The Case Against Overhead Pesticide Spraying in The Townsite of Waskesiu Lake, Prince Albert National Park of Canada

PREPARED BY:

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in conjunction with

Permanent Residents of

Waskesiu Lake, Saskatchewan

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"It is the public that is being asked to assume the risks that the insect controllers calculate. The public must decide whether it wishes to continue on the present road, and it can only do so when in full possession of the facts."

Rachel Carson, Author - "Silent Spring".
April, 1963.

Cover photo: White Admiral butterfly, a non-target species native to Prince Albert National Park.

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Executive Summary / Introduction

On October 18th, 2002, Parks Canada announced that it will consider selective use of Bacillus thuringensis var. kurstaki (BtK) pesticide to reduce the impact of spruce budworm within the townsite of Waskesiu, Prince Albert National Park (PANP).

This announcement was made after Parks Canada had previously acknowledged, during several rounds of public consultation on vegetation management in spring and summer 2002, that pesticide use is not an option in Waskesiu and is inconsistent with national park legislation and policy. Parks Canada changed course in response to pressure from the Waskesiu Community Council and a pro-pesticide lobby group, the Save Our Spruce (SOS) committee. The objective of these groups is to apply pesticides to maintain a townsite vegetation aesthetic based on mature spruce. The pesticide program will involve overhead spraying of BtK pesticide twice a year for each of the next three years and further if necessary.

Saskatchewan Environmental Society (SES) and permanent residents of Waskesiu oppose the overhead spraying of pesticides to control spruce budworm for the following reasons:

1. The spruce budworm and the species it is feeding upon (white spruce, black spruce and balsam fir) are all native to PANP and are integral components of the biological community.
2. The application of pesticides to interfere with natural forest ecosystem processes for aesthetic purposes is not consistent with national park legislation and policy. National park legislation is clear: "the maintenance or restoration of ecological integrity, through the protection of natural resources and natural processes shall be the first priority of the Minister when considering all aspects of the management of parks" (Section 8(2), Canada National Parks Act)
3. Alternative vegetation management actions exist which are consistent with national park legislation and policy. These are being developed in the context of a Vegetation Management Strategy for Waskesiu, a planning process being led by Parks Canada. The objectives of the pesticide program are not consistent with the objectives of the Vegetation Management Strategy.
4. BtK pesticide is not "natural", "safe" or "environmentally friendly". There are significant human health and environmental risks associated with its use. These risks have been minimized or ignored by the pro-spray lobby in their effort to secure public support for pesticide application.

A decision to use overhead spraying of pesticides in PANP would contravene the responsibility given to the Minister to protect natural processes as required in Section 8(2) of the Canada National Parks Act. By giving the Waskesiu Community Council authority to develop a pesticide spray program, PANP has directly contravened Section 9 of the same act. Should this spray program proceed, both the park and the council will be in contravention of Section 32(1) of the Act governing the release of substances capable of degrading the environment.

We believe that a decision to use overhead spraying of pesticides in PANP would contradict 6 of the 10 guiding principles for Parks Canada. None of the guiding principles support a decision to interfere with a scientifically-recognized naturally occurring ecological cycle. Further, National Parks Policy, which specifically addresses situations such as insect cycles, stipulates that there are no grounds for such an intervention. Such a decision would be contrary to principles of environmental stewardship, no-net-negative environmental impact (NNNEI) and model environmental community as presented in the Waskesiu Community Plan.

Most important, such a decision would not pass any of the screening criteria outlined in the Parks Canada Integrated Pest Management Directive on the use of pesticides.

Health related information that has been considered by Parks Canada and presented by the Community Council is misleading and omits research which shows that there are serious potential human health effects associated with BtK pesticide formulations. These health effects have led French scientists to call for a ban on Bt pesticides. Although variations of the product are currently registered by Health Canada, the product formulation proposed by the Waskesiu Community Council (Foray 76B) is not approved for application over residential areas. No studies are readily available on the health effects of Foray 76B. In fact applying Foray 76B to a residential area would be illegal under the Pest Control Products Act.

The Pest Management Regulatory Agency (PMRA) has identified Foray 48B as the appropriate pesticide for aerial application to residential areas. This product has resulted in a myriad of adverse health conditions in targeted communities. Most importantly, the PMRA has determined that both Foray products (indeed, all aerially applied pesticides) are not to be applied on or near bodies of water. Waskesiu Lake is the primary drinking-water source for permanent residents and the 200,000 annual park visitors.

Pesticide formulations based on Bt bacteria are not “safe and environmentally friendly” as professed by the pesticide industry. In fact, Health Canada prohibits such characterizations- it is illegal to make such statements. Research shows that BtK pesticides have adverse effects across the ecosystem and are not narrow-spectrum agents which target a single species. Many non-target lepidopteran (moth and butterfly) and other insect species can be affected. This effect ripples up the food chain to produce potentially lethal or toxic effects in birds, mammals, fish and other organisms native to the forests of PANP. The BtK pesticide has been shown to persist in air, water, and soil for weeks and months after application.

The scope of negative effects of BtK is compounded by aerial application. Significant drift effects are associated with aerial pesticide applications, resulting in pesticide application to water bodies and other sensitive areas. Aerial applications also pose a risk to elk calves, deer fawns and other newly born offspring that will be especially vulnerable to the acoustic effect of multiple low level flights. Research shows that animals can panic due to the noise which can lead to trampling of the young.

In summary, this paper presents information essential to any decision which considers a potential pesticide application over Waskesiu Lake townsite in Prince Albert National Park. The evidence gathered and references cited indicate that information provided by the pro-spray lobby is incomplete, inaccurate and misleading. These groups have significantly minimized the environmental and health implications of BtK use.

PANP, as true of all National Parks, is meant to be a place where families can visit and live without having to be concerned about the health implications of their environment. This commitment has been made to all Canadians and international travellers and reinforced through National Parks legislation and policy.

What YOU Can Do

Your voice is required to stop overhead spraying of pesticides in Prince Albert National Park. Please write or email your local Member of Parliament, Parks Canada CEO Alan Latourelle, and/or the Minister Responsible for Parks Canada, Sheila Copps to voice your objections.

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PART I

Applicable Legislation and Policy

Canada's national park system has led the North American approach to nature protection over the last 125 years. Contained in Canada's first National Parks Act, passed in 1930, were the words: "Parks are dedicated to the people of Canada for their benefit, education and enjoyment...such parks will be maintained and made use of so as to leave them unimpaired for the enjoyment of future generations." Thus, was a legacy for protection born.

Many documents exist that give specific guidance to National Parks managers on appropriate practices and direction for the stewardship of Parks. These documents are manifestations of the public voice of Canadians across the country in their desire to protect the national interest in National Parks. Prince Albert National Park ***is*** a National Park and as such its interests belongs in the hands of all Canadians.

The following is an analysis and interpretation of these guidelines and Legislation.

Canada National Parks Act C. 32 2000[1]

1. Ecological Integrity:

The minister is given the responsibility of managing park lands under Section 8(1) with the following requirement:

> *Section 8 (2): Maintenance or restoration of ecological integrity, through the protection of natural resources and natural processes, shall be the first priority of the Minister when considering all aspects of the management of parks.*

Section 2(1) defines ecological integrity.

> *"ecological integrity" means, with respect to a park, a condition that is determined to be characteristic of its natural region and likely to persist, including abiotic components and the composition and abundance of native species and biological communities, rates of change and supporting processes.*

In reference to these sections of the act, we interpret the following:

- Insect cycles are considered supporting processes which are characteristic of the natural region.
- The spruce budworm (*Choristoneura fumiferana*) and the affected vegetation of White Spruce, Black Spruce and Balsam fir *(Picea glauca, P. mariana, and Abies balsamea*) are all species native to this area and are integral, interdependent components of the regional biological community[2].

- Supporting processes (the outbreak), native species and biological communities (which includes the bud worm) are all components required to ***maintain ecological integrity***.
- The maintenance of ecological integrity is ***the Ministers first priority*** regarding all aspects of the management of the park.
- No where in the National Parks Act does it exclude National Park communities (ie Waskesiu Lake town site) from the principles or values referred to in these sections.

