

# Pesticide Toxicity Report

## COUNCIL DIRECTION

On 2016 November 07, a Motion Arising came forward at Council and directed Administration to:

Evaluate pesticide toxicity as part of the Integrated Pesticide (sic) Management Plan review, with the goal of eliminating the more toxic pesticides from use on city land. As well, include members of the public who are health professionals or from health organizations as part of the review team and return to City Council, through the SPC on Community and Protective Services, no later than 2017 Q2 on the progress made.

The Motion Arising required that Administration evaluate pesticide toxicity with the goal of eliminating the more toxic pesticides from use on City of Calgary lands and include input on the matter from public health advocates.

## SUMMARY

This Pesticide Toxicity Report is Administration's response to Council direction to evaluate pesticide toxicity with the goal of eliminating the more toxic products used on City land.

- Reducing exposure to pesticides is key to their safe and low-risk use.
- Exposure is mitigated through federal and provincial regulations, and municipal policy and procedures.
- The City of Calgary does not have the authority to evaluate pesticide toxicity.
- Pesticide toxicity is evaluated by a division of Health Canada, which regulates the use of pesticides to prevent unacceptable risks to individuals and the environment.
- The City of Calgary limits pesticide use on City-owned land through its Integrated Pest Management Plan, which prescribes a policy-based, multi-faceted approach to managing assets.
- As directed by Council and the Biodiversity Policy (2015), Administration will revise its Integrated Pest Management Plan.
- Through its revision, The City will commit to updating its procedures in alignment with current best practices and annually reporting on the program, pesticide use and trials undertaken.

# Pesticide Toxicity Report

## OUTLINE

In order to address Council's direction regarding pesticide toxicity, this report contains the following content:

1. Definition of pesticide
2. Regulatory context
3. Pesticide toxicity
4. The City's Integrated Pest Management (IPM) program
5. Pesticide use in Calgary
6. Stakeholder positions
7. Conclusion
8. Recommendations
9. Appendices

## DEFINITION OF PESTICIDE

Health Canada defines, categorizes and regulates pesticides in Canada. Through the federal Pest Control Products Act, the Pest Management Regulatory Agency (PMRA) of Health Canada defines "pesticide/pest control product" as:

Any product, device, organism, substance or thing that is manufactured, represented, sold or used as a means for directly or indirectly controlling, preventing, destroying, mitigating, attracting or repelling any pest. Control products include active ingredients used in the manufacture of end-use products and the end-use products themselves. Includes herbicides, insecticides, fungicides, antimicrobial agents, pool chemicals, microbials, material and wood preservatives, animal and insect repellents, and insect- and rodent-controlling devices.

Active ingredients are the components of a pest control product that act to control the pest. Each pesticide product has at least one active ingredient and may have other ingredients that improve the effectiveness or shelf-life of the pesticide.

## REGULATORY CONTEXT

In Canada, the PMRA tests and evaluates pesticides for safety and risk for human and environmental exposure. The primary objective of the Minister of Health is to administer the federal Pest Control Products Act to prevent unacceptable risks to individuals and the environment from the use of pest control products.

At the provincial level, categories or schedules of pesticides are established through the Environmental Protection and Enhancement Act and the Pesticide Regulation, which govern the sale, handling, use, application, storage, transport and disposal of pesticides in Alberta.

# Pesticide Toxicity Report

The provincial Weed Control Act regulates invasive plant species by two categories: noxious and prohibited noxious. The former requires control; the latter eradication. Inspectors appointed under the Act may give notice to direct the method and timeframe for compliance.

The provincial Agricultural Pests Act declares pest and nuisance species. Via the Act, an inspector may issue a notice to specify the measures to be taken and the material, if any, to be used to prevent the establishment of or to control or destroy the pest.

The provincial Fisheries Act stipulates that invasive organisms shall not be kept, placed or allowed to enter water of any kind. The schedule of species includes aquatic plants that are already listed under the Weed Control Act, various fish species, and species other than fish or plants such as mussels, snails and water fleas. A fishery guardian may be appointed by the minister to exercise compliance under this act.

