TORONTO STAFF REPORT

March 18, 2003

To: Board of Health

From: Dr. Sheela V. Basrur, Medical Officer of Health

Subject: Pesticide Use and Effect on the Environment

Purpose:

To provide information on the presence of pesticide residues in the Toronto environment.

Financial Implications and Impact Statement:

Continued monitoring for selected pesticides in Toronto's rivers is possible with on-going involvement by Works and Emergency Services, Environment Canada and the Ontario Ministry of Environment. The resources required by Works and Emergency Services to continue its involvement in pesticide monitoring are available within its current 2003 operating budget.

Recommendations:

It is recommended that:

(1) the Board of Health commend the Federal and Provincial Ministers of the Environment, and the Commissioner of Works and Emergency Services, for undertaking a special study on surface water contamination from the use of pesticides in the Toronto area;

(2) the Board of Health request the Commissioner of Works and Emergency Services, in consultation with the Medical Officer of Health and appropriate staff from Environment Canada and the Ontario Ministry of the Environment, to continue sampling and undertake laboratory analysis in-house of those pesticides commonly detected in Toronto's streams and rivers;

(3) the Board of Health forward this report to the Works Committee and the Economic Development and Parks Committee for their consideration; and

(4) the appropriate City Officials be authorized and directed to take the necessary action to give effect thereto.

Background:

At its meeting of November 6, 7 and 8, 2001, City Council discussed a strategy to achieve a phase out of non-essential outdoor uses of pesticides and requested the Medical Officer of Health to submit a report to the Economic Development and Parks Committee on all pesticide use by industry and their effect on the environment. This report was prepared in consultation with staff from Works and Emergency Services, and has been reviewed by staff from Economic Development, Culture and Tourism.

Comments:

Currently, there is no legal requirement for pesticide retailers or pesticide applicators to submit information on pesticide sales or use in Ontario. Consequently, it is not possible to provide an accurate assessment of all pesticide use by industry and the public in Toronto. The recent amendments to the federal Pest Control Products Act will require the submission of pesticides sales data to the Federal Minister of Health in the future. The details of the regulation specifying this reporting requirement are under development and will likely not be in effect until after mid-2004. However, by examining the results of pesticide use surveys and pesticide residue testing in Toronto's streams, it is possible to provide some comments on pesticide use and its potential effects on the aquatic ecosystem in Toronto.

Pesticide Use Surveys:

In 1993, the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) conducted a survey of pesticide users, including professional lawncare applicators, to estimate the total amount of pesticide active ingredients used in Ontario. Ten chemicals accounted for about 95% of the total amount of active ingredients applied by professional applicators (OMAFRA, 1994). The most frequently used lawn care pesticides, in order of decreasing amounts used, were mecoprop (MCPP), 2,4-D, dicamba, diazinon, chlorpyrifos and MCPA. Provincial data were not available specifically for Toronto.

Toronto Public Health has conducted two surveys of Toronto residents regarding pesticide issues, including self-reported use of lawn and garden care pesticides by members of the household and/or professional applicators. In the first survey, 341 randomly selected residents participated, each of whom lived in a house with a lawn and was responsible for making lawncare decisions. The majority of telephone interviews were conducted in January 2001. Respondents were questioned on the use of outdoor pesticides at their homes during the previous two-year period (1999 and 2000). The survey indicated that 45% of residential lawns (nearly one in two Toronto lawns) had been treated with chemical pesticides during 1999 and/or 2000. Of the 45% of residential lawns treated with chemical pesticides, 53% were applied by householders,

29% by a lawncare company, and 18% by both the householder and a lawncare company (Toronto Public Health, 2002A).

In a second telephone survey by Toronto Public Health, 1,000 randomly selected residents participated, including those living in apartments. Telephone interviews were conducted during the last week of September and first week of October 2002. Those households (n = 635) with lawns and an opportunity to make garden care choices were asked about the use of outdoor pesticides during the previous two year period (2001 and 2002). This survey indicated that during 2001 and 2002, 38% of residential lawns (or about 2 in 5 lawns) had been treated at least once with pesticides. Of the 38% of pesticide-treated lawns, 50% were treated only by householders, 8% only by a lawncare company, and 42% by both the householder and a lawn care company) (Toronto Public Health, 2002B).

These survey results suggest that while outdoor pesticide use may be declining somewhat in Toronto, pesticide use continues to be a common practice. City staff, primarily from the Health Promotion and Environmental Protection Office (Toronto Public Health), Parks and Recreation (Economic Development, Culture and Tourism) and Environmental Services (Works and Emergency Services) continue to work together to reduce the potential for pesticide run-off into the water system.