2. *Administration of Park Lands:*

> *Section 9: Powers in relation to land use planning and development in park communities may not be exercised by a local government body, except as provided in the agreement referred to in section 35 (Banff townsite).*

In reference to this section of the act, we interpret the following:

The development of a pesticide spray program in Waskesiu is currently in the hands of the Waskesiu Community Council. The stated purpose of this program is to achieve a particular vision of the townsites vegetation community. It would seem that this land use planning exercise is in direct contravention of Section 9 which specifically prohibits any local governing body (except in Banff - S. 35) from exercising any powers related to land use planning.

3. *Mitigation of Environmental Damage:*

Section 32(1) is an offence section relating to pollution:

> *32. (1) Where a substance that is capable of degrading the natural environment, injuring fauna, flora or cultural resources or endangering human health is discharged or deposited in a park, any person who has charge, management or control of the substance shall take reasonable measures to prevent any degradation of the natural environment and any danger to the fauna, flora or cultural resources or to persons that may result from the discharge or deposit.*

In reference to this section of the act, we interpret the following:

It is well accepted that BtK can and does cause injury to fauna including the target spruce budworm species as well as other non-target lepidopteran species native to the area (see Part III). A number of scientific papers have documented human health concerns related to the proposed pesticide product (see Part II). Therefore this section places a legal obligation on the proponent to take reasonable measures to prevent degradation to the environment and/or danger to persons. In addition, the Minister has committed to incorporating the concept of No-Net-Negative Environmental Impact (NNNEI) into decisions impacting park communities.

Parks Canada Guiding Principles and Operational Policies[4]

This document presents the overall vision, purpose, principles and policies for Parks Canada. Within this document there are references to both ecological and commemorative integrity. It should be noted that National Parks are primarily tasked with the protection of ecological integrity of natural resources while National Historic Sites have primary responsibility for commemorative integrity of cultural resources. It should also be noted that, in Prince Albert National Park flora (including spruce trees) are recognized as a natural resource. There are currently no approved documents which identify any Spruce trees in PANP as a cultural resource nor are Spruce trees considered a park facility.

National Parks Guiding Principles

1. Ecological and Commemorative Integrity:

This is the first guiding principle and reinforces Parks Canada's legislated mandate to protect ecological integrity. It requires that management decisions be based on sound ecosystem-based management practices. The proposed pesticide spray program is contrary to this paramount guiding principle in the following respects:

- the program will cause significant mortality to at least one native faunal species plus numerous other non-target organisms.
- the program will interfere with a natural process.
- the objectives of the program are to protect trees which are in a mature state and will be subject to extensive mortality in the coming years regardless of efforts to save them.

2. Leadership and Stewardship:

This guiding principle imparts a leadership role on Parks Canada to demonstrate, by example, the protection of natural heritage through environmental ethics and practices. The proposed pesticide spray program contravenes this principle as it is an inappropriate approach to managing a peak in the natural cycle of a native species. Since 1991 at least 36 communities across the country[7] in Quebec, Nova Scotia, Ontario, PEI, Newfoundland and BC have adopted by-laws banning all non-essential cosmetic pesticide usage from public and private lands. These by-laws have been upheld by the Supreme Court of Canada and in their rulings make reference to "the respect for international law's precautionary principle". Communities across Canada are demonstrating true leadership and stewardship in protecting their citizens from exposure and risks associated with pesticides through bans and restrictions. Here is an opportunity for Parks Canada to do the same.

3. Education and Presentation

This principle recognises that successful efforts to protect natural heritage are dependent on an understanding and appreciation of this heritage by Canadians. Parks Canada is obliged to increase awareness and a sense of trusteeship in Canadians through education and presentation. Parks Canada and PANP have failed in this task. They have failed to convey the importance of properly functioning natural processes as integral components of a healthy ecosystem. They have failed to show how the current budworm cycle is part of a healthy boreal forest community. They have failed to show how applying pesticide to control spruce budworm puts both the ecosystem and human health at risk. They have failed to provide any leadership in presenting Waskesiu as a "Model Environmental Community" in deed - not just in name.

4. Research and Science:

Management decisions are to be based on the best available knowledge supported by a wide range of research including a commitment to integrated scientific monitoring. In this situation, ***no science or research has been considered*** regarding several key issues:

- the current age structure of the forest and the likelihood that these trees will die despite a serious intervention such as pesticide application.
- the increased budworm population is in the 7th year of its cycle and the majority of the damage is already done.
- spraying will not eliminate spruce budworm from Waskesiu. As long as favorable environmental conditions exist, we can expect increased population levels to return in years subsequent to the spray program.
- multiple applications of pesticide may prolong a peak in the budworm cycle by postponing a natural crash in the population or by building resistance to the pesticide within the target population.
- the potential long term health effects on humans as well as the larger ecosystem.
- alternative measures to treat potential tree mortality have not been considered. The advisory body has stated that "there are no alternatives".[5]

5. Public Involvement

In its principle of public involvement, Parks Canada recognises that the consultation process, which adheres to the policies and legislation to which Parks is bound, is a cornerstone for sound decision-making. The public consultation process surrounding the decision to spray for spruce budworm within the context of the Prince Albert National Park vegetation management plan has been questionable.

The vegetation management strategy and public meetings were initiated in the summer of 2002 in PANP and resulted in Parks Canada presenting a firm "No-Spray" decision. This decision, based on science, was accepted by the majority of participants throughout subsequent consultations. This is also consistent with previous policy interpretations which led to "No-Spray" precedents in National Parks across the country. The purpose of subsequent vegetation management meetings were to generate ideas that would become components of the Vegetation Management Plan for the Waskesiu town site. While members of the public regularly continued to support this process in good faith, pro-spray factions staged media events, disrupted then boycotted the meetings. Consequently, in 50% of the public meetings to discuss vegetation management issues, they choose not to be present or have input into the process.

On Friday, October 18, 2002, Parks Canada announced that, despite their initial commitment to stand by National Parks policy Section 3.2.4 to not spray pesticides, they would include use of the pesticide BtK in the Waskesiu Vegetation Management Strategy. This unilateral decision was inexplicably made outside of the public process and appeared as a direct contradiction of the public consultation process to that date.

The Waskesiu Community Council subsequently drafted a spray program proposal for environmental assessment by Parks Canada. This proposal suggests that the majority of people participating in the development of the vegetation management plan were supportive of spraying. This is false and misleading to the public. A more accurate statement must reflect that the majority of participants in the vegetation management process strongly opposed any spraying in the park. Eighty percent of the permanent residents in Waskesiu have said "NO" to spraying. Three hundred and fifty petitioners across the country have said "NO" to spraying. Furthermore, the voice of organizations representative of the larger Canadian public have been disregarded. The Canadian Parks and Wilderness Society, Nature Saskatchewan and the Saskatchewan Environmental Society have said "NO" to spraying. These organizations collectively represent over 60,000 Canadian citizens who depend on Parks Canada to manage parks according to accepted legislation and policy.

6. Accountability.

Parks Canada is accountable for the application of and adherence to these principles and for the implementation of the activity policies.

- Prince Albert National Park is part and parcel of a collective system of National Parks. The policies of National Parks are a manifestation of the collective values and desired direction of all Canadians.
- Waskesiu is a community located within Prince Albert National Park. Special care and precautions should be taken to ensure that the families of the hundreds of thousands of visitors and permanent residents are not placed at risk by Parks Canada management decisions. Families rely on PANP to offer a safe environment in which to live or visit. They should not have to be concerned about pesticide residue in their drinking water, on the playgrounds or in the sand on the beach. Concerns such as these will impact the Waskesiu's unique socio-economic situation if people are forced to consider the health of their children when choosing where to vacation and where to make their home.
- Parks Canada is accountable to ALL Canadians including environmental groups, visitors, residents and staff. Instead, a local advisory body with no decision making power or accountability has been handed the job of determining the future of Vegetation Management and use (or misuse) of pesticides in Prince Albert National Park. In light of Section 9 CNPA, this is questionable.

National Parks Policy[4]

1. Ecosystem Protection

3.1.1 National Park Ecosystems will be given the highest degree of protection to ensure the perpetuation of natural environments essentially unaltered by human activity.

A pesticide application program which threatens native species and disrupts a naturally occurring process is in direct contravention of this policy statement.

2. Ecosystem Based Management

> *3.2.2 Decision making associated with the protection of park ecosystems will be scientifically based on internationally accepted principles and concepts of conservation biology.*

A pesticide application program which threatens native species and disrupts a naturally occurring process is not consistent with accepted principles and concepts of conservation biology.