The City of Calgary is legally obliged to abide by federal and provincial regulations. Adhering to The City's Integrated Pest Management Plan and Policy (CSPS017) further reduces pesticide exposure risk on City-land. Additionally, the Community Standards Bylaw includes details about the role of a weed inspector, enforcement of the Weed Control Act and what constitutes an infraction. Bylaw officers are appointed provincial weed inspectors.

The City can respond to unique municipal issues on both public and private property. For example, under the Weed Control Act a municipality may elevate the regulatory status of a weed within city limits, if deemed necessary (e.g. poses a threat to human health or infrastructure). The City may also create a bylaw to restrict pesticide use on public and/or private property. For further details on implications, costs and citizen perspectives on pesticide use restrictions, see Appendix A, Perspectives on pesticide use.

## PESTICIDE TOXICITY

### ***Authority***

The PMRA is mandated to define, categorize and regulate pesticides via the Pest Control Products Act. "The PMRA determines which pesticides can be registered for use in Canada through a series of detailed, science-based evaluations that assess a pesticide's potential risk to human health and the environment, and its value in relation to the intended use."<sup>i</sup>

The PMRA performs toxicity studies to determine the nature and extent of the hazard posed by a pesticide proposed for use in Canada. Short and long term exposure studies are performed. For a list of the studies undertaken, see Appendix B, Toxicity studies.

### ***Exposure risk***

Toxicity refers to the ability of a pesticide to cause short-term or long-term harm to an organism. The potential health risk a pesticide poses is a product of its toxicity and exposure to the pesticide. When

# Pesticide Toxicity Report

either toxicity or exposure to a pesticide increases, the risk of harm increases. This can be expressed as an equation:

$$\text{Risk} = \text{toxicity} \times \text{exposure}$$

Risk of a pesticide product is dependent on:

- The capacity of the pesticide to harm – called toxicity; and
- The amount of exposure to the pesticide – the means by which a pesticide can get into the body: breathing, swallowing or absorption.

Reducing pesticide exposure is key to their safe and low-risk use. Pest control product labels include directions for the safe use of the product.

## ***Toxicity***

Toxicity refers to the ability of a pesticide to cause harm to an organism. Harm may be acute (short-term) or chronic (long-term). The toxicity of a pesticide is described on the product's label using precautionary words and symbols. Product labels can be viewed by the public on the product label search of Health Canada's website.

## ***Health Canada's approach to toxicity studies***

In 2004, The Ontario College of Family Physicians reviewed public health population (epidemiology) literature from 1992-2003. Their report concluded that "exposure to commonly used pesticides ... has shown positive associations with adverse health effects."

Health Canada reviewed and responded to the report summarizing,

This report examined a small group of epidemiology studies, and reported potential associations between pesticides and certain cancers. The wider scientific community raised significant concerns with respect to how this literature study was conducted because it did not consider all of the relevant epidemiological evidence.

[...]

Examining animal toxicity studies that analyze the absorption and break down of toxins, combined with exposure studies, is a preferred method for assessing risks to human health. Health Canada uses this approach, which is also supported by the international scientific community, in determining if a pesticide can be used safely.<sup>ii</sup>

# Pesticide Toxicity Report

## ***Reducing risk***

According to the PMRA, all products registered for use in Canada are considered to be of acceptable risk when used in accordance with the label. Pesticides that pose unacceptable risk to individuals and the environment are not approved by the PMRA.

The province further limits risk by categorizing pesticides into four schedules. Schedules of pesticides are established through the Alberta Pesticide Ministerial Regulation. The schedule of a pesticide (1 to 4) is determined based on risks to the environment or human health, and are divided into the following four categories:

- Schedule 1: Federally labeled restricted and some commercial pesticides. These pesticides (consisting mostly of fumigants and vertebrate toxicants) can only be used directly by or under the supervision of a certified pesticide applicator.
- Schedule 2: Federally labeled commercial, agricultural, horticultural and industrial pesticides and can only be used by certified applicators and their assistants.
- Schedule 3: Federally labeled domestic pesticides are for use by homeowners and may be bought and used by anyone around their own homes. If these products are being used to provide a service for hire or reward, then pesticide applicator certification is needed. Certification is also required when used in and around multi-family dwellings, daycare facilities, hospitals, nursing homes and schools.
- Schedule 4: Federally labeled domestic and commercial pesticides do not pose significant risks to individuals or the environment when used in accordance with the label. They may be purchased and used by anyone.

