DESIGNING A GENERIC EXPOSURE ASSESSMENT PROTOCOL FOR WORKERS USING ANTI-SAPSTAIN CHEMICALS

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Abstract

When the British Columbia (B.C.) sawmill industry began to look for safe and efficacious substitutes for chlorophenol antisapstain fungicides, a committee of those with interests in the choice of new fungicides was formed: the B.C. Stakeholder Forum on Sapstain Control. It includes members from industry, labour organizations, government, and environmental groups, and has as a primary goal the prevention of adverse occupational and environmental health impacts by the new fungicides. In response to concerns about the measurement of worker exposure, the Stakeholder Forum has set up a Scientific Advisory Panel to develop a generic exposure monitoring protocol that would be followed by any fungicide manufacturer wanting to have its product used in the B.C. lumber industry. This communication will summarize the rationale, methods, and benefits of such a protocol.

Rationale

The British Columbia coastal lumber industry has used anti-sapstain agents to prevent fungal growth on export lumber for 50 years. The formulations used during most of this period contained chlorophenols, but in the late 1970s and early 1980s, studies reported that these chemicals were contaminated with dioxins, and that they might be associated with certain human cancers, including soft-tissue sarcoma, non-Hodgkins lymphoma, and nasal cancers (1-6). In response to these concerns, importing nations, including Japan and Germany, suggested that they would prohibit importation of wood treated with this class of chemicals by the end of the 1980s. The B.C. sawmill industry was therefore required to find substitute fungicides that were both effective at preventing fungal growth on the lumber surfaces, and able to meet the safety interests of workers, environmentalists, and consumers.

In order to monitor the introduction of new fungicides in the industry, a committee of interested members of industry, labour unions, environmental groups, and government agencies was formed. The B.C. Stakeholder Forum on Sapstain Control has taken the initiative to oversee occupational and environmental safety issues for these new chemicals, and may require manufacturers to follow certain procedures either prior to or during the introduction of their products into the industry.

The first substitutes used by the industry were the only formulations which had previously been registered by Agriculture Canada: those containing copper-8-quinolinolate and those containing thiocyanomethylthiobenzthiazole (TCMTB). Their introduction into the

sawmills required attention in many areas of concern. Since chronic animal tests had not been done, the manufacturers were asked to complete them. Acute effects of the chemicals in lumber application had not been identified, therefore a cross-sectional study of these effects was initiated (7). Education programs were held for the workers who would be handling the new products. Since no air or biological monitoring methods were available, appropriate measurement methods were developed. Because of various problems with both these new chemicals, many mills continued the search for chlorophenol substitutes (7,8,9). This required that new products, not previously registered in Canada, be considered.

In order for a pesticide to be registered for use in Canada, the manufacturer must follow the Registration Guidelines published by Agriculture Canada (10). These include requirements for testing of the product's toxicity and metabolism in animals, its environmental fate, and the potential for human exposure. Health and Welfare Canada uses human exposure data in conjunction with animal toxicity data to qualitatively describe the potential risk the pesticide might pose to humans, and to advise Agriculture Canada about the health aspects of the chemical being proposed for registration. The Canadian registration process has no formal criteria for the performance of exposure studies, but applicants are referred to documents published by the Environmental Protection Agency in the United States: Subdivision U, Applicator Exposure Monitoring; and Subdivision K, Exposure Reentry Protection (11,12). These documents were written with agricultural pesticide application in mind, and members of the B.C. Stakeholder Forum on Sapstain Control agreed that sawmill application of antisapstain fungicides differs substantially. The lumber industry uses methods of application not used in agriculture, and there are more workers at potential risk of exposure. They therefore decided that an exposure monitoring protocol should be developed specifically for the B.C. antisapstain applications. This protocol would then be followed by any manufacturer wishing to have its pesticide used by the industry.

Methods

The Stakeholder Forum contracted an independent group of university-based scientists, called the Scientific Advisory Panel, to design the exposure monitoring protocol. Its members include Dr. Richard Fenske, an industrial hygienist whose research focuses on pesticide exposure monitoring, Dr. Chris van Netten, a toxicologist, and Kay Teschke, also an occupational hygienist. Dr. Andrew Jin, an occupational physician, has been asked to carry out the basic data collection and organization for the Panel.

The funding of the Scientific Advisory Panel itself is unique and worthy of mention. It was decided that the cost of the exposure monitoring protocol should be shared amongst the fungicide manufacturers. Dr. Bill Leiss of Simon Fraser University, who chairs the B.C. Stakeholder Forum, wrote to all pesticide manufacturers and formulators who might have an interest in marketing antisapstain agents in British Columbia, asking them to contribute a small amount (on the order of several thousand dollars) to fund the design of the generic exposure assessment protocol. To date, 17 companies have contributed; they include firms from Canada, the United States, France, Denmark, and Finland.

We would now like to address the goals and methods of the Scientific Advisory Panel, as well as some of the benefits that such a protocol might have both in the anti-sapstain context and more generally in industry.

