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THOUGHTS ON URBAN USE PESTICIDES

INSTITUT NATIONAL DE SANTÉ PUBLIQUE DU QUÉBEC

Québec

MEMORANDUM

THOUGHTS ON URBAN USE PESTICIDES

GROUPE SCIENTIFIQUE SUR LES PESTICIDES

DIRECTION DE LA TOXICOLOGIE HUMAINE AND

DIRECTION DES RISQUES BIOLOGIQUES, ENVIRONNEMENTAUX ET OCCUPATIONNELS

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FOREWORD

Quebeckers' keen interest in ornamental horticulture has resulted in the widespread use of pesticides in urban areas. In an effort to address pesticide-related concerns, the Minister of State for the Environment and Water, André Boisclair, has established a focus group on urban use pesticides in order to identify solutions that will enable Quebeckers to reduce their dependency on these products.

As part of the consultation process put in place by the focus group, (under the direction of the Member for Bertrand, Claude Cousineau), the *Groupe scientifique sur les pesticides, Institut national de santé publique du Québec* (INSPQ) was asked to produce a memorandum on ways to reduce the environmental and public health risks associated with urban use pesticides. Since the INSPQ's area of expertise is public health, the present memorandum emphasizes the health risks that justify a more rational use of pesticides in urban environments, rather than actual means of reducing pesticide use. A consultation was held with the *Table nationale de concertation en santé environnementale* to discuss the contents of this memorandum.

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1 INTRODUCTION

In Quebec, according to current data, sales of domestic pesticides, that is, those used by private individuals, rose by almost 600% between the end of the 1970s and the start of the 1990s, and by 60% between 1992 and 1996.[1] This development, which is the result of a keen interest in landscape maintenance and ornamental horticulture on the part of the public, is also a source of concern for many members of the public, as well as for public health authorities. This memorandum offers a brief overview of current knowledge on the health effects of urban use pesticides and suggests ways to ensure that pesticides are used rationally and safely.

[1] Estimate based on sales statistics published by the MENV (ministère de l’environnment).

2 PESTICIDES AND HEALTH: AN OVERVIEW OF CURRENT KNOWLEDGE

In view of the time frame allotted to draft this memorandum and the Commission's many editorial duties, it was not possible to produce an exhaustive review of the current state of knowledge on the health effects of pesticides. We nonetheless felt that it was important to highlight areas of concern from a public health standpoint. Since there have already been many studies on the health risks of pesticide use, we determined that it would be more useful to focus on the exposure risks faced by children living in residential areas. Generally speaking, children are at greater risk of pesticide exposure as a result of their specific behavioural patterns and their greater susceptibility. The federal Standing Committee on Environment and Sustainable Development (2000) placed particular emphasis on the vulnerability of this group in its report entitled: "Pesticides: Making the Right Choice for Protection of Health and the Environment."

The INSPQ's *Direction de toxicologie humaine* is currently evaluating the pesticide exposure risks faced by children, based on the scientific literature. This evaluation will consider both direct risks to children in urban and agricultural areas, as well as indirect risks through parents' exposure. Except in the case of acute poisoning, the data presented in this memorandum deals only with home pesticide use.

During the period from 1995 to 2000, the *Centre Anti-Poison du Québec* (CAPQ), *Institut national de santé publique du Québec*, recorded an average of 1,518 cases of acute poisoning per year (Sanfaçon, 2001). Approximately 45% of these cases involved children aged 0-15 years, and 91% of all cases were classified as involuntary poisoning. Most of the poisoning cases reported to the CAPQ came from the general public (86%), as opposed to occupational cases (14%). While it is impossible to follow every case (and therefore difficult to evaluate the seriousness of every incident), the data show that 63% of all recorded cases produced symptoms and that 15% of victims presented at hospital. Overall, treatment was recommended in 32% of cases. It is not possible to determine the exact number of cases associated with pesticide use in the context of landscape maintenance, but close to one hundred reported cases each year are linked to direct contact with treated lawns (Sanfaçon, 2001). Close to 40% of reported cases involve oral exposure, primarily in children, which points to the risks associated with improper storage of these products in the home.

The fact that so many cases of acute poisoning are being reported raises a number of questions concerning pesticide safety, particularly when these products are used and stored in the home. We know that non-professional users tend to be less cautious in their use of these products. This lack of concern can lead to negligence and an increased risk of toxic effects.

While the risks of acute pesticide poisoning have been amply demonstrated, the chronic effects of these products are now also raising many concerns. Although not every study has shown a statistically significant association or risk, some epidemiological studies suggest that certain cancer risks are greater for children who are exposed to pesticides in residential areas (whether inside or outside the home), as well as for children whose mothers were environmentally exposed during pregnancy.

