PREVENT CANCER NOW

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To: Standing Committee on Climate Change and Environmental Stewardship, an all-party committee of the Legislative Assembly of New Brunswick

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Protect health and the environment:
Eliminate glyphosate from New Brunswick forests
Transition to healthier pest control in New Brunswick

This submission is in response to the New Brunswick Standing Committee on Climate Change and Environmental Stewardship invitation for information regarding pesticides. *Prevent Cancer Now* aims to stop cancer before it starts, and we are grateful for the opportunity to discuss opportunities to improve cancer prevention and health, as well as protection of the environment of New Brunswick. The submission includes an overview of pesticide assessment and regulation by Health Canada, and briefly reviews evidence of effects of glyphosate-based herbicides (GBHs), including cancer. The provincial government has distinct roles, and we provide support for modernization of New Brunswick forestry by elimination of herbicides (currently GBHs). Modern, least-toxic approaches are addressed, including for "cosmetic" uses.

CONTEXT AND OVERVIEW

Climate imperatives highlight needs to support resilient, bio-diverse lands in New Brunswick, where forests, wetlands, streams, rivers, and lakes are a rich home for many interdependent species. Perspectives are evolving as to of what are considered to be "pests," as biodiversity of plants and insects, including bio-controls, contribute to overall sustainability. Herbicide-free forestry, established in Quebec since 2001, will protect workers' and residents' health, and support resilient landscapes into the future.

Cumulative, interacting low dose contaminants in the environment, including mixtures of biologically active chemicals, can contribute to adverse effects on numerous species and impact human health from conception on, and across generations. This highlights the need to re-examine pesticide uses, and to use least-toxic strategies to support interdependent species and to achieve resilient, productive landscapes.

This submission focuses primarily on the analyses of health related to pesticides, particularly GBHs. To understand why public domain scientists come to different conclusions from regulators regarding pesticide safety, please refer to Annex 1. Federal registration sets a floor for pesticide use, not a ceiling. Provinces further restrict pesticides in their best interest, to protect human and

environmental health, to meet the needs and desires of their citizens. New Brunswick restricts pesticide use on lawns and gardens, otherwise known as "cosmetic use" in order to protect health while maintaining landscapes. The provincial government can also enable restrictions of pesticides to protect natural systems in forests, including on Crown Land.

In New Brunswick, almost two thirds (by weight) of pesticides used are glyphosate-based herbicides, such as "Roundup," with most used in the forestry industry. Economic arguments that timber yields decrease as biodiversity increases are outdated, because coniferous monocultures burn more quickly and thoroughly than biodiverse stands that include deciduous species, as seen in British Columbia.[1] How do costs and hazards of fires borne by the public, as well as the impacts on the environment and human health compare with private profits from forestry?

This submission covers:

1. Glyphosate, the formulated herbicide product, and related health effects;
2. Brief discussion of other herbicides in forestry;
3. Other uses of pesticides in New Brunswick.

Annexes include:

1. Canadian Federal Pesticide Regulation: Why Other Levels of Government Restrict Pesticides and Require Least-Toxic Approaches to Pest Control
2. Contamination of fish and eels in the vicinity of CFB Gagetown with dioxins and furans from historical herbicide spraying (Task 4 Factfinders report, Aug. 2007)
3. Non-Hodgkin's Lymphoma (nHL) data altered in final Agency for Toxic Substances and Disease Registry (ATSDR) Toxicological Profile for Glyphosate

GLYPHOSATE

Glyphosate is a small molecule, that is highly bioactive. It has been patented three times, as a broad-spectrum herbicide, an antibiotic, and a chelator (having the capability to mobilize metals into water, in the case of ecosystems making toxic elements such as cadmium, lead and mercury available to plants and other species in the environment). This remarkable chemical can thus have wide-ranging effects.

Chemical effects and implications

Antimicrobial Effects on Microbiomes

There are more bacterial cells in and on your body than human cells. This is called the "microbiome." The myriad of microbes in the intestine includes species that are more or less beneficial, and this microbiome directly impacts health. Intestinal microbiota digest food, manufacture essential nutrients, modulate the immune system (potentially causing inflammation), affect feelings of satiety (potentially contributing to over-eating) and affect the nervous system (including mood). This all may be affected by antimicrobial effects of glyphosate as well as other toxic and beneficial exposures.[2]

Glyphosate has been reported to disrupt the microbiome of birds,[3] rodents,[4,5,6] and honey bees.[7] On the other hand, removal of glyphosate from the diet may relieve intestinal dysbiosis, because some beneficial bacteria are susceptible, while pathogenic *Clostridia* and *Salmonella* strains are

resistant.[2] [There is anecdotal evidence of improvement of IBD in humans with food from countries where glyphosate is restricted, or with change to an organic diet. Probiotics (including beneficial microbes for the intestinal microbiome) and prebiotics (foods that support beneficial microbiome species) and fecal transplants may provide relief.]

