Environment Canada
Atlantic Region

Environment Canada Technical Review

of the

Revised Environmental Impact Statement

on

Military Flying Activities in Labrador and Quebec

July 1994

Environment Canada Technical Review

of the

Revised Environmental Impact Statement

on

Military Flying Activities in Labrador and Quebec

July 1994

TABLE OF CONTENTS

* References are identified alphabetically for each section.

Preface

The scientific and technical merits of the revised Environmental Impact Statement (EIS) on Military Flying Activities in Labrador and Quebec have been reviewed in terms of Environment Canada's mandate. This document, developed by the Atlantic Region of Environment Canada in cooperation with the Quebec Region, summarizes the Department's findings. The Department is prepared to explain or enlarge upon any of the commentary provided and plans to do so at the public hearings.

Environment Canada acknowledges the considerable efforts of the Department of National Defence (DND) in consolidating existing knowledge of Labrador and Quebec, and in sponsoring additional studies to address data gaps. Continued research and monitoring will enhance our understanding of ecological interactions in the region and will facilitate decisions relating to military flying activities in Labrador and Quebec should they continue or expand. The following commentary is intended to assist the Panel in identifying, and the proponent in addressing, concerns and data gaps which remain outstanding from our review of the 1989 EIS and the revised deficiency statement issued to DND in 1992. It is understood that the proposed NATO Tactical Fighter Weapons Training Centre has been postponed indefinitely, and therefore, Environment Canada concerns which were specific to that aspect of the military flight training program are no longer relevant to the current proposal.

A Departmental position statement on existing and proposed expansion of military flying activities will be provided to the Panel prior to the beginning of public hearings on this proposal.

OVERVIEW

In addressing the commentary provided on the 1989 EIS, generally, and the deficiencies identified by the Panel, specifically, DND has made important strides towards ensuring impacts associated with military flight training activities are adequately identified and fully evaluated. The development and presentation of testable impact predictions (Chapter 11) and identification of related research and monitoring studies (Chapter 15) collectively represents a progressive approach to environmental assessment that will help ensure the review process remains dynamic and relevant through the life of the project. In terms of Environment Canada's mandate (Appendix I), the revised deficiency statement issued by the Panel primarily focuses on data gaps pertaining to migratory birds. However, within the context of the original 1987 guidelines for preparation of an EIS, other concerns identified by Environment Canada during review of the 1989 EIS (A) remain valid and are cross-referenced to the revised 1994 EIS as appropriate.

The available database on **migratory birds** has been improved since preparation of the 1989 EIS and DND recognizes that data collection is a long term proposition if military flight training over large territories in Labrador and Quebec continues. However, survey results, and methods used to conduct population inventories and assess habitat capability, have not been fully described. These details should be made available to enable a comprehensive evaluation of potential effects on migratory birds. While the harlequin duck, black duck, Canada goose and common loon are reasonably documented, all the main groups of migratory birds and associated habitat requirements should be presented in a uniform manner. DND should provide an evaluation of different approaches to developing avoidance criteria to enable a determination of the project's acceptability. Provisions for determining long term effects of low level flying on staging, breeding, and moulting migratory bird populations in training areas should be indicated.

No additional model runs or field surveys appear to have been undertaken in support of efforts to evaluate **atmospheric dispersion and deposition of pollutants** emitted by military aircraft. Further explanation of assumptions adopted in the study has not been offered in the revised EIS. As a consequence, Environment Canada observations on data presented in the 1989 EIS largely remain as previously stated. Based on information provided by DND, it is not clear that worst case meteorological conditions are reflected in the modelling effort with the attendant implications for predicted changes in ambient air and surface water quality. DND should provide additional rationale for the approach selected to characterize atmospheric dispersion and deposition of pollutants, and offer further clarification on assumptions and model inputs. Based on the model results, DND predicts that nitrogen dioxide (NO_2) concentrations in ambient air within the vicinity of the airport will exceed acceptable air quality objectives. The frequency of the predicted exceedances should be indicated to facilitate evaluation of impact importance and magnitude.

Our review of the 1989 EIS emphasized the importance of ensuring that environmentally acceptable practices for managing **hazardous materials** are reflected in any strategy to

minimize or eliminate potential adverse effects on surrounding communities and the local environment. In this regard, the 1993 Goose Bay Environmental Action Plan prepared by DND and reviewed by Environment Canada is frequently referenced within the revised EIS. As an outline of how DND proposes to address a full range of environmental issues related to the operation and maintenance of facilities at Canadian Forces Base (CFB) Goose Bay, the Environmental Action Plan represents an important and commendable initiative. However, the movement of supply vessels, including fuel carriers, through Groswater Bay and Lake Melville (Hamilton Inlet), provisions for storage and handling of hazardous materials at the Base, and current waste disposal practices, remain a concern to Environment Canada within the context of the proposed continuation and expansion of military flight training activities. DND should provide further details on provisions for hazardous materials management which will enable an evaluation of the adequacy of existing procedures and practices in mitigating potential adverse impacts.

Untreated **wastewater**, composed of domestic sewage, stormwater and industrial wastewaters from the Base and Town, is released to Churchill River and Terrington Basin. It is understood from the EIS and the Goose Bay Environmental Action Plan that a feasibility study investigating options for wastewater treatment has been prepared and that a monitoring program designed to enable characterization of various wastewater streams has been implemented. DND should provide further information on the volumes, physical-chemical properties and toxicity of wastewaters, and outline a timetable for implementation of pollution prevention and control measures that will enable adherence to federal effluent guidelines and mitigate impacts on receiving waters.

In assessing **cumulative effects** over a large study area, it is suggested that regions subject to multiple influences receive particular attention. DND should consider the full range of activities and pollutant sources impacting Hamilton Inlet, especially the Churchill River-Terrington Basin-Lake Melville system, and assess cumulative effects in terms of established environmental quality guidelines for receiving waters. The predicted increase in NO_2 concentrations within ambient air, and potential exceedances of acceptable ambient air quality objectives in the Happy Valley-Goose Bay region, suggest all sources of this pollutant be investigated in a consideration of cumulative effects and determination of appropriate mitigative measures.

References - Overview

A. Environment Canada (1990) "Environment Canada Review - EIS on Military Flying Activities in Labrador and Quebec". Scientific and Technical Comments.

MIGRATORY BIRDS

Assumptions and Impact Predictions

The database that characterizes waterfowl resources potentially affected by military flying activities has been improved since preparation of the 1989 EIS. Knowledge of waterfowl resources within a study area that includes territories currently overflown during military flight training appears to be based on a reasonable analysis of the available data. Deficiencies in the presentation of seasonal distributions of harlequin duck, Canada geese and other waterfowl have been generally addressed. Flight paths have been adequately described in the revised EIS and it is understood additional data are available from DND. At this stage, the assessment of impacts on migratory birds is principally limited by available information on populations and not by the lack of data on flight paths.

Unfortunately, the simplicity of the presentation precludes a rigorous evaluation of the impacts of low level flying on migratory birds. While results of the surveys and data analyses are summarized in the revised EIS, the study methodologies and raw data have not been submitted for review. It is recognized that some of these details may be included in the referenced supporting documentation; however, a comprehensive scientific and technical review is not possible based on the information presented in the EIS alone.

The migratory bird inventory program which supported preparation of the revised EIS should be described in greater depth with attention to methodologies, sampling periods, sampling efforts and results obtained. It is expected that data collected during inventories include details on seasonal variations in migratory bird populations and associated densities; the distribution of populations over the study area during periods of staging, moulting and breeding; and an indication of the accuracy and reliability of estimates.