Buckley et al. (1989) have observed associations between residential exposure to pesticides (actual products not specified) and the onset of leukemia in children. These associations were found to be significant for mothers who had been exposed to domestic pesticides for prolonged periods of time during pregnancy ($P < 0.05$), for children who had been directly exposed less than once a week (O.R.[2] 1.8; C.I. 95% = 1.0-3.0), and for children who had had more sustained exposure (O.R. 3.5; C.I. 95% = 0.9-13.8; P = 0.04). Lowengart et al. (1987) also demonstrated a possible increased risk of leukemia in children whose parents had used pesticides in the home one or more times a week (O.R. 3.8; C.I. 95% = 1.37-13.02; P = 0.004) or in the garden and/or yard one or more times a month during pregnancy or breastfeeding (O.R. 6.5; C.I. 95% = 1.47-59.33; P = 0.007). Meinert et al. (1996) uncovered a significant association between the use of pesticides in gardening (O.R. 2.52; C.I. 95% = 1.0-6.1) and leukemia in children. The authors indicated that in communities which had had a high incidence of childhood leukemia between 1984 and 1993, the rate of pesticide use in gardening had been 21%, compared to 10% in the other communities examined in the study.

According to Buckley et al. (2000), the frequency of home insecticide use by mothers during pregnancy is associated with an increased risk for non-Hodgkin's lymphoma (O.R. 2.62; $P < 0.05$ for one or two uses per week and O.R. 7.33; $P < 0.05$ for more frequent use). An association has also been demonstrated for mothers exposed in the course of household pest extermination (O.R. 2.98; $P< 0.002$). The authors established odds ratios for various immunopathological and histological parameters, as well as for different age groups, to determine whether the risks observed might be associated with one of these variables in particular. The most statistically significant association was with direct childhood exposure ($P < 0.01$ for B and T cell lymphoma, large-cell lymphoma in the 0-6 age group, and $P < 0.05$ for Burkitt lymphoma and acute lymphoblastic leukemia in the 6+ age group). According to these authors, direct postnatal exposure to pesticides is significantly associated with non-Hodgkin's lymphoma in children (O.R. 2.35; P = 0.05).

Leiss and Savitz (1995) conducted a case-control study in children up to age 15. A strong but imprecise association was demonstrated between soft tissue sarcoma and yard pesticide use during the period beginning at birth and ending two years prior to diagnosis (O.R. 4.1; C.I. 95% = 1.0-16.0) or during the two-year period immediately prior to diagnosis (O.R. 3.9; C.I. 95% = 1.7-9.2). The authors indicate that these findings are consistent with the hypothesis of Kelly and Guidotti (1989) to the effect that 2,4-D is associated with soft tissue sarcoma in adults. This study also showed numerous significant associations between *in utero* or postnatal exposure to insect strips and the onset of leukemia. Such an association has also been demonstrated for brain cancer in young people exposed during the two-year period prior to diagnosis (O.R. 1.8; C.I. 95% = 1.2-2.9).

[2] O.R. = odds ratio

In their case-control study, Davis et al. (1995) showed significant associations between brain cancer in children and exposure to pesticides when the cases were analyzed through comparisons with controls selected among the friends of the sick children (Davis et al., 1993). Such associations have been demonstrated with respect to the use of insecticides (O.R. 3.4; C.I. 95% = 1.1-10.6) or insect strips (O.R. 5.2; C.I. 95% = 1.2-22.2) in the home, the use of diazinon in yards and orchards (O.R. 4.6; C.I. 95% = 1.2-17.9), and yard use of herbicides for weed control (O.R. 2.4; C.I. 95% = 1.0-5.7). When comparisons were made with a control group composed of children also suffering from cancer, significant positive associations were observed with respect to the use of aerosol pesticides in the home (O.R. 6.2; C.I. 95% = 1.4-28.4), the use of insecticides in yards and orchards (O.R., 2.6; C.I. 95% = 1.1-5.9), and yard use of herbicides (O.R. 3.4; C.I. 95% = 1.2-9.3). The authors admit that the size of the sample, the potential for recall bias, the multiple comparisons made, and the difficulty of accurately characterizing exposure may have influenced their results. Based on the same arguments, Duffy et al. (1994) noted that the study may in fact present numerous false positives. Despite these uncertainties, the authors of the study believe their findings strongly suggest that significant associations exist between brain cancer in children and several residential pesticide-use scenarios.