Inflammatory bowel disease (IBD) results from and is associated with intestinal dysbiosis, and Canada's children under six years of age are unfortunately among the top sufferers in the world, with IBD increasing 7% per year.[8] There is likely an association between IBD and the fact that colorectal cancer is increasing at 6-7% per year in Canadian adolescents and young adults.[9,10] These astounding increases in life-changing and life-limiting conditions in the young require broad-based precautionary approaches, including avoidance of unprescribed dietary antibiotics (i.e., glyphosate) as well as low level toxic mould contamination of foods (see "Soil Microbiome" below). The PMRA recently commenced a consultation on increasing the maximum residue limit for glyphosate in some foods.[11]

The Pest Management Regulatory Agency (PMRA) did not consider evidence regarding dysbiosis, even though the registrant-submitted test data reported "anal staining" of rodents fed GBH – a clear indication of intestinal distress. This was noted during a visit to the "Reading Room" in Ottawa where the public may view anonymized test data. They first swear an affidavit promising not to use the information to "register a pest control product in Canada or elsewhere," enforced by criminal penalties. Then, in an Ottawa cubicle they surrender electronic devices, view often-unsearchable files on a PMRA computer, and take hand-written notes that are photocopied before leaving. The public cannot, however, view or verify key PMRA analyses and summaries of this voluminous data.

The PMRA does not systematically assemble and review the peer-reviewed science, according to modern scientific approaches and methods – work that requires specific expertise, infrastructure and resources. The PMRA instead relies heavily on thousands of pages of data and internal studies provided by applicant chemical companies. This information is not verifiable, even though the Pest Control Products Act (PCPA) intends for risk assessment to be transparent.

Soil Microbiome

Toxic mould contamination originates in the soil microbiome, that may also be affected by glyphosate. Use of the herbicide in agriculture is linked to higher levels of fungal disease species including *Fusarium* (toxic black mould that can rot plants, and render grains and other foods highly hazardous).[12,13] Canadian commodities are also affected by cadmium contamination originating naturally in some soils and present in Canadian potash fertilizer. An industry website https://keepingitclean.ca urges Canadian producers to preserve markets and ensure that exports meet international standards for contaminants such as glyphosate and cadmium. Productivity of nutritious plants and the health benefits as well as risks of food contaminants may thus be affected by glyphosate. This may also apply to berries and other edible plants that survive or recolonize following glyphosate spraying of logged lands.

Fertility and Birth Outcomes

Exposure to glyphosate during pregnancy may shorten gestation and cause spontaneous abortion. An early (2001) Health Canada led study found preliminary evidence of increased risk of spontaneous abortion with glyphosate exposure.[14] In 2018, a California study replicated association of exposures to glyphosate applications with increased risk of pre-term birth (particularly of

females fetuses),[15] and in an Indiana cohort a strong association was reported between urinary glyphosate levels (a better indicator of exposure) and shortened pregnancy.[16]

Hormone-like Activities (Endocrine disruption)

One of the potential reasons behind glyphosate effects on gestation, and a sex-linked specificity, is that it affects hormone activities. Laboratory studies have been varied, with early demonstration of glyphosate-induced growth of human breast cancer cells,[17] with some demonstrations of glyphosate (but not adjuvants) exerting indirect effects on hormone activities affecting the gonodal (sex-linked)[18] and thyroid axes.

A detailed animal study pin-pointed the importance of timing, with early life exposures being particular important in disruption of thyroid signalling and normal metabolism.[19] Early life exposures are well known to potentially alter the trajectory of physical and intellectual development throughout life.

Does Glyphosate Cause Cancer?

Yes, according to independent scientists, and U.S. courts and juries; no, according to many regulators. The World Health Organization's (WHO) International Agency for Research on Cancer (IARC) found in 2015 that glyphosate is a category 2A probable human carcinogen, based on: *sufficient* evidence of carcinogenicity in animals, *limited* evidence of carcinogenicity in humans and *strong* evidence for two carcinogenic mechanisms.[20] A study of a population in a relatively pesticide-free environment being sprayed with glyphosate demonstrated genetic damage proportional to distance from spraying.[21]

Like other regulatory bodies, the PMRA relies largely on confidential (not available to IARC), industry sponsored and supplied studies, to determine with there is a health effect that is both "established" and "adverse." No major regulatory body has concluded that glyphosate is a carcinogen. This is in part because IARC and regulatory bodies consider very different bodies of evidence, and in part because occupational risks trigger requirements for protective gear, rather than decreased use.[22] A more extensive discussion of shortcomings of federal pesticide assessment is provided in Annex 1, "Canadian Federal Pesticide Regulation: Why Other Levels of Government Restrict Pesticides and Require Least-Toxic Approaches to Pest Control".

