

Gagetown Harmful Chemical Study Commission

Established by [Public Law 2025, Chapter 763](#)

Materials from Commission Members

At its onset, the Gagetown Harmful Chemical Study Commission (“Commission”) aimed to continue to elevate the experiences of the members of the United States Armed Forces, as a member of the reserve component of the United States Armed Forces or as a member of the National Guard of any state who trained at Base Gagetown and who are experiencing illness(es) associated with tactical herbicide exposure.

The following information was provided by commission members for consideration during the Commission’s work. Please note that these materials, many of which are primary sources requested through public access laws, have not been reviewed for accuracy and are being made available only for informational purposes. *No materials herein are a statement of the Commission.*

How were substances on the Domestic Substances List (DSL) categorized?

Toxic substances can have different effects on human health and the environment. A substance that might be dangerous to wildlife in low levels might have no effect on people even at much higher levels. The opposite is also true: some substances can do more harm to humans than to the environment.

For this reason, Health Canada and Environment Canada used different but complementary criteria when sorting through the approximately 23 000 substances on the Domestic Substances List (DSL). This was to make sure that every substance that could potentially affect human health or our environment was evaluated to determine the need for further attention.

Environment

Persistence, bioaccumulation and inherent toxicity to the environment

Under the Canadian Environmental Protection Act 1999 (CEPA 1999), Environment Canada's Existing Substances Evaluation Program (<http://www.ec.gc.ca/ese-ees/>) is responsible for categorizing DSL substances to identify those that are suspected to be:

Either one of:

- a. **Persistent (P)**: chemical substances that take a very long time to break down in the environment - sometimes many years. These substances can affect the environment for a long period of time. Because they last for so long, they can travel long distances and pollute a much wider area than those that break down quickly.
- b. **Bioaccumulative (B)**: chemical substances that can be stored in the organs, fat cells or blood of living organisms and remain for a long time. Over time, concentrations can build up and reach very high levels, and can also be transferred up the food chain.

and

- c. **Inherently Toxic to the Environment (iT_E)**: chemical substances that are known or suspected, through laboratory and other studies, to have a harmful effect on wildlife and the natural environment on which it depends.

Human health

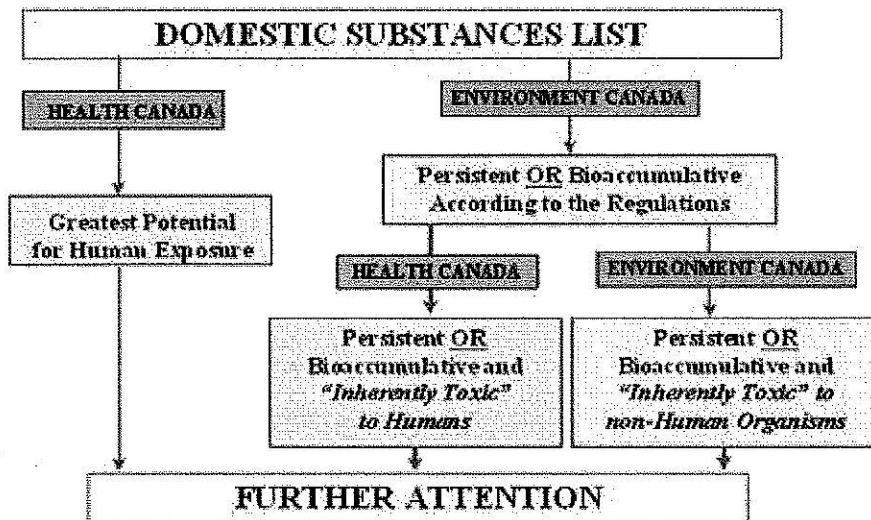
Greatest potential for human exposure and inherent toxicity to humans

Under CEPA 1999, the Existing substances program at Health Canada (http://www.hc-sc.gc.ca/ewh-semt/contaminants/existsub/index_e.html) is responsible for identifying substances that have the greatest potential for exposure and are inherently toxic to humans.

- a. **Greatest Potential for Exposure (GPE):** when assessing human exposure to chemical substances, scientists look at more than persistence and bioaccumulation. Some shorter-lived substances might affect humans just as much as persistent ones. To get the complete picture, scientists look at how a substance is used. Health Canada identified those chemical substances on the DSL to which people are expected most likely to be exposed.
- b. **Inherently Toxic to Humans (iT_H):** these are chemical substances that are known or suspected of having harmful effects on humans. Substances were examined for a number of human health effects, including cancer, birth defects and damage to genetic material.

Chemical substances that can potentially affect human health were also placed in a priority sequence so the Government of Canada can first deal with those suspected of presenting the highest hazard and greatest potential for exposure.

The categorization process that was followed by Health Canada and Environment Canada is illustrated in the figure below.



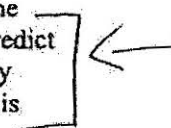
► Description of Image

- Categorization of existing substances ([default.asp?lang=En&n=1695F8D0-1](http://www.ec.gc.ca/lcpe-cepa/default.asp?lang=En&n=1695F8D0-1))
- How were substances on the DSL categorized?
- What are the overall results of DSL categorization? ([default.asp?lang=En&n=76D45C61-1](http://www.ec.gc.ca/lcpe-cepa/default.asp?lang=En&n=76D45C61-1))
- How do I find the results of DSL categorization? ([default.asp?lang=En&n=B5542613-1](http://www.ec.gc.ca/lcpe-cepa/default.asp?lang=En&n=B5542613-1))
- Search engine for substances on the DSL ([default.asp?lang=En&n=D031CB30-1](http://www.ec.gc.ca/lcpe-cepa/default.asp?lang=En&n=D031CB30-1))

Date modified:

2017-04-12

Spray drift incidents

- Three spray drift incidents occurred during the annual herbicides spray program (1964, 1972 and 1988). Details are at Flag A. They were captured in the Task 2A Report with other incidents such as spills.
- REMSpC Spray Consulting conducted the drift modeling of aerial herbicide sprays using the AGDISP model. This model was developed through the US Department of Agriculture Forest Service. The REMSpC report is appended at Appendix F of the three-tiered reports.
- REMSpC's rebuttal to peer review comments was accepted by the peer reviewers concluding "Despite the comments given above, the AGDISP model, with all of its limitations, is probably the best tool that is currently available". One of the comments was that "it does not appear that the model has the capability to predict spray drift in a scenario with a capping inversion, a condition that is generally believed to be a worst case condition for spray drift with small droplets". This condition appears to have been the main factor in the 1964 spray incident. 
- We have sought more information and clarification from Health Canada. The query and response is at Flag B.
- HC has also prepared a Q&A that is at Flag C.

Spray Incidents:

When?	What?	Where?	How Much?	For What?	What Happened?
1964 - Unknown date	2,4-D & 2,4,5-T	Upper Gagelown and Sheffield Area	\$250K	Damage to market crops	"a temperature inversion and increasing soil temperatures" which "suspended the spray above the target species. Several hours later, the increased winds carried the spray to the Upper Gagelown and Sheffield area"
July 1972	Tordon	3 miles below New Bridge @ Burton on Rte 102	\$1K	Damage to one individual market crop (tomatoes)	"since spraying was carried out within a mile of this we can assume reasonably it came from this contract" and that "investigation found evidence over other adjacent areas of damage from Tordon"
29 Jun to 17 Jul 1988	Dicamba, 2,4-D and 2,4-DP	Unknown area	\$358K for 65 claims	Homeowners and market crops	"unavoidable, freak accident" caused by vapor drift (vs. spray drift) "where fine particles of the herbicide are given off the treated area after the application has taken place"

Note:

The spreadsheet produced by the BASG Engineer Branch Property Management Office (what is usually referred to as the 8-1/2 x 14" list) supports the herbicides used in these time periods. However, the records reviewed here at DGE do not specify which Tordon herbicide was used in 1972 (spreadsheet shows Tordon 101 and 10K used), nor do they show the actual brand name used in 1988 (spreadsheet shows Dyceler and LV Brush Killer were used; active ingredients listed above are components of these herbicides).

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DISCLOSURE EN VERTU DE LA LAI RENSEIGNEMENTS NON
CLASSIFIÉS

Perras LCol JYC@ADM(IE) DIEIM@Ottawa-Hull

From: Ted Kuchnicki [Ted_Kuchnicki@hc-sc.gc.ca]
Sent: Thursday, April 26, 2007 11:40 AM
To: Perras LCol JYC@ADM(IE) DIEIM@Ottawa-Hull
Cc: Brown KD@ADM(IE) DIEIM@Ottawa-Hull; Headley L@ADM(IE) DIEIM@Ottawa-Hull;
Mary_Mitchell@hc-sc.gc.ca; Ted_Kuchnicki@hc-sc.gc.ca
Subject: RE: Spray Incidents (1964, 1972, 1988)

Claude,

"Negligible" is relative. The fine drops will be transported on the wind and will deposit out based on their mass. The smaller the drops the longer the distance; the higher the wind the longer the distance.

Within most drops you will have the active ingredient but the concentration of the active within drops of equal mass may not be the same. The mix in the tank is a suspension and so the spray coming out (as drops) is not as consistent as you would think.