The evaluation of impacts is essentially premised on the hypothesized capability of the Quebec-Labrador environment to support migratory birds. Habitat capability appears to be based on overall avifaunal species richness as indicated by vegetation communities. However, DND has not clearly identified the approach used to evaluate habitat capability or verified the relationship between estimated habitat capability and actual population densities revealed by inventory data. The methodology used to define capability in the EIS should be identified. Depending on the accuracy of the approach adopted for preparation of the EIS, the ecological land classification system developed for Labrador by Fisheries and Environment Canada (1978) should be re-examined as an alternative basis for determining habitat capability and designing monitoring programs **(A)**.

The level of detail on habitat capability and the evaluation of impacts appears to be highly variable among groups of birds. Each species of raptor is well documented. In terms of waterfowl, the harlequin duck, and to a lesser extent the Canada goose, black duck and common loon, are reasonably documented. Unfortunately, there is much less information on other species. For example, it is not clear if the surf scoter is uniformly distributed over the

study area, what densities have been observed, and if the habitat capability identified for waterfowl in general meets the specific requirements of the scoter. There is minimal information on passerines on which to base any conclusions regarding potential impacts. In the absence of a more complete evaluation of the chief groups of migratory birds and associated habitat requirements, a full understanding of avifaunal diversity and habitat capability within the study area remains elusive. It is suggested, therefore, that all main groups of migratory birds and associated habitat requirements be presented in a uniform manner.

Mitigation

Within the 1989 EIS, DND had surmised that waterfowl would not be affected by low level flying. This is no longer a conclusion and the revised EIS accepts that noise can cause serious impacts in some situations. However, the avoidance criteria for waterfowl as currently proposed may be inappropriate. The need to avoid nesting waterfowl other than harlequin duck should be considered further given the limited confidence in impact predictions related to overflights of breeding populations. In addition, the proposal to avoid isolated aggregations of birds dispersed throughout the flight training areas may be impractical in terms of a viable flying program. A more realistic approach may be to avoid larger areas with high densities of staging, moulting and breeding birds. DND should take responsibility for collecting data, and obtaining appropriate expertise to evaluate and revise the criteria accordingly. An evaluation of different approaches to developing avoidance criteria should be presented.

It should be recognized that the available data do not suggest the reconfigured low level flying areas proposed under Option B are less valuable to waterfowl and other migratory birds than areas currently used. Studies should be conducted to supplement the migratory bird database as it pertains to additional territories proposed for military flight training activities.

Monitoring

Further efforts are planned by DND to improve information on migratory birds that will enable a better evaluation of present resources and possible impacts of military flight training. While potential adverse impacts on breeding harlequin duck are recognized by DND, it remains uncertain whether continuous disturbance adversely affects other nesting waterfowl. Accordingly, the proposed effects monitoring program (Section 15.3.14) should also be designed to verify predicted impacts on breeding waterfowl, including the surf scoter. Experimental work on the effects of overflights on breeding passerines should also be considered. The proposal to undertake monitoring over a two year period may determine the immediate effects of low level flying; however, if birds shift their distribution to avoid the overflights, the long term effects may be more important. Provisions for evaluating long term implications of overflights on migratory birds should be identified.

References - Migratory Birds

A. Fisheries and Environment Canada (1978) "The Ecological Land Classification of Labrador: A Reconnaissance". Ecological Land Classification Series. No. 4. Lands Directorate. Halifax, N.S.

EXHAUST EMISSIONS AND ATMOSPHERIC DISPERSION

Assumptions

The PAL (Point Area Line) model used by DND (Technical Report 2 - TR2: p. 17) (EIS: p. 11-41) is viewed by Environment Canada to be the most appropriate model for estimating air contaminant concentrations from a line source such as CFB Goose Bay airport and likely could be adapted for low-level flying situations. However, the appropriate atmospheric stabilities and accurate emission rates are required. As noted in our review of the 1989 EIS, further explanation of assumptions and model inputs used to predict air contaminant concentrations should be provided.

Depending on the fuel source, the assumption of 0.05% sulphur content may or may not be accurate (TR2: p. 7). The 1994 Environment Canada report, "Sulphur Content in Liquid Fuels", reveals that the average sulphur content of aviation fuel produced in, or imported to, Atlantic Canada during 1992 was 0.084% while the national average was 0.037% **(A)**. A higher sulphur content may not significantly affect calculations of pollutant loadings, air contaminant concentrations and deposition; however, the sulphur content of aviation fuel used at CFB Goose Bay should be verified.

Emission rates used to calculate estimated annual air pollutant loads produced by non-airport related activities (TR2: p. 9, table 2), and the source of these rates, should be identified. Estimates of carbon monoxide (CO) and particulate matter produced by the combustion of 900 tonnes/yr of wood appear too high. Consequently, comparison of these estimates to aircraft emissions may be misleading.

It should be specified how many years of meteorological data were used to calculate the frequency of various stability classes. Although DND implies that 30 years (1961-1990) were employed (TR2: table 7, pp. 15-17), this seems unlikely. Five to ten years of meteorological data should be used for this calculation.

The criteria used to select the receptors "where the maximum concentrations of air pollutants would be expected to occur" should be specified (TR2: p. 17). It should be confirmed if the meteorological conditions presented in table 11, Technical Report 2, are the conditions that produced the maximum hourly concentrations at each receptor site for the month of September 1987. One month of hourly data is not sufficient for determining the maximum hourly concentrations in a modelling study. A few seasons of data reflecting the time span of military flight training activities (April to October) are needed to ensure worst case meteorological conditions are considered.

It should be clarified if maximum daily and maximum monthly predicted concentrations of atmospheric pollutants in the vicinity of the airport, and maximum hourly predicted concentrations of pollutants in the training corridors, are also derived from use of September 1987 meteorological data for Goose Bay.

Predictions

Unfortunately, the interpretation of predicted concentrations of air contaminants in the vicinity of the airport (TR2: Section 3.3.3.1) is complicated by inaccuracies in the presentation of the "National Ambient Air Quality Objectives" published by Environment Canada under the Canadian Environmental Protection Act **(B)** (TR2: tables 8, 12, 13, 14). The 24-hour tolerable objective for particulate matter is 400 ug/m^3 and not 240 ug/m^3 (table 8) while the 1-hour desirable carbon monoxide (CO) objective is 15,000 ug/m^3 and not 1,500 ug/m^3 (table 12). The objectives for CO presented in table 13 are for an 8-hour averaging period and not 24 hours. All of the ambient air quality objectives presented in table 14 are for an annual - not monthly - averaging period.

DND asserts that with an expansion of existing military flight training activities from CFB Goose Bay "a deterioration in air quality is predicted in the immediate vicinity of the airport and, to a lesser extent, in the Spruce Park area" while "air quality in Hamilton Heights and Happy Valley will deteriorate slightly, but will generally remain within acceptable levels" (EIS: p. 11-41). More specifically, maximum hourly concentrations of nitrogen dioxide (NO_2) are predicted to exceed the acceptable objective in the vicinity of the airport (eastern end of main runway, Spruce Park elementary school) and the tolerable objective at the air traffic control tower. Maximum predicted daily concentrations at the control tower will exceed the acceptable objective for NO_2. Under existing activity levels, modelling results suggest that maximum hourly NO_2 concentrations already exceed the acceptable objective. More information on the frequency of predicted exceedances should be provided to substantiate the claim that "acceptable air quality objectives established by Environment Canada will not be exceeded in Central Labrador except on an irregular, infrequent basis" (EIS: p. 11-41).