While IARC is restricted to information in the public domain and does not consider the confidential test data provided to regulators, an independent analysis of the studies provided to the European Union and to the U.S. EPA found that many tumours had been overlooked; "The analyses identify 37 significant tumor findings in these studies and demonstrate consistency across studies in the same sex/species/strain for many of these tumors."[23]

The IARC findings led to retrenching by the European and North American regulatory assessors, but the regulatory affirmations of lack of carcinogenicity was disputed by 94 prominent scientists, including Canadian experts in epidemiology, occupational and public health, in a commentary published the Journal of Epidemiology and Community Health.[24]

Non-Hodgkin's Lymphoma (nHL), and scientific rigour and transparency

The "Monsanto Papers"[25] is an extensive collection of evidence brought into the public domain, and made available by Baum Hedlund Aristei & Goldman – the California law firm that obtained verdicts of billions of dollars in compensation for nHL patients who previously applied GBHs. The law firm

states, “The Monsanto Papers tell an alarming story of ghostwriting, scientific manipulation, collusion with the Environmental Protection Agency (EPA), and previously undisclosed information about how the human body absorbs glyphosate.” High awards were in part because of Monsanto’s prior knowledge, and suppression of information regarding the hazards of glyphosate. With this background and disclosure of the extensive body of evidence, the question remains, will parties to further use of glyphosate be liable? U.S. class actions are now being settled.

In 2019, Canadian experts in occupational health and epidemiology revisited the data regarding glyphosate and nHL, finding evidence of an association between glyphosate use and nHL.[26] This occupational/environmental epidemiology is difficult and time-consuming, and requires long-term commitments for funders and researchers, not least because cancer is a disease that emerges after a long lag time. Repeated positive signals internationally should be taken very seriously.

In April 2019, the U.S. Agency for Toxic Substances and Disease Registry (ATSDR) published a draft Toxicological Profile for Glyphosate, and its 257 pages contained the most comprehensive publicly available review regarding glyphosate.[27] In the U.S. political climate at the time, one might speculate that had this report stated that glyphosate causes cancer it would not have been published. Nevertheless, meta-analyses clearly indicate that glyphosate is significantly linked to increased risk of nHL (Figure 2-4; p 86; pdf p 99) and increased risk of multiple myeloma (Figure 2-5; p 87; pdf p 100). In 2020, the final Toxicological Profile of glyphosate[28] summary figure for nHL had an error introduced, that suggests lack of consensus and engenders doubt as to the carcinogenicity of glyphosate. See Annex 2 for details.

Inflammatory Bowel Disease and Colorectal Cancer

As discussed above, there is reason to believe that glyphosate can contribute to the epidemic of inflammatory bowel disease in youngsters[8] and increasing colorectal cancer in adolescents and young adults.[9,10]

Public and Occupational Health

Drawing connections between chemical exposures and disease such as cancer is contingent upon understanding exposures. Given that glyphosate has been the most-used herbicide in Canada for decades, it is surprising that we have no federal mapping available mapping use of GBHs or data on the body burden of glyphosate. Canada’s flagship study, the Canadian Health Measures Survey, is slated finally to report on glyphosate in 2025 (or possibly later, due to the pandemic). Without exposure data, it is more difficult to relate changes in public health to chemicals in air, water and food.

There are limited reports of glyphosate in groundwater, including in New Brunswick where glyphosate was detected in at least one sample from 8 of the 11 domestic wells sampled.[29]

Prevent Cancer Now recommends that provinces, and ideally the entire country, collect information related to environmental exposures. This could populate infrastructure, with the ability to be securely linked to health data in order to investigate environmental contributors to health and disease.

In terms of workers’ health, successful U.S. litigation has brought awards of millions of dollars for professional applicators who went on to develop nHL. It is important to consider the long term

health of those who are carrying out spraying on foot, by truck and by plane, as well the health of tree planters working on sprayed lands.

We do not see the same high stakes lawsuits in Canada as seen in the U.S. because of fundamental differences in the laws. In Canada, should an individual's case fail at trial, the ill worker could be responsible for the costs of the corporate legal costs, and should the individual win the awards would be much less.[30]

Chelation

A chelator is a chemical that can wrap around a metal ion and bring it into solution. In this way, glyphosate may alter mobility – movement into water and uptake by plants – of toxic metals in soils such as mercury, cadmium and lead.

Consumption guidelines for fish recommend limiting exposure to toxic chemicals including mercury (originating from chlor-alkali plants associated with old pulp mills, methylmercury forms in sediments then is absorbed by fish from the water and food). As well, organ meat of deer and moose may contain high levels of cadmium, resulting in consumption guidelines. If present, these metals accumulate from soils into certain plants browsed by the deer family, such as willow and poplar. Thus, not only does glyphosate kill food for wildlife, it may contribute to higher levels of toxic elements in animals, and hence higher levels in hunters and fishers eating these foods

SCIENTIFIC RIGOUR, AND INTERNATIONAL DEVELOPMENTS

Prevent Cancer Now was among several groups that objected to the PMRA re-registration of glyphosate on scientific grounds. After a year and a half the PMRA summarily dismissed all objections, with no citations of science, much less reference to relevant studies that had been published in the intervening time. An appeal by *Safe Food Matters* is currently making its way through the Canadian courts. In North America, Mexico is banning glyphosate, while banning of glyphosate in a growing number of European jurisdictions might trigger another Canadian federal review.