Of the 35 pesticide products that The City used in 2016: 88% are Schedule 2, 6% are Schedule 3, and 6% are Schedule 4 (low risk). No products are Schedule 1, the highest risk category.

## **THE CITY'S INTEGRATED PEST MANAGEMENT PROGRAM**

The City's current pesticide use practices are in alignment with the mandates of Health Canada and Alberta Environment and Parks. The City's invasive species and pest management practices are further governed by its Integrated Pest Management Plan and Policy (1998) and Invasive Plant Strategic Management Plan (2008).

The City's IPM work group is a portfolio in Calgary Parks that provides corporate-wide services including mechanical removal of invasive plants (e.g., hand pulling, mowing), biological and cultural controls (e.g., insects, goats), application of pesticides and consulting services. Its programs include working with Civic Partners (Calgary Zoo and Heritage Park), City of Calgary golf courses, and facilities and arenas run by Calgary Recreation.

Detailed records are kept for pesticide applications on land that is owned and managed by The City. At the end of each growing season, an annual active ingredient report is prepared where total active

# Pesticide Toxicity Report

ingredients for all products are calculated including how much was used and the extent of application (total area in hectare, or number of trees). As a pesticide service registrant, The City is legally obligated to keep detailed records of pesticide applications for not less than five years and provide them to Alberta Environment and Parks when requested.

## ***Environmental impact***

Pesticides are often used to enhance the environment's productivity, the viability and diversity of the environment and to protect the health and safety of humans. An assemblage of best practices and risk management procedures are employed by The City to minimize environmental impact, including:

- Use pesticides only when necessary.
- Use non-chemical controls whenever possible.
- Select the lowest risk pesticide possible for the pest being controlled.
- Be sensitive to the presence of wildlife and their young.
- Identify and leave buffers around sensitive areas (e.g. schools, hospitals, playgrounds, etc.).

## ***Reducing exposure risk and environmental impact***

The IPM Plan provides the direction for invasive species and pest management on City property. It promotes an ecological approach to suppressing pest populations with the aim to keep pests at acceptable levels in effective, economical and environmentally sound methods. All necessary techniques of pest control are consolidated in a unified program, including mechanical control and pesticide application. A key objective is to use pesticides only when necessary.

The IPM work group has employed the following approaches to minimize the use of and exposure to pesticides:

- Pesticide-free parks
- Tot lot buffer (30 m)
- Spot spraying
- Public notification of pesticide application
- Citizen education (Healthy Yards Program and web-based communication)
- Early Detection and Rapid Response (EDRR)
- Targeted grazing (goats)
- Biological control (insects)
- Plant health care
- Naturalization

For a summary of these pesticide reduction and exposure risk strategies, see Appendix C, IPM programs and approaches to reduce pesticide use and exposure risk.

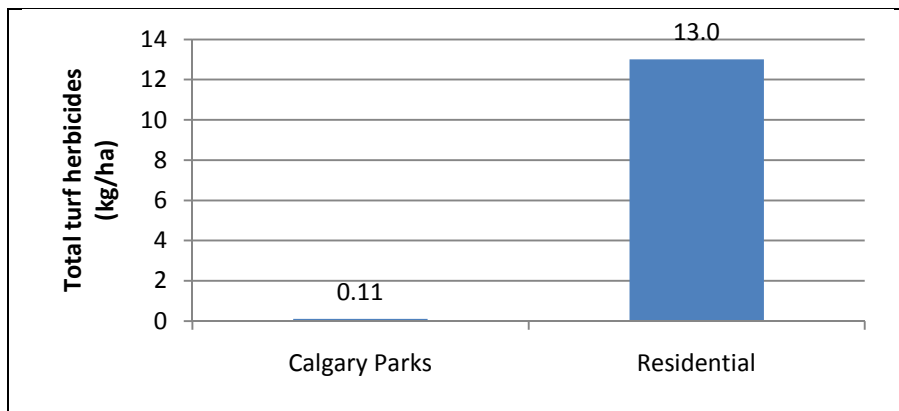
# Pesticide Toxicity Report

## PESTICIDE USE

Intensity of pesticide use can be understood as either the total volume of pesticide applied per hectare or the total active ingredient applied per hectare. Active ingredients are components of pesticides that control the target pest. Other ingredients improve the effectiveness of the product, such as binding the liquid to a plant.

