Agenda – Executive Policy Committee – July 20, 2005

REPORTS

Item No. 3 Review of the Insect Control Strategy
File PA

CIVIC ENVIRONMENTAL COMMITTEE RECOMMENDATION:

On July 11, 2005, the Civic Environmental Committee recommended that the draft review of the Insect Control Strategy (comments and recommendations by the Committee) be forwarded to the City Entomologist for comment.

DECISION MAKING HISTORY:

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City of Winnipeg Insect Control Strategy (April 2005)
Comments and Recommendations from the Civic Environmental Committee - Draft

A new three-year Insect Control Strategy was released to the public and subsequently approved by Council in April of 2005. This strategy has been reviewed by several members of the Civic Environmental Committee. Although the plan gives a general indication of the direction that the City is heading in terms of insect control, it lacks sufficient detail to allow a comprehensive review. The plan focuses on the costs related to the changes that will take place without providing enough detail to fully assess the implications of the changes themselves. As such, this report and its resulting recommendations are limited by the information available. Many information gaps have been identified. A more comprehensive review of the strategy can only be done when these gaps have been filled.

Dursban®, Methoprene, and Bti

The strategy states that Dursban® currently accounts for 85% of the City of Winnipeg Insect Control Branch's larviciding program. It also states the intention to replace Dursban® with Methoprene over the next three years - in anticipation that Dursban® will be deregulated by the PMRA within that same time frame. Although this is a welcome step, the report does not indicate why Dursban® is being deregulated. If it is because there are questions regarding its impact on human health (especially children) and safer alternatives are currently available, it would be prudent to discontinue the use of Dursban® immediately rather than phasing it out over three years – regardless of the cost. The strategy does not specify the quantity of Dursban® that will be used in 2005 and 2006 or where it will be applied. This information is essential for citizens to make informed decisions regarding insect control in Winnipeg. The strategy states that during Phase 1 (2005) all larval development sites within the City of Winnipeg that are larvicided by ground crews will become "biologically-based." Does this mean that the City will continue to use Dursban® for its aerial applications in 2005 and 2006? If so, where will Dursban® be used and where will Methoprene be used?

The report identifies Methoprene rather than Bti as the widespread substitute for Dursban®. The strategy refers to "biological products" but does not identify which products it considers biological versus chemical. Although both Methoprene and Bti may be considered biological, Bti is known to be more specific to the target organisms. Methoprene is harmful to all invertebrates – including mosquito predators. As such, Methoprene is not recommended for use in natural basins or artificial bodies of water that connect to natural systems. Despite this, the strategy states that in phase 1: *"a certain number of defined larval development sites within the City of Winnipeg and in the Capital Region will be identified as pilot sites for Methoprene® treatments. These pilot sites will include golf courses, industrial sites and specific large water bodies in the Capital Region. Methoprene® will be applied every 20 days via aerial and ground applications.* It does not appear that Methoprene will be limited to artificial basins unless all bodies of water created by people (either accidentally or intentionally) are defined as artificial. If this is the case, are roadside ditches, sheetwater on public and private lands, retention ponds, water hazards on golf courses, or ephemeral wetlands created by drainage activities defined as artificial basins? More information is needed regarding where Methoprene will be used.

The strategy indicates that the Branch is participating in the process better pesticides approved for use in Canada. These efforts are strongly supported by the Civic Environmental Committee. Until these options become available, the strategy proposes using Methoprene extensively instead of the form of Bti that is currently available in Canada. As such, the public should be informed about how much and where each pesticide is being used. If the City currently uses Bti, what criteria are used to determine where to use the Bti versus Methoprene and/or Dursban? Since Bti is available and is known to be more specific to the target organisms, why is the City opting to use Methoprene – an agent that is known to be harmful to all aquatic invertebrates – including mosquito predators?