OTHER HERBICIDES IN NEW BRUNSWICK FORESTS

Many herbicides have been used in forestry over the decades, including chlorinated herbicides dating back to defoliants in warfare. This was highlighted for New Brunswick during the Factfinder investigations of after-effects of herbicide testing at CFB Gagetown, of herbicides that had first been employed in Vietnam. The lasting legacy of dioxin contamination in eels, fish and mussels was obscured with simplistic data interpretation in the Factfinder Task-4 report, but is presented in full in Annex 3. Today's choice in forestry (and on the training grounds) is glyphosate.

Since glyphosate has been identified as a probable carcinogen and having other toxic effects, other newer herbicides have been used on roadsides in Ontario and elsewhere. These may cause adverse health and environmental repercussions. *Prevent Cancer Now* would be pleased to provide overviews and to discuss other chemicals of interest, at the Committee's request.

In short, there is no "other" or "alternative" herbicide that should be utilized. Today New Brunswick has an opportunity to act on knowledge of glyphosate risks, plus the resilience of biodiversity during climate change, and build on the twenty years of experience in its sister province (Quebec) to seize the opportunity to shift to herbicide-free forestry.

OTHER USE OF PESTICIDES

"Cosmetic" uses of pesticides for landscaping

It is commendable that "cosmetic" pesticide use has been recognised as an important issue in New Brunswick. The government is encouraged to investigate the Ontario model, whereby pesticides are restricted to a list of permitted least-toxic solutions. This is much more practical than a list of banned products, as innovation may result in toxic look-alikes that may not be captured.

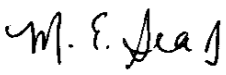
During formulation of Ontario's law, the golf course organizations argued successfully that they would use "Integrated Pest Management" (IPM) to minimize pesticide use and so the Ontario law requires annual reporting of pesticide use by golf courses. *Prevent Cancer Now* analysed this data reported by golf courses among the top 50, and found that although some courses used substantially lower quantities of pesticides than others (i.e., there was a lot of room for improvement by many courses), that the promises of implementation of IPM made no significant difference to pesticide use (see the Summary and Full Report).

In summary, we congratulate the Government of New Brunswick's timely re-examination of pesticide uses. Focusing on least-toxic solutions provides an opportunity to have positive impacts on human, ecological and financial health of the province. Today New Brunswick can act on knowledge of glyphosate risks, plus the resilience of biodiversity during climate change, and build on the twenty years of experience in its sister province to seize the opportunity to shift to herbicide-free forestry.

In conclusion, *Prevent Cancer Now* encourages the Committee to recommend herbicide-free forestry in New Brunswick. This will protect the health of workers and their offspring, and permit more biodiverse, resilient growth that will be more likely to thrive and support wildlife as climate change intensifies. Choice of least-toxic solutions for landscaping and agriculture are opportunities to protect health and the environment as well.

We have covered a great deal of information in this submission, briefly and at a high level. Our expertise reaches deeper and more broadly than we have shared here, so please do not hesitate to ask for clarifications.

Sincerely,



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Prevent Cancer Now is a volunteer civil society organization of scientists, medical practitioners, other professionals and concerned citizens, working to stop cancer before it starts. We carry out public education, conduct scientific analyses, participate in public consultations, and partner with others to further science-based decisions and laws.

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PREVENT CANCER NOW

Annex 1: Canadian Federal Pesticide Regulation: Why Other Levels of Government Restrict Pesticides and Require Least-Toxic Approaches to Pest Control

Many Canadian jurisdictions restrict the use of pesticides, surpassing federal requirements.
Reasons include human and environmental health.
This summary is to help you understand why.

Pesticides are products that destroy or control "pests."

Pests are defined as organisms that are "harmful, noxious or troublesome."

Pesticides include herbicides against plants, insecticides, fungicides, rodenticides, algaecides, etc. Disinfectants for surfaces and devices and that kill or disable contagions (bacteria, viruses) while "cleaning" air are also pesticides. Every pesticide must be registered for use, and users are legally obliged to follow specific, detailed instructions.

Health Canada's Pest Management Regulatory Agency (PMRA) regulates pesticides, under the Pest Control Products Act (PCPA).[1] The PMRA uses a two-step process of risk assessment, first identifying hazards and then assessing risk on the basis of exposure. Risk management amounts to controlling exposure by adjusting application rate, conditions and frequency, and protective measures (e.g., using protective equipment and restricting access to treated areas). Products are registered for sale and assigned a PCPA number if the pesticide poses "acceptable risks" according to the PMRA's scientific assessments.