> *3.2.3 National park ecosystems will be managed with minimal interference to natural processes. However, active management may be allowed when the structure or function of an ecosystem has been seriously altered and manipulation is the only possible alternative available to restore ecological integrity.*

It has been argued that the town site should be managed differently because it has no ecological integrity. The boundaries of the town site however are only administrative and the values and policies of the greater park ecosystem apply to the town site as well. While there is some evidence that certain ecosystem components have been modified through development of the town site, there is still adequate evidence of fully operating processes and components of ecological integrity (predator prey processes and fully functioning food webs). The structure and function has not been seriously altered by the occurrence of budworm but is functioning perfectly well from an ecosystem perspective, therefore should be managed with minimal interference.

In this situation, manipulation of the ecosystem through the pesticide spray program is primarily focused on aesthetic and cosmetic objectives and is not intended to restore ecological integrity. Indeed, numerous studies clearly indicate that Bt application programs have significant negative ecological consequences across the ecosystem (see Part III). In fact this program will have a **negative** impact on ecological integrity of Waskesiu and Prince Albert National Park. Pesticide spray programs *may* be an argument in the case of eradication of an invasive, exotic species that was threatening the structure and functioning of the ecosystem. However, spruce budworm is a native species to the boreal forest and poses no threat to the natural function of the ecosystem of PANP.

Section 3.2.4 permits the manipulation of naturally occurring processes under the following circumstances and conditions:

> *i) there will be serious adverse effects on neighbouring lands*

- The current budworm cycle poses no threat to neighbouring lands. Spruce budworm is endemic to the provincial forests and the province has been monitoring natural peaks in the cycle since the 1980s.

> *ii) major park facilities, public health or safety will be threatened*

- The budworm does not present a threat to any park facilities. As mentioned above, no approved documents identify any flora in PANP as a cultural resource nor is flora considered a park facility.

- The budworm does not threaten public health. In fact research shows that the proposed spray (BtK) poses a health risk (see Part II).
- The budworm situation in Waskesiu does not pose a threat to safety. An argument has been put forward that blowdown associated with increased tree mortality may become a safety issue. Over the next decade or so, the risk of blowdown will be present regardless of the budworm outbreak since most of the affected trees have reached maturity and mortality rates are increasing regardless. Environment Canada and the Canadian Forest Service report that climate change will produce profound shifts in the forest. As such, a pesticide control program for budworm will not reduce tree mortality in PANP over the coming decades. Parks Canada already removes problem trees on a regular basis for public safety, a program that will continue in the future.

Section 3.2.4 indicates that monitoring must take place to demonstrate that one of these conditions exists. No such monitoring program is in place and no science or research has been referred to in this decision. Furthermore, if Spruce budworm monitoring becomes the focal point of Ecological Integrity funding, other programs to address ecological issues in PANP will suffer.

An independent report on the situation of spruce budworm in Fundy National Park[6] was produced to counter a recommendation by the Province of New Brunswick which included a spray program for spruce budworm. The report concluded that a program to eliminate spruce budworm was not compatible with the Policies and Mandate of National Parks. "The application of insecticides constitutes an environmental stress that undoubtedly causes changes in the components and dynamics of the forest ecosystem….regardless of the magnitude of the effects, their impact is contrary to Park policy." It further asked, "What is the ecological rationale for mounting an attack on the spruce budworm? There is none!!" We cannot find a rational or science-based reason why PANP is exempting Waskesiu from this same policy.

Furthermore, any concerns regarding increased fire hazard in Fundy were addressed as well and were concluded not to be an issue. The same has been found for Prince Albert National Park.

Integrated Pest Management (Directive 2.4.1, December 1998)

This directive provides guidance for the management and minimization of pesticides on Park lands. The basis of Integrated Pest Management (IPM) is to incorporate all suitable measures to reduce pest-related losses. The primary purpose of IPM is to prevent pest problems from occurring and to use pesticides only when viable alternatives are not available. An IPM plan should provide a long-term sustainable approach to pest management which minimizes impacts on non-target organisms and the environment. Pest activity must be monitored and threshold levels set. Only after these levels are exceeded should interventions be considered. PANP currently has no IPM plan addressing spruce budworm. No monitoring program is in place and no threshold levels have been determined.

Directive One describes conditions for which the application of a pesticide should be considered. The current situation does not meet any of the criteria outlined:

- other control methods may be available.
- no adjacent lands are threatened - the budworm cycle is peaking across the province.
- budworm is not an introduced organism.
- budworm does not threaten a threatened or endangered species. In fact, no research has been conducted to determine if threatened or endangered species may be impacted as a result of the spray application.
- budworm populations are not interfering with any restoration efforts. In fact, the budworm caused mortality and renewal process is essential for a healthy boreal forest in the long term.
- these organisms pose no threat to human health.
- these organisms do not interfere with the function or use of park lands.
- budworm does not threaten the integrity of cultural resources.

Likewise, the spray proposal does not meet additional criteria listed in Directive Six:

- alternative means of control have not been considered.
- this product will not be effective in controlling the target organisms as studies have shown no long term decrease in mortality in sprayed versus unsprayed lands.
- buffer zones over and near residential areas, playgrounds and surface water have been rejected.

Despite the absence of an IPM Plan, Parks Canada and the Waskesiu community council are going forward with a proposal to spray the Waskesiu townsite. In the current situation, alternatives other than pesticide application are not being considered. To compound this problem, the Waskesiu Community Council's stated vision for Waskesiu's vegetation is to maintain a mature conifer-dominated forest. This will not reduce future pest problems. A mixed-wood, uneven aged stand will be far more resilient to future fluctuations in natural insect and disease levels. The proposal completely ignores potential human health risks, potential species at risk and susceptible ecological processes. These are key considerations in any IPM Plan.

Pest Control Products Act and Regulations

According to the Federal Pest Control Products Act[10], BtK products are restricted-use pesticides that must be used in accordance with their product labels. The label for Foray 76B[11] (figure 1), the BtK formulation proposed for use by the Waskesiu Community Council, states that this product has been registered for use only over Forests and Woodlands. It is <u>not</u> registered for use over residential areas. This restriction makes it quite clear that Foray 76B cannot legally be applied to Waskesiu.

The Pest Management Regulatory Agency (PMRA) has informed stakeholders that Foray 48B is the correct product application given the residential considerations in Waskesiu.

However, PMRA Directions for Use for Aerial Application of any Pesticide Product in Canada state: "Do *not apply to any body of water. Avoid drifting onto any body of water or other non-target areas.*" This is a serious consideration regarding the use of either BtK formulation as the townsites drinking water supply (Waskesiu lake) is immediately adjacent to the proposed spray zone, and extensive wetlands exist within the townsite.

Both Canadian and U.S. labels for BtK products list precautions for workers handling the pesticides.[11,13] These precautions include wearing chemical resistent gloves, coveralls and goggles or faceshield. However, there is a discrepancy when it comes to protecting the public. Canadian labels state only to keep out of reach of children, while U.S. labels state; "do not enter treated areas without protective clothing until sprays have dried". This contradiction creates confusion at the community level given that the Government of Canada and the PMRA (Health Canada) have publicly stated a commitment to harmonize pesticide regulations and guidelines between the two countries.[12]

Bill C-8, Pest Control Products Act

Health and environmental considerations are now more prominent with Bill C-8 receiving Royal Assent December 12, 2002. Pursuant to the new Pest Control Products Act (upon coming into force), the Minister shall, when making a decision to register or amend the registration of a pest control product:

- consider available information on aggregate exposure to the pest control product, namely dietary exposure and exposure from other non-occupational sources, including drinking water and use in and around homes and schools. s.7(7)(a)(i).
- apply appropriate margins of safety to take into account the different sensitivities to pest control products of major identifiable sub-groups, including pregnant women, infants, children, women and seniors. s.7(7)(a)(ii).

RESTRICTED USES
FORESTS, WOODLANDS

NOTICE TO USER: This control product is to be used only in accordance with the directions on this label. It is an offence under the Pest Control Products Act to use a control product under unsafe conditions.

NATURE OF RESTRICTION: This product is to be used only in the manner authorized. Consult local pesticide regulatory authorities about use permits which may be required.

Forestry Use: Ground/Aerial Application for sites greater than 500 ha.
Woodlands Use: Aerial Application for sites 500 ha. Or less.