Pogoda and Preston-Martin (1997) did not observe an increased risk of brain cancer in young children exposed to insecticides, herbicides, or fungicides used to treat gardens, regardless of whether the exposure occurred *in utero* or after birth. They did note, however, that ignorance of certain preventive measures was associated with significantly higher risks. Preventive measures include evacuating the household during pesticide treatment (O.R. 1.6; C.I. 95% = 1.0-2.6), waiting the required time before harvesting (O.R. 3.6; C.I. 95% = 1.0-13.7), and following label instructions (O.R. 3.7; C.I. 95% = 1.5-9.6).

In another case-control study, Daniels et al. (2001) evaluated the relationship between neuroblastoma in young children and residential pesticide exposure. The authors noted a modest association in cases where pesticides were used in the home (O.R. 1.6; C.I. 95% = 1.0-2.3) or garden (O.R. 1.7; C.I. 95% = 0.9-2.1). Based on the results presented, herbicides (O.R. 1.9; C.I. 95% = 1.1-3.2) were more strongly associated with neuroblastoma than were insecticides (O.R. 1.3; C.I. 95% = 0.7-2.3). It should be noted that significant associations were noted only where both parents confirmed that they had used pesticides. Moreover, a greater association was observed in children diagnosed after age one than in infants.

In a further case-control study, Gold et al. (1979) observed that the children with brain tumors had had more extensive exposure to insecticides than the controls (O.R. 2.3) and that this association approached the point of significance (P = 0.10).

One of the products which raises the most concern is 2,4-D, one of the phenoxy herbicides most frequently used in lawn care. Despite continuing concerns about the risks associated with these herbicides, the International Agency for Research on Cancer has classified this chemical group as a potential human carcinogen. While the manner in which 2,4-D may induce cancer has not been fully explained, some authors believe that it acts by disrupting the immune system (Hoar Zahm et al., 1997). The results of epidemiological studies on these products are contradictory and the toxicological data derived from experimental studies do not provide convincing evidence of the carcinogenicity of 2,4-D. In the early 1990s, a group of investigators evaluated the available data in an attempt to determine the cancer-causing potential of 2,4-D. They concluded that, although a causal relationship between 2,4-D exposure and non-Hodgkin's lymphoma had not been proven, the evidence strongly suggested that such a relationship did exist and that further investigations were needed. According to the group's evaluation, the association between 2,4-D and soft tissue sarcoma or Hodgkin's disease is not strong, but neither is it impossible. No association was established with any other form of cancer (Ibrahim et al., 1991).

Hayes et al. (1991) found a higher rate of malignant lymphoma in dogs whose owners used pesticides to treat their properties. On the subject of human risks of exposure in urban environments, a University of Guelph study (RCCT, 1995) suggests that, under normal circumstances, 2,4-D poses minimal risks to ecosystems or to humans. A recent study funded by Health Canada, the Foundation for Health Research in British Columbia, and the Centre for Agricultural Medicine at the University of Saskatchewan (McDuffie et al., 2001), indicates that exposure to the chemical classes of phenoxy herbicides (O.R. 1.38; C.I. 95% = 1.06-1.81) and dicamba[3] (O.R. 1.88; C.I. 95% = 1.32-2.68) increases the risk of non-Hodgkin's lymphoma in a statistically significant manner. A similar finding was made with respect to carbamates (O.R. 1.92; C.I. 95% = 1.22-3.04) and organophosphorus insecticides (O.R. 1.73; C.I. 95% = 1.27-2.36). Multivariate analysis indicates that, taken individually, 2,4-D (O.R. 1.32; C.I. 95% = 1.01-1.73), mecoprop (O.R. 2.33; C.I. 95% = 1.58-3.44) and dicamba (O.R. 1.68; C.I. 95% = 1.00-2.81) significantly increase the risk of non-Hodgkin's lymphoma. A number of statistically significant relationships were also reported for insecticides such as malathion (O.R. 1.83; C.I. 95% = 1.31-2.55) and carbaryl (O.R. 2.11; C.I. 95% = 1.21-3.69). It should be noted that the study took into account numerous confounding variables, including various demographic factors, personal and family medical history, general exposure to pesticides and smoking behaviour. Contrary to several earlier studies which focused on small geographic regions or specific occupational groups, the study by McDuffie et al., (2001) encompassed six Canadian provinces, a variety of agricultural practices, and various forms of occupational and non-occupational exposure to pesticides.

Most authors of cancer studies on children and residential pesticide use indicated that methodological biases inherent to case-control studies may have influenced their results. The primary factors causing uncertainty are recall bias, the difficulty in accurately characterizing pesticide exposure levels, multiple comparisons, and sample sizes. As with studies conducted in agricultural areas, residential studies do not consistently demonstrate significant levels of risk. However, the results taken as a whole indicate that numerous pesticide exposure scenarios involve a far from negligible cancer risk.