Maximum predicted hourly concentrations of particulate matter are also high in the vicinity of the airport under current and projected activity levels although no objectives have been established for this measurement. While the predicted concentrations of unburned hydrocarbons appear to be high, there is no Canadian ambient air quality objective that can be used in evaluating this parameter. Relevant standards from other jurisdictions should be referenced accordingly.

It should be recognized that conclusions based on modelling results are likely valid for the month of September 1987 and are indicative of what may occur in other months. However, predicted effects on ambient air quality cannot be convincingly extrapolated to a more general period of time based only on this one month.

In referencing data obtained from a recent Transport Canada study, DND implies that there are no air quality problems at Canadian airports with flight frequencies similar to those projected for CFB Goose Bay (TR2: p. 29) although data reproduced in technical report 2 (table 18) reveal that particulates may be an occasional problem (i.e., Edmonton, Winnipeg). On the strength of data from airports with similar flight frequencies, DND does not anticipate

air quality problems at the Base. However, the different meteorological characteristics at each location preclude such a conclusion unless the data are interpreted in this context.

Monitoring

The 1987 field program described in technical report 2 was conducted in an effort to confirm the relative accuracy of modelling results (Section 3.4). The 24-hour measurements taken for some of the pollutants will only indirectly reflect any large hourly values because of averaging. As no SO_2 measurements were obtained, a comparison to the predicted values can not be made for this pollutant.

Again, inaccuracies in the presentation of "National Ambient Air Quality Objectives" complicate the interpretation of monitoring results obtained from Spruce Park in the vicinity of the airport (TR2: table 16) (EIS: table 9.3) and training areas as represented by Northwest River (TR2: table 17)(EIS: table 9.4). The objectives for CO are for an 8-hour averaging period, not 24 hours as stated. The concentrations identified for particulate matter objectives are incorrect - there is no desirable 24-hour objective while the acceptable 24-hour objective is 120 ug/m^3 and not 70 ug/m^3. The tolerable 24-hour objective for particulate matter is 400 ug/m^3. Also, as noted earlier, although there are no Canadian standards for unburned hydrocarbons, relevant standards from other jurisdictions should be used for comparison.

DND suggests in the EIS that "air quality in the vicinity of Happy Valley-Goose Bay is currently good" (p. 11-39) based on data collected during the 1987 survey. However, some measurements of unburned hydrocarbon and NO_2 concentrations within ambient air sampled at Northwest River are high. The exact location of the monitoring site should be indicated and some explanation of the elevated concentrations offered.

The proposed monitoring program should help verify predicted changes in NO_2 concentrations in the vicinity of CFB Goose Bay which are related to increased military flight training activities (Section 15.3.2). It is suggested that at least two analyzers be used to enable determination of background and worst case conditions. Monitoring results should be provided to Environment Canada for review, and as implied in the proposed study, DND should be prepared to implement abatement measures to ensure acceptable ambient air quality is maintained in the Happy Valley-Goose Bay area. DND should also consider monitoring unburned hydrocarbons if comparison with standards from other jurisdictions suggests that predicted concentrations in the vicinity of the airport are high.

Documentation on development and maintenance of the National Air Pollution Surveillance (NAPS) network, which is administered by Environment Canada in cooperation with provincial governments, should be consulted in finalizing the study design **(C).** The documentation offers guidance on appropriate siting criteria and positioning of the monitoring equipment (e.g., height above ground, distance from supporting structures, distance from site influences). Analyzers should be calibrated on a six month schedule by a trained technician (p. 15-13).

References - Exhaust Emissions and Atmospheric Dispersion

A. Environment Canada (1994) "Sulphur in Liquid Fuels 1992". Oil, Gas and Energy Division. Environmental Protection Service. Ottawa.

B. Environment Canada (1989) "National Ambient Air Quality Objectives for Air Contaminants". Canadian Environmental Protection Act, Part I.

C. Environment Canada (1988) "Site Documentation for the National Air Pollution Surveillance (NAPS) Network Air Monitoring Stations". Environmental Protection. Ottawa.

EXHAUST EMISSIONS AND DEPOSITION

Assumptions

It should be recognized that the Canadian Air and Precipitation Monitoring Network (CAPMoN) is administered by Environment Canada to meet several objectives including "the measurement of regional-scale spatial and temporal variations and long-term trends in the chemical composition of air and precipitation, and wet and dry deposition" (Environment Canada, 1991, p. 2) **(A)**. Given the objectives of the monitoring program, stations are located in accordance with specific siting criteria so measurements of the Long Range Transportation of Atmospheric Pollutants (LRTAP) will not be significantly affected by local emission sources (Technical Report 2 - TR2: p. 43). However, it is acknowledged that the Goose Bay CAPMoN is only marginally acceptable because of its proximity to the airport.

It is suggested that the "excess" sulphate data from the Goose Bay CAPMoN site be used in the calculation of deposition attributable to aircraft emissions. Excess means that the sea salt sulphate has been deducted and provides a more accurate, although only slightly different, measure of the true LRTAP fraction. For example, in 1987, excess sulphate deposition was 4.42 kg/ha, whereas the sulphate deposition was 4.59 kg/ha.

The source of 1984-1991 data is uncertain as the sulphate and nitrate deposition values presented by DND (TR2: table 24) vary slightly from the values reported by Environment Canada. The most recent published CAPMoN data are for 1987 (Environment Canada, 1991) **(A)**. The data summary published by Environment Canada in 1988, and which is referenced in Technical Report 2, only includes information for 1985. The rationale for using 1987 as a representative year remains unclear. An average of the annual nitrate and sulphate deposition values measured between 1984 and 1991 may be more appropriate.

Predictions

It is variously suggested in the EIS that "surface water acidification is likely to continue as a direct consequence of LRTAP deposition" (TR2: p. 46) (EIS: p. 11-47) and that "freshwater bodies in the study area appear to be unaffected by anthropogenic acidification" (EIS: p. 14-28). The potential impact of military flight training activities on acidification of freshwater systems in Labrador and Quebec should be considered in the context of ongoing research conducted by Environment Canada. Spatial variations in the sensitivity of the Labrador environment to a west - east gradient in acidic inputs have been hypothesized based on an interpretation of historic data and geological conditions **(B)**. An interpretation of available data by Environment Canada suggested that "all the Labrador lakes have experienced only moderate alkalinity losses and that the present atmospheric loading scenario has had a minimal effect on lake pH" (Environment Canada, 1987, p. 89) **(B)**. Monitoring conducted by Environment Canada at thirty five southern Labrador lakes in both 1981 and 1989, revealed that there was no discernable change in water quality between sampling dates which

could be attributed to acidification and that there was "no significant acidification of the lakes sampled" (Environment Canada, 1989; p. iv) **(C)**.

Monitoring

It is noted that water samples collected in the 1987 survey conducted for the assessment were frozen prior to analysis (TR2: p. 37). The freezing process can have many effects such as degassing and flocculation of organic matter. This may in turn influence the laboratory measures of pH, alkalinity, water colour, dissolved organic carbon and heavy metals. For example, mean pH values ranging between 5.44 - 5.61 measured in samples obtained during the 1987 survey (EIS: table 11.9)(TR2: table 21) are not consistent with historical data presented in technical report 2 (Section 4.3.3), and the Environment Canada 1987 interpretation report which notes that Labrador surface waters exhibit a median pH range of 6.1-6.5 units **(B)**. As a consequence, use of these 1987 survey data in interpreting background conditions is of questionable validity and may be misleading. In future monitoring efforts, samples should be refrigerated and not frozen.

