ARCTIC MONITORING AND ASSESSMENT PROGRAMME

External Documentation

Guidelines for the AMAP Phase 2 Assessments

AMAP Report 2001:1

Preface

In 1997, AMAP presented its first *State of the Arctic Environment Report*. This assessment was conducted according to an agreed set of guidelines (Guidelines for the AMAP Assessment, AMAP Report 95:1).

AMAP's second phase (1998-2003) aims to produce a series of assessments between 2002 and 2004 that will update and expand upon the information presented in its 1997 assessment. As a part of this activity, a revised set of assessment guidelines has been prepared by the AMAP Working Group as part of its direction to the Assessment Steering Group (ASG) that is responsible for the preparation of the phase 2 assessments.

The first draft of the revised "*Guidelines for the AMAP Phase 2 Assessments*" (Version 1.0) was prepared during 2000 and published as Version 1.1 (AMAP Report 2001:1) in January 2001. It is the intention that these Guidelines be updated and extended as necessary, to incorporate new information arising as work in preparing the assessment reports proceeds. The AMAP Secretariat would appreciate any comments concerning improvement or additions to these guidelines and will distribute revised sections as appropriate.

The Arctic Monitoring and Assessment Programme (AMAP) was established in 1991 under the Arctic Environmental Protection Strategy (AEPS) and is, since 1997, a programme group of the Arctic Council. AMAP is mandated to "*monitor the levels of and assess the effects of anthropogenic pollutants in all compartments of the Arctic Environment and to prepare regular State of the Arctic Environment Reports, summarising the results of AMAP as a basis for necessary steps to be taken to reduce pollution*".

It is the intention that all experts involved in the drafting of the AMAP assessments will follow the recommendations presented in these guidelines, especially regarding quality assurance and data handling procedures and instructions to authors and drafting groups regarding language, document registration and identification, exchange and distribution of assessment texts, units/symbols/abbreviations, statistics, biological data and bibliographical references, etc.

Oslo, JANUARY 2001

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GUIDELINES FOR THE AMAP PHASE 2 ASSESSMENTS

1. Introduction

The Arctic Monitoring and Assessment Programme (AMAP) was established in 1991 as part of the Arctic Environmental Protection Strategy (AEPS) at the First Arctic Ministerial Conference in Rovaniemi, Finland with the task to monitor, on a continuing basis, the levels of, and assess the effects of, anthropogenic pollutants in all components of the Arctic environment including humans. The assessment(s) should be presented through preparation and updating of integrated reports on the state of the Arctic environment, summarising the results of AMAP, in order to initiate further co-operative actions of the participating countries to reduce pollution. The AMAP Assessment Report(s) should:

- include information on status and trends in the condition of Arctic ecosystems;
- identify possible causes for changing conditions;
- detect emerging problems, their possible causes, and the potential risk to Arctic ecosystems, including indigenous peoples and other Arctic residents;
- recommend actions required to reduce risks to Arctic ecosystems.

Under the Arctic Environmental Protection Strategy (AEPS), AMAP was requested to address, as priority issues: persistent organic contaminants (POPs), heavy metals, and radioactivity; and in a subregional context, to acidification and Arctic haze, and oil pollution. Environmental consequences of, and biological effects due to global climate change and stratospheric ozone layer depletion, relevant to the Arctic, should also be addressed.

To prepare its first assessment, AMAP:

- designed and implemented a coordinated monitoring programme to monitor the levels of pollutants and assess the effects of pollution in all compartments of the Arctic environment (the atmospheric, terrestrial, freshwater and marine environments, and human populations);
- instituted an assessment process to produce assessment reports. The assessment was performed according to agreed guidelines and was based on: (i) data already published in scientific literature, (ii) data obtained from AMAP's monitoring programme, and (iii) traditional knowledge.

The first AMAP Assessment Report, presented in 1997, was the main product of AMAP activities for the first stage of its development (1993-1996) and in addition to describing the state of the Arctic environment with special focus on the issues of first priority, also:

- formulated recommendations for actions to the Governments of the Arctic Countries concerning environmental protection policy, and
- recommend strategies for further development of the AMAP Monitoring Programme to eliminate gaps in information needed for a comprehensive assessment of the Arctic environment.

This framework for future AMAP work is reflected in the *AMAP Strategic Plan: 1998-2003* (AMAP Report 99:6).

Under AMAP Phase 2, priority continues to be the environmental pollution issues of first circumpolar priority as identified above. Effects of pollution on the health of humans living in the Arctic, including effects due to increased UV radiation as a result of ozone depletion, and climate change, have been given a special priority within the future work of AMAP. Similarly, combined effects of pollutants and other stressors on both ecosystems and humans shall be addressed.