But to answer you question specifically herbicides are meant to kill plants and most do so effectively but selectively. What this means is that if a herbicide is applied at the rates indicated on the label it will most likely affect plants but usually not affect insects nor fish, and most certainly not humans. On the other hand, just because it's a herbicide does not mean it will affect all plants equally. We often find herbicides are, as are other pesticides, selective in the species that they affect. In other words, (to use an example) it may effect lettuce but have no effect or minimal effect on carrots.

Consequently, it's not only the amount of herbicide found at a certain distance, in this case 800 m, but the sensitivity of the organism to the inherent toxicity of the herbicide. In other words, at 800 m you could see an effect on a plant but not on other organisms.

Now to confuse things a bit more the drift curve predicts concentrations downwind when the application is undertaken under certain conditions. In the RemSpec report the inputs for the model were chosen such that off-target drift would be maximized. You will note different tables for deposit and air concentrations, as model inputs required to maximize these downwind values are different. However, you can get greater concentrations of a herbicide downwind if you apply it under unrealistic conditions. What I mean is that if you apply the herbicide at the wrong time or improperly you can get greater concentrations downwind. For example, if you fly very high you get almost no deposit under the aircraft (or to the target) and all the drops drift far off-target. Another example is applying a herbicide during stable (inversions) atmospheric conditions. Stable conditions occur usually in the morning when the wind speed is low and the air near the ground is cooler than the air above. This phenomenon can be seen as fog. When a herbicide is sprayed at this time, the spray cloud does not drift down to the ground but hangs in the air as a concentrated mass over the target area. If the wind speed increases slightly, this concentrated cloud then moves away from the target area (it can move great distances) and eventually deposits at high concentrations.

If you want to talk more in detail, don't hesitate to call me at 736-3733.

Ted

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CLASSIFIES

s.19(1)

<PERRAS.JYC@force
s.gc.ca>

2007-04-26 10:28
AM

<Mary_Mitchell@hc-sc.gc.ca>,
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To

cc

<BROWN.KD4@forces.gc.ca>,
<Headley.LD@forces.gc.ca>

Subject

RE: Spray Incidents (1964, 1972,
1988)

Good morning,

Just to follow-up on the spray drift thing.

We would like to rationalize in our own mind that spray drift modelling indicates that at 800m and beyond, the deposit is negligible (my word as I try to understand the REMSpC report) and yet, herbicides can kill crops as far as 6km in the 1964 incident for example.

Could you enlighten us in this matter?

Thanks in advance.

Claude
944-6181

-----Original Message-----

From: Mary Mitchell [mailto:Mary_Mitchell@hc-sc.gc.ca]
Sent: Tuesday, April 24, 2007 5:22 PM
To: Ted Kuchnicki; Perras LCol JYC@ADM(IE) DIEIM@Ottawa-Hull
Subject: Fw: Spray Incidents (1964, 1972, 1988)

Could you follow-up on this please Ted? Elise sent us some info a while ago which I will forward as well.

----- Forwarded by Mary Mitchell/HC-SC/GC/CA on 2007-04-24 05:19 PM -----

<PERRAS.JYC@force
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2007-04-24 09:58
AM

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2

Veterans and Agent Orange

Update 11 (2018)

Committee to Review the Health Effects in Vietnam Veterans
of Exposure to Herbicides
(Eleventh Biennial Update)

Board on Population Health and Public Health Practice

Health and Medicine Division

A Consensus Study Report of
The National Academies of
SCIENCES • ENGINEERING • MEDICINE

THE NATIONAL ACADEMIES PRESS

Washington, DC

www.nap.edu

Summary

From 1962 to 1971, the U.S. military sprayed herbicides over Vietnam to strip the thick jungle canopy that could conceal opposition forces, to destroy crops that those forces might depend on, and to clear tall grasses and bushes from the perimeters of U.S. base camps and outlying fire-support bases. Mixtures of 2,4-dichlorophenoxyacetic acid (2,4-D), 2,4,5-trichlorophenoxyacetic acid (2,4,5-T), picloram, and cacodylic acid (collectively, the “chemicals of interest” or COIs) made up the bulk of the herbicides sprayed. The herbicide mixtures used were named according to the colors of identification bands painted on the storage drums. The most-used chemical mixture sprayed was Agent Orange,¹ a 50:50 mixture of 2,4-D and 2,4,5-T. At the time of the spraying, 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD), the most toxic form of dioxin, was an unintended contaminant generated during the production of 2,4,5-T and so was present in Agent Orange as well as some of the other formulations sprayed in Vietnam.

Concerns from returning Vietnam veterans about their own health and that of their children combined with emerging toxicologic evidence of the adverse effects of phenoxy herbicides and TCDD exposure from animal studies and some positive findings from epidemiologic studies led Congress to pass Public Law (PL) 102-4, the Agent Orange Act of 1991. This legislation directed the Secretary of Veterans Affairs to ask the National Academies of Sciences, Engineering, and Medicine (the “National Academies”) to perform a comprehensive evaluation

¹Despite loose usage of “Agent Orange” as a collective term for all of the herbicides sprayed by U.S. forces during the Vietnam War—including in the title of this publication—it was only one of the formulations used. The text of the report uses “herbicides” or “COIs” to refer to the full range of herbicide agents, while “Agent Orange” is reserved for that specific formulation.

of scientific and medical information regarding the health effects of exposure to Agent Orange, other herbicides used in Vietnam, and the various components of those herbicides, including TCDD. The legislation also instructed the Secretary to ask the National Academies to conduct updates every 2 years for 10 years from the date of the first report in order to review newly available literature and draw conclusions from the overall evidence.

In response to the first request, the Institute of Medicine convened a committee whose conclusions were published in 1994 in *Veterans and Agent Orange: Health Effects of Herbicides Used in Vietnam* (VAO). The work of later committees resulted in a series of biennial updates (*Update 1996*, *Update 1998*, *Update 2000*, *Update 2002*, and *Update 2004*) and focused reports on the scientific evidence regarding type 2 diabetes, acute myeloid leukemia in the children of veterans, and the latent period for respiratory cancers.

Enacted in 2002, PL 107-103, the Veterans Education and Benefits Expansion Act of 2001, mandated a continuation of the VAO biennial updates. *Update 2006*, *Update 2008*, *Update 2010*, *Update 2012*, and *Update 2014* were published under that legislation and subsequent extensions to the Department of Veterans Affairs' (VA's) authority to request reports. The current update presents this committee's review of peer-reviewed scientific reports concerning associations between various health outcomes and exposure to TCDD and other chemicals in the herbicides used in Vietnam that were published between September 30, 2014, and December 31, 2017, and the committee's integration of this information with the previously established evidence database.

CHARGE TO THE COMMITTEE

The committee was asked to "determine (to the extent that available scientific data permit meaningful determinations)" the following regarding associations between specific health outcomes and exposure to TCDD and other chemicals present in the herbicides used by the military in Vietnam:

- A. whether a statistical association with herbicide exposure exists, taking into account the strength of the scientific evidence and the appropriateness of the statistical and epidemiological methods used to detect the association;
- B. the increased risk of disease among those exposed to herbicides during service in the Republic of Vietnam during the Vietnam era; and
- C. whether there exists a plausible biological mechanism or other evidence of a causal relationship between herbicide exposure and the disease. [PL 102-4, § 3(d)]

In addition, the committee was asked to address the current research available on possible generational health effects that may be the result of exposures to these

chemicals, including the biologic plausibility or potential for exposures to lead to an increased risk of birth defects or other adverse conditions in the descendants of male veterans; on myeloproliferative neoplasms (MPN) as part of its consideration of the literature concerning leukemias and related diseases; and on glioblastoma multiforme in its review of brain cancers.

In conducting its work, the committee operated independently of VA and other government agencies. It was not asked to make and did not make judgments regarding specific cases in which individual Vietnam veterans have claimed injury from herbicide exposure or such broader issues as the potential costs of compensation for veterans or policies regarding such compensation.

COMMITTEE'S APPROACH TO ITS CHARGE

Following the pattern established by previous VAO committees, the present committee concentrated its review on epidemiologic studies so as to fulfill its charge of assessing whether specific human health effects are associated with exposure to at least one of the herbicides sprayed in Vietnam or to TCDD. The committee also examined controlled laboratory investigations that provided information on whether a scientifically relevant association between the COIs and a given effect is biologically plausible. Information on dioxins other than TCDD and dioxin-like chemicals was considered because of the common mode of action underlying biologic effects.

The evidence evaluation process presumes neither the presence nor the absence of association for any particular health outcome. Over the sequence of reviews, evidence has accrued of various degrees of association, lack of association, or persistent indeterminacy with respect to a wide array of disease states. For many conditions, however, particularly ones that are very uncommon, any association with the COIs has remained unaddressed in the medical research literature. The committee does not offer a conclusion for these conditions unless the condition is logically subsumed under a broader disease category that has been evaluated, abiding by the maxim that "absence of evidence is not evidence of absence."

In accord with Congress's mandated presumption of herbicide exposure of all Vietnam veterans, VAO committees have treated Vietnam-veteran status as a proxy for herbicide exposure when no more specific exposure information is available. To anticipate the health conditions associated with aging and to obtain additional information potentially relevant to the evaluation of health effects in Vietnam veterans, the committees have reviewed studies of other groups potentially exposed to the constituents present in the herbicide mixtures used in Vietnam.