It is recognized in the EIS that a concentration of low level flying activities in river valleys, especially those leading to target areas, may serve to intensify the scope and magnitude of projected impacts (e.g., TR2: p. 45). The DND proposal to conduct water quality monitoring as part of a larger effort to study selected river valleys in Labrador and Quebec should help verify impact predictions related to these ecosystems (Section 15.3.18). It is suggested that the proposed monitoring program be further refined, and research sites chosen, with reference to ongoing federal and provincial data collection efforts related to determination of regional hydrological and climatological conditions, and environmental quality.

Hydrometric survey stations are located on several rivers representative of drainage basins within Labrador and Quebec. Stations are identified and described in the "Surface Water Data Reference Index" **(D)** and the collected data are available from Environment Canada. Under the current Canada-Newfoundland Water Quality Monitoring Agreement, water from Churchill River at Muskrat Falls and Eagle River above Eagle Falls are sampled quarterly and analyzed for a range of physical and chemical parameters **(E)**. While DND suggests that water quality data for Labrador and Quebec are limited (TR2: p. 42, table 23), several published Environment Canada surveys, data summaries and interpretation reports have not been referenced or discussed (e.g., **C, E, F, G, H**). The results of historical and ongoing water quality data collection efforts are available from these documents and the National Water Quality Database (NAQUADAT) administered by Environment Canada.

Water quality monitoring efforts should be conducted, and results interpreted, in accordance with the methods recommended by Environment Canada for detecting trends in acidification **(B, C)**. Monitoring results obtained from the proposed study of river valley ecosystems should be provided to Environment Canada for review. DND should be prepared to implement abatement measures to ensure acceptable ambient water quality, as defined by the

Canadian Council of Ministers of the Environment - CCME "Canadian Water Quality Guidelines" **(I)** and background conditions, is maintained in surface waters.

References - Exhaust Emissions and Deposition

A. Environment Canada (1991) "Canadian Air and Precipitation Monitoring Network (CAPMoN) Precipitation Chemistry Data Summary 1987". Report ARD 89-1. Atmospheric Environment Service.

B. Environment Canada (1987) "An Assessment of LRTAP Acidification of Surface Waters in Atlantic Canada". IW/L-AR-WQB-87-121. Inland Waters Directorate. Moncton, N.B.

C. Environment Canada (1991) "Weather Effects of Natural Organic Acids and Acid Precipitation in Labrador Lakes". IWD-AR-WQB-91-163. Inland Waters Directorate. Moncton, N.B.

D. Environment Canada (1992) "Surface Water Data: Reference Index - Canada 1991". Water Survey of Canada. Ottawa.

E. Environment Canada (1991) "Canada-Newfoundland Water Quality Agreement". IWD-AR-WQB-171-91. Inland Waters Directorate. Moncton, N.B.

F. Environment Canada (1982) "Data Report: Water Quality of Surface Waters of Newfoundland and Labrador". IWD-AR-WQB-82-32. Inland Waters Directorate. Moncton, N.B.

G. Environment Canada (1987) "Chemical Characterization of Water, Sediment and Biota from Five Labrador-Quebec Transboundary Basins". IW/L-AR-WQB-87-120. Inland Waters Directorate. Moncton, N.B.

H. Environment Canada (1986) "Water Quality Branch Activities in Newfoundland 1965-1985". IW/L-AR-WQB-86-107. Inland Waters Directorate. Moncton, N.B.

I. Canadian Council of Ministers of the Environment - CCME (1987, updates to March 1994) "Canadian Water Quality Guidelines".

HAZARDOUS MATERIALS RELEASED IN FLIGHT TRAINING AREAS

Inert Weapons

The assertion that "there are no hazardous materials contained in any of the practice ordnance(s) currently in use or planned" (p. 5-117) is inaccurate. Vanadium oxitrichloride ($VOCl_3$) and Titanium tetrachloride ($TiCl_4$) are hazardous compounds released by inert weapons used in practice target areas (p. 5-84). It is understood these compounds are combustion products from weapons equipped with cold smoke charges. While it is recognized the quantities involved may be small, these compounds should be characterized (i.e., toxicity, vapour pressure, solubility, octanol/water partition coefficient, degradation rate), potential contamination of the practice target areas addressed, and impact mitigation measures identified as appropriate.

Fuel Dumping

It is claimed that fuel dumped by aircraft during military training activities never results in soil contamination (referenced as greater than 1,000 mg/Kg) (p. 11-49). However, it should be recognized that there is potential for contamination when the entire tank is jettisoned and breaks on impact.

The proposed study of fuel dumping areas should help verify if this practice is resulting in environmental contamination (Section 15.3.4) and monitoring results should be provided to Environment Canada for review. While it may be useful to compare data obtained to the Alberta MUST Guidelines (p. 15-16), criteria for benzene, toluene, ethylbenzene and xylenes (BTEX) outlined in the CCME "Interim Canadian Environmental Quality Criteria for Contaminated Sites" **(A)** and any current Newfoundland criteria for Total Petroleum Hydrocarbons would be referenced to determine whether remediation was required.

References - Hazardous Materials Released in Flight Training Areas

A. Canadian Council of Ministers of the Environment - CCME (1991) "CCME Interim Canadian Environmental Quality Criteria for Contaminated Sites". CCME EPC-CS34.

HAZARDOUS MATERIALS MANAGEMENT AT CFB GOOSE BAY

Assumptions and Predictions

Impact predictions related to the socio-economic implications of hazardous materials management appear to be largely premised on adequacy of existing transport, storage, handling and disposal facilities, on the acceptability of current practices and on compliance with existing federal and provincial regulations (p. 11-208). On this basis, DND predicts that socio-economic impacts associated with management of hazardous materials in support of expanded military flight training activities will be negligible (p. 11-208). With reference to definitions provided in the EIS, negligible impacts are understood to be "of no consequence to anyone and can be ignored" (p. 10-28). Environment Canada is an acknowledged stakeholder in this issue (p. 11-206), and it is suggested that further attention to hazardous materials management is required.

DND reports that there have been several leaks and spills attributable to management of large volumes of petroleum products and related wastes (e.g., slop oil, waste oil) and that future releases are a distinct possibility (e.g., p. A11-4). While potential biophysical impacts associated with such releases are recognized by DND (e.g., hypothesis A11, hypothesis A14), they are not fully characterized. For example, the claim that "petroleum products appear not to be highly toxic to fish" (p. A11-6) is an oversimplified representation of potential adverse effects which is not supported by toxicity data presented in the unpublished Environment Canada report, "A Catalogue of Crude Oil and Oil Product Properties" **(A)** and scientific literature (e.g., Miller, 1982) **(B)**.

It is important that the range of sensitivities to oil exhibited by fish at different stages in their life cycle be reflected in an assessment of potential impacts. Decreased hatchability of eggs, mortality of young fish, and sublethal effects on adult fish (e.g., reduced reproduction, behavioral changes) can be attributed to the toxicity of oil. Impacts at the population level are not limited to acute effects associated with large accidental fuel spills (p. A11-6) as chronic oil pollution can have serious long term implications for local fish populations and ecosystem processes.

DND notes the potential adverse effects of oil on waterfowl found within the vicinity of the Base (e.g., Terrington Basin). However, it should also be recognized that vessel traffic in support of military flight training activities places marine birds and waterfowl frequenting Lake Melville, Groswater Bay and adjacent marine areas at risk to the effects of major oil spills and chronic oil releases. The scope of the impact may also include destruction or tainting of local fish stocks and oiling of marine mammals. The resultant loss of food and income sources could disrupt the lives of residents of Rigolet and other communities.