Consult local Transport Canada office regarding air regulations for aerial applications. Foray 76B may be used for aerial application on forests and woodlands by both fixed wing and helicopter aircraft.

Undiluted applications are recommended for Eastern and Western Spruce Budworm, Gypsy Moth, Jackpine Budworm, and Eastern Hemlock Looper and Whitemarked Tussock Moth; however, Foray 76B may be diluted with water and applied at the rates indicated in the dose rates table. Total volume of spray material to be applied per hectare depends upon target pest, target foliage, weather, spray equipment and droplet size. Recommended droplet size spectra are from 30-80 microns for coniferous foliage and 50-150 microns for broadleaf foliage.

Figure1: Restricted Uses, Foray 76B label, Pest Management Regulatory Agency.

- in the case of a threshold effect, if the product is proposed for use in or around homes and schools, apply a margin of safety that is ***ten times greater*** than the margin of safety that would otherwise be applicable. s.7(7)(a)(iii).

Directions for Use and Restricted Use statements on product labels are based upon the results of such considerations, and are the law. Current label restrictions, then, must be observed. Product re-evaluation under the new Act will be more rigorous, given the Ministers obligations under Section 7(7).

Waskesiu Community Plan

The Waskesiu community plan lays out the direction for how a National Park community should operate and was committed to "developing a clear vision consistent with the National Parks Act, Regulations and policies announced by the Minister, Sheila Copps in June 1998"[9]. While there is mention of protection of historic and visual character, the protection of ecological integrity and cultural resource integrity will be the primary consideration. Some of the environmental objectives of the plan are:

- To operate Waskesiu in an environmentally responsible manner
- Adoption of a "stewardship" approach that minimizes impacts on the environment
- To conserve and protect the natural environment for present and future generations
- To minimize to "the greatest extent possible", impacts generated through community development, planning, and restoration or mitigative measures
- To maintain the community as a model environmental community compatible with its National Park settings.

The positive direction or "initiatives" of the plan seem to point in a direction towards minimizing impacts by recycling, reduction of water and energy consumption and reducing our contribution to greenhouse gas emissions. In short - to find ways and means to reducing the impact of our presence on the landscape and conveying a message of protection and conservation. We submit that initiating a aerial pesticide spray program, whatever the duration, will take us in a direction that is off-target from where Parks is heading and is not consistent with the principles of a) environmental stewardship b) no-net-negative environmental impact or c) a model environmental community . These principles are the basis for community planning in Waskesiu as legislated in the National Parks Act.

Waskesiu is considered and marketed as a "Model Environmental Community". In June of 2001, Canada's Supreme Court ruled that individual municipalities have the right to ban pesticide use on public and private lands[8]. When challenged in the courts by the pesticide companies the Courts ruled unanimously in favor of the municipalities quoting the "precautionary principle" in it's decision. This would be an excellent opportunity for Parks Canada to deliver on the principles of "stewardship", "no-net negative environmental impact" and operation as "a model environmental community". A suggested beginning would be sanctioning a ban on all pesticide usage for non-essential aesthetic purposes including BtK pesticides. If others can achieve this in municipalities across the country, we should be able to achieve this in a protected national park community.

PART II

Health Concerns Related to BtK pesticide

Health Effects

The number of references pointing to the potential for serious health effects of Bt pesticides continue to grow as we find out more information. Genetic damage to human cells[7], toxic shock, lung inflammation and internal bleeding when administered to immunocompetent lab animals[8] , potential for fatalities in patients using anti-ulcer drugs[9] , respiratory tract problems and eye and skin irritation[15] have all been documented. While BtK formulations are currently registered for use by Health Canada, at least 370 pesticides once deemed “safe” (officially) have been removed from the market over the past 10 years in Canada.[20] Furthermore, French Scientists have already called for a ban on Bt pesticides after finding that inhaled spores cause lung inflammation, internal bleeding and death in lab studies[33]. They point out that concentrations sprayed on forest pests might pose a danger to people in the immediate spray area.

Many health related concerns were identified during a hearing into an Agriculture Canada application to spray New Westminster, B.C., with BtK (Foray 48B) in December, 1995. A provincial Environmental Appeal Board (EAB) Panel cancelled the permit on the grounds that the pesticide posed a threat to human health, and that the spraying was unlikely to be effective. In its decision, the EAB Panel noted that:

“The Panel finds that aerial spraying will create an unacceptable risk of health problems among the residents of these densely populated areas. In particular, the Panel agrees with the Appellants that there is a risk to the health of children, people of all ages who have allergies, asthma, and other respiratory ailments, people with immuno-deficiencies, chemical hypersensitivities, and the elderly. It also poses an unreasonable adverse effect to the environment (non-target species.)” [34]

The Panel based its decision on evidence indicating:

1. BtK had caused health reactions in previously sprayed areas, including: “..skin rash and other immune, allergic and sensitization responses such as dry, itchy skin; red, burning eyes; dry sore throat; cough and tightness in the chest..”

2. Children are at particular risk from the effects of BtK. “With smaller weight, and developing systems, children are likely to be more susceptible for all potential health effects.”

3. BtK is respirable in mammals, therefore, there is the possibility of lung injury on exposure to it.

4. According to the manufacturer, repeated exposure via inhalation can result in sensitization and allergic response (stated on label).

5. Some ground spray workers suffered health reactions and remained culture positive for prolonged periods of time.

6. There have been no long-term studies done on the effects of BtK on human health.

The risk to human health of pest control products in general was obviously a driving force behind the development of the new Pest Control Products Act. With Bill C-8 receiving Royal Assent December 12, 2002, the Minister shall now pay increased attention to:

- aggregate exposure to a pesticide through diet, drinking water, and use in and around homes and schools;
- the different sensitivities of major identifiable sub-groups, including pregnant women, infants, children, women and seniors.
- use in or around homes and schools, where a margin of safety will be applied that is ten times greater than the margin of safety that would otherwise be applicable.

Ingredients

The active ingredients of Bt formulations are those ingredients used to control the target pest and must be listed on the product labels. The other so-called "inert" ingredients are used as carriers for the active ingredient, to help dissolve them, to make them adhere to vegetation, or to make them easier to apply. These ingredients are some of the most dangerous substances known to cause health problems including central nervous system disorders, liver and kidney damage and birth defects.[29]

Foray 48B, the BtK formulation most often cited, has been found to contain 40 different chemicals[10]. Some of the possible inert ingredients include the following: ***SODIUM HYDROXIDE*** —caustic soda (ie. Draino); ***SULFURIC ACID*** — battery acid; ***PHOSPHORIC ACID*** — irritant to skin and mucous membranes; vapors cause coughing and throat irritation[11]; ***METHYL PARABEN*** — shown to produce birth defects in laboratory animals.12,13

The United States Environmental Protection Agency has categorized inert ingredients into four groups. At least 5 ingredients in Foray 48B are classified "inerts of unknown toxicity". Two are classified "generally considered to be safe for use in pesticides". The way an inert gets on list is that a company requests it. Limited, if any testing of inert ingredients occurs, a substantive concern shared and raised by the medical community and NGO's.[22]

Exposure and pesticide drift

If you think that staying indoors or staying away during the aerial application will keep you safe…think again. Aerially applied pesticide will not settle exclusively on trees. If you live, work, or visit in Waskesiu you will breathe, drink and eat BtK. BtK spores have been measured in air up to 17 days following application.[23] Standard water treatment does not destroy BtK spores[24] that can be found in water up to 2 months after application. Spatial distribution patterns of BtK indicate indoor concentrations exceed those outdoors after 5 - 6 hours of spraying commencement.[27] Drift of BtK aerosol has been detected over 3 km away from spray area. Therefore, even areas unsprayed will be contaminated.[28] The pesticide will be in your homes, offices, stores, hotels and restaurants in Waskesiu Lake townsite if aerial application occurs.

Vancouver health surveillance studies that are frequently cited to demonstrate BtK pesticide safety [32] fail to take into account the long-term effects. Most health reports have been based on the short-term application of Foray 48B, and concerns on adequate testing for carcinogenicity or mutagenic properties have been raised. No known studies have been conducted on the health effects of Foray 76B.