[3] Dicamba is generally classified as a phenoxy herbicide. For the purposes of their study the authors placed it in a separate category which includes Banvel, Target, a mixture of dicamba and glyphosate (Rustler), and mixtures of dicamba, 2,4-D and mecoprop (Dinnel or Killex).

Some studies raise the possibility of a link between pesticide exposure in pregnant women and certain congenital abnormalities. While such a link has primarily been observed in studies of occupational users, a few studies support the existence of a link in residential pesticide users as well (Shaw et al., 1999; Correa-Villasenor et al., 1991; Loffredo et al., 2001). Moreover, certain authors have observed a relationship between statistics on stillbirths and residential proximity to areas treated with pyrethroid, organohalogenated and organophosphorus pesticides (Bell et al., 2001). In a recent Canadian study, 2,4-D was found in the semen of occupational users, a factor which could significantly increase the incidence of spontaneous abortion in the partners of these men (Arbuckle et al, 1999 a and b). Although 2,4-D is widely used in ornamental horticulture, we have very little data on the impact of this class of pesticides on the general population.

A growing number of authors suspect a relationship between exposure to certain contaminants during pregnancy and subsequent problems in children. Such a connection is suspected between learning and developmental disorders in children and exposure to neurotoxic pesticides such as organophosphorus and organochlorine pesticides (Guillette et al., 1998). Certain pesticides may also interrupt the neurological development process during a particularly critical period and induce harmful effects on sensory, motor and cognitive functions (Tilson, 1998). Experimental studies have shown that low-dose neonatal exposure to pesticides, including those in the organophosphorus category, may cause irreversible changes in the cerebral functions of adult animals (Eriksson, 1997 and 2000). Recent data concerning the effects of organophosphorus insecticides on the early development of the nervous system have prompted Health Canada and the EPA in the United States to re-evaluate the toxicity of these products. It was on the basis of these new evaluations that severe usage restrictions were recently imposed for chlorpyrifos, an insecticide widely used in residential landscape maintenance.

Although the number of studies on the immune system effects of pesticides is still quite limited, some studies indicate a probable causal relationship between pesticide exposure and increased levels of infectious disease, reduced antibody production, and delayed hypersensitivity reactions. Repetto and Baliga (1996) have conducted extensive studies into the effects of pesticides on immune system functioning; they noted that several pesticides which are commonly used in residential and agricultural areas may suppress normal human immune responses to viruses, bacteria, parasites and tumors.

Certain synthetic chemicals, including pesticides, may disturb the hormonal or endocrine system and, in some cases, may induce a physiological imbalance. The effects of endocrine-disrupting chemicals are poorly documented at present but the list of pesticides which are suspected of having this potential continues to grow as more studies are published (CPEDD, 2000; Colborn et al., 1993). Commonly used pesticides such as 2,4-D, malathion and benomyl are substances for which endocrine-disrupting effects have been reported (Colborn et al., 1993).

There is still considerable uncertainty about the human health risks of esthetic pesticide use, due to difficulties inherent to the methodological approaches:

- relatively few studies have examined pesticide exposure in non-occupational populations;
- epidemiological studies often deal with several pesticides, making it difficult to identify the effects of specific agents;
- numerous biases make it difficult to interpret study findings and to accurately determine exposure levels.

In addition to the toxic effects mentioned earlier, it should be noted that available toxicity studies deal primarily with active ingredients and that little is known about the inert ingredients added to commercial products. This lack of information is generally the result of trade secret protection. There are also few studies on the effects of using several products in combination or combining active and inert ingredients. Certain combinations may potentially have additive or synergistic effects.

Finally, the impact of pesticide exposure on potentially more sensitive groups, such as fetuses, children, pregnant women and the elderly is not always taken into account in toxicity studies. The greater vulnerability of young children to pesticide exposure warrants repeating. Not only are children's exposure levels greater than those of adults, due to behavioural factors, but harmful effects are more marked in children due to the immaturity and sensitivity of certain target organs.

The data which are presently available, the fact that certain aspects remain poorly understood, and the increased vulnerability of certain groups provide ample reason to justify taking a prudent approach and applying the precautionary principle with respect to pesticide use. The precautionary principle, which is well known in public health circles, applies to situations where decision-making must take into account the risk of serious or irreversible harm in the presence of significant scientific uncertainty. We are of the opinion that the use of pesticides in urban areas fully meets these conditions.