The original legislation calling for the report series, PL 102-4, did not provide a list of specific diseases and conditions suspected of being associated with herbicide exposure. Instead, a list was developed on the basis of diseases and conditions that had been mentioned in the scientific literature or in other documents identified through the original VAO's extensive literature searches. The VAO list

has since been augmented in response to new scientific findings, requests by VA, and concerns of Vietnam veterans.

The information that the present committee reviewed was identified through a comprehensive search of relevant databases, including databases covering epidemiologic, biologic, medical, toxicologic, chemical, historical, and regulatory information. To determine whether there is a scientifically relevant association between exposure and a health outcome, epidemiologists estimate the magnitude of an appropriate measure (such as the relative risk or the odds ratio) that describes the relationship between exposure and disease in a defined population or group. In evaluating the strength of the evidence linking herbicide exposure with a particular outcome, the committee considered whether such estimates of risk might not be consistent with a causal association (because of confounding, chance, or bias related to errors in selection and measurement) or might be an indication of a true association. Although they are not required, data supporting biologic plausibility can increase the confidence that an association is not spurious, and such data are presented in each of the sections. In this regard, it is important to note that while the biologic plausibility for a particular effect has been considered sufficient evidence of association by other bodies that have reviewed the health effects of environmental exposures, PL 102-4 specifies that the scientific determinations concerning the association between exposures and outcomes be supported by epidemiologic evidence. It has been the practice of all VAO committees to evaluate all studies according to the same criteria and then to weight findings of similar strength and validity equivalently, whether or not the study subjects are Vietnam veterans, when drawing conclusions. The committee recognizes that an absolute conclusion about the absence of association might never be attained, because—as is generally the case in science—studies of health outcomes after an exposure cannot demonstrate that a purported outcome is impossible, only that it is statistically improbable.

Tables on individual health outcomes summarizing the salient results of epidemiologic studies that have been evaluated over the entire series of VAO reports have been compiled and are available in digital form from www.nap.edu/catalog/25137. The results for a particular endpoint are grouped by study population to emphasize and clarify the relationship among successive publications based on the repeated study of particular exposed populations.

EVIDENCE REVIEWED BY THE COMMITTEE

The sections below describe the epidemiologic information that was newly evaluated for this update and illustrate the broad scope and nature of that information. The studies are divided, both here and in the report's health-outcome chapters, into four categories—Vietnam-veteran, occupational, environmental, and case-control—reflecting the committee's judgement of their relative relevance to the exposures of interest. Details of these publications are presented in Chapters 5–11.

TABLE S-1 Summary of the *Eleventh Biennial Update* Findings on Vietnam-Veteran, Occupational, and Environmental Studies Regarding Scientifically Relevant Associations Between Exposure to Herbicides and Specific Health Outcomes

Sufficient Evidence of an Association

Epidemiologic evidence is sufficient to conclude that there is a positive association. That is, a positive association has been observed between exposure to herbicides and the outcome in studies in which chance, bias, and confounding could be ruled out with reasonable confidence.^b For example, if several small studies that are free of bias and confounding show an association that is consistent in magnitude and direction, there could be sufficient evidence of an association. There is sufficient evidence of an association between exposure to the chemicals of interest and the following health outcomes:

Soft-tissue sarcoma (including heart)

* Non-Hodgkin lymphoma

* Chronic lymphocytic leukemia (including hairy cell leukemia and other chronic B-cell leukemias)

* Hodgkin lymphoma

Chloracne

Hypertension (category change from Limited or Suggestive in *Update 2014*)

Monoclonal gammopathy of undetermined significance (MGUS) (newly considered condition)

The committee did not reach consensus on whether the evidence regarding type 2 diabetes (mellitus) was more properly classified as *Sufficient* or *Limited or Suggestive*.

Limited or Suggestive Evidence of an Association

Epidemiologic evidence suggests an association between exposure to herbicides and the outcome, but a firm conclusion is limited because chance, bias, and confounding could not be ruled out with confidence.^b For example, a well-conducted study with strong findings in accord with less compelling results from studies of populations with similar exposures could constitute such evidence. There is limited or suggestive evidence of an association between exposure to the chemicals of interest and the following health outcomes:

Laryngeal cancer

Cancer of the lung, bronchus, or trachea

Prostate cancer

Cancer of the urinary bladder

* Multiple myeloma

* AL amyloidosis

Early-onset peripheral neuropathy

Parkinson disease (including Parkinsonism and Parkinson-like syndromes)

Porphyria cutanea tarda

Ischemic heart disease

Stroke

Hypothyroidism

The committee did not reach consensus on whether the evidence regarding type 2 diabetes (mellitus) was more properly classified as *Sufficient* or *Limited or Suggestive*.

continued

TABLE S-1 Continued**Inadequate or Insufficient Evidence to Determine an Association**

The available epidemiologic studies are of insufficient quality, consistency, or statistical power to permit a conclusion regarding the presence or absence of an association. For example, studies fail to control for confounding, have inadequate exposure assessment, or fail to address latency. There is inadequate or insufficient evidence to determine association between exposure to the chemicals of interest and the following health outcomes that were explicitly reviewed:

- Cancers of the oral cavity (including lips and tongue), pharynx (including tonsils), or nasal cavity (including ears and sinuses)
- Cancers of the pleura, mediastinum, and other unspecified sites in the respiratory system and intrathoracic organs
- Esophageal cancer
- Stomach cancer
- Colorectal cancer (including small intestine and anus)
- Hepatobiliary cancers (liver, gallbladder, and bile ducts)
- Pancreatic cancer
- Bone and joint cancers
- Melanoma
- Non-melanoma skin cancer (basal-cell and squamous-cell)
- Breast cancer
- Cancers of reproductive organs (cervix, uterus, ovary, testes, and penis; excluding prostate)
- Renal cancer (kidney and renal pelvis)
- Cancers of brain and nervous system (including eye)
- Endocrine cancers (thyroid, thymus, and other endocrine organs)
- Leukemia (other than chronic lymphocytic leukemia, including hairy-cell leukemia and other chronic B-cell leukemias)
- Other myeloid diseases (including myeloproliferative neoplasms)
- Cancers at other and unspecified sites
- Infertility
- Spontaneous abortion (other than after paternal exposure to TCDD, which appears not to be associated)
- Neonatal or infant death and stillbirth in offspring of exposed people
- Low birth weight in offspring of exposed people
- Birth defects in offspring of exposed people, including spina bifida
- Childhood cancer (including acute myeloid leukemia) or other adverse health outcomes in offspring of exposed people
- Neurobehavioral disorders (cognitive and neuropsychiatric)
- Neurodegenerative diseases, excluding Parkinson disease
- Chronic peripheral nervous system disorders
- Hearing loss
- Respiratory disorders (wheeze or asthma, chronic obstructive pulmonary disease, and farmer's lung)
- Gastrointestinal, metabolic, and digestive disorders (changes in hepatic enzymes, liver disorders including cirrhosis, lipid abnormalities, and ulcers)
- Immune system disorders (immune suppression, allergy, and autoimmunity)
- Circulatory disorders (other than hypertension, ischemic heart disease, and stroke)
- Endometriosis

continued

TABLE S-1 Continued

Disruption of thyroid homeostasis (other than hypothyroidism)
 Eye problems
 Bone conditions
 Kidney and urinary disorders (including chronic kidney disorder, differences in kidney function, nephropathy, and end stage renal disorder)
 Chronic skin disorders (including skin infections and changes in skin pigmentation)

The committee used a classification that spans the full array of cancers. However, reviews for non-malignant conditions were conducted only if they were found to have been the subjects of epidemiologic investigation or at the request of the Department of Veterans Affairs. By default, any health outcome on which no epidemiologic information has been found falls into this category.

Limited or Suggestive Evidence of No Association

Several adequate studies, which cover the full range of human exposure, are consistent in not showing a positive association between any magnitude of exposure to a component of the herbicides of interest and the outcome. A conclusion of “no association” is inevitably limited to the conditions, exposures, and length of observation covered by the available studies. In addition, the possibility of a very small increase in risk at the exposure studied can never be excluded. There is limited or suggestive evidence of no association between exposure to the herbicide components of interest and the following health outcome:

Spontaneous abortion after paternal exposure to TCDD

^a*Herbicides* indicates the following chemicals of interest: 2,4-dichlorophenoxyacetic acid (2,4-D), 2,4,5-trichlorophenoxyacetic acid (2,4,5-T) and its contaminant 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD or dioxin), cacodylic acid, and picloram. The evidence regarding association was drawn from veteran, occupational, and environmental cohort studies in which people were exposed to the herbicides used in Vietnam, to their components, or to their contaminants.

^bEvidence of an association is strengthened by experimental data supporting biologic plausibility, but its absence would not detract from the epidemiologic evidence.