Recommendations:

- Human Health: Discontinue the use of Dursban® immediately rather than phasing it out over 3 years. Failing this, set clear targets for the reduction of Dursban® using actual amounts applied instead of percentages and make the public aware of where Dursban® will continue to be used for the next two years.
- Ecological Health: Use the most specific pesticide currently available (Bti) in all surface water in Winnipeg - despite its location (public parks, private lands, "ditches", etc.) and the challenges associated with application, costs, etc. Clearly define what the City would call artificial basins, restrict the use of Methoprene to these areas, and notify the public where Methoprene is being used.
- Transparency: The City has been gathering data related to insect control and monitoring for decades. This includes information related to the location of potential mosquito-hatching areas (standing water), results of mosquito monitoring activities, the location of its mosquito-control activities (aerial larviciding, ground larviciding, adulticiding, etc.), and the types, frequency and quantity of materials used (Dursban®, Methoprene, Bti, malathion). It has compiled detailed geographic information to assist with its own decision-making. This information should be made freely and easily available to all residents of the City so that they can be aware of the specific type of mosquito control used in their neighbourhoods. At the very least, this information should be made available to the Civic Environmental Committee so that it can fulfill its intended purpose – to provide City Council with meaningful advice.

Integrated Pest Management (dragonflies, minnows, etc.)

It is encouraging to see that the City is willing to include some "non-chemical" forms of mosquito control (natural predators) in the new strategy. Will the continued use of Dursban® or the widespread use of Methoprene undermine the effectiveness of this approach? How will the success of this approach be monitored or evaluated?

Recommendations:

- Some residents believe that the most effective approach to mosquito control is the widespread use of the strongest chemicals possible. Be prepared to support alternative approaches with scientific data. If the literature is not strong in this area, work with universities to conduct research to compare the efficacy and ecological impacts of the non-chemical approaches compared the use of Bti, Methoprene and/or Dursban® (if it is still in use).

Barrier Treatments

The strategy proposes a new method of mosquito control call "barrier treatment," however specific information about this is lacking. What chemical will be used for this treatment? How much will be used, when and where? What is its residual nature? The strategy suggests that pyrethroids will be used for this purpose. Exposure to pyrethroids can have a wide range of side effects on human health. They are also highly toxic to insects (including beneficial ones), fish, and birds (see below).

Recommendation:

- Apply the precautionary principle. Do not introduce pyrethroids into the City's environment – even in low concentrations.
- If these chemicals are used, notify the public about their use. It is not enough to simply list the chemicals that the City plans to use in the newspaper once a year. Be specific about location, quantity, and timing.

Use of Pesticides – including Malathion® - and Human Health Concerns

The strategy acknowledges that *"Malathion® is perceived by some citizens as a toxic chemical and therefore public concern regarding its use has been expressed."* However, unlike other jurisdictions in Canada that have taken the precautionary approach and no longer spray for adult mosquitoes, Winnipeg plans to continue fogging "as required" by a complex formula – the *Adulticiding Factor Analysis (AFA).* Despite significant opposition to the use of Malathion® each year, the new strategy proposes to continue applying Malathion® to kill adult nuisance mosquitoes in the event that larviciding efforts are ineffective and "urgent conditions exist." While the AFA provides a more comprehensive and scientific analysis than light trap counts, its use could actually result in an increase in the frequency of city-wide Malathion® spraying depending on the environmental conditions.

The new strategy proposes to conduct fogging: *"in specific areas of the city as determined by the City Entomologist to have a high AFA, rather than the standard practice of conducting complete coverage of the City."* Although a more targeted approach to fogging should reduce the amount of Malathion® applied in the City overall, the preferred solution to address human health concerns would be to discontinue fogging altogether.

The strategy does not make any recommendations regarding future of buffer zones. It simply states that they currently exist. This is a contentious issue almost every year. One perception is that "a few people are eliminating fogging for everyone in their neighbourhoods." However, the number of people registering for buffer zones might actually increase if it was easier to do so. Although the option for buffer zones exists, registration is not encouraged due to the difficulty of the registration process.