Genetic similarities to other disease causing bacteria

BtK pesticides are frequently reported as “natural, organic and safe”. But are they? While Bacillus thuringiensis (Bt) is a naturally occurring bacterium it shares a close resemblance genetically to other familiar bacteria such as the variety causing anthrax[1]. The difference between the two is one component (organelle) of the cell.[2] The transfer of genetic material of the two has already been documented.[4,5] The World Health Organization[30] states that “transfer between Bt strains or related species can occur, resulting in new strains with various plasmid contents”.

See Appendix A for more information on what BtK pesticide is, how it is produced, and how it works.

PART III

Ecological Concerns Related to BtK Pesticide

Spruce budworm is an insect herbivore (eats plant material) native to this mixed-wood boreal forest. Larvae feed on the new needles of white and black spruce and balsam fir. Spruce budworm is always present in this ecosystem, but when conditions are right (abundant food, drought stressed conditions etc.) populations may increase significantly.

The ecological role of spruce budworm may have been best described by Buckley Belanger, Saskatchewan Minister of Environment. In 2001, he stated: "Spruce budworm is a normal 'destructive agent' like forest fire that eventually will result in the renewal of the forest"[46] He further stated that the application of pesticides to control the effect of spruce budworm "is only a 'band aid' solution as the real cause of the problem is that this forest is well past it's prime, 'nature' is trying to bring down the old and start again with a new forest."

The application of pesticides interferes with natural forest processes that have evolved to ensure forest health. Pesticides typically affect a broad range of species and processes. While Bt-pesticides are promoted as narrow-spectrum agents (affecting only a few species) of short-term persistence in the environment, the evidence presented below establishes that application of Bt-pesticide is not just a short-term ecosystem stress. Bt has been shown to persist in the soil, water, air and on vegetation for extended periods following application. All Bt products can kill organisms other than their intended targets. Bt can dramatically reduce the number and variety of Lepidopteran (moth and butterfly) species. In turn, the animals that depend on these organisms for food are also impacted. These extended impacts may not be lethal but may be significant, such as reduced foraging, nesting and reproductive success. (See Appendix A for information on what BtK pesticide is, how it is produced and how it works)

The growing body of literature identifying significant environmental effects of BtK pesticide demonstrates that the risks and impacts associated with its use must be carefully considered against the benefits. This is particularly true as the ecology of Bt is poorly understood and there have been no studies in the proposed spray zone to identify vulnerable species or establish baseline ecological conditions. The risks argue for a careful examination of reasonable alternatives to BtK use.

Persistence of Bt-pesticide in the Environment

Soil: Naturally occurring BtK is relatively rare in soils that have never been exposed to pesticide application. However, following application, BtK pesticide can accumulate and persist in soil for months if not years [31], resulting in environmental hazards such as toxicity to non-target species and selection of toxin-resistant target species. BtK toxins in the soil have been shown to be lethal to non-target species after more than 6 months post-application.[32]

Vegetation: Bt deposited on the upper side of leaves (exposed to the sun) may remain active for only 1-2 days, but Bt protected from the sun (underside of leaves) can be much more persistent. Viable spores of BtK were recovered from white spruce foliage one year after application.[33] BtK droplets on the underside of foliage are lethal to swallowtail caterpillars more than 30 days after aerial application.[12] Bt can persist for two years in orchards and remain toxic to caterpillars.[34]

Water: BtK has been recovered from rivers and public water distribution systems after aerial application. In lake water, half of the BtK applied may remain after approximately two months, and standard water treatment processes are not adequate to destroy BtK spores.[35] The spores and crystals of a closely related bacterium (Btisraelensis) bind readily to sediments in the water column, reducing their efficacy by making them inaccessible to insect larvae. However, when sediments are disturbed, Bti can be reintroduced to the water column and be highly lethal to insect larvae at least 3 weeks post-application.[36]

Air: BtK has been found to drift for long distances (3-80 km) downwind during and following aerial application (this is dependant on the amount and method of application, as well as climatic conditions).[37, 26] Viable BtK spores can persist in air for weeks after spraying. Spores have been recovered in the air up to 17 days after spraying and reached their highest level 8 days after spraying.[38, 39]

Ecological Effects of Bt-Pesticide

Documented ecological effects of Bt pesticide include impacts on a variety non-target species, including beneficial insects, a variety of other insects, birds, fish and mammals. These impacts vary from lethal toxicity to sub-lethal impacts on foraging, nesting and reproductive success.

Beneficial insects: Bt has impacts on a number of beneficial species (those that feed or prey on "pest" species), either directly from the spray or indirectly due to residual Bt contamination on vegetation.[2] BtK has been shown to kill aphid-eating flies [3], predatory spider mites [4], and the cinnebar moth, used for biological control of the weed tansay ragwort. [5]

Other insects: Many insects that are not directly beneficial to agriculture are important in the function and structure of ecosystems. A variety of studies have shown that Bt applications can disturb non-target insects and insect communities, affecting total numbers and species richness.[1, 6, 7, 8, 40]

Numbers of non-target insects and species richness have remained depressed for up to 3 years following BtK treatment. [10] In untreated areas of Oregon, the number of insect species was 30 percent higher and the number of caterpillars 5 times greater than in BtK-treated areas two weeks after treatment; the number of caterpillars was still reduced in treated areas the following summer. [9] Longer-term effects may be partially due to BtK impacts on the reproductive capability of surviving adults. [2] There is evidence to suggest that BtK enters the hemolymph (blood) of adult butterflies, possibly contaminating the eggs and therefore the hatching larvae. [11]

Swallowtail butterflies are more than 100 times more sensitive to BtK than target species. BtK droplets on the underside of foliage are lethal to swallowtail caterpillars more than 30 days after aerial application. [12, 13] The occurrence of other butterfly and moth species have been shown to be significantly reduced by application of BtK to control gypsy moth. [14]

Aquatic insects are also affected by Bt treatments. Canadian studies found that certain stream insects were killed by applications of BtK, and that application of Bt over large forested areas "may present a potential hazard to fish in lakes and streams through effects on their food organisms".[15, 16]

Birds: Birds can be directly affected by Bt. Documented symptoms of Bt exposure include emaciation, blood in gizzard, haemorrhage in gastro-intestinal tract, reduced feeding, and reduced egg production. [17]

Because many birds feed on the caterpillars and other insects affected by BtK applications, it is not surprising that indirect impacts of BtK spraying on birds have been documented. [1, 18] Chickadees and warblers have demonstrated reduced post-spray foraging and nesting success.[19, 20] A Canadian study found the numbers of caterpillars, followed by the numbers of two species of warblers and a thrush, were reduced by BtK treatment. In addition, there were fewer spruce grouse chicks in BtK treated areas, and the chicks in those areas grew more slowly than chicks in untreated areas. [21] The impact on the caterpillar prey of black-throated blue warblers by BtK treatment was shown to limit the annual warbler breeding productivity below that needed to balance annual mortality.[20]

Other animals: As with birds, impacts of BtK on other animals that feed on caterpillars and insects are likely. Treatment with BtK has been shown to change the structure of a shrew population in response to a reduction in caterpillars. [22] Bats feeding exclusively on lepidoptera could also be affected. [23]

Research has shown that Foray 48B at high concentrations (about 3 percent) is acutely toxic to rainbow trout, probably because the product is highly acidic. [24] Some juvenile coho salmon died at the high dose rate when they were exposed for 7 days to doses ranging from 5.2 x 10 to 26.4 x 10 spores per ml. [25]

Microbial Communities: The application of BtK may influence the microbial ecology of the soil. Scientists suggest Bt spores can persist in soil up to 10 years, and that "there is an urgent need to elucidate the relationships between Bt and natural soil microflora and fauna." [26] Why is this important? Because bacteria and fungi in the soil are essential for proper ecosystem function and many are in fact beneficial to humans. The anti-microbial substances produced by BtK have been shown to inhibit the growth of 16 of 20 bacterial strains and six of seven fungal strains isolated from forest environments where Bt is regularly applied. These strains included a beneficial bacteria, a fungus that helps trees obtain nutrition and resist drought, and a fungus that can infect and kill target species. [27]

Ecological Effects of Aerial Application

The mode of application can also be a factor in the ecological effect of the pesticide being applied.

Pesticide Drift Effects

Pesticide drift is defined as "that portion of the spray that leaves the target area."[41] Drift is unavoidable whenever pesticides are applied. As a result, health and environmental effects associated with the pesticide are also unavoidably incurred outside of the target area and away from the target "pest". Drift associated with aerial application programs can be significantly greater than that associated with ground spray programs.