3 TOWARD A MORE RATIONAL AND SAFER USE OF PESTICIDES

In view of the potential health hazards of pesticides, improved pesticide management and information procedures are needed. While many members of the public do not use these products and would be in favour of usage restrictions or outright prohibition (Collas and Duclos, 1994), the fact remains that a significant proportion of the population uses pesticides and would be opposed to such restrictions. Reasons for using pesticides include esthetics, belief in the efficacy of pesticides, intolerance of weeds and insects, social pressure, as well as lack of information on potential health risks and pesticide alternatives (Collas and Duclos, 1994). In order to ensure that changes in current pesticide management procedures do not give rise to popular resentment, a gradual, transitional approach supported by awareness-building activities seems advisable.

3.1 Protecting the most vulnerable population groups

For all of the various reasons we have just discussed, it is vitally important to develop means of protecting groups which are particularly vulnerable to pesticides, such as children and pregnant women. This includes reducing risks of involuntary exposure in public places, such as school yards, day-care centres, parks and playgrounds, unless a given infestation poses a specific risk to human health or threatens to destroy plant species which have a recognized heritage value.

3.2 Rationalizing the use of pesticides in residential areas

The rationalization of residential pesticide use is meant to protect the most vulnerable population groups. Efforts to rationalize pesticide use must involve reducing exposure, in terms of quantity, concentration and toxicity, as well as improving safety practices among users. The primary reasons for using pesticides in residential areas are esthetic in nature. Some consumers hire professionals while others apply the pesticides themselves. Regardless of who does the actual work, there is always a risk of exposure, which is why mechanisms to promote more efficient and safer pesticide use are needed. Furthermore, pesticide exposure risks are not limited to outdoor exposure. In a recent study, Nishioka et al. (2001) evaluated household concentrations of 2,4-D before and after lawn treatment with the herbicide. Following lawn treatment, the investigators detected the presence of 2,4-D in the ambient indoor air and on various household surfaces. The principal factors which are significantly associated with the transfer of pesticides from outdoors to indoors are the contamination of domestic animals and self-contamination by residential users. Estimated indoor exposure levels for young children were 10 times higher than the levels recorded prior to pesticide treatment.

Consumers have direct access to most of the pesticides commonly used by professionals since these products are sold by most garden centres and many large retailers. Although pesticides are sold in these establishments in smaller or ready-to-use containers, no restrictions are placed on the quantities customers may purchase. Nor is there any compulsory mechanism for informing customers who buy these products off the shelf. The use of pesticides by private individuals often increases the risk of exposure, due to a lack of understanding of recommended practices for safe preparation and application or for the post-application period. Furthermore, home storage of these products can pose significant risks to children, as the data on incidents of poisoning kept by the *Centre Anti-Poison du Québec* make clear.

Public health officials have spoken to the MENV on numerous occasions about the importance of restricting consumer access to pesticides by, for example, keeping these products "behind the counter" (Bolduc, 1998; MSSS and CSE, 1994; MSSS and CSE, 1993; MSSS and CSE, 1989). Such provisions would require the public to deal with a clerk in order to secure a risk product. It is also crucial that sales clerks be given adequate training to inform consumers on the type of product to use, on adherence to safe use practices, and on product health risks. Moreover, consumers should not have access to products in a concentrated form. Only products which have a low level of toxicity and are ready to use should be directly available to consumers. It is also important to note that biopesticides are not entirely without risk; therefore, consumers should be informed of this fact.

It is equally important that the operating procedures of professional firms be reviewed in order to reduce exposure to pesticides in the context of landscape maintenance. There are, at present, questionable commercial practices which generate additional risks of exposure for the general population. This was one of the reasons which moved the *Association des services en horticulture ornementale du Québec* (ASHOQ), which comprises a large number of horticultural firms, to create a code of ethics which encourages its members to take an integrated approach to pest management. For example, many firms offer their services in winter through telephone solicitation. This involves proposing a given number of pesticide treatments to prospective clients even though it is usually not possible to assess needs at that time of the year. Such methods can significantly increase the amount of fertilizers and pesticides used and intensify exposure levels for the general population. On the other hand, the application of pesticides is generally performed by staff who are reasonably well-trained. Some firms are also beginning to adopt more environmentally-friendly means of maintaining green spaces, although such practices are still not widespread.

