

Danish AMAP-projects 2002 and 2003

Report prepared for the joint AMAP-CAFF meeting in Oslo 14-16 April 2004

By the Danish Environmental Protection Agency

Climate Change and Environmental Assistance

Prepared by: Morten Skovgaard Olsen

New projects initiated in 2002

Project title Continuation of BioBasis monitoring at Zackenberg, Northeastgreenland, 1. April 2003 – 31. March 2004

Objective and activities: The project is a continuation of one of the sub-programmes for the collective long-term monitoring at Zackenberg (the ZERO-programme, which was initiated in 1994. The ZERO-programme serves as a reference for other research in the Arctic under the AMAP-programme as well as for other programmes and research.

DANCEA contribution 1.255.780,- dkk.

Project holder NERI, Department of Arctic Environment

Project title Co-ordination of environmental monitoring at Zackenberg

Objective and Activities: To continue measurements in relation to GeoBasis and MarineBasis and to perform pilot investigations for glaciological monitoring at Zackenberg in 2002. The project has carried out investigations in relation to the terrestrial monitoring of physical landscape processes, the marine biological monitoring, the snow monitoring and the glacier monitoring at Zackenberg in 2002. In general the project has been carried out as planned. The few smaller corrections of the project were all related to changes not influenced by the project participants, and the changes does not change the overall succes of the project.

DANCEA contribution 751.053,- dkk

Project holder Danish Polar Centre

Project title “New” and existing contaminants in the Greenlandic environment: Long term trends in presence and effects in Birds of Prey eggs

Objective and Activities Brominated flame retardants are subject for increasing attention in relation to the environmental contamination. Recently also an unexpectedly high contamination level of other types of brominated substance than PBDE, were observed to bioaccumulate in the food chain showing a high level of contamination in Swedish peregrine falcon eggs. The primary scope of the project is to investigate the long-term time trend of brominated flame retardants for the contamination and possible effects in relation to the contamination of peregrine falcon eggs. The contamination by the conventional POP compounds will also be identified. Totally 36 out of 53 collected eggs will be analysed. Time trend analysis will be performed based on a multi-variant methodology for a period of 18 years. The result will contribute to the assessment of organic pollutant contamination in Greenland including the effect on vulnerable wild life. One report and at least one article in a scientific journal will be published. One popular article for the local administration in Greenland will also be prepared.

DANCEA contribution 801.827,- dkk

Project holder NERI

Project title Fate of atmospheric mercury in the Arctic (FAMA)

Objective and Activities The aim of this project is to measure directly the amount of mercury deposited from the atmosphere to the snow surface in Arctic during mercury depletion episodes (MDE) observed yearly during the Arctic Spring. The atmospheric processes studied here are fundamental for the development of reliable hemispheric models

e.g. the Danish Eulerian Hemispheric Model (DEHM) and the study will for the first time directly try to link the concentration of atmospheric pollutant and its availability in the snow. Furthermore the results of the project will be used to evaluate the present AMAP atmospheric monitoring programme for mercury so that the present monitoring programme can be optimised.

DANCEA contribution

350.000,- dkk

Project holder

NERI, Department of Atmospheric Environment

Project title Screening of "new" contaminants in the marine environment of Greenland and the Faroe Islands.

Objective and Activities In addition to the persistent organic pollutants (POPs) analysed in former monitoring projects, other compounds of concern have been identified by the international community (e.g. OSPAR, AMAP), and analytical methods have been developed. These compounds include brominated flame retardants (BFRs), phthalates, polychlorinated naphthalenes (PCNs), perfluorooctane sulfonate (PFOS) and synthetic musk compounds. The aim of this project is to screen the marine environment of East and West Greenland and the Faroe Islands for these compounds. The analyses will be based on existing samples of pilot whale and fulmars from the Faroe Islands as well as marine sediments, shorthorn sculpins, ringed seals, minke whales from West Greenland and shorthorn sculpins, ringed seals and polar bears from East Greenland. As several trophic levels of the marine Arctic food chain are taken into account, the project will also result in information on the bioaccumulation of these compounds. The results will be published in a technical report.

