

ARCTIC CONTAMINANTS PROJECT SYNOPSIS

1. TITLE: Contaminant Pathway Modelling of Chlorinated and Non-chlorinated Hydrocarbons in the Mackenzie River and Beaufort Sea Shelf.
2. PRINCIPAL INVESTIGATORS: M.B. Yunker, M.C. Hamilton and D.J. Thomas.
3. OBJECTIVES: To use comprehensive contaminant database generated by the IOS/NOGAP studies to build a model of the natural geochemical pathways of chlorinated and non-chlorinated hydrocarbons on the Beaufort Sea Shelf.
4. CONTRACTOR: Seakem Oceanography Ltd.
5. DESCRIPTION/ACTIVITIES/RESULTS:

The basic concept central to this work is that by using the extensive sample suite of alkane and PAH hydrocarbons and geochemical biomarkers available without further (and expensive) field expeditions, one can delineate the major inputs and transport of contaminants on the Beaufort Sea Shelf and tie this into source/distribution/sink modelling. Once a model is developed for these parameters, it can be applied to other contaminants that behave geochemically in a similar manner in the marine environment, specifically chlorinated and non-chlorinated industrial organic chemicals. Information will also be provided on the flux and budget of each parameter in the Beaufort Sea and the accumulation, transport and sedimentation of natural and anthropogenic contaminants via the marine planktonic community. This is a unique new approach to the problem of contaminant dispersion because it gives simultaneous information on the behaviour of the ecosystems being studied.

The environmental and geochemical parameters employed in the modelling include HCH, PCBs, HCB, DDTs, cyclodienes, toxaphenes, dioxins/furans, alkanes, PAH and alkylated derivatives, hopanes and alcohols/alkenes steroids. The 1987 Beaufort Sea data set of atmospheric samples and

Mackenzie River/Beaufort Sea samples of filtered and sedimented particulates, sediments, peat, ice algae, zooplankton and in situ extractions of water form the primary data sources for the study. In addition, organochlorine data from samples of marine mammals from the Beaufort Shelf area are also being used in the model.

The study is on-going. Data have been produced for all samples. Data analysis/modelling is continuing.

The result of the study will be a large verified multi-variate data set. Summary statistics include the mean, standard deviation, range, maximum, minimum, etc., will be prepared for each variable in each class of sample. Data will also be plotted to check for trends and to look for outliers. These procedures will serve the dual purpose of summarizing data for interpretation and publication and highlighting any suspect or invalid data.

To aid in the analysis and interpretation, chlorinated and non-chlorinated hydrocarbon data for the suspended particulates will be merged with the physical data for concurrent water samples. This will include data on depth, salinity, temperature, nutrients, dissolved oxygen, chlorophyll, etc., and possibly on productivity.

Data will be analyzed using Cluster analysis, principal component analysis and partial least squares path modelling. The expected result is that models for the chemical signature of each chlorinated and non-chlorinated hydrocarbon source (Mackenzie River, atmosphere, peat, zooplankton, etc.) will be developed. The contribution of each source to individual Beaufort Sea locations and samples will also be modelled. When all this information is interpreted in terms of the seasonality and productivity of the Beaufort Sea Shelf, the importance of each source to the hydrocarbon geochemistry will be assessed and related to the pathways for the dispersal of contaminants. Ultimately a mass balance for contaminants on the Beaufort Shelf will be possible.

6. EXPECTED PROJECT COMPLETION DATE

September 1991