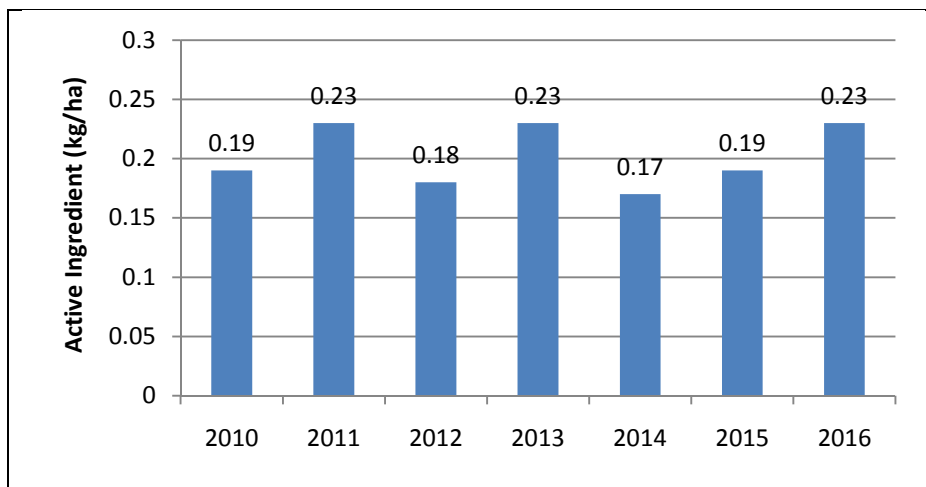
In 2015, the province compared Calgary Parks to private residential use of herbicides on turf grass. Residential use included pesticides purchased for home use; commercial application services were excluded. The City applied 0.11 kg/ha of herbicides on turf; citizens applied 13.0 kg/ha on private yards.

Figure 1. Public and private residential turf herbicide use intensity in 2015.



Pesticide use by The City extends beyond turf herbicides. Pesticides may also be applied to natural areas, trees, planting beds and hard surfaces. At a City-wide scale, annual use since 2010 has fluctuated between 0.17 kg/ha to 0.23 kg/ha of active ingredient. Fluctuations over time result from changes in the area and asset quality of land owned by The City, pest management priorities and pest outbreaks, which may vary in severity according to weather (temperature, precipitation, etc.).

Figure 2. Herbicide use intensity by The City of Calgary from 2010-2016, expressed as active ingredient per hectare. In 2010, the Weed Control Act was updated to reflect provincial priority weed species.



# Pesticide Toxicity Report

## STAKEHOLDER POSITIONS

As part of its response to the Motion Arising, Administration solicited feedback from professionals and public health advocates for their position on the use of pesticides and what strategies should be employed to eliminate the more toxic products from use on City-owned land. Stakeholders were invited to extend the request to their professional network. As a result, additional responses were received.

Responses were official, in that they represented the position of an organization, and unofficial, in that they were an opinion of an individual. The following table identifies those stakeholders who were solicited by Administration and who responded.

Stakeholder	Solicited	Responded
Alberta Health Services	X	X
Alberta Invasive Species Council	X	X
Association of Alberta Agricultural Fieldmen		X
Canadian Association of Physicians for the Environment	X	X
Canadian Cancer Society		X
City of Edmonton	X	X
Coalition for a Healthy Calgary	X	X
College and Association of Registered Nurses of Alberta		X
CropLife Canada		X
Dow AgroSciences Canada Inc.		X
Federal pest management practitioner, Leslie Farmer, Agriculture and Agri-Food Canada	X	X
Grow Calgary		X
Joyce Woods, Mount Royal University School of Nursing and Midwifery		X
Landscape Alberta Nursery Trades Association	X	X
M.D. Foothills	X	
Parents for Pesticide-Free Schools		X
Pest Management Regulatory Agency (Health Canada)	X	
Prevent Cancer Now		X
Rethink Breast Cancer		X
Rob McGregor, Douglas College	X	
Rocky View County	X	X
Town of Canmore	X	
University of Calgary (three public health-related departments)	X	
University of Toronto (two public health-related departments)	X	