Some risks, as well as instructions for use, risk mitigation, emergency instructions and other details are on pesticide labels, that may be found on the PMRA website.[2] Label instructions are legally enforceable, under the PCPA.

While the PMRA registers products for sale and use, provincial governments are responsible to qualify and licence applicators, and often further restrict or ban certain pesticides or uses to protect human and environmental health. In most provinces, municipal governments may impose further restrictions. Across jurisdictions "cosmetic" pesticides for turf and landscaping are limited to varying degrees, with the province of Ontario and City of Halifax requiring least-toxic approaches. Quebec restricts pesticide uses, including banning the use of herbicides in forestry.

Practical limitations of Canadian federal pesticide management – safest options not "approved"

The PMRA only assesses pesticides for which it has data packages – information that is assembled by firms that anticipate financial gain from sales of the proposed product. There are many means to

control pests that pose lower risks, but these are not legally available or used widely if products are not assessed and there is no PCPA number.

Scientific limitations of Canadian federal pesticide regulation

The PMRA and the health and medical community often reach opposite conclusions regarding pesticides and human health. Doctors, who urge precautionary minimization of pesticide exposures, rely upon the publicly available, real-life human epidemiological research rather than the confidential industry-produced animal test data that is relied upon by the PMRA. The PMRA conducts virtually no testing itself, and does not systematically assess the publicly available existing science.[3,4] Rather, it conducts a paper audit of data submitted by the pesticide manufacturers. The PMRA assessment of human health risk has many shortcomings:

1. **High-dose animal testing in labs is of limited relevance for people.** Testing determines the maximum dose that does not make an animal (usually a rodent such as a rat or mouse) seriously ill. Rodents are different from humans, in that they have enzymes that help to metabolize poisons. Humans do not have the same enzymes and, of course, tests are not conducted on humans. That would be unethical. Also, tests do not generally cover the animal's lifespan, and further generations. In humans, exposures that may cause no symptoms in the mother can cause life-long harm to her unborn child, and early life exposures can cause symptoms during puberty and in adulthood.

   A female newborn's eggs are fully in place at birth, and exposures of her mother during pregnancy are known to affect the baby's future offspring (e.g., exposure to the now-banned insecticide DDT affects metabolism and obesity of grandchildren[5]). Such effects may be passed through generations due to changes in gene expression, called epigenetic effects.

   When a substance causes cancer in animals, it is not considered a human carcinogen until there is evidence in people. This can take a generation or longer, and many contributors to cancer may never be convincingly proven in people because of limitations in the science of human epidemiology. Substances may work in concert to cause cancer,[6] or the signal of cancer from one substance may be obscured by other exposures.

2. **Tests do not address low-dose or cumulative effects, as they build up with multiple exposures and over time.** The regulatory system does not require, and in effect dissuades companies from doing low-dose, environmentally relevant testing, because any findings of adverse effects would preclude the product being registered. This highlights the need for independent research, and for this information to be considered in decisions. Some health effects occur at doses commonly encountered in the environment, including developmental harms, and effects that may predispose people to cancers as well as other major chronic diseases. One important mechanism by which this happens is endocrine disruption.[7]

3. **No testing is done on endocrine disruption – an important mechanism behind many pesticides' chronic toxicities.**[7] Many pesticides have already been found to disrupt the endocrine or hormone systems.[8] Hormones orchestrate every step of development from

gestation through the entire lifespan. Endocrine-disrupting chemicals act at extremely low concentrations in the body, and can have different, even opposite effects at higher doses.[9] Alterations of hormone levels during critical windows of development can cause permanent changes to children's lives, affecting their intelligence and behaviour, and making them more susceptible to infections, asthma, obesity, diabetes, reproductive failure, cardiovascular disease and cancers. One 2011 study reviewed endocrine effects of 91 pesticides.[8] A second study confirmed previously known androgen (male hormone) effects of some pesticides,[10] and that among previously untested pesticides nine were anti-androgenic and seven were androgenic. The US Environmental Protection Agency and the European Union are screening pesticides for effects related to actions of estrogen, androgen, thyroid and other hormones. A 2012 review of 845 scientific papers showed evidence that endocrine-disrupting chemicals have adverse health impacts at very low doses in animals and humans.[11] The Endocrine Society – a global group of medical science professionals [12] – published in 2015 a 150-page updated research review and statement calling for scientific and regulatory attention to endocrine-disrupting chemicals.[9] In 2020, scientists called for a body comparable to the International Agency for Research on Cancer to assess EDCs.[13]

4. **Only active ingredients are tested – not the products on the shelf.** Products can contain more than one pesticide ingredient. As well, additives, "adjuvants" or "formulants" are used in pesticide products to improve spreading and absorption of the product, and to slow metabolism of the active ingredient (i.e., prolong its effect). Additives can do the same when pesticides contact humans. A 2014 study found that 8 of 9 common commercial products tested were hundreds of times more toxic to human cells than just the pure pesticide active ingredient without formulants.[14]

5. **Pesticides are not tested in combination.** While we know that chemicals can act very differently in combination, single pesticides (and often only one active ingredient of pesticides) are assessed in isolation. Greater toxicity when mixed with additives to improve effectiveness, or multiple pesticides in combination (as on a golf course), are not assessed.