*The committee notes the consistency of these findings with the biologic understanding of the clonal derivation of lymphohematopoietic cancers that is the basis of the World Health Organization classification system (Campo et al., 2011; see table here: www.ncbi.nlm.nih.gov/pmc/articles/PMC3109529/table/T1, accessed May 17, 2018).

limitations of the epidemiologic evidence reviewed in this report and in previous VAO reports. Although the studies published since *Update 2014* are the subject of detailed evaluation in this report, the committee drew its conclusions in the context of the entire body of literature, and the committee did not weigh new findings more heavily than past research.

As mandated by PL 102-4, the distinctions among categories are based on statistical association and not on strict causality. The committee was directed to review the scientific data, not to recommend VA policy; therefore, the conclusions reported in Table S-1 are not intended to imply or suggest policy decisions. The conclusions are related to the associations between exposure and outcomes in

veterans at the group level. However, TCDD has a half-life of about 7.6 years, and the half-lives of the other COIs are considerably less. With the passage of several decades, serum concentrations decrease exponentially, and newly drawn serum samples are thus unlikely to be useful metrics for assessing health outcomes in surviving Vietnam veterans, occupational cohorts, or Seveso residents. The factors influencing TCDD's half-life are discussed in Chapter 4.

The consideration of records detailing the herbicide spray missions has provided another approach to deriving individual-specific exposure estimates. Two models—a proximity-based Exposure Opportunity Index (EOI) model and an aerial spray distribution model (explained and contrasted below)—have been proposed for estimating the exposure of Vietnam veterans. However, to date only a few studies (which are addressed in detail later in the chapter) have used these exposure assessment methodologies to study the health of Vietnam veterans.

Other National Academies reports have addressed the issue of exposure assessment in military environments, pointing out both the challenges of gathering good contemporaneous information and the desirability of such data for assessing service members' and veterans' health and well-being (IOM, 2000a; NRC, 2000a,b).

Methodologic Issues and Considerations in Exposure Assessment

The focus of this section is on three key methodological issues that complicate the development of accurate exposure estimates in the Vietnam-veteran population and the other study populations discussed in this report: the latent period between exposure and disease, exposure misclassification, and exposure specificity.

Latency

The temporal relationship between exposure and disease is complex and often difficult to define in studies of human populations. Many diseases do not appear immediately after exposure. Cancers, for example, might not appear for many years after exposure. The latency period refers to the amount of time between an initiating event, such as a toxic exposure, and the manifestation of the clinical disease. For many disease processes the latency period is not known. If the latency period is underestimated, the effect of the exposure of interest on health outcomes will not be captured by epidemiological methods. Exposures can be brief (acute) or occur over a longer period of time (chronic). At one extreme, an exposure can be the result of a single event, as in an accidental poisoning. At the other extreme, a person exposed to a chemical that is stored in the body may continue to experience "internal exposure" for years even if exposure from the environment has ceased.

APPENDIX B

LIMITATIONS OF THE FURLONG REPORT AND TASK 3A-TIER 1 RISK ASSESSMENT

[From Lisa Laird, Pensions Advocate Pensions Advocate for Bureau of Pensions Advocates,
Veterans Affairs Canada]

A. Degree of exposure of any individual was indeterminable

In Dr. Furlong's covering letter to the Minister, he sets out "some salient information" in bullet points. Arguably, these points contain, in Dr. Furlong's opinion, the most important facts the Minister needs to know. The very first point in the list is that "the degree of exposure of an individual to any chemical sprayed was indeterminable."

This fact bears highlighting in the context of claims adjudication because the approach taken to date by the Department and the Board requires that each individual prove the degree of his or her exposure. The information required to do so was not available to Dr. Furlong in 2006 with all the resources of the fact-finding study available to him, which included many public meetings, personal interviews, and a "vet net" coordinated by two Veteran volunteers (pp. 4-11). It is an impossible standard for an individual Veteran to meet in 2020. **Imposing such an impossible evidentiary burden on claimants forecloses the possibility of favourable decisions for genuine and deserving claims and thus defeats the purpose of the legislation.**

B. Military Trainee category applies only to those exposed one year after testing

The conclusions of the Task 3A-1 Risk Assessment with respect to the category of Military Trainees apply only to service members who began training in or near the sprayed areas one year after the spraying took place (pp. 44, 104-105). **These conclusions do not apply to individuals whose claims are based on exposure during 1966 and/or 1967.** The Military Trainee section of the Task 3A-1 begins at p. 44 with the following assertion and assumption:

Historical records indicate that lands affected by herbicide applications may have been used for training military personnel. ... The 1966 spray campaign was completed between June 14th and June 16th. **It was assumed that military training operations commenced the following year** on the exact plot locations of the 1966 spray campaign...."

The assumption is not as clearly spelled out for 1967, but as the same paragraph on page 44 discusses both 1966 and 1967 spray campaigns, and as that page also records that the concentrations of PCDD and HCB in the surface soil were predicted “at each plot one year after the initial spray campaigns” it is reasonable to infer that the same assumption of a one-year delay in use was applied to both the 1966 and 1967 test sites.

It must be noted that the “Problem Formulation” section of the Task 3A-1 (pp. v, 18) states that “it was assumed that training exercises occurred in direct proximity to the spray areas during the time of spraying.” The basis for this assumption is not given, nor is “direct proximity” defined. The discrepancy between the descriptions of the Military Trainee category in the problem formulation and results sections of the report is not explained.

Importantly, the Risk Assessment and Conclusions sections for long-term or chronic risk estimates for exposure to both dioxins and HCB for Military Trainees repeat the defining characteristic of those who may have trained in the 1966-67 spray areas more than a year following the spray applications. **Accordingly, these conclusions cannot reasonably be applied to claims from individuals who may have trained in or near the spray areas anytime between June 14, 1966, and June 1968 – during and up to one year after the spray tests.**

C. Some evidence that training in spray areas may have occurred

The excerpt from page 44 set out above provides further support within the Furlong report’s source documents for the Federal Court’s conclusion in the *McAllister* case that training may indeed have occurred in the sprayed areas.

The reference to “historical records” indicating use of the areas for training is repeated on page 25 of the Task 3A-1 report. Unfortunately, neither the Furlong nor the Task 3A-1 reports provide references to their source documents for such statements. **It is nevertheless clear that there were historical records of some form indicating the use of these areas for training during and/or sometime after the spray campaigns.**

At page 12 of the Furlong report, Dr. Furlong states that he was “*informed by the Base that the specific areas used by the Americans for testing in 1966 and 1967 have not been used since for formal training by the Base.*” Although this has often been repeated in unfavourable claims decisions, **the reliability of this statement is not known and cannot be tested:** no information is given about who at the Base provided the information or what records he or she had available to come to this conclusion.

However, if the statement is to be taken as fact, it must be considered in conjunction with the historical records referred to on pages 25 and 44 of the Task 3A-1 report. Only two conclusions are then possible:

(1) the spray area *may indeed have been used for training in 1966 and 1967*;
and

(2) the area *may have been used for informal training or other purposes after the spraying in 1966 and 1967*.

Either conclusion is a reasonable inference based on the evidence. As such, pursuant to s. 39 of the VRAB Act, either (or both) inferences must be drawn if it favours the claimant's case.

D. Some evidence of uncertainty about spray areas

Despite significant details about the US tests and test areas, **the Furlong report uses tentative language suggestive of some doubt about whether Agent Orange, White or Purple may have also been sprayed elsewhere.**

For example, at the bottom of page 21, the Furlong report states, "***It appears that Agent Orange, Agent Purple, and Agent White were only applied on the USDoA test plots.***" At page 24, the report refers to category 1 being "***areas where Agent Orange is suspected to have been applied*** at CFB Gagetown."

This language contrasts sharply with the description only one sentence later of category 2: "***all areas at CFB Gagetown, other than Category 1 areas, where Priority 1 chemicals have been applied.***"

There is therefore at least some textual evidence of a level of uncertainty about precisely where these chemicals may have been sprayed. Combined with a failure to identify the source material from which the boundaries of the test sites were identified, this introduces a level of uncertainty in the evidence that is worthy of consideration.

E. "Critical inputs" are not defined or provided

It should be noted that at page 20, the Task 3A-1 report indicates that *contact with chemicals in non-designated spray areas was not considered as part of the risk assessment* because of information from a spray drift model, but that areas "***immediately adjacent*** to the spray plots were considered as part of the actual spray

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plots.” Task 3A-1 distinguishes between direct and indirect exposure in the following terms:

Direct exposure would result when an individual is within the general vicinity of the application area during a spray event as illustrated in Figure 4-2.

Indirect exposure might occur as a result of an individual coming into contact with various environmental media that have been impacted by previous spraying events. Defining on- and off-site areas which may have been either directly affected by historical spray events and/or as a result of spray drift is a critical input to the historical reconstruction of exposure.

Despite identifying this as a “critical input”, the Task 3A-1 report does not define what it means by “within the general vicinity”, “direct proximity”, or “immediately adjacent to” the spray plots.