Administration received 18 responses. Stakeholder positions can be generalized into two categories:

1. Voluntary pesticide use restriction: stakeholders support an integrated approach (judicious use of pesticides) to manage invasive species and pests within the legislative context of Health Canada-approved pesticides (9 letters).
2. Non-voluntary pesticide use restriction: stakeholders support some degree of regulatory (non-voluntary) pesticide restriction (9 letters).



# Pesticide Toxicity Report

## CONCLUSION

Administration was asked to evaluate pesticide toxicity and to outline how the use of the more toxic products could be eliminated. Health Canada holds the authority to evaluate and register pesticides for use if their value and the risks to human health and the environment are deemed acceptable.

According to the PMRA, all products registered for use in Canada are considered to be of acceptable risk when used in accordance with the label. Additional exposure risks to pesticides are mitigated through provincial regulations and The City's Integrated Pest Management Plan.

Based on the findings contained within this report, Administration has concluded that the level of pesticide exposure risk to Calgarians from The City's use of pesticides is acceptable. This finding is based on the federal and provincial regulations, the existing policies and procedures contained in the IPM Plan and a review of the current intensity of pesticide application by The City.

However, through the development of this report, preliminary gaps in The City's IPM program have been identified. Additionally, further direction for invasive species management was identified in the Biodiversity Policy adopted by Council in 2015.

In order to fill gaps and act on Council direction, Administration is revising the Integrated Pest Management Plan. To date, Administration has completed the following:

- Developed a project charter for the IPM Plan revision, which also identifies preliminary gaps and opportunities within the current IPM program;
- Conducted a risk assessment for the IPM Plan revision;
- Began developing criteria for background research to inform the IPM Plan revision; and
- Developed a strategy for stakeholder engagement and communications.

Through the revision, Administration commits to updating procedures in alignment with current best practices. Additionally, public-facing annual reporting on the program, pesticide use and pest management trials undertaken will be implemented. Administration will continue to mitigate potential risks associated with pesticide use to achieve its mandate to protect human health and safety, public assets and biodiversity.

## RECOMMENDATIONS

Based on the findings of this report, Administration proposes the following recommendations to Council:

- Revise the current IPM Plan and Policy and enact new strategies to continue a multi-faceted and reduced risk approach to invasive species and pest management;
- Report annually on pesticide use, trends, current standards, non-chemical use/trials, etc.; and
- Use this report's findings to inform the IPM Plan revision.

# Pesticide Toxicity Report

## APPENDICES

### ***Appendix A. Perspectives on pesticide-use***

In Canada, municipal pesticide policies range from mandatory bans on pesticide use via bylaw (e.g. Victoria) to voluntary reduction strategies via policy (e.g. Calgary). In December 2009, Council voted to not support a City bylaw to regulate the use of pesticides by private citizens (UE2009-34). This continued the voluntary pesticide use reduction strategies based on the Integrated Pest Management Plan.

For example, The City of Toronto's Pesticide Bylaw came into effect in 2004. A 2009 report by Toronto's Medical Officer of Health states that the bylaw "succeeded in reducing pesticide use and encouraging residents and companies to adopt more sustainable lawn and garden products." The report continues that an additional result of the ban was to increase citizen tolerance of weeds. The report does not contain implications for human or environmental health.