The amount of drift has been characterized as "considerable" and is thought to vary from 5 percent (under optimal low wind conditions) to 60 percent (under more typical conditions).[42] The Office of Technology Assessment estimates that about 40 percent of an aerial insecticide application leaves the target area and that less that 1 percent actually reaches the target pest.[43] Drift distances can be significant: "typical estimates of pesticide drift following aerial application range from 100 metres to 1600 metres. In virtually every study available pesticides were detected as far away from the application as samples were taken." [45]

The impacts of BtK drift on 7 at-risk, non-target lepidopteran species were investigated during a gypsy moth eradication program in Utah. An increased risk of death was associated with larvae fed cuttings from host foliage exposed to the BtK drift cloud at locations 0 metres through 3 km outside the spray-zone. In addition, sublethal dosages of BtK slowed the rate of larval development. Furthermore, exclusion plots established to mitigate spray program impacts on at-risk species were found to provide poor protection due to drift. Two species did not appear to recover to pretreatment levels over 4 and 7-year monitoring periods, respectively. [44]

The only way to avoid pesticide drift and its associated impacts is not to use pesticides and to adopt sustainable non-pesticide management practices.

Acoustic Effects of Aerial Spray Programs

Most researchers agree that noise can affect an animal's physiology and behaviour, even in the short-term. In regards to the physiological responses of wildlife to aircraft overflights, the reaction of a particular animal can range from mild annoyance to panic and escape behaviour (startle response). [28] "A common concern among biologists is that animals will occasionally fall, run into objects or become trampled when they panic and run from aircraft". [29] Young animals are more likely to be trampled in panic situation, and reproductive losses include those caused by "…altered patterns of attendance to young," accidental breakage of eggs in a panic response, and malnourishment of young due to inhibited milk production. [28, 29]

Acoustic impacts should be a concern in Waskesiu. The proposed aerial spray program could negatively affect late-term pregnant elk and deer and their newborn calves that are common within and adjacent to the townsite during the proposed spray period (late May-early June). Other mammals and birds are also vulnerable to disturbance during the spring as they are typically attending to newly born offspring.

SUMMARY

Saskatchewan Environmental Society (SES) and the permanent residents of Waskesiu oppose the overhead spraying of pesticides to control spruce budworm for the following reasons:

1. The spruce budworm and the species it is feeding upon (white spruce, black spruce, balsam fir) are all native to PANP and are integral components of the biological community.
2. The application of pesticides to interfere with natural forest ecosystem processes for aesthetic purposes is not consistent with national park legislation and policy. National park legislation is clear: "the maintenance or restoration of ecological integrity, through the protection of natural resources and natural processes, shall be the first priority of the Minister when considering all aspects of the management of parks" (Section 8(2), Canada National Parks Act).
3. Alternative vegetation management actions exist which are consistent with national park legislation and policy. These are being developed in the context of a Vegetation Management Strategy for Waskesiu, a planning process led by Parks Canada. The objectives of the pesticide program are not consistent with the objectives of the Vegetation Management Strategy.
4. BtK pesticide is not "natural", "safe" or "environmentally friendly". There are significant human health and environmental risks associated with its use. These risks have been minimized or ignored by the pro-spray lobby in their effort to secure public support for pesticide application.

This paper has presented the case against overhead spraying of BtK pesticides in detail.

Part 1 "Applicable Legislation and Policy" summarized and interpreted the specific direction provided by the National Parks Act and the "Parks Canada Guiding Principles and Operational Policies". The Waskesiu Community Plan's application to this issue was also explored, as was the Waskesiu Vegetation Management Strategy, Parks Canada's Integrated Pest Management Directive, and the Pest Control Products Act The conclusion is clear: there is no valid legislative or policy basis allowing the overhead spraying of pesticides to control spruce budworm in Waskesiu.

Part 2 "Human Health Concerns Associated With Aerial Pesticide Application" provided clear evidence of the human health impacts associated with the use of BtK pesticide. The conclusion is clear: the growing body of literature on the subject indicates that human health concerns related to the use of BtK pesticides are real.

Part 3 "Ecological Concerns Associated with Aerial Pesticide Application" provided clear evidence of the environmental and ecological impacts associated with overhead spraying of BtK pesticide. The conclusion is clear: BtK pesticide is toxic to many non-target species and has ecosystem-wide impacts.

Additional reference materials are provided as appendices to this document:

Appendix A "The Nature of BtK" provides background information regarding what BtK is, how it's made, and how it works.

Appendix B "Rebuttal to BioForest Information Regarding the Safety of BtK" presents rebuttals to statements made by BioForest Technologies Inc. in their review of the spruce budworm situation in Prince Albert National Park. This exercise demonstrates that there is more information in the peer-reviewed scientific literature that the public should be made aware of.

Appendix C "References" lists the references for each section of this report.

We believe it is a violation of Canadians intent (as expressed in the National Parks Act) and the public trust to manage national park lands for aesthetic purposes while incurring significant ecological and human health risks.

What YOU Can Do

Your voice is required to stop overhead spraying of pesticides in Prince Albert National Park. Please write or email your local Member of Parliament, Parks Canada CEO Alan Latourelle, and/or the Minister Responsible for Parks Canada, Sheila Copps to voice your objections.

The Honourable Sheila Copps,
Minister of Heritage (Parks Canada)
Room 511-S
House of Commons
Ottawa, Ontario K1A 0A6

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Alan Latourelle, Chief Executive Officer
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Appendix "A"

The Nature of Bt-based Pesticides

What is Bt?

Bacillus thuringiensis (Bt) is a live microorganism that kills certain insects. This characteristic has led to commercial development of Bt-based pesticides used to kill unwanted insects in forests, agriculture and urban areas. Bt-based pesticides are promoted as toxic only to the target pest, having less impact on other species and posing fewer environmental hazards than conventional pesticides. "However, there is evidence suggesting that Bt-based insecticides are not as benign as the manufacturers would like us to believe, and that care is warranted in its use."[1]

Very little is known about Bt's natural ecology. There are at least 34 subspecies of Bt (also called varieties or stereotypes) and probably over 800 strains. As a group, Bt affects a specific range of insect orders, with each variety exhibiting toxicity to different insects.[1] Bt does occur naturally in many soils around the world, but its relative abundance compared to other soil bacteria is variable and can be quite low. In the United States, in a survey of soils never previously treated with Bt, it occurred with a frequency of only 0.75% in the approximately 32,000 bacteria isolates obtained, and was rated as relatively rare in natural soils. Other references state that BtK can barely be found in soils. [2]

How is the Commercial Pesticide Produced?

Bt products available in the United States are comprised of 5 varieties:

- Bt var. kurstaki **(BtK)** and var. morrisoni which cause disease in moth and butterfly caterpillars (brand names: Foray, Dipel and Thuricide);
- Bt var. israelensis (Bti.) which causes disease in mosquito and blackfly larvae;
- Bt var. aizawai (Bta.) which causes disease in wax moth caterpillars; and
- Bt var. tenebrionis (Btt.) which causes disease in beetle larvae.

The products consist of Bt bacteria (the "active" ingredient) and inerts ("inactive" ingredients, or those not directly effective against the target species). Bt bacteria compose a very small proportion of the product relative to inerts (eg: Foray 76B = 3.3% BtK vs. 96.7 % inerts).[1]

The Bt in commercial Bt-based pesticides are cultivated strains of bacteria that contain significantly more of the toxic Bt protein crystals than the natural soil Bt's do. Many commercial Bt-based pesticides are patented which means they are recognized as human inventions and not "natural" soil bacteria (even though they were originally prospected from the natural environment).

Inert ingredients might be spreading or sticking agents, UV inhibitors, emulsifying agents, solvents, and other substances. Inerts are classified as "trade secrets" and are potentially the most toxic components of the formulation. Some known inert agents include sodium hydroxide, sodium sulfite, sulfuric acid, phosphoric acid, methyl parabem and potassium sulfate. Often touted as "food grade" additives, inert ingredients may pose health hazards on exposure.[1]

How does the pesticide work?