As stated in the EIS, "the project creates, and will continue to create, significant volumes of solid and hazardous wastes" (p. 11- 206). Although DND claims that "few concerns have been voiced regarding possible contamination of groundwater" (p. 11-207) and that

"contamination of freshwater bodies is unlikely" (p. A11-5), waste management practices described in the EIS suggest that possible impacts on water resources require investigation.

Mitigation

It is understood the proposed hazardous materials management strategy, referenced in the 1993 Goose Bay Environmental Action Plan and the 1994 EIS (pp. 5-116, 11-207), is under preparation. Such a strategy should help ensure management of hazardous materials at CFB Goose Bay complies with applicable regulations and reflects recommended practices and procedures designed to prevent or minimize releases to the environment. It is suggested that the following specific issues be addressed further by DND in an evaluation of potential impacts and the appropriate mitigative measures.

Fuel Resupply

Within the Guidelines, DND is directed to examine unloading and local transportation of fuel, as well as accident prevention systems and emergency plans, especially with respect to the present practice of discharging fuel near the passenger facility in Terrington Basin (Guidelines: Section 6.3.2.2, item vii). DND acknowledges requirements for large volumes of fuel in support of military flying activities - a demand which will more than double with the proposed expansion (e.g., p. 11-161, table 11.33). However, DND does not accept any Departmental responsibility for safe delivery of fuel to the Base, and apparently with respect to Terrington Basin, for discharging fuel, when it is stated "the fuel unloading dock is a common-user facility owned and operated by Transport Canada, and the operation of that facility, including any safety related aspects is the responsibility of that Department" (pp. 5-116, 117).

Shipment of fuel through Groswater Bay and Lake Melville (Hamilton Inlet) to the discharge terminal at Terrington Basin represents a potentially major impact of military flying activities from CFB Goose Bay should a fuel carrier experience a mishap enroute or at dockside. Transport of fuel in, or offloading from, vessels other than those belonging to DND, should not relieve DND of responsibilities to ensure fuel is delivered and offloaded with due regard to safety and environmental emergencies. Accordingly, DND should ensure that vessels comply with current Canada Shipping Act regulations as a minimum standard and that qualified pilots are available to assist navigation through Groswater Bay, Rigolet Channel and Lake Melville. DND should confirm that sufficient spill response resources are available with reference to a 'probable maximum spill'. Positioning of appropriate oil spill equipment at Rigolet or Goose Bay should be given serious consideration.

Shipboard Waste Oil

DND has not identified any plans for the establishment of a waste oil collection facility at the Terrington Basin dock. However, the demand for this service remains given the reliance of military flight training activities on vessel delivered supplies, including fuel. The provision of

a waste oil collection facility will help minimize the possibilities of accidental or deliberate discharges of oily wastewater (i.e., engine room bilgewaters) to the environment. The proposed expansion of military flying activities, and attendant increase in vessel traffic, further highlight the need for such a facility.

Fuel Storage

As described in the EIS and 1993 Goose Bay Environmental Action Plan, the CFB Goose Bay tank farm is currently being upgraded through implementation of an ongoing rehabilitation program. It is understood that various components of the program are alternately scheduled for completion in 1996 (underground storage tank systems) and 1998 (aboveground storage tank dykes). Current standards applicable to storage tanks containing petroleum products include codes of practice for aboveground **(C)** and underground **(D)** tanks published by the CCME, the National Fire Code of Canada **(E)**, and the technical guidelines **(F)** and registration guidelines **(G)** for underground storage tanks at federal facilities proposed for publication under Part IV (Section 53) of the Canadian Environmental Protection Act (CEPA).

In the 1989 EIS, and more recently in the 1994 EIS, DND claims that the sand dykes which surround each aboveground storage tank at the CFB Goose Bay tank farm are capable of holding twice the volume of an individual tank (p. 5-115). Sand dykes will not contain the fuel product, and until the upgrading program is completed, any rupture of a tank or associated pipes will likely result in groundwater contamination and possibly result in the release of fuel into Lake Melville. DND should be particularly vigilant in operating and inspecting the facilities until the existing dykes have been replaced and storage facilities upgraded to meet current design and operating standards.

Slop Oil

Slop oil is described in the EIS as a mixture of petroleum products which accumulates at the tank farm. Provisions for management of slop oil - which is variously quantified using three different systems of measurement (gallons, litres, drums) - require clarification.

It is understood that approximately 50,000 gallons of slop oil are stored in underground storage tanks in Building 805 (p. 5-115). Inventory controls should be in place for stored slop oil to facilitate detection of any leakage. Separate references are made to 350,000 litres of slop oil owned by Imperial and stored in fuel storage tank 1535 and a further 2,000 litres of slop oil/water retrieved from 20 storage tanks stored in fuel storage tank 1537. It should be specified if these tanks are aboveground or underground. Standards pertaining to fuel storage are also applicable to storage of slop oil **(C, D, E, F, G)**. An additional 20 drums of slop oil are stored in a drum yard on Loring Drive.

Imperial Oil, or a 'Hazmat disposal company', is understood to be gradually shipping slop oil out of the province for recycling (pp. 5-115, 11-207); however, it is not clear that this is how

the entire inventory at the Base will be managed. CFB Goose Bay is described to be currently 'disposing' of slop oil (p. 5-115). Slop oil should be sampled and analyzed for determination of appropriate treatment and disposal methods.

PCBs

While it is implied in the EIS that all PCBs have been successfully destroyed (pp. 5-73, 5-116, 11-208, 8D-14), it should be acknowledged that a small amount of PCB waste is currently stored in a bunker at the Base in compliance with the "Storage of PCB Material Regulations" under CEPA **(H)**. It is understood from the Environmental Action Plan that these wastes will be shipped to the proposed Atlantic Region PCB destruction facility should it should become operational.

Other Hazardous Wastes

It should be clarified if services provided under the Multinational Memorandum of Understanding (MMOU) include management of hazardous wastes generated by Allied military users (p. 5-27). Assuming these services are included, it should be confirmed that hazardous wastes are collected and stored by DND on a routine basis and the Allies billed for costs associated with appropriate disposal.

While management of hazardous wastes other than PCBs may not be subject to comprehensive regulations as of yet (pp. 5-73, 11-208), guidelines and codes of practice which outline environmentally acceptable practices are available and should be adopted. In addition, the draft "Federal Hazardous Waste Management Regulations", scheduled for promulgation under CEPA **(I)**, provide direction on the proper management of hazardous wastes generated at the Base and should be consulted accordingly.

Provisions for management of liquid hazardous wastes are unclear. An aboveground 50,000 litre storage tank for the bulking of liquid wastes was not described in Chapter 5 as suggested in the discussion of infrastructure related concerns (p. 11-207). Unfortunately, the outline of provisions for liquid hazardous waste storage presented in Chapter 11 is somewhat muddled (p. 11-207, para. 6). It is understood from the project description that mixtures of liquid wastes, including "fuels, lubricants, hydraulic fluids, solvents, antifreezes, acids and a variety of products used in relatively small quantities", are contained within 205-litre drums and "deposited in an outdoor storage area" (p. 5-115). As previously indicated, it is understood that slop oil is stored in underground storage tanks, fuel storage tanks 1535 and 1537, and drums. The apparent discrepancies between Chapters 5 and 11 should be clarified.

DND predicts that the volume of liquid hazardous wastes generated at the Base will triple from between 36,000 and 41,000 litres per year to 113,000 litres per year (pp. 5-115, 11-207). However, it is also suggested that "quantities of waste products are estimated to increase from the current amount of 75,000 litres/year to 113,000 litres/year" (p. A11-5). This apparent

discrepancy should be clarified. It should also be confirmed that estimates include wastes generated by all Allied users at CFB Goose Bay.

