useful method for monitoring employee exposure to the pesticides. In experiments in human volunteers, one does not find even the earliest signs of poisoning until cholinesterase activity of both plasma and red blood cells decreases to 20% of baseline values. Lawn care workers have a slow gradual decrease in plasma cholinesterase with the lowest levels occurring around August. Plasma levels may decrease by 40% but red blood cell cholinesterase is usually not affected. These decreases, of course, completely reverse after insecticide use is discontinued. The rate of reversibility is quite variable, depending on the insecticide. When employees are removed from exposure to chlorpyrifos, for example, it takes from 1 to 3 weeks for cholinesterase activity to reverse to levels where they can return to the use of insecticides. Because the reversibility is not rapid, blood samples taken on Monday, following a week-end of time away from work, are still of value for detecting significant depressions of the enzyme. Returning to work after an incomplete recovery of cholinesterase activity does not make the employee more sensitive to subsequent exposure. To the contrary, there appears to be development of tolerance after repeated exposures.

We have compared cholinesterase values in workers spraying lawns while wearing gloves with workers who did not wear gloves. There were 179 employees in the study divided as follows:

	No	Yes
Gloves	78	101
Cigarette smokers	91	96

Among the conclusions of this season long study were:

1. There was no difference in cholinesterase values attributable to wearing gloves while spraying.
2. Workers who were cigarette smokers had greater decreases in cholinesterase than non-smokers.
3. Experienced workers (more than six months employment) wearing gloves had less decrease than inexperienced workers wearing gloves.

Monitoring employee cholinesterase has enabled us to detect defective equipment and incorrect fill procedures in addition to the effects of unavoidable drift.

Future developments of occupational health monitoring of lawn specialists applying pesticides will most probably use techniques of urinary sampling similar to the studies reported here for 2,4-D. However, we need more data on controlled human exposures to allow us to interpret such results.