6. **Pesticide registration is based on all directions being followed.** Even if people make the effort to access the label fine print, instructions are extremely difficult to follow. For example: "avoid inhaling"; "avoid contact with the skin or eyes"; and "apply only when there are no children, pregnant women, elderly persons, pets or animals present."

7. **The PMRA does not take into account much of the scientific, medical literature.** Methods and standards are developed for systematic review in environmental health (e.g., by the US National Toxicology Program[4,15]). Real-life study of the effects of pesticides is difficult, and the PMRA dismisses this information as showing only correlation and not at the level of causation requiring protective action. The PMRA is of the opinion that it is virtually impossible to *prove* that chronic pesticide exposures cause harm to humans, leaving the federal regulator relying upon industry-supplied high-dose animal testing. As reported in 2017 in the prestigious journal *Science*, ignoring the majority of the science is the status quo among regulators.[16]

8. **Precautionary Principle is *not* up front.** Health Canada and industry groups point out that the Precautionary Principle is incorporated in the *Pest Control Products Act*. In fact, this is quite limited because precautionary approaches are only incorporated late in the process, during risk management, such as determinations of permissible exposures (noted below, an additional margin introduced in 2002, to protect the most vulnerable, is rarely if ever being implemented). Application of the Precautionary Principle to the first step – hazard identification – could potentially push the process towards least-toxic choices. On the other hand, industry representatives have been known to turn this approach upside-down, advocating precaution against rushing to remove "tools from the toolbox" before being 100% certain that any pesticides are causing substantial harm. The Precautionary Principle is operationalized with the Substitution Principle;[17,18] i.e., informed substitution with a least-toxic option. Such options (e.g., dish soap against insects) may not be as profitable, but with no data package a product cannot be registered, or sold or used commercially.

Federal audits of Health Canada's pesticide management

The Federal Commissioner of the Environment and Sustainability in the 2015 audit of pest control products found glaring deficiencies and concerns regarding pesticide registration.[19] Some concerns are as follows:

- The PMRA had made little progress since the 2008 audit to limit the duration of some conditional registrations (when pesticide sales are permitted pending further information to complete the assessment). Eight of nine products that had been registered conditionally for a decade or more were neonicotinoids, a class of neurotoxic insecticides that have been linked to Bee Colony Collapse Disorder and the death of other pollinators and aquatic species.
- Under conditional registrations the PMRA permits use of the pesticide without having received and assessed the risk and value assessments to determine the impacts on human health and the environment. At the time, 80 out of 7,000 pesticide products were conditionally registered. None of the industry studies are available to the public until the pesticide is fully registered, and even then an individual must personally visit offices in Ottawa and record relevant information with pen and paper. Many of these conditional registrations have been finalized since.
- The PMRA has never exercised its authority to cancel a conditional registration when a registrant has failed to satisfy conditions of registration, within a five-year period.
- Re-evaluations of older pesticides are behind schedule.
- Cumulative health impacts have not been addressed when required in the re-evaluations of pesticides.
- It took the filing of a lawsuit before the PMRA began to consider whether special reviews were deemed necessary for pesticides banned since 2013 in OECD countries.

- PMRA has not promptly cancelled the registrations of some pesticides when risks were deemed unacceptable. In one case it took 11 years to cancel the registration of a pesticide after it was determined the risks posed to human health were unacceptable.
- Lengthy phase-out periods have been allowed to occur despite the risks posed to human health of continued use.
- An additional "uncertainty factor" to protect the most vulnerable individuals, introduced to the *Pest Control Products Act* in 2002, is very rarely incorporated in assessments.

For more information, please contact *Prevent Cancer Now*. Info@PreventCancerNow.ca

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April 2021

Annex 2: Contamination of fish and eels in the vicinity of CFB Gagetown with dioxins and furans from historical herbicide spraying (Task 4 Factfinders report, Aug. 2007).

During the 2000s, it came to public attention that the Americans had tested some of the herbicides used during the Vietnam War (e.g., Agent Orange, Agent White, Agent Purple), in northern forests at CFB Gagetown. Many similar herbicides were also used to eliminate foliage from training grounds. Concerns regarding cancers in past trainees at CFB Gagetown possibly being related to dioxins from herbicides led to a "Factfinders" initiative sponsored by the Government of Canada. A common comment during this exercise was that the investigators were looking in water and sand, but not where dioxins would accumulate – particular in fatty tissues. When all else was finished, a report emerged that partially addressed bioaccumulation of chlorinated dioxins, with examination of dioxin contamination in eels, fish and mussels upstream, within and downstream of the training grounds.