#### *Restrictions costs*

A 2004 pesticide report by The Canadian Centre for Pollution Prevention found that a bylaw is more effective than education alone in reducing pesticide use on private property. A private-use bylaw can reduce pesticide usage by 51-90%; education and outreach alone reduces use by 10-24%.<sup>iii</sup>

The authors continue, "By-laws and education were more expensive than education alone. The cost to implement a by-law appears to be in the order of \$0.50-\$1.00 per person per year, while the cost to implement an outreach component alone appears to be in the order of \$0.13 to \$0.24 per person per year." Based on Calgary's current population, a projected cost to implement such a program in Calgary would be:

Assumptions: includes average annual inflation from 2005-2016

Calgary population (2016) = 1,235,171

Current estimated cost for bylaw = \$0.60-\$1.20/person

Current estimated cost for outreach = \$0.16-\$0.29/person

Estimate to deliver Bylaw = \$741k-\$1,482k/year

Estimate to deliver outreach = \$197k-\$358k/year

The City of Calgary currently supports a voluntary pesticide reduction approach and accommodates public outreach and education within existing budgets. Determining a regulatory or voluntary approach to reducing pesticide use should consider these costs.

#### *Public perception*

Health-risk perception research<sup>iv</sup> indicates that a person's preference for restricting pesticide use is not solely informed by health concerns of pesticides; health concerns tend to be the lowest variable. The most significant variables are social:

- Home ownership
- A "weed-free" aesthetic preference

# Pesticide Toxicity Report

- Nuisance pest annoyance control (e.g. biting mosquitoes)
- Perceived neighbour conflict in terms of lawn care

The researchers write, “neighbourhood norms encourage mutually reinforcing behaviours in order to achieve common aesthetic ideals and to avoid conflict.” Thus homeowner use of pesticides is more informed by day-to-day life (e.g., experience with yard care) where decisions to use or avoid pesticides are made – choice isn’t primarily health-based.

As revealed via a City of Calgary public survey<sup>v</sup> on citizen tolerance towards dandelions, over 60% of Calgarians state that pesticides should be used to manage the appearance of Calgary parks and private property. However, a report carried out for Canadian Association of Physicians for the Environment and Prevent Cancer Now found that 68% of Albertans support a law to restrict pesticides for lawns and gardens.<sup>vi</sup> These results suggest that risk-perception should also be considered in any public survey of pesticide use.

311

Reports were pulled from The City’s 311 system to find Service Requests (SRs) related to pesticides over a 10-year period (2007-2016). This was done to gain a sample of Calgarians’ perspective on this issue. This resulted in 3966 SR records. A cursory review of the records was completed for relevance to pesticides, and it was found that 65% of these SR records were relevant to the topic of pesticides.

Relevant SR records include a range of pesticide-related topics:

- Requests for spraying City lands to manage weeds
- Concerns or complaints about spraying; including human and pet health, environmental health and property damage
- Questions and concerns about pesticide signage and spray schedules
- Requests for information about City programs that use pesticides and products used
- Requests for information on allowable use and safe disposal of pesticides by private citizens

Line-by-line research is required to draw conclusions from SRs regarding citizen’s perceptions on pesticides. Each SR requires analysis to determine the intent of the SR.

## ***Appendix B. Toxicity studies***

A detailed explanation about how toxicity evaluations are conducted is available through the PMRA. The following studies are required for new chemicals proposed for registration:

- Acute toxicity
- Short-term toxicity
- Long-term toxicity and carcinogenicity
- Reproductive toxicity
- Developmental toxicity/teratology
- Genetic toxicity
- Metabolism and toxicokinetics

# Pesticide Toxicity Report

- Neurotoxicity
- Immunotoxicity
- Endocrine disruptor potential

## ***Appendix C. IPM programs and approaches to reduce pesticide use and exposure risk***

### *Pesticide-free parks*

Pesticide-free parks in Calgary are a long-term pilot project. Considerations include community involvement to maintain the park and monitoring park use and condition. There are five pesticide free parks in Calgary.

<b>Park</b>	<b>Community</b>	<b>Ward</b>
Chinook Park	Chinook Park	11
Hawkwood Park	Hawkwood	2
Killarney Park	Killarney/Glengarry	8
New Edinborough Park	Sunnyside	7
Penbrooke Park	Penbrooke Meadows	10

### *Tot lot buffer (30 m)*

Pesticides cannot be applied within 30 metres from the edge of a tot lot (playground). This includes children's spray parks and outdoor pools. If a tot lot is located in a small park that results in the 30 m buffer extending to the park edge, the park may never be treated with pesticides. As a result, there are 200 additional parks that are effectively pesticide-free.