DANCEA contribution

899.650,- dkk

Project holder

NERI, Department of Environmental Chemistry and

Microbiology

Project title Effects of POPs in Polar Bears in the Greenland Sea.

Objective and Activities Very high POP levels have been found in polar bears from East Greenland and Svalbard. POPs are suspected to cause pseudohermaphroditism in female polar bears from these regions. Furthermore, studies in Svalbard have indicated that high POP levels affects immune defence reactions of polar bears.

In 1999 NERI and the Greenland Institute of Natural Resources initiated a study of the biological effects of POPs in polar bears from East Greenland. The objective is to study, if the high POP levels affect cells and tissues. Old and recent polar bear crania are also studied to evaluate possible POP related changes.

From 1999 to 2001 tissue samples were collected from 100 hunted polar bears in East Greenland. These samples will be examined for possible tissue damage and effects will be related to the POP level in each bear.

DANCEA contribution

765.000,- dkk

Project holder

NERI, Department of Environmental Chemistry and

Microbiology

Project title The Women from Disko Bay

Objective and Activities Pollution from the world's heavy industries is responsible for women in the Disko Bay area in Northwest Greenland having some of the highest levels of contaminants recorded in humans. PCB and mercury are absorbed into the food chain and

these women are the final link in the chain as they eat mammals. Nevertheless, there are no signs of children affected by the high levels of contaminants. The documentary will tell this story and report on the latest research on why apparently the women and children of the Disko Bay area do not suffer from illnesses caused by PCB and mercury. The film is a follow-up of the film "The Arctic Dilemma" and will be made in order to strengthen the dissemination of the knowledge of this problem via TV-stations worldwide.

DANCEA contribution 300.000,- dkk

Project holder LOKE films

Project title AMAP International TV-nyhedsfilm

Objective and Activities At the 16th AMAP Working Group Meeting in Torshavn, Faroe Island, April 30 - May 3, 2002 Executive Secretary Lars-Otto Reiersen reported to the meeting about an activity that had been initiated by Denmark earlier in the year to see if there was any interest in jointly producing and funding a film/video to communicate the AMAP phase 2 results. Two companies had responded with letters expressing their interest in producing such a film/video. The Secretariat had subsequently circulated information about this initiative to some SAOs to hear their reactions to this proposal.

The response in general had been "positive with reservations". In the meeting, both Denmark and USA indicated their interest in co-sponsoring a short video/film production (10-15 min.). Denmark informed that they were currently considering production of an updated version of "The Arctic Dilemma" video that had been prepared in 1998 to communicate AMAP phase 1 results in Greenland. Other countries were invited to join as co-sponsors in this activity.

DANCEA contribution 243.400,- dkk

Project holder the AMAP Secretariat

Project title Does eating of birds killed with lead shot pose a health risk?

Objective and Activities The objective of the project is to determine whether human beings eating large quantities of bird, consume so much lead that it poses a health risk. The project is based on two groups of humans (25 individuals in each group) one which consumes large quantities of birds and one which does not. The lead concentration in the blood of each individual is measured before, during and after the winter hunting season. Cost interviews are conducted in connection to the measurements; focusing on the amount and species of birds consumed. Each individual registers each bird meal. The blood samples are analysed for lead, fatty acid and cotinin (marker for smoking) and results of the analyses are examined against choice of food and limit values.

DANCEA contribution 475.000,- dkk

Project holder NERI, Department of Arctic Environment

Project title Fate of mercury in the Arctic; Subproject: The processes controlling the fate of Atmospheric mercury in Arctic - equipment supply

Objective and Activities This project includes partly financing of equipment for fractioning of mercury. The equipment is included in the subproject "The processes controlling the fate of Atmospheric mercury in Arctic".

The project is part of a bigger package "Fate of mercury in the Arctic" including 3 subprojects dealing with mercury which will be approved by DEPA, beginning of 2003.

The fraction equipment is co-financed by SNF with DKK 248.000 with the condition of

allocation of the financing in 2002. Therefore, DEPA has decided to approve the application of equipment in 2002.