F. Key records were incomplete and contradictory

On page 21 of his report, Dr. Furlong notes in the first bullet of a 10-bullet point list:

It should be noted that the annual herbicide files that were supplied to Jacques Whitford [the expert retained for the study] **were, more often than not, incomplete** and information frequently **had to be pieced together** from several different documents within the same file or from different files, and in some cases, the documents contained in any given file **contradicted one another**. Furthermore, the details found in the applicator and monitor records were often **sparse**, and in more recent years, **when applications were closely monitored, inconsistencies were still observed**. (Emphasis added)

While this describes the annual spray program and not the USDoA tests in 1966 and 1967, it demonstrates the potential problems with historical and documentary evidence – even for more recent, “closely monitored” applications. None of the incomplete, inconsistent, or contradictory records that the Furlong Report and its underlying studies relied upon are identified. Nor is it clear what conclusions may be questionable because their factual foundations were merely “pieced together”. **In light of this acknowledgement of inadequate record-keeping, there is no justification for treating the Furlong Report as inherently reliable.**

G. The description of the 1966-67 tests is unreliable and inaccurate

The Furlong report states: *"The testing, according to the records, was conducted in an area of the Base that was difficult to access, under strictly controlled conditions, ensuring minimal spray drift."* (p. 12)

1. **Dr. Furlong does not identify which records provided this information**, nor does he provide any details about their creation, maintenance, and comprehensiveness from which the reliability of the information could be determined. Task 3A-1 contains many details about the test parameters and a map of the 1966 and 1967 test sites in relation to the base as a whole; however, once again, the source of this information is, for the most part, not given.
2. **The assessment that the conditions were "strictly controlled" is attributed to unidentified "records" and appears to be mere opinion from an unknown source.** No details are provided to indicate what measures were taken that were considered to have been indicative of "strict control".
3. The report itself contradicts the description of the test sites as "remote" and "difficult to access". **In fact, both test sites were accessible by road, within walking/hiking distance of a populated area** for most able-bodied individuals (< 5-10kms).

At p. 12, Dr. Furlong states that the 1966 tests were located between two roads (the Broad Rd and the Blissville Road) only 4.5 kilometers from the nearest populated area. He describes the 1967 test site as "located along the Ripon Road, east of the Broad Road", 8.5 kilometers from the nearest populated area.

Some of the information relied on by Dr. Furlong may have been two Technical Memoranda ("TM") published by the US Department of the Army in October 1968:

- **TM 145 confirms that the 1967 test plots were "laid out on both sides of Rippon Road."**
- **TM 141 confirms the 1966 test site was between Broad Road and Blissville Road.**
- The map provided at Figure 1 and the map at p. 32 of the Furlong report clearly indicate that both test sites **begin right at the Broad Road** and shows their proximity to the Blissville Airstrip and the Enniskillen range complex.
- Moreover, Demaree and Creager confirm that **the 1966 test plots were marked off along an existing, partially-vehicle-accessible trail** (p. 3). At p. 7, they provide more detail: *"At first, wheeled vehicles such as jeeps and ¾-ton trucks were able to traverse the swampy areas along the trail, but eventually only tracked vehicles could navigate through the mud and mire."*

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- At p. 13 of TM 141 (1966 test), Demaree and Creager confirm: “Plots were evaluated at monthly intervals from time of application to the end of September 1966. ... Certain plots, those that were sprayed at 3 and 4 gallons per acre and with high concentration of material, were evaluated by walking into the sprayed area and recording effects of various species.”

See: Technical Memorandum 141, “Defoliation tests in 1966 at Base Gagetown, New Brunswick Canada” K. Demaree and R. Creager, October 1968.

Technical Memorandum 145, “Chemical Defoliation of Northern Tree Species” K. Demaree and A. Haws, October 1968

4. There is no information in the Furlong report or its underlying studies to support the conclusion that there was “minimal spray drift”

(i) Wind conditions are known only for 1966; 1967 had “unfavourable weather”

Many summary reports and claims decisions rely on the fact that the Agent Orange tests were carried out when there was “little to no wind.” However, p. 7 of Task 3A-1 indicates that this data was for 1966 only. For the 1967 dates, “Demaree and Haws (1968) reported unfavourable weather conditions during spraying; however, no details were provided.” It is therefore not known what the wind conditions were during the 1967 tests.

Dr. Furlong erroneously applied the data from 1966 to the 1967 tests at page 12 of his report, where he wrote: “Records indicate that spraying was conducted when there was very little wind.” **This example of inaccurately summarizing source material necessarily undermines the reliability of other unattributed statements within the report and of the report as a whole.**

Importantly, the inaccurate statement about wind conditions appears in the same paragraph as the statement cited above, attributed only to “the records”, about the testing having been done in an area that was difficult to access and under strictly controlled conditions. The absence of source references for these and other critical statements in his report makes fact-checking impossible and further undermines the reliability and probative value of the report and its conclusions.

(ii) Missing critical facts and inconsistent spray drift distances:

Although both the Furlong and Task 3A-1 reports mention spray drift modelling that estimated a possible exposure limit away from the flight path, the two reports appear to give different figures:

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Dr. Furlong states at page 15: “Spray drift modeling has demonstrated that the spray could only drift 800 meters under normal conditions.” What constitutes “normal conditions” is not defined. **Nor is there any information about whether the conditions that existed during the test days in 1966 and 1967 were, in fact, the “normal conditions” used as inputs for the modelling exercise.**

The Task 3A-1 report at page 20 refers to information provided by REMSpC (2006) regarding spray drift that “indicates that virtually all of the herbicide product would have deposited on the foliage and/or ground within 500 ft (152 m) of the flight line.” For this reason, drift to non-designated spray areas was not considered in Task 3A-1. “Virtually all” is not given any definition or context. **It is clear that not all of the herbicide was deposited within the flight line and 500 ft margin.**

Neither of these reports provide the facts or assumptions that were used to create the spray drift model. **It is unknown whether the error about the wind conditions in 1967 may have affected the outcome of the modeling exercise.**

(iii) The peer review of the spray drift model demonstrated important limitations:

The peer reviewers of the spray drift model commented, among other concerns, that “*it does not appear that the model has the capability to predict spray drift in a scenario with a capping inversion, a condition that is generally believed to be a worst case condition for spray drift with small droplets.*”

The fact that Agent Orange was apparently sprayed with a very small droplet size has been cited in unfavourable claims decisions (although the source of this information is not given so we cannot determine its reliability)

After reviewing REMSpC’s response to the peer review comments, the best endorsement the peer reviewers were able to give was: “*Despite the comments given above, the AGDISP model, with all of its limitations, is probably the best tool that is currently available.*”

It is clear that the spray drift model had significant limitations and may have failed to predict spray drift for Agent Orange with a sufficient or reasonable degree of accuracy to allow its conclusions to be considered reliable.

H. The Risk Assessment is based on many unproven assumptions

Unfavourable claims decisions often refer to the fact that Task 3A-1 was completed by non-governmental experts with the specific goal of assessing potential exposures and resulting human health risks. However, the fact that the experts arrived at a set of conclusions does not mean that this goal was successfully met or that the conclusions can be reliably applied to individual claims determinations.

First and foremost, the Task 3A-1 report itself states clearly that “the risk assessment does not evaluate risks to particular people” (p. iv). Nor was there sufficient information in the historical records to be able to determine the magnitude of exposure to particular groups of people. Rather, **the exposure assessment was completed on the basis of a series of estimates and predictions based on incomplete information and, in some circumstances, using data from wholly different situations and time periods.**

In addition, certain exposure pathways were eliminated from the study (pp. v-vi). **Exposure through drinking water from streams or other sources in the area was not considered. Pathways related to brush clearing and burning were also not considered** based on information that brush clearing was not conducted manually in either 1966 or 1967. Unfortunately, no source is given for that information, so once again its reliability cannot be ascertained.

Because of gaps in available information and the passage of several decades, Cantox Environmental was **forced to rely on a number of assumptions** in order to complete its risk assessment. As a result, **the evidentiary foundation, and thus the probative value, of Task 3A-1’s conclusions are questionable** and must be carefully weighed if the report is to be used in an adjudicative context.

The Task 3A-1 report itself acknowledges that “variability and uncertainty in the input parameters or risk model result in variability and uncertainty in the estimate of risk”. The report lists **5 ½ pages of uncertainties** in its assessment (pp. 98-103). Some of these include “conservative assumptions” designed to ensure that risks are not underestimated. Others, however, do not appear to meet that criteria. A few items of note are the following:

1. **The level of contamination** in Agent Orange and Agent Purple was not known but only **assumed** for the purposes of the risk assessment (p. 9)
2. **Only two contaminants in the herbicides were assessed** in the Tier 1 risk assessment of the 1966-67 tests: PCDD/PCDF and HCB. (p. 17) **The rate of exposure to these chemicals of concern was not known**, but was predicted “using a series of conservative assumptions” (p. 11) However, **essential data about**

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historical exposures was missing and substitutions for this data had to be found. The report states at page 17 that:

Depending on the extent of data and historical records available, the reconstruction of historical exposures ranged from **a qualitative discussion** of potential exposures of individuals **(based upon reviews of quantitative studies conducted elsewhere)** to a detailed quantitative assessment of historical exposure estimates based on detailed herbicide application data.