Further details on management of liquid hazardous wastes should be provided with attention to waste types and chemical analyses, volumes generated by specific sources, bulking processes and disposal locations. Hazardous liquid wastes should be managed in accordance with the draft "Federal Hazardous Waste Management Regulations" and should not be stored "on permeable surfaces" (p. A11-5). Opportunities to reduce the amount of liquid wastes generated by Base activities should be explored. Segregation of hazardous waste liquids should be considered to reduce the potential of chemical incompatibilities arising from mixing. Segregation may also serve to reduce the potential for non-chlorinated wastes to become contaminated by chlorinated materials.

The municipally-operated landfill is unlined (pp. 8-81, 8D-14) and situated on "highly permeable" sandy soils (p. A11-5). While there are separate areas for disposal of hazardous wastes within the landfill (p. 8-81), it is acknowledged by DND that there are no special provisions for containment (pp. 8D-14, 11-207, table 8D-6). Standards for landfilling of hazardous wastes are provided in the CCME publication, "National Guidelines for the Landfilling of Hazardous Wastes" **(J)**. Adherence to the design, operating and performance standards documented in the guidelines "will minimize the risks to human health and to the environment posed by landfilling of hazardous wastes" (CCME, 1991; p. 1). Other CCME guidelines on management of hazardous wastes pertain specifically to biomedical wastes **(K)**, incineration **(L)** and physical-biological-chemical treatment **(M)**.

DND indicates that institutional and chemical wastes generated at CFB Goose Bay, including paint, thinner, and perchlorethylene, are disposed of at the landfill's designated hazardous waste area "in accordance with guidelines established by governing agencies" (p. 8D-14). Paint, thinner and perchlorethylene wastes are not suitable for landfill disposal. The 'established guidelines' should be identified and a list of the 'governing agencies' involved in this decision noted. Licenced facilities are available for the proper treatment and disposal of these waste materials.

Similarly, waste oils should not be landfilled (pp. 11-207) or burned with domestic waste (pp. 8-81, 8D-14, table 8D.6), especially in the absence of any chemical analyses which confirms the oil is uncontaminated. Licenced facilities are available for the proper treatment and disposal of waste oils. DND should be aware that an assessment of waste crankcase oils (i.e., used lubricating oils removed from the crankcase of internal combustion engines) is being conducted by Environment Canada and Health Canada to enable a determination of the toxicity of this substance as defined under Section 11(a) of the CEPA **(N)**.

In addition to the above noted examples provided in the EIS, all hazardous waste types disposed of at the landfill by CFB Goose Bay, either in the past or at present, should be identified. It is further suggested that a network of sampling stations be established at variable depths (bedrock and overburden) upgradient and downgradient of the landfill to

facilitate monitoring of leachate migration and analyses of groundwater quality. The monitoring program should include a sampling schedule, provisions for QA/QC and a groundwater remediation action plan.

Site Remediation

As noted in the EIS (Section 12.16), a decommissioning strategy is important to ensuring proper rehabilitation of military training areas. The CCME publication, "National Guidelines for Decommissioning Industrial Sites" **(O)**, should be consulted in the further development of such a strategy.

In general, underground storage tanks should be removed and not abandoned in place unless justification can be provided (p. 12-75). In addition to purging storage tanks and associated piping (p. 12-75), provisions should be made for removal and proper disposal of sludge. Prior to disposal, sufficient openings should be cut in storage tanks to render them unfit for further use. Alternatively, upon approval, underground storage tanks abandoned in place should be completely filled with an inert material, such as sand (p. 12-75).

While DND has affirmed that all contaminated soil would be appropriately treated, this commitment should also be extended to all contaminated groundwater and surface waters (p. 12-75). At present, the CCME "Interim Canadian Environmental Quality Criteria for Contaminated Sites" **(P)** and any current Newfoundland criteria for Total Petroleum Hydrocarbons would be referenced to determine remediation requirements.

In a decommissioning strategy, DND should also commit to closing and rehabilitating all landfills or disposal areas in a manner consistent with current standards (p. 12-75).

References - Hazardous Materials Management at CFB Goose Bay

A. Environment Canada. "A Catalogue of Crude Oil and Oil Product Properties". Environmental Protection. Unpublished 1992 edition.

B. Miller, G. (1982) "Ecotoxicology of Petroleum Hydrocarbons in the Marine Environment" Journal of Applied Toxicology 2: 88-98.

C. Ganadian Council of Ministers of the Environment - CCME. "Environmental Code of Practice for Aboveground Storage Tank Systems Containing Petroleum Products". (A 1993 draft is currently available. The Code of Practice is scheduled for 1994 publication).

D. CCME (1993) "Environmental Code of Practice for Underground Storage Tank Systems Containing Petroleum Products and Allied Petroleum Products". CCME EPC-LST-61 (The 1993 edition replaces the 1988 edition).

Environment Canada. "Environmental Code of Practice for Underground Storage Tank Systems Containing Petroleum Products and Allied Petroleum Products". CEPA, Part I. March 1993.

E. National Fire Code of Canada

F. Environment Canada. "Technical Guidelines for Underground Storage Tank Systems Containing Petroleum Products and Allied Petroleum Products". CEPA, Section 53. Part IV. (Draft 3.6T).

G. Environment Canada. "Guidelines for the Registration of Underground Storage Tank Systems Containing Petroleum Products and Allied Petroleum Products". CEPA, Section 53. Part IV. (Draft 3.6R).

H. Environment Canada. "Storage of PCB Material Regulations". CEPA, Part II. Registration SOR/92-507, 27 August 1992.

I. Environment Canada. "Regulations Respecting the Federal Management of Hazardous Wastes". CEPA. Part IV. (Draft #4, 16 February 1990).

J. CCME (1991) "National Guidelines for the Landfilling of Hazardous Wastes". CCME-WM/TRE-028.

K. CCME (1992) "Guidelines for the Management of Biomedical Waste in Canada". CCME-EPC-WM-42.

L. CCME (1992) "National Guidelines for Hazardous Waste Incineration Facilities: Design and Operating Criteria".

M. CCME (1989) "National Guidelines on Physical-Chemical-Biological Treatment of Hazardous Waste". CCME-TRE-27.

N. Environment Canada and Health Canada (1994) "Waste Crankcase Oils". Priority Substances List Assessment Report. CEPA.

O. CCME (1991) "National Guidelines for Decommissioning Industrial Sites". CCME-TS/WM-TRE013.

P. CCME (1991) "CCME Interim Canadian Environmental Quality Criteria for Contaminated Sites". CCME EPC-CS34.

NON-HAZARDOUS SOLID WASTE MANAGEMENT AT CFB GOOSE BAY

It is suggested that all non-hazardous solid wastes generated at CFB Goose Bay (e.g., p. 8D-14) be managed in accordance with environmentally acceptable practices described in the unpublished report, "Sanitary Landfilling Guidelines for Federal Agencies" **(A)**. These guidelines recommend that uncontrolled open burning of wastes not be conducted at landfills so as "to prevent negative impacts associated with ...air emissions, risk to the environment, and hazards associated with any fire close to the fill area" (R. Cave and Associates Ltd., p. 24).

Opportunities for minimizing solid wastes should be identified. Provisions for proper disposal of all solid wastes, including construction and demolition debris, should be described and included in a revised Environmental Action Plan (p. 12-81).

References - Non-Hazardous Solid Waste Management at CFB Goose Bay

A. R. Cave and Associates Ltd. "Sanitary Landfilling Guidelines for Federal Agencies". Oakville, Ontario. (1988 unpublished report).

