

TASK 3 SUMMARY REPORT

INVESTIGATION OF POTENTIAL HEALTH EFFECTS FROM THE USE OF HERBICIDES AND ANY HERBICIDE-RELATED CONTAMINANTS, PARTICULARLY DIOXINS USED AT CFB GAGETOWN FROM 1952 TO THE PRESENT

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August, 2007

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This report serves to integrate the findings of the CFB Gagetown Task 3A and the Task 3B reports in order to provide an assessment of the documented or potential exposures to the combination of previous herbicide exposures that occurred at the base from 1952 to 2003 and health effects. Recommendations for future research and the feasibility of conducting such investigations are described.

Highlights – Task 3A Report

The Task 3A Human Health Risk Assessment Report was prioritized into three tiers:

- Tier 1 – 1966 to 1967 U.S. Trials - Manufacturing Impurities (contaminants);
- Tier 2 – 1952 to the present - Manufacturing Impurities (contaminants); and,
- Tier 3 – 1952 to the present - All Herbicide Products, Carriers (*i.e.*, fuel oil), and other chemicals identified on product labels.

The overall assessment identified that most people who lived and worked at or near CFB Gagetown were not at risk. Only specific populations were at possible risk. These included those directly involved with herbicide applications (mixers and loaders, applicators, flaggers) and post application activities (brush clearing and scouting, soon after application). The conclusions of the overall assessment were as follows:

- Individuals directly involved with herbicide applications (*e.g.*, mixer/loaders, applicators and flaggers), may have experienced elevated exposures to herbicides and contaminants (including dioxin); as such, the potential for health effects cannot be eliminated;
- Individuals involved in post-application brush clearing and/or scouting soon after application may have experienced elevated exposures (dermal route) to herbicides and contaminants; and, as a results, these individuals may have experienced potentially unacceptable health risks;
- It was not considered possible to provide any meaningful evaluation related to smoke inhalation during burning of brush. However, it would appear that smoke inhalation is an insignificant exposure pathway based on assessments conducted by the U.S. Department of Agriculture;

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- A significant amount of evidence exists to suggest that exposure of family members to pesticides through the take-home or track-in pathway can occur. However, it was not possible to quantify this exposure pathway with any level of certainty due to the large number of variables and assumptions required. Based on the information reviewed to-date, it is not possible to determine (based on any scientific evidence) the significance of this pathway relative to other pathways and/or receptors. It is expected that risks experienced by family members would be substantially less than those experienced by persons directly involved in spraying and/or forestry activities;
 - Bystanders located directly downwind of the target area at the time of spraying may have experienced elevated short-term exposures to herbicides *via* inhalation and direct dermal contact with off-target drift. Potential bystander exposures were increased on an acute basis only. These elevated short-term exposure levels are not indicative of elevated risks of long-term irreversible health effects, rather, the potential for short-term reversible effects to have occurred;
 - No chronic health risks were identified for hunters exposed to herbicides;
 - Due to the lack of historical water and sediment data, no conclusions concerning human health risks associated with historical exposures *via* the consumption of water or fish can be provided at this time;
 - Non-occupational receptors (*i.e.*, those not directly involved with herbicide applications such as soldiers training at the Base) are not expected to have experienced unacceptable long-term human health risks associated with herbicide use at CFB Gagetown; and,
 - Accidents (*e.g.*, direct spray and/or direct contact with a spill with inadequate personal protection equipment) could produce unacceptable risks.

It must be noted, that the level of uncertainty resulting from the reconstruction of activities, some of which occurred more than 50 years ago, coupled with the uncertainties inherent in standard forward-looking risk assessment, is large. The expectations regarding the level of precision that this risk assessment exercise can produce, as a result, should be limited. The risk assessment should be considered part of the weight-of-evidence needed to identify groups of individuals who may have been adversely affected by historical exposures.