3. The estimate of site-related exposure is contrasted with the historical estimated daily intake (EDI) value of “background exposure” from normal activities unrelated to herbicide use at CFB Gagetown. However, with respect to dioxin, the report indicates that “historical EDI rates for the Canadian population are **difficult to estimate for years prior to the 1980s due to a paucity of data.**” (p. 26) Instead, Task 3A-1 used a value derived from **a single study** from 2002 that **estimated** that EDIs in the 1960s and 1970s were “**as high as** 6.0 pg TEQ/kg bw/day”. There is no discussion of what a reasonable low-end estimate of EDI may have been for that time period. **As a result of using high-end values for background exposure**, only the accident scenarios and routine flagging activities were found to exceed these background exposure estimates. **This fed directly into the conclusion that exposure for most individuals at CFB Gagetown was not greater than that of the general population in that time period.**
4. **The concentrations of chemicals of concern in the soil one year after spraying were not known but merely predicted** using a range of forest canopy intercept fractions and estimated application rates of PCDD or HCB (p. 44-45).
5. The uncertainty that estimation introduced is **compounded** by the fact that the “incidental soil ingestion rate” used to characterize the soil intake of a military trainee in the area one year after spraying also had to be estimated. As no data was available, the Task 3A-1 authors **substituted the rate reported in 2004 for construction workers.** (p. 45) It is readily apparent that construction workers in 2004 were engaged ***in very different activities, with different clothing, and different access to washing-up facilities***, than military trainees on exercise for days at a time belly-crawling around in the bush in 1966, digging “foxholes” and latrines, stripping branches and pulling up plants to camouflage their locations, drinking water from streams, eating berries, rolling in the dirt and sleeping on the ground with no access to showers, washing their clothes in streams if at all etc.

6. For the accident scenario, the liquid herbicide mixture was assumed to be in contact with the skin for approximately 20 minutes, which affected the proportion of the applied dermal dose that could have been absorbed. **No reason is given for choosing this amount of time. No consideration appears to have been given to limited washing facilities or opportunities for members on field exercises.**
7. ***I was unable to find an estimated duration of dermal contact for the flagger, field scout, or trainee scenarios despite the acknowledgment in the report that the duration of time the chemical is in contact with the skin has a direct impact on the absorbed dose. It is therefore impossible to evaluate whether a realistic duration was applied to generate the risk assessment conclusions and to determine whether and to what extent that assumed duration is applicable to an individual applicant's circumstances.***
8. At page 42, the rate of dislodgeable residue and rate of transfer to the skin for the field scout was estimated using **US Forest Service estimates from 2003**. It is reasonable to infer that these estimates were derived from chemical residue of approved and/or registered herbicides with which US Forestry workers would come into contact in 2003. **No evidence is available to explain how or why those estimates are applicable to the unregistered, contaminated chemicals in Agents Orange, Purple, and White.**
9. Also on page 42, the exposure rate for the field scout category was based on one 12-hour shift of walking through all 45 plots. No consideration appears to have been given to the **very different activities engaged in by military trainees on exercise** in defoliated areas: see above, belly-crawling, camouflaging, digging in, sleeping on the ground, etc.
10. Dr. Furlong refers to a 24-hour time limit for hazardous concentrations of chemicals sprayed (p. 16). **He does not provide a reference for this information. The Task 3A-1 report does not refer to this timeframe.** I have not yet found the source of the 24-hour limit. However, from other *summary* reports available on the VAC website, it appears that this timeframe may be related in some part to the rate at which Agent Orange degrades in sunlight. **The 24-hour timeframe has been relied on in some claims decisions without any consideration of the reliability of this unsourced information, its applicability to the weather conditions in Gagetown on the relevant days in 1966 and 1967, or the potential effect of a lack of direct sunlight, rain, or shade from the “densely forested” area and “heavy canopy.”**

The uncertainties introduced in the risk assessment due to the lack of data, substitution of data from unrelated dissimilar sources and time periods, and reliance on unproven assumptions supports the Federal Court's findings that these reports cannot be considered the best evidence of what occurred at CFB Gagetown in 1966-67.

The risk assessment itself acknowledges that its results "***must be put into context***" as "***the level of uncertainty resulting from the recreation of activities, some of which occurred more than 50 years ago, coupled with the uncertainties inherent in standard forward-looking risk assessment is very large.***" (Furlong report p. 43)

Logically, this "very large" level of uncertainty undermines the probative value of the report's conclusions when applied to individual disability claims adjudication.

All of which is respectfully submitted.

Lisa Laird
Pensions Advocate

SAMPLE OF ARGUMENTS FREQUENTLY PRESENTED TO VRAB

(Details of specific individuals have been removed)

Presumption of service-relationship for environmental exposure:

With respect to the liberal interpretation of the presumption mandated by the legislation itself and affirmed through Federal Court jurisprudence, the Applicant relies on the statutory interpretation analysis set out in Appendix A: Interpreting the Environmental Hazard Presumption, page 26.

The Applicant submits that the presumption in s. 50(g) of the *VWBR* applies when the evidence reasonably establishes: (1) he was exposed to an environmental hazard in the course of his duties; (2) a causal association between that hazard and the claimed condition is reasonably *possible*; and (3) there is insufficient “evidence to the contrary” to establish on a balance of probabilities that his service exposures were inconsequential to the development of his disease.

Reasonable evidence of exposure:

Training for CAF members involved in field exercises in the Gagetown Range and Training Area (“RTA”) necessitated close contact with the soil, vegetation, and water in the area.

Training involved bivouacking within the RTA for extended periods of time, sleeping in tents in the field or sometimes in the open without a tent, and drinking from area streams. Mess tins and utensils were washed with

ground water from the area. Food was often prepared with this same ground water. (evidence from individual veterans, witness statements, and testimony given in previous decisions)

Some members have testified that standing orders were to “take your ponchos with you because aerial spraying was going on.”

USDoA tests in 1966 & 1967:

These chemicals “are known to be persistent as defined by CEPA”, the *Canadian Environmental Protection Act*. (EA-Ex-D1: Furlong Report, p. 27) This means that they “...take a very long time to break down in the environment - sometimes many years. These substances can affect the environment for a long period of time....” (EA-Ex-D9: Environment and Climate Change Canada definitions of Persistent and Bioaccumulative)

There is no evidence to support the often-cited contention in past cases that the USDoA testing grounds remained “unused” during or after the tests were completed or that they were “remote” and “difficult to access”. The *McAllister (2014)* and *Blount* Federal Court decisions found that the Furlong Report did not support such a conclusion. Indeed, the Furlong Report contradicts its own use of these descriptions by providing facts demonstrating that both test areas were accessible by road and an established trail and were within walking/hiking distance of a populated area for most able-bodied individuals (only 4.5 kms in 1966 and 8.5 kms in 1967) (EA-Ex-D1: Furlong Report, pp. 12, 32 (map)).

CFS/DND Trials in 1966 & 1967:

In addition to the American army tests, trials of unregistered herbicides involving the same chemicals as Agent Orange were conducted by the Canadian Forestry Service and the Department of National Defence in both 1966 and 1967. The tests are reported to have included spraying in an area north of Enniskillen Road in the Medium Machine Gun Field Firing Area near the Enniskillen Range Complex. (EA-Ex-D1: Furlong Report, p. 23; EA-Ex-D2: Task 2A Final Report, p. 25)

There is no evidence of any restrictions on use or accessibility of the CFS/DND unregistered herbicide test sites in 1966 and 1967 or thereafter.

CFB Annual Spray Program:

The Furlong Report also confirms that CFB Gagetown used chemical defoliants containing the same chemicals of concern studied in the IOM research in “many areas” “throughout the RTA”.

What was sprayed:

The list of chemical compounds and their active ingredients that were confirmed to have been used by CFB Gagetown and the years in which they were confirmed to have been used can be found in Exhibit 2: Task 2A Final Report, pp. 21-23, Tables 2 & 3)

Additionally, the Furlong researchers admit: “It is possible that a limited number of other products may have been applied in the RTA given the level of documentation provided in the earlier years of the herbicide application program.” The products and dates reflected in the tables created by the HHRA researchers include only those products that “were confirmed to have been applied by DND at the RTA” despite incomplete and contradictory records. (EA-Ex-D1: Furlong Report, pp. iii, 21).

Although many summary reports, briefing notes, and past decisions stress the fact that the chemical herbicides applied as part of the annual spray program were understood to be “commercial” and/or “regulated”, the Furlong research was unable to confirm that fact. The report states: “For the purpose of the current assessment, all herbicide products applied at the base were assumed to be products registered for use in Canada. As such, contaminant levels have been assumed to fall within levels deemed acceptable through the pesticide registration process.” (EA-Ex-D1: Furlong Report, p. 39) As can be seen from the peer review comments on the Task 2A report, there is no consistent, comprehensive evidence to confirm those assumptions.

On the contrary, in addition to the confirmed evidence of the CFS/DND and USDoA trials of unregistered products in 1966 and 1967, there is reference within the Task 2A report to evidence indicating “the potential use by applicators of unregistered herbicide products” as part of the annual spray program. (EA-Ex-D2: Task 2A Final Report, pp. iii, 38, Appendix F)

Furthermore, regulatory approval in the 1960s and 1970s, when health effects were unknown, does not establish that the herbicides in question were not capable of causing serious illness. For example, 2,4,5-T (one-half of the active ingredient in Agent Orange and a common component of the annual spray program in early years) was the subject of extensive investigations beginning in the 1970s but was not ultimately withdrawn from North American commercial registrations until 1985. It was found to have been contaminated with harmful dioxins. (EA-Ex-D5: Briefing Note dated 7 December 2005, p. 3).