WASTEWATER MANAGEMENT AT CFB GOOSE BAY

Assumptions and Predictions

Untreated wastewater is currently discharged into the Churchill River (pp. 5-114, 8-81, 8D-13) with overflows and stormwater also entering Terrington Basin (p. 8D-13). It is implied that an increase in wastewater volumes associated with the proposed expansion of military training activities will only be related to an increase in Base and Town populations (table 11.30, pp. 11-204, 205). However, it should be recognized in the EIS, as noted in the 1993 Goose Bay Environmental Action Plan, that wastewaters include not only domestic sewage, but also stormwater from Base property and effluents from the battery shop, photo sections, maintenance shops, oil/water separators, and stationary plants. Process wastewater volumes, associated with local businesses and industries identified in the EIS (Annex B), may also increase with an expansion of military flight training activities.

Impact predictions related to the socio-economic implications of wastewater discharge appear to be largely premised on the adequacy of existing facilities, on the acceptability of current practices and on compliance with existing federal and provincial regulations (Sections 10.5.2, 11.5.3.5.4). On this basis, wastewater discharge would seem to warrant a moderate impact rating which is defined in part as "exceeding objective standards ... and requiring some form of remediation and mitigative action" (p. 10-28). While a moderate impact rating is confirmed in the summary matrices presented in table 11.30, the scope of the socio-economic assessment appears to be narrowed when DND subsequently asserts that "the increase in sewage volume generated by the project will have a minor impact on the existing sewage collection system" (p. 11-205). This apparent discrepancy should be clarified.

In terms of socio-economic effects, the assessment does not recognize the adverse effects the discharge of wastewater has had on recreational opportunities and attendant implications for tourism and community goals. As noted in our review of the 1989 EIS, the Newfoundland Department of Environment and Lands has affirmed that concentrations of fecal coliforms in the Churchill River near Happy Valley-Goose Bay exceed water quality guidelines for recreational waters. DND recognizes this impact in the 1993 Goose Bay Environmental Action Plan.

Impact predictions related to the biophysical implications of wastewater discharge are largely premised on the effects of reduced dissolved oxygen concentrations on salmonids (pp. 11-125, A11-5, A11-6). In terms of domestic sewage, this interaction is an important indicator of impacts on aquatic life. However, as previously indicated, it should also be acknowledged that other wastewaters with different physical-chemical characteristics and toxicities are also discharged via the storm and sanitary sewer systems. It is understood from the 1993 Environmental Action Plan, that these wastewater streams are currently being monitored. The Canadian Council of Ministers of the Environment (CCME) "Canadian Water Quality Guidelines" **(A)**, and the existing quality of receiving waters upstream and downstream of

CFB Goose Bay, should provide a suitable context for assessing the magnitude and importance of impacts attributable to wastewater discharge.

Mitigative Measures

Provisions for collection, treatment and monitoring of all wastewater streams from CFB Goose Bay should be identified. The assertion that "an upgrade of the sewage system is currently in progress" (p. A11-5) may be somewhat premature. It is understood that a feasibility study examining alternative collection and treatment options has been prepared (pp. 8D-13, 11-205, 12-64). At a minimum, DND should commit to compliance with the "Guidelines for Effluent Quality and Wastewater Treatment at Federal Establishments" **(B)** and Environment Canada should be acknowledged as a stakeholder in this issue (table 11.30, p. 11-204) as in the case of hazardous materials management (table 11.30, p. 11-206).

The "Guidelines for Effluent Quality and Wastewater Treatment at Federal Establishments" provide direction on the degree of treatment necessary to help ensure effluents from federal facilities are "free from materials and heat in quantities, concentrations or combinations which are toxic or harmful to human, animal, waterfowl or aquatic life" before discharge to receiving waters (Environment Canada, 1976; p. 2) **(B)**. Based on these guidelines, Environment Canada generally recommends installation of a system which offers secondary treatment - defined as a system capable of at least 85% removal of suspended solids and 5-day biological oxygen demand (BOD) - with disinfection. Proper maintenance and operation of such a system will be critical to its effectiveness in this regard. Ozonation or ultraviolet radiation should be considered as preferable technologies for disinfection. Alternatively, if wastewater is chlorinated for disinfection purposes, provisions should be made for dechlorination. DND should be aware that chlorinated wastewater effluents have been deemed toxic as defined under Section 11(a) of the CEPA, and regulatory controls or guidelines may be promulgated in the future **(C)**.

The "Guidelines for Effluent Quality and Wastewater Treatment at Federal Establishments" further specify minimum standards for suspended solids (25 mg/L), 5-day BOD (20 mg/L), phenols (20 ug/L), fecal coliforms (400 per 100 ml), residual chlorine (0.5 mg/L), oils and grease (15 mg/L), phosphorus (1.0 mg/L) and pH (6-9 units) which should be achieved without dilution. With respect to aircraft de-icing and anti-icing activities at federal airports, the "Glycol Guidelines", published by Environment Canada under Part IV of CEPA, recommend that glycol within discharges to receiving waters be limited to 100 mg/L **(D)**.

Even a modest expansion of Base activities will exacerbate existing impacts associated with discharge of wastewater, and accordingly, a timetable for achieving an acceptable level of treatment as specified by the applicable federal guidelines should be outlined. As an integral component of any strategy to reduce impacts associated with wastewater discharge, DND should consider measures that will minimize or eliminate the potential for hazardous substances to be released to receiving waters via the storm and sanitary sewer systems. Hazardous materials and substances can be substituted with less harmful products, or

alternatively, contained at source for treatment, reuse or disposal. For example, devices are available for the collection, retention and reuse of glycol. In addition, efficiencies realized through new or retrofitted equipment and improved operating practices may reduce the quantities of hazardous materials used at the Base.

Monitoring

Over the past two decades, Environment Canada has monitored water quality on the Churchill River upstream from CFB Goose Bay. Under the current Canada-Newfoundland Water Quality Monitoring Agreement, water from Churchill River at Muskrat Falls is sampled quarterly and analyzed for a range of physical and chemical parameters (E). Data for the Churchill River are available in previously referenced published reports and through the National Water Quality Database (NAQUADAT) administered by Environment Canada. These water quality data should help define background conditions.

Based on information within the 1993 Environmental Action Plan, it is understood that DND is currently monitoring receiving waters in the vicinity of wastewater outfalls. An environmental effects monitoring (EEM) program should be designed to help verify impacts associated with the discharge of wastewaters and the effectiveness of any mitigative measures implemented. Ongoing federal and provincial monitoring efforts on the Churchill River should be considered in the design of such a program. Monitoring results should be provided to Environment Canada for review. DND should be prepared to implement additional abatement measures to ensure acceptable ambient water quality, as defined by the CCME "Canadian Water Quality Guidelines" and background conditions, is maintained in the lower Churchill River and Terrington Basin.

References - Wastewater Management at CFB Goose Bay

A. Canadian Council of Ministers of the Environment - CCME (1987, updates to March 1994) "Canadian Water Quality Guidelines".

B. Environment Canada (1977) "Guidelines for Effluent Quality and Wastewater Treatment at Federal Establishments". EPS-1-EC-76-1. Environmental Protection. Ottawa.

C. Environment Canada and Health and Welfare Canada (1993) "Chlorinated Wastewater Effluents". Priority Substances List Assessment Report. Canadian Environmental Protection Act (CEPA).

D. Environment Canada. "Glycol Guidelines". CEPA, Part IV. Order in Council. 5 February 1994.

E. Environment Canada (1991) "Canada-Newfoundland Water Quality Agreement". IWD-AR-WQB-171-91. Inland Waters Directorate. Moncton, N.B.