Pesticide Residue Testing:

In 1998, Environment Canada, in conjunction with the Ontario Ministry of Environment and Toronto Works and Emergency Services, initiated a special study of the Don and Humber River watersheds to investigate the potential for surface water contamination from the use of pesticides and fertilizers (Struger et al., 2002). An interim report was released in December 2002, based on preliminary findings from sampling conducted during 1998, 1999 and 2000. A final report is under preparation that will include sampling data for 2001.

Works and Emergency Services staff collected water samples from several locations in streams throughout the watersheds in Toronto. A total of 133 samples were collected, 57 during “wet” events after rainfall, and 76 during “dry” periods. The samples were analysed by the University of Guelph’s Laboratory Services Division (under contract for the Ontario Ministry of the Environment), which analyzed for 159 different possible pesticides, including some pesticide metabolites or breakdown products, and some pesticide metabolites (breakdown products). Commonly used urban lawncare pesticides were included in the scan of 159 pesticides analyzed.

Nine pesticides and one pesticide metabolite were detected in the Toronto samples. For the other 149 pesticides analysed, they were either not present in the water or occurred at levels below the method detection limit. The most frequently detected pesticides were MCPP (detected in 30% of samples), followed by diazinon (in 29% of samples) and 2,4-D (in 6.6% of samples). It is noteworthy that these three pesticides are commonly used in lawncare, however, there are also agricultural uses. The other pesticides detected (and their frequency of detection expressed as % of total samples detected in) are atrazine (3.7%), metolachlor (2.0%), des-ethyl atrazine (0.5%), carbofuran (1.5%), and cypermethrin (0.7%). In the case of diazinon, pesticide levels were frequently high enough to exceed the Ontario Water Quality Objective for the Protection of

Aquatic Life, however, this was not the case for the other pesticides measured in the Toronto streams.

It is noted that the study authors report their findings based on frequency of pesticide detection, rather than based on average pesticide levels. While this information is useful, it would be even more beneficial to also have data on actual pesticide levels so that changes in pesticide levels can be tracked over time. However, in order to do this, there may be a need to increase the sampling frequency at selected locations.

Although this study can not distinguish precisely between agricultural inputs of pesticides and those arising from other uses such as lawn and garden care, more pesticides were detected at the mouth of the Humber and Don Rivers, and they were detected more frequently, than at less urbanized locations upstream. This suggests that urban inputs of pesticides arising within the City of Toronto contribute to their increased detection downstream. Furthermore, with the exception of MCPP (which is used in both agriculture and lawn/garden care), most pesticides were detected more frequently downstream (at the river mouths) than upstream (at the City limits). For example, diazinon (an insecticide used in lawncare) was detected more than twice as often at the mouth of the Don River, compared with the less urbanized upstream sampling location at the city boundary.

Another important finding of the study is that pesticides were detected most frequently, and at highest levels, in samples collected after rain events. The study authors (Struger et al., 2002) suggest that stormwater drainage systems may be conveying pesticides used on lawns in urban areas to the Don and Humber River watersheds, and ultimately into Lake Ontario. The proximity of lawns in Toronto to its storm sewer network provides ample opportunity for pesticide residues to be discharged into the aquatic ecosystem. The study also demonstrated that pesticides were most commonly detected from mid-spring to mid-fall when residential lawn pesticides are in common use, whereas there were very few pesticide detections very early in the spring or late in the fall when these pesticides are typically not applied.

Pesticide Persistence:

There are many factors that influence the quantity of pesticides detectable in the urban environment, including the amount of pesticides applied, the way in which they are applied, the frequency of application, and their persistence in environmental media such as soil and water. Applying pesticides on a routine basis and in a spray formulation, as is common with traditional insect and weed control on lawns and gardens, will result in much higher levels of pesticides in the environment than using integrated pest management (IPM) methods. IPM focuses on preventing pest problems, using pesticides only if really needed, using the lowest toxicity pesticides available, and using them in non-spray formulations (such as baits and pellets) where possible. With spray or aerosol formulations, there is a high probability that much of the pesticide will be dispersed into the general environment and only a portion will reach the target pest. With baits and pellets applied in a closed environment close to where the pests live, there is much less likelihood that the pesticide will reach non-target organisms.

Chemicals, including pesticides, have inherent differences in how long they persist in the environment before they are degraded. The relative persistence of pesticides can be compared based on their half-life (amount of time it takes to reduce the original pesticide level by 50%). Pesticide half-life values tend to be different in soil and water, as shown in Table 1. Given that common lawn and garden care pesticides can persist in the environment for several weeks, and given that pesticide use is still very common in the city, it is not surprising that pesticide residues are detectable in Toronto's aquatic environment, despite the large dilution factor resulting from their entry into streams and rivers

Table 1. Half-Life Values of Common Lawn and Garden Care Pesticides (a)

Pesticide	Pesticide Half-life	
	In Soil	In Water
Mecoprop (MCPP)	3 weeks	not available
2,4-D	less than 1 week	1 - several weeks
Dicamba	1 - 4 weeks	not available
Diazinon	2 - 4 weeks	12 hours (highly acidic water) 6 months (neutral water)
Chlorpyrifos	9 – 17 weeks	0.5 – 3 weeks (due to volatilization) 3 – 4 weeks (due to photolysis)
MCPA	2 – 4 weeks	About 2 to 3 weeks

(a) Source: Kamrin et al, 1997; Vogue et al, 1994.