When conditions for bacterial growth are not optimal, Bt (like many bacteria) forms spores. Spores are the dormant stage of the bacterial life cycle, when the organism waits for better growing conditions. Unlike many other bacteria, when Bt creates spores it also creates a protein crystal. This crystal is the toxic component of Bt.[1]

After the insect ingests Bt, the crystal is dissolved in the insect's alkaline gut. Then the insects digestive enzymes break down the crystal structure and activate Bt's insecticidal component, called the delta-endotoxin. The delta-endotoxin ruptures the midgut membrane; the insect stops feeding and starves to death. [1, 3]

If the insect is not susceptible to the direct action of the delta-endotoxin, death occurs after Bt starts vegetative growth inside the insect's gut. The spore germinates after the gut membrane is ruptured; it then reproduces and makes more spores. This body-wide infection kills the insect. [1]

As the insects body decays, the active Bt bacteria form into resting spores and produce new crystal toxins. These spores and crystals are released into the soil or water and wait to be ingested by another insect. [4]

Does Bt pesticide persist in the environment after it is sprayed?

Yes, the Bt-based pesticide does remain in the soil, water, air and on sprayed surfaces (including vegetation) for extended periods of time after it is sprayed.

Soil: BtK can accumulate and persist in soil for months if not years [5], resulting in environmental hazards such as toxicity to non-target species and selection of toxin-resistant target species. BtK toxins in the soil have been shown to be lethal to non-target species after more than 6 months post-application.[6]

Vegetation: Bt deposited on the upper side of leaves (exposed to the sun) may remain active for only 1-2 days, but Bt protected from the sun (underside of leaves) can be much more persistent. Viable spores of BtK were recovered from white spruce foliage one year after application.[7] BtK droplets on the underside of foliage are lethal to swallowtail caterpillars more than 30 days after aerial application.[8] Bt can persist for two years in orchards and remain toxic to caterpillars.[9]

Water: BtK has been recovered from rivers and public water distribution systems after aerial application. In lake water, only a 50% reduction of BtK was achieved in approximately two months, and standard water treatment processes are not adequate to destroy BtK spores.[10] Bti spores and crystals bind readily to sediments in the water column, reducing their efficacy by making them inaccessible to insect larvae. However, when sediments are disturbed, Bti can be reintroduced to the water column and be highly lethal to some aquatic insect larvae at least 3 weeks post-application.[11]

Air: BtK has been found to drift for long distances (3-80 km) downwind during and following aerial application (this is dependant on the amount and method of application, as well as climatic conditions).[12, 13] Viable BtK spores can persist in air for weeks after spraying. Spores have been recovered in the air up to 17 days after spraying and reached a high 8 days after spraying.[14,15]

Appendix “B”

Rebuttal To BioForest Statements Regarding the Safety of BtK.

BioForest Technologies Inc. produced *“A Review of the Eastern Spruce Budworm: Likely Impacts and Management Options in Prince Albert National Park.”* [22] for the Save our Spruce Committee (SOS), a pro-spray lobby group. Much of the document discusses the relative merits and safety of using BtK pesticides to reduce budworm impacts in Waskesiu.

In “*Appendix C: Some things you should know about BtK*”, BioForest presents selected information and states “We believe (this) to be a fair and objective representation of the scientific information available.” Our own examination finds that there is a significant body of scientific literature that has not been captured by the review.

Here are *“Some more things you should know about BtK.”*

1. **BioForest:** “Currently there are several Btk formulations registered for aerial application over residential areas. Newer Btk formulations such as Foray 76B have been approved for use in residential situations following review of health and environment information by appropriate government bodies (e.g. environment departments and medical health officers)”. p.18

Rebuttal: Foray 76B is not registered for aerial application over residential areas. It is restricted to forests and woodlands. It is an offence under the Pest Control Products Act to apply Foray 76B to residential areas. [32]

2. **BioForest:** “BtK is an environmentally gentle pesticide.” P. ii.

Rebuttal: Since the registering of pesticides was taken over by Health Canada, it is now illegal to claim that a pesticide is “natural,” “organic” or “safe.” And, the terms “biological” and “biodegradable” cannot be used without qualification. Regulatory Directive 96-02, dated March 15, 1996 further states: “Vague and potentially misleading statements such as “environmentally friendly,” “green,” or “ozone friendly” must not be used as they cannot clearly indicate a specific benefit.” (For copies of the Directive call the Pest Management Regulatory Agency of Health Canada at 1-800-267-6315.)

3. **BioForest:** “BtK is pathogenic to approximately 200 Lepidopterous insects … there are about 11,000 known species of Lepidoptera in Canada and the United States. Thus, Bt is considered a narrow-spectrum insecticide that is extremely safe to use to control forest pests such as the SBW because it has little or no effect on natural enemies of the SBW, other beneficial insects, and non-target organisms.” P.28.; “BtK will only kill some lepidopteran larvae.” p.53

Rebuttal: The vast majority of lepidopterans in North America have never been tested for their susceptibility to BtK, and of the small percentage that have been tested in bioassays, the majority were found to be physiologically susceptible. There are now numerous government reports as well as studies published in the primary literature that document the harmfulness of BtK to non-target lepidopterans. [3, 24, 25]

4. BioForest: "Since BtK is short-lived on foliage, it will only affect Lepidoptera with larval stages that are feeding in the area where and when BtK is sprayed." P. 53; "Only those species with actively feeding larvae present at the time of SBW spray can be affected." P. 42; "BtK will only persist on foliage for 3-7 days." (pp. 50, 54).

Rebuttal: Often quoted as persistent on vegetation for only 3-7 days, BtK is now known to remain viable and toxic on vegetation for much longer. This means non-target species can be affected even if not present when and where BtK is applied.

Research shows that viable spores of BtK can be recovered from white spruce foliage one year after application.[1] Bt can persist for two years in orchards and remain toxic to caterpillars.[2] BtK droplets on the underside of foliage are lethal to swallowtail caterpillars more than 30 days after aerial application.[3]

5. BioForest: "We are not aware of any cases of BtK building up in the soil following a treatment. In fact, it can barely be found and, to the best of our knowledge, there is no evidence to suggest that trace amounts increase after application." p. 54; "BtK can persist in the soil for up to 11 months, however, the insecticidal activity of the bacterium is greatly reduced after 3 days." p. 54

Rebuttal: BtK can accumulate and persist in soil for months if not years[14], resulting in environmental hazards such as toxicity to non-target species and selection of toxin-resistant target species. Associated toxins have been shown to be lethal to non-target species after more than 6 months.[15]

Some scientists suggest Bt spores can persist in soil up to 10 years, and that "there is an urgent need to elucidate the relationships between Bt and natural soil microflora and fauna."[16] Why is this important? Because bacteria and fungi in the soil are essential for proper ecosystem function. The anti-microbial substances produced by BtK have been shown to inhibit the growth of 16 of 20 bacterial strains and six of seven fungal strains isolated from forest environments where Bt is regularly applied. These strains included a beneficial bacteria, a mycorrhizal fungus that helps trees obtain nutrition and resist drought, and a fungus that can infect and kill the target species.[17]

6. BioForest: "Bt has been detected in soils and other substrates around the world including Canada, the US, etc." (p.53); "In fact, (BtK) can barely be found" in soils. (p. 54).

Rebuttal: These statements are confusing; BtK appears to exist everywhere and yet nowhere.

While Bt does occur naturally in many soils around the world, its relative abundance compared to other soil bacteria is variable and can be quite low. In the US, in a survey of soils never previously treated with Bt, it occurred with a frequency of only 0.75% in the approximately 32,000 bacteria isolates obtained, and was rated relatively rare in natural soils.

Furthermore, naturally occurring BtK little resembles commercial BtK. Commercial formulations are cultivated so that the bacteria produces ten times (or more) endotoxins than naturally occurring bacteria.[13] Patenting of commercial Bt pesticides means they are recognized as human inventions and not "natural" soil bacteria.

7. **BioForest:** " BtK will only survive in waterways for a short time (13 to 28 days in rivers), and its concentration will decrease rapidly." p. 54.