As part of a gradual process intended to avoid the systematic recourse to chemical pesticides for esthetic purposes, an integrated approach to pest management would seem to be a valid solution for the rational, safe use of pesticides. A pilot "integrated lawn management" project (Brodeur et al., 2000), (a partnership involving the *Association des services en horticulture ornementale du Québec* (ASHOQ), several Quebec municipalities, and the horticulture research centre at *Université Laval*) was recently conducted in Quebec. This study demonstrated that it is possible to reduce average lawn pesticide use by 61%. These results were achieved by eliminating pesticide applications considered to be unjustified and by proceeding with localized applications only when such treatment was deemed essential. In Quebec City, the application of these integrated management principles led to a 50% reduction in the use of pesticides (Pronovost, 2001). However, this type of approach cannot succeed unless effective control mechanisms are also in place. Brodeur et al. (2000) have noted that implementing this new approach at the operational level involves far more than simply adopting a “green” slogan or painting a “green” logo onto trucks. As stated in the report, corporate image concerns and good intentions must give way to concrete, positive actions. While some industry members have adopted a new code of ethics which advocates an integrated approach, the absence of monitoring procedures and clear definitions (particularly with respect to action levels) hinders the achievement of the rationalization goals which are needed in order to better protect public health and the environment.

Regardless of the approach ultimately adopted, it is important to state that consumers must always be informed of the reasons for using pesticides and, where applicable, alternative approaches should be placed at their disposal. Consumers must have the last word regarding the choice of product to be used on their properties.

3.3 Informing the public about the risks of pesticide use and the available alternatives

It is likely that consumers would be more tolerant of pests if they had a better understanding of the risks associated with pest control products. Brodeur et al. (2000) have stated that only public education can alter negative perceptions about weeds and insects. At the present time, little effort is being made by public authorities (government departments, municipalities) to inform and sensitize the public about the rational use of pesticides in urban areas. Accordingly, any major changes in the framework currently governing pesticide use should be accompanied by a comprehensive awareness campaign on health and environmental risks, so that the public fully understands the reasons behind the changes. We also believe that a campaign to promote pesticide-free approaches to landscape maintenance should be implemented. Furthermore, annual awareness campaigns should be developed in partnership with relevant government departments and municipalities.

4 NEED TO IMPROVE THE DOCUMENTATION OF ENVIRONMENTAL AND HEALTH RISK LEVELS

Although the current data already argues in favour of applying the precautionary principle with respect to pesticide use for "esthetic purposes," the fact remains that we do not have enough information on population exposure levels and on the environmental contamination which can result from pesticide use. It would therefore be desirable to promote knowledge development in this area so that the risks and health effects of urban use pesticides can be measured more accurately.

Furthermore, a number of pesticides have not been re-evaluated for many years and the toxicological data on them is derived from studies whose methodological framework does not necessarily meet contemporary scientific criteria. Accordingly, the Federal/ Provincial/Territorial Action Plan for Urban Use Pesticides (Health Canada, 2000) emphasizes the need to undertake a comprehensive review of the scientific data available on pesticides, using modern scientific standards to determine whether any restrictions need to be made to their conditions of registration. Governments should also encourage and fund population exposure studies, as well as studies to characterize environmental pesticide contamination. Having said this, the priority should be to re-evaluate the toxicity levels of the pesticides most commonly used in landscaping, as suggested in the Action Plan for Urban Use Pesticides. And, while it appears desirable to accelerate the registration process for certain biopesticides, it is also important to ensure that the highest safety standards are applied to these products.

5 CONCLUSION

Some of the health risks associated with urban use pesticides remain poorly understood due to the fact that few studies have focused on urban uses. However, the data derived from the literature on the potential effects of certain pesticides which are widely used in landscape maintenance justify a more prudent, rational approach to pesticide use, as well as for reductions in overall use. Mechanisms to inform the public about health risks and pesticide alternatives are also needed. Finally, knowledge development is another important goal, so that the risks and health effects of urban use pesticides can be measured more accurately.

6 BIBLIOGRAPHY

ARBUCKLE, T.E., SAVITZ, D.A., MERY L.S., and K.M. CURTIS. (1999a): *Exposure to phenoxy herbicides and the risk of spontaneous abortion*, Epidemiology, Vol.10, pp. 752-760.

ARBUCKLE, T.E., SHRADER, S.M., COLE, D.J., HALL, C., BANCEJ, C.M., TURNER, L.A., and P. CLAMAN. (1999b): *2,4-dichlorophenoxyacetic acid residues in semen of Ontario farmers.* Reproductive Toxicology, Vol. 13, pp. 421-429.

BELL, E.M., HERTZ-PICCIOTTO, I. and J.J. BEAUMONT (2001): *A case-control study of pesticides and fetal death due to congenital anomalies.* Epidemiology, Vol. 12, pp. 148-156.

BOLDUC, D.G., (1998): Letter to Michèle Bélanger, MSSS concerning the draft regulations under the Code de gestion des pesticides. Comité de santé environnementale du Québec, 3 p.