As a point of reference, it is of note that methoprene (a low toxicity insect growth regulator) used elsewhere in urban mosquito larviciding programs directed at controlling West Nile Virus has a half life of about 1 to 2 days in water. The use of methoprene for protection against West Nile Virus is consistent with the IPM approach: using pesticides only when really needed; using the lowest toxicity pesticide available; using non-spray formulations; and applying pellets in a reasonably closed environment close to where the pests live.

Implications for Environmental Health:

The Toronto pesticide study provides evidence that pesticides applied for lawn and garden care in the city can move from their site of application into the broader environment, particularly into local streams. The extent to which these pesticides adversely impact the aquatic ecosystem (including the small organisms at the bottom of the food chain) in the Toronto area is not known. However, it is of concern that 20% of the river samples collected in the study contained diazinon at levels exceeding the Ontario Water Quality Objective for the Protection of Aquatic Life (Struger et al., 2002). Diazinon use is expected to decline considerably in the next few years. Diazinon products for outdoor use by the public will be taken off the market at the end of 2003, and commercial lawncare product sales are required to end after 2004. The use of these products will be allowed for one year after the sales are terminated (Struger et al., 2002).

The pesticides used in lawn and garden care may also have adverse effects on the terrestrial environment. The full extent of adverse effects is unknown because of a lack of data on actual pesticide levels in the Toronto environment and their possible terrestrial impacts. In addition to aquatic life, bees, birds and beneficial soil organisms can be harmed by the pesticides used on lawns and gardens (Toronto Public Health, 2002C). In its previous report "Lawn and Garden Pesticides: A Review of Human Exposure and Health Effects Research", Toronto Public Health summarized some of the existing studies in other jurisdictions that show adverse environmental impacts, particularly to beneficial insect pollinators such as bees, and to birds.

Benefit of Continued Monitoring of Pesticide Residues in Toronto Streams:

Toronto Public Health, in collaboration with other City divisions and departments, continues to promote and facilitate shifts in pesticide use practices among the public and business community to reduce their reliance on traditional chemical pesticides. One reliable indicator of the effectiveness of the City's strategies to phase out non-essential outdoor uses of pesticides is to monitor pesticide levels in Toronto streams. For this reason, it is recommended that Toronto Works and Emergency Services, in consultation with the Medical Officer of Health and appropriate staff from Environment Canada and the Ontario Ministry of Environment, undertake sampling and laboratory analysis of those pesticides commonly detected in Toronto's streams and rivers.

While the special study (described in this report) undertaken with Environment Canada and the Ontario Ministry of Environment was a useful screening study that was able to identify which pesticides are present in Toronto-area streams, further pesticide monitoring is not contemplated by these two agencies. Works and Emergency Services have in-house laboratory facilities that can be used to test for pesticides. Staff from Public Health and Works and Emergency Services are working together to identify a suitable list of pesticides to monitor.

It is recommended that the sample collection frequency be increased at the mouth of the Don and Humber Rivers, and at selected upstream locations at the City's limits, to generate reliable trend data on actual pesticide levels. By increasing the sampling frequency of key pesticides, it will also be possible to better assess the influence of precipitation in conveying pesticides from their site of application into Toronto's aquatic ecosystem. By sampling for a much smaller number of pesticides and sampling in fewer locations, compared with the special screening study conducted during 1998 through to 2001, it will be possible to redirect limited resources to a more intensive sampling program that best reflect urban pesticide use in Toronto over the next few years.

Conclusions:

Chemical pesticides continue to be in common use for lawn and garden care by residents and professional applicators in Toronto. Although it is not possible to determine the full extent of adverse effects of outdoor pesticide use on the environment, a recent study on pesticide concentrations in the Don and Humber River watersheds provides evidence that urban pesticides are mobile and finding their way into Toronto's aquatic ecosystem. City staff from all affected departments continue to develop and implement strategies to reduce public and private sector

reliance on chemical pesticides. One method to assess the effectiveness of the city's efforts is to analyse pesticide levels in Toronto streams through the implementation of its pesticide reduction strategy. Consequently, this report recommends that Works and Emergency Services, in consultation with the Medical Offiicer of Health, Environment Canada and the Ontario Ministry of Environment, continue sampling and undertake in-house laboratory analysis of those pesticides commonly detected in Toronto's streams and rivers.

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