Where annual spraying took place:

Unfortunately, insufficient evidence now exists to reliably identify all of the chemicals used and all of the areas that were sprayed in each year of the annual spray program. The records kept by the CAF and DND about the use of herbicides at CFB Galetown are admitted to be “more often than not incomplete,” contradictory, sparsely detailed, and inconsistent, particularly in the early years but even in more recent years when applications were supposedly “closely monitored.” (EA-Ex-D1: Furlong Report, p. 21; EA-Ex-D2: Task 2A Final Report, p. iii)

What is known is that “many areas” of the RTA were sprayed occasionally, while some were sprayed repeatedly. At least seven areas within the RTA were confirmed to have been sprayed on five or more years. These included troop training areas such as Unit Training Area #1 and the

General Manoeuvre Areas as well as the Tank Driving and Manoeuvre Area and several Impact Ranges. (EA-Ex-D1: Furlong Report, p. 24)

Further, recorded spray drift incidents demonstrate that the active chemicals from such spray events can deposit in “high concentrations” several kilometers beyond the target zones depending on the method of application, the time of day, and the weather at the time of application. (EA-Ex-D2: Task 2A Final Report, p. 38; EA-Ex-D6: Email correspondence dated 26 April 2007; EA-Ex-D7: Table of Spray Incidents; EA-Ex-D8: “Spray drift incidents”)

A report dated 2 August 1966 outlining US participation in vegetation control at CFB Gagetown suggests that the CAF was specifically advised as early as 1964 to adjust its spray program by means of changes that would have significantly increased the risk of such spray drift: They were told that “factors which may have contributed to a degree of lack of success in the past” included, among other things, “droplet sizes too large”, “sub-lethal deposits only”; and “sprays delivered under *other than inversion conditions*.” However, a 2007 email on the subject of spray drift confirms that spraying during inversions is “a worst case condition for spray drift with small droplets.” (EA-Ex-D10: Report dated August 1966; EA-Ex-D6: Email correspondence dated 26 April 2007; EA-Ex-D8: “Spray drift incidents”, emphasis added.)

A 1964 spray drift incident that damaged market crops as much as six kilometers away from the target zone was thought to be the result of spraying during inversion conditions. This evidence demonstrates that atmospheric conditions conducive to significant spray drift do occur at CFB Gagetown in the summer months *and* suggests that the advice given by US technical advisors was likely followed. Although there is some evidence that DND undertook measures to try to correct the drift problem, another spray drift incident in 1972 demonstrates that these measures had limited success. (EA-Ex-D2: Task 2A Final Report, p. 38).

Additionally, a damage claim from 1988 indicates that harmful levels of active ingredients may also spread outside the target zones through “vapor drift (vs. spray drift) where fine particles of the herbicide are given off the treated area after the application has taken place.” In the 1988 incident, 65 damage claims were paid out to homeowners and commercial growers adjacent to the Gagetown training area for damage caused by vapor drift. (EA-Ex-D7: Table of Spray Incidents)

As far as can be determined, the CAF has not released evidence of how far within the RTA borders the target area lay such that the distance covered by vapor drift cannot be established. Nor is it possible to determine, 60 years later, how often vapor drift and/or spray drift affected areas outside the target zones. Again as far as can be determined, CFB Gagetown did not maintain records of drift damage that occurred within CFB borders as such incidents did not result in the payment of damage awards.

The Appellant submits that the evidence of vapor drift, in addition to spray drift, is nevertheless sufficient for the Panel to draw a reasonable inference that areas outside the target zones were likely affected by these chemicals.

That inference is further supported by the fact that the chemicals of concern “are persistent as defined by CEPA.” (EA-Ex-D1: Furlong Report, p. 27) As noted above, persistence under the *Canadian Environmental Protection Act* means:

... chemical substances that take a very long time to break down in the environment - sometimes many years. These substances can affect the environment for a long period of time. Because they last for so long, they can travel long distances and pollute a much wider area than those that break down quickly. (EA-Ex-D9: Environment and Climate Change Canada definitions of Persistent and Bioaccumulative)

We submit therefore that the totality of the evidence permits a reasonable inference to be drawn that Veterans were likely exposed to these toxic chemicals in the performance of their duties training in the field in the RTA in the 1960s, whether or not the veteran was in one of the target zones at the time the spraying occurred.

Exposure likely occurred through dermal contact with vegetation, soil, and water that had been sprayed or contaminated by spray and vapor drift;

through inhalation of particles from spray drift, vapor drift, and contaminated dust; and through ingestion from drinking ground water and from eating foods contaminated with herbicide residue from mess kits washed in ground water and/or contaminated by dust due to eating in or after moving through affected areas without the ability to wash properly or at all.

The Appellant submits that this inference is reasonable given the objective evidence of repeated spraying in unit training areas, general manoeuvre areas, and gun ranges; the nature of military field exercises; the absence of any evidence that troops were kept out of sprayed areas at the time spraying occurred or afterwards; and the evidence in respect of spray drift, vapor drift, and environmental persistence.

VRAB Jurisprudence supporting a reasonable inference of exposure

The Appellant relies on several recent VRAB decisions that have found that evidence of field work in the Gagetown RTA at a time when toxic herbicides were being sprayed there is sufficient for favourable inferences of exposure to be drawn.

The Federal Court has confirmed that such environmental exposures fall within the scope of the presumption of service-relationship: Proof of direct exposure is not necessary to benefit from the presumption. (EA-Attach-D1: *McAllister v Canada (Attorney General)*, 2014 FC 991 [*McAllister*])

On the contrary, the Board has ruled that “a broad and generous interpretation of what constitutes exposure” is required in keeping with the purpose of the presumption.” This approach is consistent with the liberal interpretation mandated by s. 2.1 of the *Veterans Well-being Act* and s. 39 of the *Veterans Review and Appeal Board Act* (“VRAB Act”). (EA-Attach-D6: VRAB Decision 100003602362, p. 20; EA-Attach-D7 VRAB Decision 100003683802, p. 11)

Thus, while mere presence at CFB Gagetown in 1966 and 1967 is not sufficient to establish exposure, the Board has found that evidence of field work in the RTA at a time when toxic herbicides were sprayed “throughout” the area is sufficient for favourable inferences of exposure to be drawn.

In both Decisions 100003602362 and 100003683802, the Board found that Veterans who had trained in the RTA over a period of years “would have come into contact with soil, vegetation and water, that had been subjected to herbicide spraying, and therefore [were] likely to have been, at minimum, exposed to these substances.” The Board found this was “sufficient to trigger the presumption”. (EA-Attach-D6: VRAB Decision 100003602362, p. 20; EA-Attach-D7: VRAB Decision 100003683802, p. 11)

In Decision 100003729377, the Appellant served four years at CFB Gagetown from 1963 – 1967, with much time spent travelling throughout the RTA. The Board concluded: “The Panel finds it unreasonable that this Appellant would not have been exposed to particulates from the spraying of

Agent Orange, even if the Appellant cannot prove he was in the spray zone.”
(EA-Attach-D8)

In Decision 100004647676, the Board concluded that a reasonable inference of exposure could be drawn for a Veteran who started his training at CFB Gagetown in the fall of 1967, had exposure to foliage and water within the RTA, and was diagnosed with diabetes in 2016. (EA-Attach-D9: VRAB Decision 100004647676)

Similarly, in Decision 100003933765, the Board granted full entitlement for diabetes to a fellow artilleryman based on his training within the RTA in 1966 and 1967, which the Board found would reasonably have resulted in environmental exposure to Agent Orange. (EA-Attach-D10: VRAB Decision 100003933765)

Reasonably possible causal association:

Pursuant to long-established policy, Veterans Affairs Canada recognizes a specified list of illnesses as being associated with exposure to Agent Orange and other herbicides for disability benefits purposes. (VAC Policy: Exposure to Agent Orange and Other Unregistered US Military Herbicides)

This list adopts the research published by the U.S. Institute of Medicine (“IOM”). (EA-Ex-D4: Excerpt from Veterans and Agent Orange: Update 11 (2018)).

The Board has accepted that in practical terms, this means that entitlement is warranted where the “Veteran has a claimed condition which is recognized by both the IOM and the Department, and his evidence regarding the nature of his duties is supportive of exposure.” (EA-Attach-D6: VRAB Decision 100003602362; EA-Attach-D7: VRAB Decision 100003683802)

As explained in recent VRAB jurisprudence:

The 50(g) presumption explicitly sets out a causal connection standard in exposure cases which differs from other cases. The test is different from other entitlement cases.

...

In the Panel’s view, paragraph 50(g) ... instructs decision-makers to accept a causal connection standard that will facilitate, rather than impede, the awarding of compensation to Veterans who may have been disabled or may have died as a result of military service. **This provision applies to environmental hazard claims where a cause and effect relationship is not clearly and readily discernible**, and permits the presumption of a service relationship in those cases where the possibility of such relationship meets the test formulated as “might reasonably” (EA-Attach-D7: VRAB Decision 100003542993; EA-Attach-D8: VRAB Decision 100004098605)

Because the purpose of the rebuttable presumption is to lessen the Veteran’s burden of proof, the Veteran is not required to prove that

environmental hazards were a *significant cause* of his claimed condition. With the benefit of the presumption, the Veteran need only establish that the hazards were a *reasonably possible* cause of Diabetes.