Recommendations:

- Commit to reducing pesticide use in response to growing pubic concerns by employing Malathion® to kill adult mosquitoes only when the Province of Manitoba declares a "health emergency." After several decades of virtually continuous use, this should help to prevent mosquitoes from developing resistance to Malathion and ultimately make the use of this pesticide more effective in the years that it is truly needed to combat a health emergency.
- Prepare an annual report that includes the total amounts of all pesticides used for mosquito control. Make this information easily available to the public – including through the Internet – so that they can see if pesticide use in Winnipeg is increasing or decreasing. Create a map showing the amounts and types of pesticides used in different areas of the City and make this available to the public so that people with specific health concerns can make informed decisions about where they wish to live, work, and play.
- Set SMART targets designed to reduce the use of the most controversial pesticides.
- Encourage people to take personal responsibility for protecting themselves from mosquito bites (using screens, appropriate clothing, repellents, timing of activities, etc.) so that people and wildlife can enjoy the benefits of fewer chemicals in the environment.
- Make it easier for people to register for the buffer zones (for example on the City's Web site) so that participation in this program can provide a better measure of the feelings of residents concerning their personal exposure to pesticides.

Site Reduction

The strategy refers to taking steps toward "site reduction" and hiring (?) a person with site reduction experience to achieve this end. Is "site reduction" a euphemism for draining the City's remaining ephemeral wetlands? What are the downstream implications of further drainage in terms of water quantity and quality? What are the ecological implications to species diversity within Winnipeg? What are the implications to groundwater recharge? Will the City's biodiversity be protected by replacing these with the restoration of larger, more permanent wetlands?

Recommendations:

- Consult with wetland experts before pursuing the idea of site reduction.
- If widespread site reduction is pursued, mitigate the environmental impacts by restoring larger, more permanent wetlands.

Targets and Evaluation of Success

The strategy is incomplete. In particular, it lacks specific targets for both mosquito reduction and the reduction of pesticides. Without clear and realistic targets, it is impossible to measure success and the mosquito reduction program in Winnipeg will continue to be influenced more by public complaints than by science.

The strategy suggests discontinuing one of the only measures (mosquitoes in light traps per night) that is currently in place without suggesting an alternative way of measuring success. This makes it virtually impossible to judge the success of the insect control program. Is the goal to eliminate all mosquitoes in Winnipeg (unrealistic) and continue spending more money until this is achieved? The strategy emphasizes the costs related to the program each year rather than setting meaningful targets. Mosquito control for nuisance reasons (due to societal pressure), can become an economic black hole unless it has clear and reasonable targets. The methods chosen will also impact society and the environment.

The strategy addresses the human resources and financial implications of the proposed changes but it does not address several of the environmental implications that were specifically requested. For example, the following items are not included in the strategy:
1. Insect Control Services prepare a cost-benefit analysis of the use of Malathion®
a) To control nuisance mosquitoes; and b) To control mosquitoes which may bear West Nile Virus or other diseases
2. Without restricting the generality of the foregoing, the analysis must include responses on the following issues:
a) What research, if any, has been conducted on the efficiency and safety of Malathion®?
b) What conclusions, if any, have been reached through such research?

With regard to the effects of larvicides on other insects, the strategy states: *Methoprene® and Dimilin®, are insect growth regulators (IGR's), and can affect other larval and pupal stage insects in water bodies in addition to mosquito larvae and pupae. This minor loss to other insect life is acceptable when searching for longer term larviciding alternatives to chemical control.* This is not consistent with the recommendations made by Ducks Unlimited Canada in its review of larvicides currently available.

The cost-benefit analysis for Malathion does not include any environmental and social costs. In reality, an environmental impact assessment is required. Other costs that have not been considered: loss of beneficial insects (pollinators, natural mosquito predators, etc.), loss of biodiversity, food chain impacts through the degradation of habitat (through the reduction of food) for specific birds, health costs (a variety of symptoms resulting from a combination of malathion, its by-products, and a multitude of other chemicals in the environment).