On occasion, a weed infestation may surpass weed thresholds adjacent to a tot lot, and the turf may need to be treated with pesticides to protect the asset. In these cases, the play equipment is plastic-wrapped, fenced off and signed to prevent public access for 48 hours following treatment.

### *Spot spraying*

The City advocates the judicious use of pesticides by spot spraying, where areas with a pest are treated directly. This differs from the less environmentally friendly practice of blanket spraying, where a pesticide is applied to a defined area and may include areas where target pests do not occur. The City does not use a blanket-spray approach to pesticide application.

### *Public notification of pesticide application*

The City notifies the public prior to herbicide applications in parks on its website and on-site signage. Online notification is updated weekly showing communities and specific parks intended to be treated in the forthcoming week. Actual applications may occur at later dates, pending appropriate weather conditions. Community entrance signs are posted 4 days prior and remain in place for 96 hours following application. Additional signage is posted at park entrances and at the site of application just before spraying begins, and remains in place for 48 hours following application.

# Pesticide Toxicity Report

## *Citizen education (Healthy Yards Program)*

The Healthy Yards Program was established in the early 2000s. The program taught citizens about the principles of pest management, how to compost and make use of a rain barrel. The Healthy Yards Program is presently operated by Water Services under the YardSmart banner.

## *Early Detection and Rapid Response (EDRR)*

The objectives of the EDRR program are to prevent the establishment of invasive weeds through early identification and control of infestations through mechanical removal (pulling, digging, cutting). Data is collected on the species, location, distribution and density. Sites where action has been taken are monitored for effect prevents the spread and aims to eradicate the weed.

## *Targeted grazing (goats)*

Targeted grazing for vegetation management is the practice of using a select type of livestock to intentionally alter plant communities and lands for specific invasive plant species and landscape management goals. Administration is aiming for the necessary bylaw amendments to be approved in 2017 in order to broaden the program for its current one-site pilot to having the ability to perform targeted grazing on any City-owned land.

## *Biological (insects) control of weeds*

Biological controls are insects that are natural enemies to the invasive species. These insects feed on specific weeds, damaging the weed and limiting their growth and spread. The table below identifies the target weed, insect used and the number of control sites.

Target Weed	Biological Control insect	# of control sites
Leafy spurge	Flea beetles	58
Houndstongue	Weevil	18
Scentless chamomile	Weevil and gall midge	3

## *Plant health care*

Plant Health Care is a holistic approach to plant (turf, shrub and tree) care that focuses on the health, growth, and appearance of plants. It utilizes a suite of information to facilitate decision making. These management practices focus on the prevention of pests by maintaining or improving the health of plants (hosts) through proper planting, pruning, mulching, and sanitation practices. The City's composting program might pose additional opportunities within this program.

## *Naturalization*

Naturalization transforms open space to reflect the naturally-occurring landscape of the region. This program helps to control weeds, pests and diseases and create sustainable landscapes that help support native plants, animals and insects (biodiversity). A reduction in long-term maintenance costs associated with fertilizing, applying pesticides and irrigating is expected on City sites where naturalization is occurring.

# Pesticide Toxicity Report

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<sup>i</sup> Health Canada. Report on Pesticide Incidents for 2014.

<sup>ii</sup> From Health Canada, Consumer Product Safety, Pesticides and Pest Management, Frequently Ask Questions. <http://www.hc-sc.gc.ca/cps-spc/pest/faq-eng.php> Accessed April 19, 2017.

<sup>iii</sup> The Impact of By-Laws and Public Education Programs on Reducing the Cosmetic/Non-essential, Residential Use of Pesticides: A Best Practices Review. 2004. The Canadian Centre for Pollution and Prevention; C2PC and Cullbridge.

<sup>iv</sup> Baxter, j, Hirsch, R. 2009. The look of the lawn: pesticide policy preference and health-risk perception in context. Environment and Planning C: Government and Policy 2009, vol. 27, pgs. 468-490.

<sup>v</sup> The City of Calgary commissioned a research company to conduct a survey on 'Dandelion Control Public Opinion Research' (Leger 2016)

<sup>vi</sup> CAPE; Prevent Cancer Now. 2016. Alberta Pesticide Survey Report.