Pollutants that accumulate in fatty tissues are usually reported on the basis of the fat content of the sample (e.g., nanograms of tetra-chlorinated dioxin/furan equivalents per gram of lipid), but strangely these results were reported per gram wet weight. Moreover, some samples (but not all) had been skinned, which would have removed the dioxins in the subcutaneous fat. Data from this report is summarized in the table below. The results varied widely, and there was no obvious difference among locations, in the raw data. Fortunately the lipid content of samples were reported separately in the report. When the results were normalized according to the total lipids in the sample, greater dioxin/furan contamination was most evident in Swan Lake Creek, which was heavily impacted by spraying.

Dioxins and furans in fish and eel samples upstream and downstream (Swan Lake Creek) of CFB Gagetown. Sample lipid concentrations were provided in Appendix of Factfinder report.

Sampling Location	Species (n=10 for each)	Avg. 2005 PCDD/F TEQ (pg/g ww)	Range (pg/g ww)	Lipid (%)	Avg. Weight (g)	*Avg. TEQ / lipid (pg/g lipid)*
Brizley Stream	American Eel	**0.213**	0.107 - 0.276	10.6	113	***2.01***
	White Sucker	**0.23**	0.218 - 0.272	1	104	***23***
Nerepis River	American Eel	**0.164**	0.038 - 0.376	15.3	90	***1.07***
	Brook Trout	**0.143**	0.132 - 0.191	2.3	140	***6.22***
	Eastern Pearlshell Mussels	**0.098**	0.058 - 0.184	0.7		***14***
Swan Lake Creek	American Eel	**1.703**	0.222 - 6.198	5.8	418	***29.4***
	Chain Pickerel	**0.154**	0.074 - 0.304	0.4	824	***38.5***
	Eastern Elliptio Mussels	**0.386**	0.203 - 0.641	1		***38.6***

TCDD/F = 2,3,7,8-tetrachlorodibenzo-p-dioxin or furan (the forms of dioxin and furan that are most potent in the mode of toxicity (binding to the aryl hydrocarbon receptor); TEQ = total equivalents of TCDD/F, normalized to equivalent quantity of the 2,3,7,8-tetrachloro isomer (version).

Strength of binding to the aryl hydrocarbon receptor (an early surrogate for toxicity of dioxins and furans) is used to calculate the combined toxicity of dioxins and furans. According to this measure, the tetra- isomer is most toxic.

Annex 3: Non-Hodgkin's Lymphoma (nHL) data altered in final Agency for Toxic Substances and Disease Registry (ATSDR) Toxicological Profile for Glyphosate (nevertheless, strong consensus of carcinogenicity among independent scientists)

The U.S. ATSDR, within the U.S. Centers for Disease Control and Prevention (CDC), has a mandate to assess the science about toxic exposures. It is independent from the regulatory function of the U.S. Environmental Protection Agency. Comprehensive reviews of health effects of toxic exposures are published as "Toxicological Profiles." These are subject to peer and public review and are considered by academics and governments to be among the world's authoritative, exhaustive reviews of important substances. An indication of data being altered to the benefit of industry is of great concern. This contributes to "generation of doubt" and statements dismissing the potential for adverse health effects including cancer because the results are not consistent.

The type of cancer for which scientific evidence is most abundant and strongest, and regarding which litigation in the U.S. is resulting in large awards and now billions of dollars in class settlements, is a somewhat common malignancy – non-Hodgkin's lymphoma (nHL). The following two pages are reproductions of the summary graphs (called "Forest plots") of risks of nHL in pesticides applicators, from the 2019 draft[1] for review, and 2020 final[2] versions of the Toxicological Profile for Glyphosate.