Recommendations:

- Set SMART objectives (specific, measurable, attainable, realistic, and time-sensitive) so that the success of the insect control program can be evaluated.
- Set clear targets that can be easily understood by the public. Targets must relate to the number of mosquitoes being counted in some manner (emergence from water bodies, caught in light traps, bites per hour, etc.). They must also incorporate some measure of the impact on other organisms in the environment. For example, objectives should not simply address mosquito or larva numbers. They should also include a statement about limiting harmful byproducts or impacts on other species. Techniques that might be very effective at reducing or "eliminating" the emergence of mosquitoes from a body of water could also have serious and unacceptable impacts on other organisms – including people. All techniques employed should be judged using a combination of both criteria.
- Set targets related to the reduction of specific chemicals within the given time frame. Use concrete amounts rather than percentages.
- Apply the principles of sustainability to the insect control strategy. Give equal consideration to the impacts of the methods on environment, society, and economy. The City allocates a huge amount of money each year to an essentially unsustainable activity. Mosquitoes will ever be completely

eliminated in Winnipeg. Consider some long-lasting alternatives to reducing the number of mosquitoes. Over time, and with education, these techniques may reduce or eliminate the need for larviciding and adulticiding. For example, subsidize the purchase of screen shelters or bug jackets/hats in the same way that the City currently subsidizes composters. Encourage personal responsibility.

- Use research and science as a basis for decision-making and allocate sufficient money to scientific study and monitoring the results of the control techniques.
- Work with universities to conduct research on the effectiveness of the City's control methods.

Monitoring and Research

The strategy indicates that the efficacy of the treatment methods will be monitored through. Will the impact on other aquatic organisms also be monitored? Will the downstream effects of treatments be monitored? How will Methoprene impact the ecological balance within wetlands that are being integrated into developments such as Royalwood and Frog Plain?

The strategy indicates that there is a significant amount of monitoring is being conducted, however, the results of the monitoring and research are not being shared with the public. The strategy does emphasize the need for scientific study to assist with decision-making and management. Does the City use emergence traps for monitoring the actual emergence of adult mosquitoes from specific bodies of water?

Recommendation:

- To reduce costs of monitoring, raise awareness, and empower residents, involve high school students and other residents in monitoring mosquitoes (larvae, pupae, and adult emergence) in bodies of standing water in neighbourhoods around the city.
- Make the results of the monitoring and research readily available to the public – including through the Internet.

Role of the Civic Environmental Committee

The strategy states that it is *"consistent with both Plan Winnipeg and Sustainable Winnipeg: A Comprehensive Environmental Strategy that promote the implementation of new and innovative IPM methods aimed at reducing pesticide use and increasing safety and effectiveness."* This statement would be a stronger endorsement if it were to come from the Civic Environmental Committee itself. Unfortunately, the Committee received the new strategy at the same time that it was released to the public. It did not have an opportunity to provide input or advice before this document was approved by Council. As such, none of the concerns or recommendations in this review are addressed by the strategy.

Recommendation:

- Allow the Civic Environmental Committee to determine the degree to which the strategy is consistent with the city's Environmental Strategy by providing an opportunity to comment on activities such as this before they are approved by Council. The committee's comments could then be passed on to the administration for possible integration into the plan.

Pyrethroids and Human Health

Striatal dopaminergic pathways as a target for the insecticides permethrin and chlorpyrifos.
Karen DJ, Li W, Harp PR, Gillette JS, Bloomquis JR. Department of Entomology, Virginia Polytechnic Institute and State University, Blacksburg 24061, USA. *Neurotoxicology* 2001 Dec;22(6):811-7