Consistent with the structure of a rebuttable presumption of law, the onus is then transferred to Veterans Affairs to provide affirmative evidence establishing that the hazards were not a significant cause of the Veteran's disease before entitlement may be denied. (EA-Attach-D3: *Léonelli v. Canada (A.G.)*, 2003 FC 1374, para. 52)

Absence of “evidence to the contrary”

In the present case, there is no medical opinion or other medical evidence in the record capable of establishing that the Applicant's service-related exposures to environmental hazards were *insignificant* in the development of his disease.

Furlong Report:

The Furlong Report has been discredited and is “no longer used as a vehicle to deny entitlement to disability pensions.” (EA-Attach-D8: VRAB Decision 100003729377).

This is because, first, the *Human Health Risk Assessment* (“HHRA”) research study from which the conclusions of the Furlong Report are drawn did not include an assessment of “health risks associated with historical exposures via the consumption of water or fish”. Thus, an entire exposure

pathway to which Veterans, including the Appellant, were subjected was not studied and forms no part of the Furlong conclusions. (EA-Ex-D1: Furlong Report, p. 60)

Second, and more generally, the available historical data for the exposure pathways that *were* studied had so many gaps, uncertainties, and contradictions within it that the study's peer reviewers concluded it was simply inadequate to allow for "meaningful environmental and human health risk assessment." The Furlong conclusions were found to be so "fraught with uncertainty" that they were not considered scientifically credible. The lack of reliable data was so significant that the peer reviewers questioned "the validity and the ultimate utility of the report for its intended purpose." (EA-Ex-D2: Task 2A Report, Appendix F)

Notably, the limited value of the report to individual claims adjudication is openly recognized not only in the response to the peer review but also within the report itself. Dr. Furlong and the authors of the research studies caution repeatedly throughout the report that the conclusions of the HHRA are merely "*predictions*" subject to "*very large*" uncertainty. The following paragraph appears many times:

The results of the HHRA must be put into context. The level of uncertainty resulting from the recreation of activities, some of which occurred more than 50 years ago, coupled with the uncertainties inherent in standard forward-looking risk assessment, is very large. As a result, the expectations regarding the level of precision that

this risk assessment exercise can produce should be limited. (EA-Ex-D1: Furlong Report, p. 61 and p. 43, among others, emphasis added)

Latency

Although the Appellant was not diagnosed with diabetes until 2010 (SOC 69), no medical evidence has been presented in support of a temporal cut-off point after which environmental exposures to toxic herbicides could reasonably be found to be insignificant. On the contrary, the latency period between exposure to the chemicals of concern and the onset of several of the diseases on the IOM list is unknown. (EA-Ex-D4: Excerpt from Veterans and Agent Orange: Update 11 (2018), p. 9)

Of particular importance in respect of the latency issue is the fact that 2,4-D; 2-4-5-T; Picloram; HCB, and TCDD “are known to bioaccumulate”, meaning that they are stored in the body. This means that a person “may continue to experience ‘internal exposure’ for years even if exposure from the environment has ceased.” (EA-Ex-D1: Furlong Report, p. 27; EA-Ex-D4: Excerpt from Veterans and Agent Orange: Update 11 (2018))

Accordingly, the available evidence does not support any negative finding regarding causal significance based merely on the passage of time between the Veteran’s exposure and ultimate diagnosis.

Other risk factors

We submit that when evidence of other risk factors is being considered, the ruling of the Federal Court of Appeal must be applied: entitlement for a multifactorial condition is warranted even if personal factors have a larger causal connection to the claimed condition than the service-related factors. A claim cannot be denied simply because a Veteran has been shown to have other significant risk factors for the condition at issue. (EA-Attach-D11: *Cole v. Canada (A.G.)*, 2015 FCA 119, paras. 78-80)

In the context of a rebuttable presumption, this ruling applies with even greater force because the existence of one or even several other recognized risk factors does nothing to disprove a significant causal contribution from service-related exposures. Accordingly, such evidence is insufficient to displace the presumption of service relationship in s. 50(g).

In worker's compensation cases, the Court has held that a similar presumption must hold unless there is evidence of "sufficient weight to show the presumption wrong." This requires "affirmative evidence of an alternative cause and evidence that the employment was *not* contributory" (EA-Attach-D4: *MacLaren*, emphasis added; EA-Attach-D5: *Alberta WCAC*, para. 37)

Importantly, an absence of medical evidence establishing that the exposure *was* significant cannot reasonably defeat a presumption designed to lessen the burden of proof on Veterans. To allow such reasoning would mean that to obtain entitlement, the Veteran would have to produce proof of

significant cause, which is exactly the same burden of proof he would have to meet to gain entitlement without the benefit of the presumption.

The problem with treating an absence of positive data as “evidence to the contrary” is explained as follows:

In practice, this statutory presumption has commonly been ignored, and it has even been replaced by contrary presumptions in the process of adjudication. For example, a Board doctor may render an opinion that the injury was not caused by the employment. That opinion may rest on nothing except the absence of any positive data about employment etiology. When that happens, the statutory presumption is, in effect, reversed. The opinion imports a presumption of the negative while the Act prescribes a presumption of the affirmative. Yet the opinion may be applied by the adjudicator as evidence rebutting the presumption of employment causation. To reach conclusions in that way is clearly illegal. (Ison, *Worker's Compensation in Canada*, 2nd ed. Butterworths, 1989, at p. 208, as cited in EA-Attach-D5: *Alberta WCAC*, para. 37)

Professor Ison's comments were relied on by the Alberta Worker's Compensation Appeals Commission in examining rebuttal medical evidence suggesting non-employment causes for a worker's illness in the context of a very similar legal presumption of employment-relatedness. The Appeals Commission found as follows:

The evidence to rebut is weighed on the balance of probabilities, and must do more than just raise a reasonable doubt that the accident *arose out of* the worker's employment. Medical evidence, specifically, must do more than merely offer an opinion that it is not likely the injury was related to work. The medical evidence must be based on some positive data about employment etiology, and not just an assertion that it is not likely or not probable that the injury was the result of a work accident. In effect, once the presumption has been triggered, the claim for compensation is acceptable unless there is specific evidence of adequate weight to *disprove* that the accident *arose out of* the worker's employment. (para. 40, emphasis added.)

... providing evidence that merely suggests that alternate causes might exist, or even might be likely, is not adequate to displace the presumption. (para. 45, emphasis added)

In the Appellant's case, given the substantial frailties of the Furlong Report's conclusions, there is no affirmative evidence in the record capable of establishing that the Appellant's service-related exposure to toxic chemicals did not significantly contribute to the development of his disease.

In the result, there is no "evidence to the contrary" that is sufficient to displace the legal presumption that the claimed condition is a service-related disease, being a disease that "arose out of" the Veteran's service in accordance with the provisions of the *Veterans Well-Being Act*.

CONCLUSION

The Veteran is entitled to the benefit of the legal presumptions Parliament created to assist him in discharging his burden of proof. The preponderance of the evidence in the Veteran's case establishes his environmental exposure to toxic chemicals, particularly when "a broad and generous interpretation of what constitutes exposure" is applied in keeping with the purpose of the presumption. The IOM research discloses a reasonably possible causal relationship between those chemicals and diabetes that is not only sufficient to meet the lesser standard of causation demanded by the presumption but that VAC has long deemed sufficient for disability benefits purposes. The Veteran has therefore established presumptive entitlement.

The available evidence to the contrary, including the Furlong Report and the Veteran's personal medical risk factors for the disease, is insufficient to establish that the Veteran's exposures were *insignificant* and that his condition therefore did *not* arise out of his service. Accordingly, it is insufficient to displace presumptive entitlement.

All of which is respectfully submitted.

Lisa Laird
Pension Advocate

Exhibits frequently filed with the Veterans Review and Appeal Board:

Ex 1: CFB Gagetown Herbicide Spray Programs 1952-2004 Fact Finders' Report, by Dr. Dennis Furlong (the "Furlong Report") including Peer Review at Appendix F finding conclusions to be not scientifically credible.

Ex. 2: Final Report Task 2A: The History and Science of Herbicide Use at CFB Gagetown from 1952 to Present (excerpts)

Ex. 3: Task 3A Final Report (excerpts)

Ex. 4: Veterans and Agent Orange: Update 11 (2018), (excerpts)

Ex. 5: Draft Briefing Note dated 7 December 2005

Ex. 6: Email correspondence dated 26 April 2007

Ex. 7: Table of Spray Incidents.

Ex. 8: "Spray drift incidents"

Ex. 9: CEPA definitions of Persistence and Bioaccumulative

Appendix to submission: Limitations of the Furlong Report and Task 3A-Tier 1 Report (written by Lisa Laird, LLB, Bureau of Pensions Advocates)

Gagetown Harmful Chemical Study Commission

Materials from commission member Dana Michaud

CFB Gagetown Range and Training Area