DANCEA contribution 215.000,- dkk

Project holder NERI, Department of Atmospheric Environment

Project title Production of a Danish and a Greenlandic edition of the AMAP report "Arctic Pollution 2002".

Objective and Activities: Production costs

DANCEA contribution 306.000,- dkk

Project holder the AMAP Secretariat

Project title AMAP, Status of modelling 2002

Objective and Activities The purpose of the project is to make a description of the status of the models, official and unofficial international commitments, outstanding with AMAP, applications of the model system in national and international connections. Furthermore the purpose of the project is to maintain and apply a system of basic meteorological models for calculation of transport and deposition of air pollutants in the Arctic and in Greenland in particular. It is further the purpose to develop the Mercury model further towards a scenario model.

DANCEA contribution 500.000,- dkk **Dato 2002**

Project holder NERI, Department of Atmospheric Environment

Project title Nuuk station: Monitoring of atmospheric pollution in West Greenland.

Objective and Activities There is strong belief that long range transport of atmospheric pollution to Westgreenland and possibly from Canada and the USA is the main reason for abnormally high levels of heavy metals and organic contaminants found in tissue- and blood samples from the population in the area as well as in the marine food-web. It is presumed that the pollution enters into the food-web via atmospheric deposition on the sea. The monitoring station at Nuuk situated on the mountain "Lille Malene" 340 m above sea level, is used for monitoring of long range atmospheric transport to the south-western part of Greenland. The results of the monitoring are used for determination of the level of pollution in the air and the fluctuation over the year in this populated part of Greenland. The results are used for identification and quantification of the sources which has the most impact on the air pollution and deposition in the area. Areas of Sources and atmospheric routes of transport are mapped using model-calculations. The approach used is expected to lead to an understanding of the origin of the air pollution its sources, routes of transport, and the extend of deposition.

DANCEA contribution 1.289.000,- dkk

Project holder NERI, Department of Atmospheric Environment

Project title Epidemiological assessment of the linking between contaminant load, life-style factors, effect markers and health effects in Greenland.

Objective and Activities The objective of the project is to establish a coherent and permanent monitoring system in Greenland for surveillance of contaminant load on human being and the health effects of the load.

The project consist of 3 co-ordinated activities:

1) The monitoring is based on established cohorts consisting of 50 females and 50 males randomly selected in three geographically different districts, which are examined every 4 years according to the AMAP core programme. In connection to the monitoring the content of contaminants in 50 double meal portions from the seventies is examined and compared to contemporary samples.

2) Bio-marker study, which on a molecular basis examines effects on a range of cellular hormone receptors (Oestrogen and androgen and the dioxine receptor AhR) for the same persons as the ones taking part in monitoring activities.

3) Health effects, which on an epidemiological basis examine contaminate related effect on reproduction in a cohort of children. The study provides opportunity for a later study of health effect (for instance late neuro-psycological development and impaired immune response. The project co-ordinates the enviro-medical activities in Greenland as the AMAP related monitoring and assessment programme, the IVAAQ study (cohort of children), and the EU-financed INUENDO-study on fertility.

DANCEA contribution 10.951.000,- dkk

Project holder University of Aarhus, Department of Environmental and Occupational Medicine

Project title Translation of “Arctic Pollution 2002” to Greenlandic

Objective and Activities

DANCEA contribution 200.000,- dkk

Project holder Carl Chr. Olsen

Project title Translation of “Arctic Pollution 2002” to Danish

Objective and Activities

DANCEA contribution 180.000,- dkk

Project holder Flexsprog

Project title Measurements of primary production and CO₂ in Arctic vegetations types by use of spectral analysis

Objective and Activities Pilot project in which monitoring fields are determined and marked. Furthermore leaves from dominating species are collected in order to establish the correlation between leaf-area-index and weight of the leaf from the specie. The purpose is to calibrate NDVI measurements at Zackenberg, making estimates of biomass, vegetation-cover, LAI, Chlorophyll content and CO₂-emissions possible by use of spectral analysis. This will make measurements of primary production possible by use NDVI data collected from hand-held or satellite borne equipment. Furthermore the BioBais programme is supplemented by continuous non-destructive measurements of primary production.