Because insecticide exposure has been linked to both Parkinsons disease and Gulf War illness, the neurotoxic actions of pyrethroid and organophosphate insecticides on behavior and striatal dopaminergic pathways were investigated in C57BL/6 mice treated with permethrin (three i.p. doses at 0.2-200 mg/kg) or chlorpyrifos (three s.c. doses at 25-100 mg/kg) over a 2-week period. Permethrin altered maximal [3H]dopamine uptake in striatal synaptosomes from treated mice, with changes in Vmax displaying a bell-shaped curve. Uptake was increased to 134% of control at a dose of 1.5 mg/kg. At higher doses of PM (25 mg/kg), dopamine uptake declined to a level significantly below that of control (50% of control at 200 mg/kg, $P < 0.01$). We also observed a small, but statistically significant decrease in [3H]dopamine uptake by chlorpyrifos, when given at a dose of 100 mg/kg. There was no significant effect on the Km for dopamine transport. Evidence of cell stress was observed in measures of mitochondrialfunction, which were reduced in mice given high-end doses of chlorpyrifos and permethrin. Although cytotoxicity was not reflected in decreased levels of striatal dopamine in either 200 mg/kg PM or 100 mg/kg CPF treatment groups, an increase in dopamine turnover at 100 mg/kg CPF was indicated by a significant increase in titers of the dopamine metabolite, 3,4-dihydroxyphenylacetic acid. Both permethrin and chlorpyrifos caused a decrease in open field behavior at the highest doses tested. Although frank Parkinsonism was not observed, these findings confirm that dopaminergic neurotransmission is affected by exposure to pyrethroid and organophosphorus insecticides, and may contribute to the overall spectrum of neurotoxicity caused by these compounds.

Side Effects

Pyrethroids:
Inhalation: coughing, wheezing, shortness of breath, runny or stuffy nose, chest pain, or difficulty breathing.

Skin contact: rash, itching, or blisters.

Long term effects: disrupts the endocrine system by mimicking the female hormone, estrogen, thus causing excessive estrogen levels in females. In human males, its estrogenizing (feminizing) effects include lowered sperm counts. In both, it can lead to the abnormal growth of breast tissue, leading to development of breasts in males and cancerous breast tissue in both male and females.

Neurotoxic effects include: tremors, incoordination, elevated body temperature, increased aggressive behavior, and disruption of learning. Laboratory tests suggest that permethrin is more acutely toxic to children than to adults.

Other: A known carcinogen. There is evidence that pyrethroids harm the thyroid gland. Causes chromosomal damage in hamsters and mice; deformities in amphibians; blood abnormalities in birds.

So, what's the big deal?
While pyrethroids may be amongst the least toxic of insecticides, they are an excitatory nerve poison, acting upon the sodium ion channels in nerve cell membranes:

- by sending a train of impulses rather than a single one, they overload the pathways, blocking the passage of sodium ions across cell membranes; similar in action to organophosphates (which

include the now banned DDT); inhibits ATPase, which affects the release of acetylcholine, monoamine oxidase-A and acetylcholine;

- inhibits GABAa receptors, resulting in convulsions and excitability (and more 'minor' problems such as sleep disorders);
- known to be carcinogenic;
- liver damage
- thyroid function
- cause chromosomal abnormalities in mice and hamsters;
- are highly toxic to insects, fish, and birds;
- mimic estrogen, leading to estrogen dominant (http://www.anapsid.org/aboutmk/xenoest/estrogen.html) in females and feminizing effects in males, including lowered sperm counts and abnormal breast development;
- sublethal doses have produced a wide array of abnormal behaviors, including aggression, and disruption in learning and learned behaviors

From the EPA Fact Sheet:

Do Pyrethroids Pose Risks to Human Health?

Pyrethroids can be used for public health mosquito control programs without posing unreasonable risks to human health when applied according to the label. Pyrethroids are considered to pose slight risks of acute toxicity to humans, but at high doses, pyrethroids can affect the nervous system.

Do Pyrethroids Pose Risks to Wildlife or the Environment?

Pyrethroids used in mosquito control programs do not pose unreasonable risks to wildlife or the environment. Pyrethroids, when applied at mosquito control rates, are low in toxicity to mammals, and are practically nontoxic to birds. Mosquito control formulations of permethrin break down in the environment, and high temperatures and sunlight accelerate this process. However, pyrethroids are toxic to fish and to bees. For that reason, EPA has established specific precautions on the label to reduce such risks, including restrictions that prohibit the direct application of products to open water or within 100 feet of lakes, streams, rivers or bays.