The overall objective of the Scientific Advisory Panel is to develop a protocol for assessing occupational exposure to antisapstain products. Our specific aims are as follows:

1. To determine approaches and methods currently used to assess exposures in similar work sites;
2. To identify and categorize specific work situations in which exposures occur; and
3. To prepare a report proposing an exposure assessment protocol which addresses the concerns of the Stakeholder Forum and of government agencies interested in exposure assessment, such as Health and Welfare Canada.

The process began in September 1991. We have conducted searches of the scientific and government literature related to industrial hygiene sampling strategies, pesticide exposure monitoring techniques, and current international government exposure monitoring guidelines. The literature on exposure monitoring for pesticide applicators focuses mostly on techniques to ensure that all pertinent routes of exposure are assessed (11-14). This is a particularly important question since many pesticides may be skin absorbed as well as inhaled, and many have direct irritant effects at the point of body contact (7,8,15-18). It is interesting to note that the more generic hygiene sampling strategy literature brings up additional issues which have received less attention in the pesticide registration process (19-21). For example, this literature addresses the issue of how to select the individuals to be sampled, and the question of how many workers should be sampled to make sure that at least some of the most exposed are included in the sampling group. It also asks whether the samples should be of long or short duration to reflect the way each specific chemical acts on the body.

In addition to the literature review, we are also attempting to determine the likely means of exposure in the antisapstain application process. We have obtained from Environment Canada a list of all the facilities in British Columbia using antisapstain agents, updated in the summer of 1991. This will be used as the basis for selecting sites to visit for direct observations of treatment processes so that we can determine the range of potential exposure conditions. Individuals familiar with antisapstain application procedures and worker activities, including workers and managers, will be interviewed at each site. Some sawmills have been visited already. In addition, in order to determine which jobs have a potential for exposure, we are compiling an inventory of exposure data that has been gathered over the years in British Columbia, including data on urinary chlorophenate levels. Information about jobs, exposure levels, and fungicide application processes will be examined to determine how job groups should be the selected for monitoring.

The final step will be to design a protocol for monitoring work place exposure to antisapstain products, addressing the following questions.

1. Which workers should be sampled? We may be able to name some specific jobs which always need to be sampled, as is commonly the case in the agricultural pesticide applicator protocols, but we may also have to set out a more generic method for selecting workers to be sampled depending on the application processes used at the site.
2. How many workers should be sampled? Enough workers need to be sampled to ensure that at least some in the highest exposure group are selected. On occasion, selecting the most exposed workers may be straight forward, but in our experience, there are also often surprises, so an effective monitoring protocol must allow for more than the 'obvious' workers to be sampled.
3. What should the duration, frequency, and timing of the samples be? It is important to link the duration of sampling to the anticipated biologic outcome of exposure. For example if a chemical is quickly eliminated from the body, it will not accumulate, and any adverse effects will be related to exposure levels over a short period of time. On the other hand, if the agent has the potential for accumulation, it is important to assess exposure over a longer period. Frequency and timing of sampling are questions similar to the earlier ones of how many samples to take and who to sample and will involve some of the same issues.
4. Finally, specific monitoring techniques will be addressed. For example, how will inhalation exposures be measured? If skin absorption or dermatologic effects are an issue, how will dermal exposures be assessed? Should measurements include biologic monitoring which would integrate the systemic dose from all routes of exposure including ingestion? What about chemicals for which no measurement method has been developed; should surrogate exposure measurements be accepted? If the fungicide has toxic breakdown products, how can we be sure that the measurement protocol assesses these exposure as well?

In addition to addressing each of these questions, the protocol should provide a mechanism for regular review and up-dating.

Once the exposure protocol has been drafted by the Scientific Advisory Panel, it will be sent out for review to the members of the Stakeholder Forum, the participating fungicide manufacturers, Health and Welfare Canada, Agriculture Canada, and other interested parties. In order to promote an exchange of ideas about the protocol, a workshop will be held in the Spring of 1992. This will allow a more interactive discussion of the issues addressed in the protocol and, of course, any which have been missed. After this discussion, a final report will be submitted to the Stakeholder Forum.

Benefits

The generic exposure assessment protocol should offer benefits on several fronts. Its main aim is to provide the B.C. Stakeholder Forum on Sapstain Control with a method of exposure assessment which meets the unique conditions of antisapstain fungicide application in this province. For the fungicide manufacturers, it will provide a uniform exposure monitoring requirement for all manufacturers who wish to introduce a new agent in the industry.

Exposure assessments conducted with this protocol should also provide data that can be used in conjunction with toxicological data for risk assessment, and as such may be used for pesticide registration or setting exposure standards. Risk assessments might be performed by government agencies, for example, Health and Welfare Canada or the Workers' Compensation Board, or by the lumber industry itself. Exposure monitoring data might also provide the basis for dose-response evaluations of health outcomes in epidemiologic studies of the antisapstain fungicides.

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