DANCEA contribution 142.800,- dkk

Project holder NERI, Department of Arctic Environment

Project initiated in 2003

Project title Nuuk station: Monitoring of atmospheric pollution in West Greenland.

Objective and Activities The aim of the project is to get a picture of the load of the air born pollution in Westgreenland. The station was supported in 2002 measuring the particularly bounded compounds including heavy metals, nitrate and others. The measurements of 1 year extra is needed in order to find out if the placing of the station is correct. Furthermore, measurements of POP's have been included in the programme based on the experience from the AMAP Symposium in 2002 where it was shown that the load of POPs were increasing.

DANCEA contribution 1.556.000,-dkk

Project holder NERI, Department of Atmospheric Environment

Project title Fate of mercury in the Arctic (FOMA)

Objective and Activities The aim of the project is to upgrade the understanding of the fate of mercury in the Arctic environment. The project consists of 3 sub projects investigating the transport of atmospheric mercury in the environment in the Arctic.

The sub projects will investigate the transport of mercury via 1) the chemical and physical processes controlling the deposition of atmospheric mercury 2) the transposition atmospheric mercury and its entry into carnivores as well as 3) mercury's entry into the marine food chain. The field data from these projects will used in another modelling project simulating the transport of mercury and its processes.

DANCEA contribution 2.786.000,- dkk

Project holder NERI, Department of Atmospheric Environment

Project title Effects of POPs in Arctic Animals – better assessment by use of new methodology: Critical Body Residue

Objective and Activities The aim of the project is to improve the condition for evaluating POP effects in arctic animals. The critical body residue technique (CBR) will be used in the assessment by

- extrapolations from measured effects in animals in the primary part of the food chain to higher trofical levels in the food chain
- extrapolations from measured effects on organisms in the temperated climatic zone to estimated effects on arctic organisms
- evaluation of risks for effects at arctic toppredators by using CBR

DANCEA contribution 602.859,- dkk

Project holder DHI, Water and Environment

Project title Lead Country function for Human Health, AMAP

Objective and Activities The project enables Denmark to meet its commitments to AMAP as co-lead of the international Human Health Working Group.

DANCEA contribution 625.078,- dkk

Project holder University of Aarhus, Department of Environmental and Occupational Medicine

Project title Effects of marine pollution on child development on the Faroe Islands, Phase III

Objective and Activities The project has as its aim to examine children just before the 5 year vaccination in the ordinary vaccination programme, which has been examined in an earlier phase of the project, in order to thoroughly to describe their health status, map their postnatal environmental effects, and to examine the antidote response on the vaccination with tetanus and difteria toxin. Hereby a possibility for assessing the immune response will be given and it will be possible to relate it the exposure at birth, but also with the actual exposure, because the level of PCB, DDT and mercury will be measured in blood samples from the children.

DANCEA contribution 3.147.825,- dkk

Project holder Faeroe Islands Hospital Services

Project title Pilot study of POP-effects in pilot whales at Faeroe Islands.

Objective and Activities Earlier AMAP-studies have revealed that Pilot Whales are in general seriously contaminated by heavy metals. The project will examine effects on the Pilot Whale in terms of response on selected POP bio-markers.

DANCEA contribution 414.000,- dkk

Project holder Heilsufrødiliga Starvsstova

Project title GeoBasis, 2003

Objective and Activities Operation of physical and geomorphologic monitoring at Zackenberg Station. The programme includes CO₂-flux monitoring, snow- and perm-frost monitoring, soil humidity, soil chemistry, hydrology, water flow, and sediment monitoring.

DANCEA contribution 1.500.000,- dkk

Project holder NERI, Department of Arctic Environment

Project title Glaciological surveillance of the Greenland Inland Ice, monitoring of surface temperature, melting and thinning.

Objective and Activities The project establishes an efficient and economical monitoring system for collection on ice melt and relates the measurement with surface temperature and ice movement.