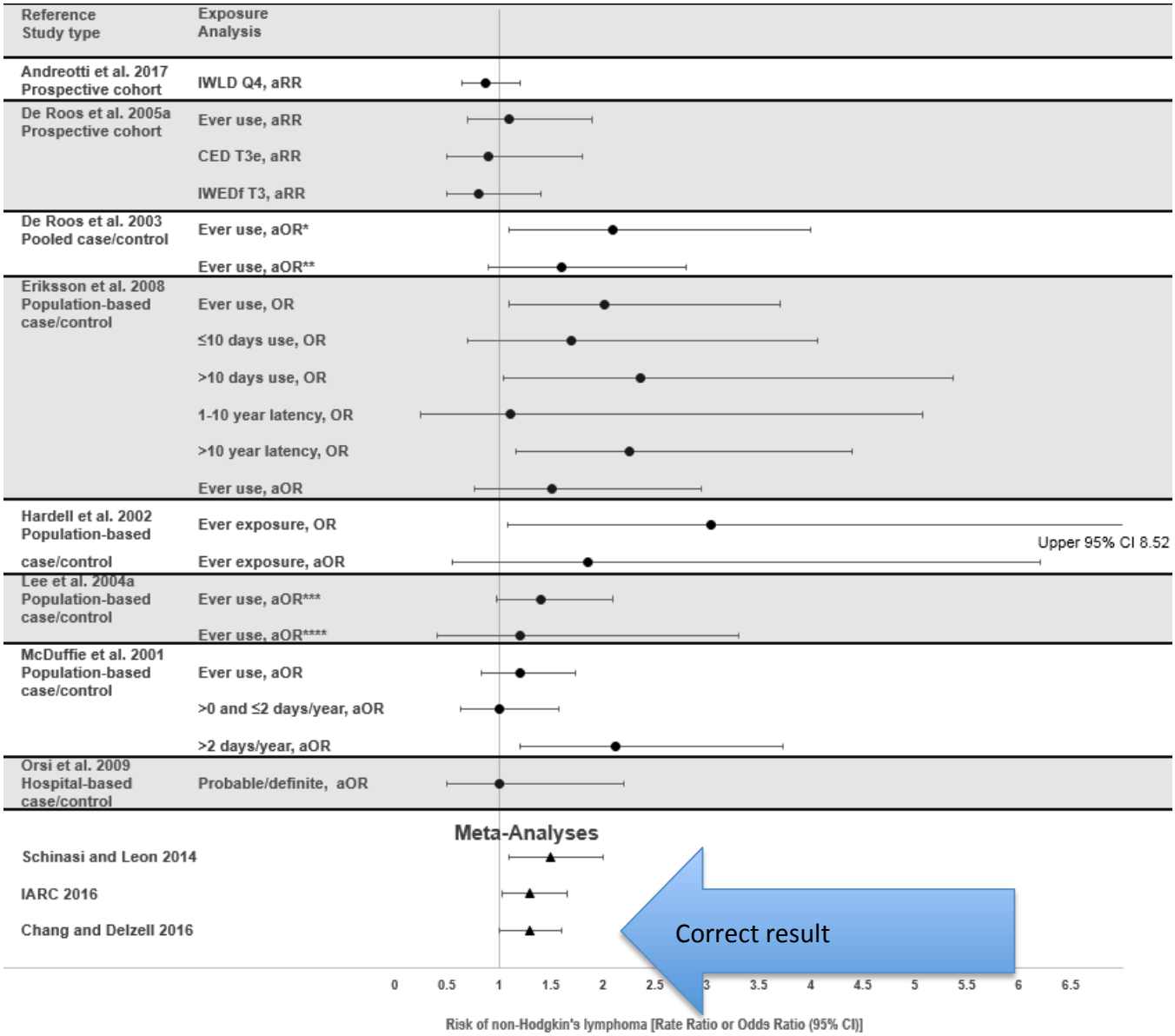
On the Forest plots, dots represent the summary risk of nHL in various groups according to their exposure to glyphosate based herbicides (GBHs) (heightened risks are greater than 1.0) and bars are 95 percent confidence ranges. This is the degree of certainty commonly considered to be "statistically significant."

The final version added some recent overview analyses (meta-analyses) including a strong Canadian study by national experts in occupational health, that found evidence that glyphosate causes nHL (Pahwa et al., 2019).[3]

In these meticulous analyses, however, it is very concerning that in the final 2020 Toxicological Profile, the study by Chang et al. that was correctly noted in the draft was altered to depict incorrectly that the study did not find statistically significant evidence that glyphosate causes non-Hodgkin lymphoma. The 2020 image is also of noticeably poorer graphical quality (lower resolution).

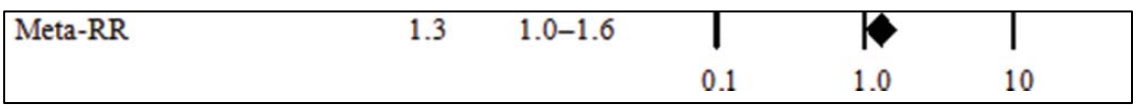
Agency for Toxic Substances and Disease Registry (ATSDR) Toxicological Profile for Glyphosate Draft for Public Comment April 2019

Figure 2-4. Risk of non-Hodgkin's Lymphoma Relative to Self-Reported Glyphosate Use or Exposure



*Logistic Regression; **Hierarchical regression; ***Non-Asthmatic farmers; ****Asthmatic farmers
a = adjusted; CED = cumulative exposure; IWED = intensity-weighted exposure days; IWLD = intensity-weighted lifetime days; OR = odds ratio; Q4 = 4th quartile; RR = rate ratio; T3 = 3rd tertile

Extract from Figure 1. Chang and Delzell[4] Systematic review and meta-analysis of glyphosate exposure and risk of lymphohematopoietic cancers. The odds ratio point estimate is 1.3, with a 95% confidence interval of 1.0 to 1.6.



Toxicological Profile for Glyphosate (ATSDR)
August 2020
Figure 2-4. Risk of non-Hodgkin's Lymphoma Relative to Self-Reported Glyphosate Use or Exposure (notes the same as above)