Rebuttal: BtK has been recovered from rivers and public water distribution systems after aerial application. In lake water, only a 50% reduction of BtK was achieved in approximately two months. Standard water treatment processes are not adequate to destroy BtK spores.[18]

8. **BioForest:** "Studies showed that normal field applications of BtK are not likely to adversely affect aquatic invertebrates." P. 29; BtK in aquatic systems "does not impact fish, crustaceans, or other aquatic invertebrates." "Aquatic insects are not affected by the doses of BtK used in field applications." p.53

Rebuttal: Aquatic insects, invertebrates and fish <u>are</u> affected by Bt treatments. Canadian studies have found that certain aquatic insects are killed by BtK, and that application of Bt over large forested areas "may present a potential hazard to fish in lakes and streams through effects on their food organisms".[4, 26] Elevated mayfly (Baetis spp.) mortality was noted after direct BtK application to a stream on Vancouver Island.[5] Exposure of snails (Biomphalaria alexandria) to low concentrations of Thuricide (a BtK formulation) caused a significant decrease in both egg production and size of egg masses, and reduced the percentage of egg hatchability.[6]

9. **BioForest:** "The lack of any documented fish kills…has been advanced as an argument that BtK does not kill fish." P. 29; "BtK applications are not toxic to freshwater fish." P. 55.

Rebuttal: There is evidence that BtK is toxic to fish. Research has shown that Foray 48B at high concentrations (about 3 percent) is acutely toxic to rainbow trout, probably because the product is highly acidic.[7] Some juvenile coho salmon died at the high dose rate when they were exposed for 7 days to doses ranging from 5.2 x 10 to 26.4 x 10 spores per ml.[8]

10. **BioForest:** "BtK is not toxic to earthworms." p. 55

Rebuttal: There is evidence that BtK may be toxic to earthworms and to brine shrimp.[9]

11. **BioForest:** "BtK is not toxic to honeybees." p. 53

Rebuttal: There is evidence that high concentrations of BtK spores can be toxic to bees.[9]

12. **BioForest:** "BtK is not toxic to sparrows, robins, grouse, finches, and black-throated warblers or any other birds that we are aware of." p. 55; "BtK will not kill small mammals." P. 55.

Rebuttal: Birds can be directly affected by Bt. Documented symptoms of Bt exposure include emaciation, blood in gizzard, hemorrhage in gastro-intestinal tract, reduced feeding, and reduced egg production.[23] Secondary effects on birds and mammals that depend on target and non-target species may also be significant. Chickadees and warblers have demonstrated reduced post-spray foraging and nesting success. [10, 21] A Canadian study found the numbers of caterpillars, followed by the numbers of two species of warblers and a thrush, were reduced by BtK treatment. In addition, there were fewer spruce grouse chicks in BtK treated areas, and the chicks in those areas grew more slowly than chicks in untreated areas.[11]

As with birds, impacts of BtK on other animals that feed on caterpillars and insects are likely. For example, treatment with BtK has been shown to change the structure of a shrew population in response to a reduction in caterpillars.[12]

13. BioForest: "In some instances, some birds and small mammals that rely on pest larvae for food may be indirectly affected by the reduction in numbers of larvae as a result of BtK sprays. These bird and mammal populations would have originally increased in response to the increased abundance of food when the pest outbreak developed. Their numbers would normally decline when the outbreak ended and their food source disappeared. Any impacts on these animals are likely to be short-term and confined to relatively small areas." p.55

Rebuttal: BtK is an ecosystem-wide stress that has been shown to persist in the soil, water, air and on vegetation for extended periods following application. BtK products can kill organisms other than their intended targets. BtK can dramatically reduce the number and variety of moth and butterfly species. In turn, the animals that depend on these organisms for food are also impacted. These extended impacts may not be lethal but may be significant, such as reduced foraging, nesting and reproductive success. Determination of the ecological effects of a multi-year spray program conducted in the context of a 20-30 year outbreak cycle would require considerable research effort.

14. BioForest: Re: Comments from human health surveillance conducted following spraying for gypsy moth on Vancouver Island. P. 51.

Rebuttal: "This report was prepared by the Capital Health Region Office of the Medical Health Officer, Director of Research. It is a medical bureaucrat's effort to subdue public concern about the spray program. For the most part the scientific literature review selected those studies that supported the spray program and ignored studies that raised concern. Discussion of study results was bizarre in many instances because interesting leads and results were dismissed casually. The report appeared to suffer from tunnel vision including reluctance to pursue leads. Canadian Medical Health Officers are hired by and report to local political authorities. Their reports are not held to the same standard as professional publication in journals requiring peer review." [19]

15. BioForest: Re: Discussion of health issues and information summarized from the Extension Toxicology Network (EXTOXNET), Michigan State University, etc. p.51.

Rebuttal: EXTOXNET has produced a pesticide information profile on Bacillus thuringiensis designed to alleviate concerns about Bt use. Please note that it has not been updated since June of 1996, and at that time failed to identify human health and environmental concerns that had already been pinpointed.

A referenced, point-by point rebuttal of Michigan State University Bulletin E-2421- "Using BT to Control Gypsy Moth", regarding the environmental and human health effects of BtK can be found at www.praxis-ibc.com/id103.htm.

16. BioForest: "In some cases, BtK has been sprayed over cities and other residential areas to control invasive pests such as the gypsy moth (Victoria, Vancouver, Auckland NZ)." P. 43.

Rebuttal: BioForest appears to be making this statement to indicate that BtK can be safely used over residential areas. We present evidence below to counter this position.

- Re: Vancouver BtK application. During the aerial BtK spraying of Vancouver in 1992, a 10 per cent sample of Emergency Department visits found 1,839 patients with discharges from eyes or respiratory tract, 1,352 with respiratory problems, 100 with rashes, 60 with unexplained allergic reactions and 119 with nosebleeds. It is important to remember, that the potential exists for 10 times these numbers - 1,190 nosebleeds. etc. [20]

- In December 1995, Agriculture Canada applied for a pesticide use permit to ground spray 4 city blocks in New Westminster, BC, with BtK for the control of gypsy moths. The targeted area was residential and was also home to an elementary school. Public outrage was swift and relentless. Over 90% of residents signed a petition against the spraying. A dozen appeals were filed with the Environmental Appeal Board (EAB), including one from the Parent Teachers Association of the targeted school.

In April 1996 the EAB cancelled the permit on the grounds that the pesticide posed a threat to human health, and that the spraying was unlikely to be effective. In its decision the EAB Panel noted that:

"The Panel finds that aerial spraying will create an unacceptable risk of health problems among the residents of these densely populated areas. In particular, the Panel agrees with the Appellants that there is a risk to the health of children, people of all ages who have allergies, asthma, and other respiratory ailments, people with immuno-deficiencies, chemical hypersensitivities, and the elderly. It also poses an unreasonable adverse effect to the environment (non-target species.)"APPEAL NO.98-PES-03(b), March 31 - April 3, 1998. [33]

The Panel based its decision on evidence indicating:

1. BtK had caused health reactions in previously sprayed areas, including: "..skin rash and other immune, allergic and sensitization responses such as dry, itchy skin; red, burning eyes; dry sore throat; cough and tightness in the chest.."

2. Children are at particular risk from the effects of BtK. "With smaller weight, and developing systems, children are likely to be more susceptible for all potential health effects."

3. BtK is respirable in mammals, therefore, there is the possibility of lung injury on exposure to it.

4. According to the manufacturer, repeated exposure via inhalation can result in sensitization and allergic response.

5. Some ground spray workers suffered health reactions and remained culture positive for prolonged periods of time.

6. There have been no long-term studies done on the effects of BtK on human health.

The panel also found that the efficacy and benefits of the spray program were disputable, that alternatives to spraying were not thoroughly considered, and that the decision to issue a permit to apply BtK was “an unreasonable departure from policy”.

17. BioForest: “The use of (GPS) satellite guidance systems has greatly improved the accuracy, coverage and the deposit of the pesticide on the target trees. It has also greatly reduced or eliminated the accidental spraying of sensitive sites.” P. 28.

Rebuttal: For greater clarity – the use of GPS cannot directly improve the accuracy of the spray once it leaves the aircraft; this technology can only improve the accuracy of the aircraft’s flight path, and location at which the pesticide is released. After release, some pesticide always leaves the target area – this is called pesticide drift.[27]

Pesticide drift has been characterized as “considerable” and is thought to vary from 5 percent (under optimal low wind conditions) to 60 percent (under more typical conditions).[28] The U.S. Congress Office of Technology Assessment estimates that about 40 percent of an aerial insecticide application leaves the target area and that less that 1 percent actually reaches the target pest.[29] Drift distances can be significant: “typical estimates of pesticide drift following aerial application range from 100 metres to 1600 metres. In virtually every study available pesticides were detected as far away from the application as samples were taken.” [30] Drift distances of 3 km or more are common in the literature, and drift cloud impacts on non-target species are documented.[31]

Appendix "C"

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