DANCEA contribution 1.657.344,- dkk

Project holder Geological Survey of Greenland and Denmark (GEUS)

Project title MarineBasis, 2003

Objective and Activities The project aims to establish long stable series of measurements of key parameters, which will make it possible to clarify how marine plants and animals distribution, composition and production are affected by on-going climate changes in the

Arctic area. The project will contribute to an increased understanding of the interdependence between physical parameters such as snow and marine ice conditions, salinity, temperature- and water currents, and biological conditions such as primary production, grassing, decomposition, food chain structure and composition of species. A detailed understanding for the regulation of the lower links in the food chain is a prerequisite for predicting climate related changes in the food basis for benthic organisms, fish, and for larger mammals such as walrosses and seals.

DANCEA contribution 2.039.000 dkk

Project holder NERI, Department of Marine Environment

Project title Carbon uptake in the Greenland Sea

Objective and Activities The objective is to determine the marine carbon uptake in the Greenland Sea based on existing measurements of the partial pressure of CO₂ in the atmosphere and in the surface of the sea combined with measurements of the resulting turnover and transport of carbon in the water column. Measurements in the Greenland Sea have shown that there are large variations in spatial volume and time of CO₂ concentrations in the sea, and that these variations correlate with the amount of Chlorophyll in the surface layer. An improved description of the exchange of carbon from the sea surface and the subsequent transport and biological turnover in the upper part of the water column will give a better basis for determining the marine uptake of carbon in global scale.

DANCEA contribution 1.373.600 dkk

Project holder Research Centre Risø

Project title Effect of POPs in Sledge Dog and Polar Bear (POESI)

Objective and Activities The project aims at solving unclarified questions, which have been raised in connection with the international AMAP work with POPs and their potential toxic effects on higher trophic levels in the Arctic marine food chains. Especially there has been focussed on polar bears in East Greenland and Svalbard and lately also in the Kara Sea, because bears in these areas have the highest levels of POPs in the Arctic. The potential effects shown in polar bears and which are thought to be due to high POP levels, is an impact of the immune defense system, hormone balance and reproduction, and possibly also higher mortality.

DANCEA contribution 2.464.500,- dkk

Project holder NERI, Department of Arctic Ecology

Project title Review of ACIA Scientific report

Objective and Activities The project has as its aim to see to that Danish experts participate in the scientific review of the scientific report, which has been prepared as part of the ACIA process.

DANCEA contribution 100.060,- dkk

Project holder NERI, Department of Atmospheric Environment

Project title Local Greenlandic sources' contribution to pollution with slow degrading pollutant

Objective and Activities The project aims at estimating load of local pollution from emissions and discharges of the heavy degradable pollutants, such as dioxins (dioxins and furans), PCB, PAH, PBDE and of the heavy metals mercury, cadmium and lead, and establish more knowledge of the turnover of the pollutants in Greenland, and point at solutions for reducing the emissions and discharges. The project will be executed in accordance with the principles applied for mass stream analyses by the Danish EPA. As a point of departure the results of similar projects in Denmark will be used to make estimates for Greenland by combining the existing knowledge with information about the factual activities in Greenland. For this purpose, statistical data and other information about the turnover of relevant products in Greenland will be collected, as well as all available data concerning discharges, amounts of waste and deposition of the substances.

DANCEA contribution 972.090,- dkk.

Project holder COWI

Project title Digital topographic model for Zackenberg

Objective and Activities The project will establish a digital topographic model of the Area close to Zackenberg station and associated water-sheds.

DANCEA contribution 70.000,- dkk

Project holder Danish Polar Centre

Project title Zackenberg Workshop spring 2004

Objective and Activities The workshop marks the kick-off of the celebration of Zackenberg station's 10 year anniversary and the joint report of results from the stations, scheduled for 2006.

DANCEA contribution 110.000,- dkk

Project holder Danish Polar Centre

Project title Support to AMAP Thematic Data Centre.

Objective and Activities Support to the establishment of a Thematic data Centre

DANCEA contribution 150.000,- dkk.

Project holder the AMAP Secretariat