BRODEUR, J., CARRIÈRE, Y., DESJARDINS, Y. and ROCHEFORT, S. (2000): *Projet-pilote de lutte intégrée dans les pelouses (final report).* Centre de recherche en horticulture. Université Laval. 28 p. Appendices.

BUCKLEY, J.D., MEADOWS, A.T., KADIN, M.E., LEBEAU, M.M., SIEGEL, S. and L.L. ROBISON (2000): *Pesticide exposures in children with non-Hodgkin lymphoma.* Cancer, Vol. 89, pp. 2315-2321.

BUCKLEY, J.D., ROBISON, L.L., SWOTINSKY, R., GARANGRANT, D.H., LEBEAU, M., MANCHESTER, P., NESBIT, M.E., ODOM, L., PETERS, J.M., WOODS, W.G. and G.D. HAMMOND (1989): *Occupational exposures of parents of children with acute nonlymphocytic leukemia: A report from the children's cancer study group.* Cancer Research, Vol. 49, pp. 4030-4037.

CANADIAN NETWORK OF TOXICOLOGY CENTRES (CNTC): *Environmental persistence and human health threats of the herbicide 2,4-D*. TOXTALK, Fall/Winter 1995. 2 p.

COLBORN, T., VOM SAAL, F.S. and A.M. SOTO (1993): *Developmental effects of endocrine-disrupting chemicals in wildlife and humans.* Environ. Health Perspect., Vol. 101, pp. 378-384.

CORREA-VILLASENOR, A., WILSON, P.D., LOFFREDDO, C. and C. FERENCZ (1991): *Cardiovascular malformations and prenatal environmental exposures.* John Hopkins Medical Institutions, Department of Epidemiology, Baltimore.

DANIELS, J.L., OLSHAN, A.F., TESCHKE, K., HERTZ-PICCIOTTO, I., SAVITZ, D.A., BLATT, J., BONDY, M.L., NEGLIA, J.P., POLLOCK, B.H., COHN, S.L., LOOK, T., SEEGER, R.C. and R.P. CASTLEBERRY (2001): *Residential pesticide exposure and neuroblastoma.* Epidemiology, Vol. 12, pp. 20-27.

DAVIS, J.R., BROWNSON, R.C., GARCIA, R., BENTZ, B.J. and A. TURNER (1993): *Family pesticide use and childhood brain cancer.* Arch. Environ. Contamin. Toxicol., Vol. 24, pp. 87-92.

DUFFY, L.C., COLE, P. et S.H. LAMM (1994): *Letter to the editor*. Arch. Environ. Contamin. Toxicol., Vol. 26, pp. 130-131.

ERIKSON, P., TALTS, U. (2000): Neonatal exposure to neurotoxic pesticides increases adult susceptibility: a review of current findings. Neurotoxicology, Vol. 21, No.1-2, pp. 37-48.

ERIKSON, P. (1997) : Developmental neurotoxicity of environmental agents in the neonate. Neurotoxicology, Vol.18, No. 3, pp. 719-726.

GOLD, E., GORDIS, L., TONASCIA, J.E. and M. SZKLO (1979): *Risk factors for brain tumours in children*. Am. J. Epidemiol., Vol. 109, pp. 309-319.

GUILLETTE, E.A., MEZA, M.M., AQUILAR, M.G., SOTO, A.D. and I.E. GARCIA (1998): *An anthropological approach to the evaluation of preschool children exposed to pesticides in Mexico.* Environ. Health Perspect., Vol. 106, No. 6, pp. 347-353.

HAYES, H.M., TARONE, R.E. and K.P. CANTOR et al. (1991): Case-control study of canine malignant lymphoma: Positive association with dog owner’s use of 2,4-dichlorophenoxyacetic acid herbicides. J. Natl Cancer Inst., Vol. 83, pp. 1226-1231.

HEALTH CANADA (2000): Minister Rock announces Federal/Provincial/Territorial Action Plan for Urban Use Pesticides (News Release).
http://www.hc-sc.gc.ca/english/media/releases/2000/2000_101e.htm

HOAR ZAHM, S., WARD, M.H. and A. BLAIR. (1997): *Pesticides and cancer*. Occupational Medicine: State of the Art Reviews, Vol.12, No. 2, pp. 269-289.

INTERNATIONAL AGENCY FOR RESEARCH ON CANCER (IARC). (1999): Overall evaluation of carcinogenicity to humans as evaluated in IARC Monograph Volumes 1-74.
http://193.51.164.11//monoeval/crthall.html.