Highlights – Task 3B Report

- Using the U.S. Institute of Medicine evaluation of evidence criteria, a thorough Scientific Literature Review of the published epidemiological studies about the health effects associated with the herbicides used at CFB Gagetown determined that conclusions related to causal relationships between exposure to any of the CFB Gagetown herbicide classes and chronic diseases or reproductive outcome were not supported by current evidence. There was sufficient evidence, however, to support conclusions of positive associations between exposure to chlorophenoxy herbicides and the development of soft tissue sarcoma and non-Hodgkin's lymphoma. In earlier years, chlorophenoxy herbicides were known to have contained manufacturing impurities, including dioxin as contaminants. There was also preliminary evidence of positive associations between exposure to chlorophenoxy herbicides and laryngeal cancer, breast cancer, prostate cancer, Hodgkin's disease, multiple myeloma, chronic lymphocytic leukemia, spina bifida, spontaneous abortions, Parkinson's disease, and type 2 diabetes;
- Paraquat has important neurotoxicological properties that deserve further exploration. The Scientific Literature Review indicated there is limited or suggestive evidence between exposure to this compound and the occurrence of Parkinson's disease. Paraquat use at CFB Gagetown was limited to a few experimental plots sprayed in 1966. The Human Health Risk Assessment study predicted very low levels of exposures to this agent at CFB Gagetown;
- Preliminary evidence from the Scientific Literature Review supported conclusions of positive associations between both pentachlorophenol and glyphosate exposures and non-Hodgkin's lymphoma. There was also preliminary evidence that exposure to pentachlorophenol was associated with rectal cancer. The Human Health Risk Assessment study predicted very low levels of exposures to pentachlorophenol at CFB Gagetown;
- Hexachlorobenzene is a contaminant that also needs further scrutiny. From the literature, there was preliminary evidence to support a conclusion of a positive association between exposure to hexachlorobenzene and breast cancer, prostate cancer, testicular cancer and spontaneous abortions. The capacity of this agent to bioaccumulate in the human body is of concern and there is a need for more research on this agent. The Human Health Risk Assessment study predicted very low levels of exposures to this agent at CFB Gagetown;

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- Examination of the health outcomes identified in the Scientific Literature Review in the descriptive epidemiological study of Gagetown Region residents did not generally reveal significant excess disease risks compared to the Province of New Brunswick as a whole. A slight statistical but not clinically significant excess of breast cancer in CFB Gagetown women was observed. The risk for breast cancer has been associated with a full range of factors, including smoking, fertility, obesity and many other genetic, lifestyle and environmental factors. It was not possible to identify what might explain the slightly higher rates observed in CFB Gagetown; and,
 - Detailed analysis for exposure-related health effects was not possible due to the nature of the data that were available. It was not possible to calculate herbicide-specific population attributable risk estimates. It was also not possible to comment, due to the fact that individual level information was not available, on the extent to which other known risk factors, such as smoking or genetic factors, influenced the health findings. Due to the uncertainty of the data, absence of evidence from these analyses does not necessarily mean that there were no health effects resulting from the exposures to the CFB Gagetown herbicides.

Summary

In summary, the results of the conservative assumptions used in the human health risk assessment (HHRA) proposed that only certain identifiable segments of the population may have been at greater risk for developing adverse health outcomes that could be linked to herbicide use at CFB Gagetown. The epidemiological literature review assisted to identify priority health outcomes that might be observed in this population. Due to data limitations and other difficulties in identifying the key population of interest (those exposed to the agents), the epidemiologic investigation was constrained to a study of primarily the cancer experience of residents of the Gagetown Study Region. No overall consistent patterns of significantly increased risk emerged over the four study time periods. Though this investigation provided preliminary information about the number of cases and suggestive increased risks for certain disease outcomes during more recent time periods, significant limitations precluded drawing conclusions that there was or was not an increased risk in CFB Gagetown exposed personnel. Further research may potentially provide more detailed evidence of effects in support of predictions of the HHRA.

Recommendations for Future Research

Based upon the findings from the risk assessment, further investigations into the state of health of individuals who were directly involved with herbicide applications and post application brush-clearing activities, are warranted. These further investigations could involve either targeted epidemiological evaluation of these populations or body burden analysis. The epidemiological studies might focus on the 'at risk' CFB Gagetown populations, as described above. Due to the period of time that has lapsed since exposures occurred, predictions indicate that in even the most highly exposed individuals, body burdens would likely be indistinguishable from the general population and will likely not be helpful.

Feasibility studies would be needed to determine whether the populations at risk have been documented in a systematic way, and whether these records contain details about when and where these individuals worked, before a larger epidemiological study could go forward. Power calculations would also be required to estimate the likelihood that sufficient numbers of cases have occurred to allow a meaningful analysis. As encountered in the descriptive epidemiological study, small numbers limit the likelihood of finding statistically significant conclusions. Other study design issues, such as problems of survival of those who may have been highly exposed, and sources of study bias, would need to be carefully considered before proceeding with such an investigation.