CUMULATIVE EFFECTS

Ambient Air Quality - Central Labrador

Aircraft emissions contribute to existing concentrations of NO_2 in ambient air within the vicinity of Happy Valley-Goose Bay. Modelling results based on 1987 flight data, suggest that NO_2 concentrations at the CFB Goose Bay airport are elevated. Assuming a maximum number of flights under the revised MMOU, DND predicts that NO_2 concentrations at the airport (control tower, runway), and near the airport (Spruce Park elementary school), will exceed acceptable ambient air quality objectives. The frequency of predicted exceedances; however, has not been identified.

The predicted increase in NO_2 concentrations within ambient air, and potential exceedances of acceptable air quality objectives in the Happy Valley-Goose Bay region, suggest that other sources of this pollutant be investigated in an assessment of cumulative effects. Emissions from the gas turbine generator at the Happy Valley substation (p. 8D-8), oil-fired generators (p. 8D-8) and boilers (Environmental Action Plan) at CFB Goose Bay, and open burning at the landfill (e.g., 8D-14) should be included in a consideration of local sources of NO_2 which contribute to the degradation of regional ambient air quality. Sources other than military aircraft could be targeted in an abatement strategy designed to ensure that acceptable ambient air quality objectives **(A)** are maintained within the region.

The predicted increase in unburned hydrocarbon concentrations within ambient air may also warrant further attention in an assessment of cumulative effects. However, in the absence of ambient air quality objectives for this parameter, the importance of measured background concentrations and predicted increments is uncertain. Standards from other jurisdictions should be referenced in an evaluation of this potential concern.

'Freshwater' (Estuarine) Ecosystems - Hamilton Inlet

A range of activities directly and indirectly associated with military flight training have the potential to influence water quality within the study area. Unfortunately, impacts on freshwater ecosystems are unevenly presented and interpreted throughout the EIS, and it is difficult to ascertain how the impact ratings identified for this valued ecosystem component are derived. The scope of the assessment appears to alternately narrow and broaden depending on the nature of the interaction (e.g. hypotheses 10, 11, 13, 14), type of effect under consideration (e.g., impacts without mitigation, residual impacts, cumulative impacts) and the geographical scope of those effects (e.g. flight training areas, vicinity of CFB Goose Bay). The Hamilton Inlet estuarine system (Churchill River-Terrington Basin-Lake Melville-Groswater Bay), which is described by Environment Canada in the document, "Profile of Important Estuaries in Atlantic Canada" **(B)**, is the focus of a diverse range of project-related activities. Based on information presented within the EIS, Hamilton Inlet is presently

affected or threatened by: untreated wastewater (domestic sewage, stormwater, process effluents), accidental releases of fuel from tankers, chronic oil releases associated with vessel traffic, accidental and chronic releases of fuel from storage and handling facilities, accidental releases of hazardous materials, leachate from abandoned and existing landfills, aircraft fuel dumping, and deposition of pollutants emitted by aircraft exhaust.

It is hypothesized by DND that accidental fuel spills and sewage discharges directly associated with military activities at CFB Goose Bay will result in a moderate impact on freshwater ecosystems (hypothesis 11). With implementation of mitigation measures, DND suggests that residual impacts (pp. 13.15, 13.31) and cumulative effects (pp. 14. 26 - 14.28) on freshwater systems will be minor. The justification for a minor impact rating appears to be principally based on completion of the ongoing fuel storage tank upgrading program as there are no firm commitments to construct and operate a wastewater treatment facility under an established timetable, to take responsibility for the safe delivery of fuel to CFB Goose Bay, or to provide a facility for receipt of shipboard oil wastes. In addition, provisions for managing hazardous wastes remain a concern. The cumulative effect of military flight training on water quality within Hamilton Inlet, especially the Churchill River-Terrington Basin-Lake Melville system, should be evaluated in a broader context that recognizes the full range of activities impacting these receiving waters.

An effects monitoring (EEM) program should be developed to reflect the concern for potential cumulative impacts on Hamilton Inlet. In addition, DND should be prepared to implement additional abatement measures to ensure acceptable ambient water quality, as defined by the CCME "Canadian Water Quality Guidelines" **(C)** and background conditions, is maintained in this estuarine system.

Other Issues

'Perceived Environmental Quality' of Labrador and Quebec

The proposed use of abandoned iron ore mines in the Schefferville area for disposal of wastes p. 14-19) could potentially impact groundwater and surface water systems in the study area (Section 14.6.2.2). However, there is a more general concern that the proposals could have an impact on the 'perceived environmental quality' of Labrador and Quebec with the attendant implications for tourism, and in particular, ecotourism opportunities (Section 14.6.2.5). It should also be recognized that the Schefferville projects and military flight training activities have common stakeholders among native groups.

Resource Use

Under the provincial environmental assessment process, the Newfoundland Department of Forestry recently registered its intention to allow harvesting of 450,000 m^3 of timber in District 20 (Sandwich Bay) over a five year period. Although District 20 is located

southeast of the project area, the proposal does indicate a renewed interest in logging in Labrador (p. 14-11).

Global Warming

The relative contribution of the project to global warming (p. 14.35) can be readily and more clearly defined by comparing project related emissions with existing provincial and national greenhouse gas emissions. Existing emissions are identified in the Environment Canada publication, "Canada's Greenhouse Gas Emissions: Estimates for 1990" **(D)**.

References - Cumulative Effects

A. Environment Canada (1989) "National Ambient Air Quality Objectives for Air Contaminants". Canadian Environmental Protection Act, Part I.

B. Environment Canada (1987, updated 1989 and 1991) "A Profile of Important Estuaries in Atlantic Canada". Environmental Protection. Dartmouth, N.S.

C. Canadian Council of Ministers of the Environment - CCME (1987, updates to March 1994) "Canadian Water Quality Guidelines".

D. Environment Canada (1990) "Canada's Greenhouse Gas Emissions: Estimates for 1990". EPS 5/AP/4. Environmental Protection. Ottawa.

Appendix I

ENVIRONMENT CANADA MANDATE

Environment Canada is responsible for administering the Canadian Environmental Protection Act - CEPA (e.g., environmental quality objectives, guidelines, and codes of practice - Part I; toxic substances management - Part II; nutrients - Part III; environmental protection at federal facilities - Part IV; international air pollution - Part V; ocean disposal - Part VI) and Section 36 of the Fisheries Act which prohibits the deposit of a deleterious substance (e.g. hazardous materials and substances, effluents) into waters frequented by fish. Under the Migratory Birds Convention Act ("Migratory Bird Regulations", "Migratory Bird Sanctuary Regulations"), Environment Canada is responsible for the conservation and protection of migratory birds and associated habitats. Environment Canada manages National Wildlife Areas ("Wildlife Area Regulations") and provides information related to endangered species pursuant to the Canada Wildlife Act. Through application of the Canada Water Act, Department of Environment Act and other relevant legislation, Environment Canada also has a mandated responsibility to provide information on climatology, air quality, surface hydrology and hydrogeology.

Appendix II

ENVIRONMENT CANADA TECHNICAL REVIEW COMMITTEE

Atlantic Region

Atmospheric Environment Branch

B. Beattie
L. Ketch

Corporate Affairs Branch

J. MacLellan

Environmental Protection Branch

M. Dober, Atlantic
B. Jeffrey
B. Moores

C. MacLean, Newfoundland
G. Pelly
K. Penney

Environmental Conservation Branch

D. Ambler
M. Bateman
B. Johnson
D. Randall
A. Smith

Quebec Region

D. Bordage
J. Charette
H. Marcotte