IBRAHIM, M.A., G.G. BOND, T.A. BURKE, P. COLE, F.N. DOST, P.E. ENTERLINE, M. GOUGH, R.S. GREENBERG, W.E. HALPERIN, E. McCONNELL, I.C. MUNRO, J.A. SWENBERG, S.H. ZAHM and J.D. GRAHAM. (1991): *Weight of evidence on the human carcinogenicity of 2,4-D.* Environ. Health Perspect., Vol. 96, pp. 213-222.

KELLY, S.J. and T.L. GUIDOTTI (1989): Phenoxyacetic acid herbicides and chlorophenols and the etiology of lymphoma and soft-tissue neoplasm. Public Health Rev., Vol. 17, pp. 1-37.

LEISS, J.K. and D.A. SAVITZ (1995): *Home pesticide use and childhood cancer: a case-control study.* American Journal of Public Health, Vol. 85, No. 2, pp. 249-252.

LOFFREDO, C.A., SILBERGELD, E.K., FERENCZ, C. and J. ZHANG. (2001): Association of transposition of the great arteries in infants with maternal exposures to herbicides and rodenticides. Am. J. Epidemiol., Vol.153, No. 6, pp. 529-536.

LOWENGART, R.A., PETERS, J.M., CICIONI, C., BUCKLEY, J., BERNSTEIN, L., PRESTON-MARTIN, S. and E. RAPPAPORT (1987): *Childhood leukemia and parents' occupational and home exposures.* JNCI, Vol. 79, No. 1, pp. 39-46.

McDUFFIE, H.H, PAHWA, P., McLAUGHLIN, J.R., SPINELLI, J.J., FINCHAM, S., DOSMAN, J.A., ROBSON, D., SKINNIDER, L.F. and N.W. CHOI (2001): *Non-Hodgkin's lymphoma and specific pesticide exposures in men: cross-Canada study of pesticides and health*. Cancer Epidemiol. Biomark. Prev., Vol. 10, pp. 1155-1163.

MEINERT, R., KAATSCH, P., KALETSCH, U., KRUMMENAUER, F., MIESNER, A. and J. MICHAELIS (1996): *Childhood leukaemia and exposure to pesticides: results of a case-control study in northern Germany.* European Journal of Cancer, Vol. 32A, No. 11, pp. 1943-1948.

MSSS and CSE. (1994): *Proposition de modification au projet de code de gestion des pesticides*. Ministère de la Santé et des Services sociaux and Comité de santé environnementale du Québec. 27 p.

MSSS and CSE. (1993): *Commentaires sur le document d'orientation et de consultation sur le Code de gestion des pesticides*. Ministère de la Santé et des Services sociaux and Comité de santé environnementale du Québec. 15 p. Appendices.

MSSS and CSE. (1989): *Avis sur le code de gestion des pesticides*. Ministère de la Santé et des Services sociaux and Comité de santé environnementale des DSC du Québec.

NISHIOKA, M.G., LEWIS, R.G., BRINKMAN, M.C., BURKHOLDER, H.M and J.R. MENKEDICK. (2001): *Distribution of 2,4-D in air and on surfaces inside residences after lawn applications: Comparing exposure estimates from various media for young children.* Environ. Health Perspect. Vol. 109, No. 11. pp. 1185-1191.

POGODA, J.M. and S. PRESTON-MARTIN (1997)*: Household pesticides and risk of pediatric brain tumors*. Environ. Health Perspect., Vol. 105, pp. 1214-1220.

PRONOVOST, R. (2001): Service de l'environnement, Quebec City (personal communication).

REPETTO, R., BALIGA, S. (1996): *Pesticides and the immune system: the public health risks*. World Resources Institute, D.C. 100 p., ISBN 1-56973-087-3.

SANFAÇON G (2001): Intoxication aux pesticides pour la période de 1995 à 2000: Statistiques du Centre Anti-Poison (personal communication).

SHAW, G.M., WASSERMAN, C.R., O'MALLEY, C.D., NELSON, V. and R.J. JACKSON (1999): *Maternal pesticide exposure from multiple sources and selected congenital anomalies.* Epidemiology, Vol. 10, pp.60-66.

STANDING COMMITTEE ON ENVIRONMENT AND SUSTAINABLE DEVELOPMENT (SCESD): *Pesticides: Making the Right Choice for the Protection of Health and the Environment.*
http://www.parl.gc.ca/InfoComDoc/36/2/ENVI/Studies/Reports/envi01/04-toc-e.html.

TILSON, H.A. (1998): Developmental neurotoxicology of endocrine disruptors and pesticides: Identification of information gaps and research needs. Environ. Health Perspect. Vol. 106, Suppl. 3, pp. 807-811.