As previously, the AMAP programme is built, as far as possible, on already existing monitoring and research programmes, either within the Arctic, or in adjacent areas which affect the Arctic, with

harmonisation of these programmes, based on acknowledged methodologies and quality assurance procedures, together with initiation of new programmes to fill gaps in knowledge if necessary. AMAP is initiated in a step-by-step manner and, as an initial priority, is focused on the above listed environmental issues.

AMAP includes the following subprogrammes: atmosphere, terrestrial, freshwater, marine and human health. Within the first four subprogrammes, the levels of contaminants are to be monitored in different compartments, e.g. air, snow, water, soil/sediments and biota. The monitoring also includes analyses of local food sources and dietary habits. The detailed outline of the Phase 2 monitoring programme is given in the *AMAP Trends and Effects Programme: 1998-2003* (AMAP Report 99:7). The Monitoring Programme is continuously updated, both in relation to priorities and methodology, based on AMAP Working Group decisions and recommendations from scientific organizations.

These *Guidelines for the AMAP Phase 2 Assessments* have been prepared by the AMAP Secretariat and approved by the AMAP Working Group at its 14th meeting (in Trondheim, Norway). The guidelines will be further updated as necessary.

2. Definition of the Assessment(s)

Assessment is a compilation of current knowledge about a defined area, an evaluation of this information in relation to agreed criteria of environmental quality, and a statement of the prevailing conditions in the area. It should be stressed from the outset that an assessment utilises accumulated data and information and does not necessarily require any new data to be collected during the assessment process.

An assessment should be regarded by the managers and scientists as a normal part of the environmental protection process at national, regional and other international levels. If assessments are prepared in a systematic and uniform manner, they provide a mechanism for inter-comparisons of regional environmental conditions and for assessing the nature and extent of anthropogenic influences on larger scales (e.g. global).

Comprehensive assessments of regional areas are potentially useful to both managers and scientists in the following ways:

- providing a concise summary of contemporary knowledge and necessary management action;
- enabling the identification of significant gaps in knowledge and, accordingly, providing an authoritative basis for defining priorities for future scientific and other investigations;
- providing a basis for judging the effectiveness and adequacy of environmental protection measures and for making necessary adjustments.

In summary, a regional assessment can be regarded as both a process (i.e., the procedure by which the information is collected and evaluated) undertaken periodically to assess the state of knowledge, and a product (i.e., a document presenting and synthesising information, the findings of the assessment and an action plan for future work).

In the context of the requirements of the Rovaniemi Agreement to the AMAP, the AMAP Assessments are both a process and a product that is intended to accomplish the following:

1) Summarise and analyse the contemporary state of knowledge of the sources, levels, distributions, trends, fate and effects of contaminants and other anthropogenic influences on the environment and human health;
2) Assess the relative magnitude of damage and threats to the environment and human health based on existing information;
3) Recommend actions to reduce assessed damages and threats;
4) Identify deficiencies and gaps in information and data required to improve the reliability of evaluations of such damage and threats that would warrant rectification through further scientific and social studies.

This process of evaluation is based on the acquisition and analyses of all existing sources of information and any data being acquired through national and international surveys, monitoring and research activities that are relevant to the area and focus of the specific assessment being conducted.

Whereas there is no *a priori* agreement for the acquisition of new survey, monitoring and research information, it is not unusual for the organizations concerned (e.g. AMAP) to introduce new programmes of environmental measurements, comprising survey, monitoring and/or research, that are intended to make available additional, more comprehensive, and reliable information for the conduct of a future assessment. Environmental data also provide valuable information for validating models used to assess potential consequences of anthropogenic activities and for parametrizing such models.

3. Strategy for the AMAP Assessment(s)

This overall strategy for the work under AMAP Phase 2 is presented in the *AMAP Strategic Plan: 1998-2003* (AMAP Report 99:6).

The latest version of the tentative schedule for production of M(ain) AMAP assessment reports (i.e. detailed reports on the results obtained by AMAP, in co-operation with other fora, according to the requests of the Ministers, including recommendations for actions) is as follows:

Assessment item	***Year of reporting***			
	Firm		***Tentative***	
	2000	**2002**	**2004**	**2006**
Human Health		M		M
POPs		M		M
Hg and other HMs		M		M
Radioactivity		M		M
Acidification				M
Oil and PAHs			M	
TBT			M	
Climate effects			M	
UV-B effects			M	
Combined effects			M	

The detailed strategy for the preparation of the AMAP Phase 2 assessments is still under development, however, the following approach is envisaged:

3.1 Reports

There will be two types of product:

1) A series of Issue Specific AMAP Assessment Reports (ISAARs).

   These will be fully referenced, comprehensive technical and scientifically presented assessments of all validated data available (from both published and unpublished sources) on the status of the Arctic Environment relative to the AMAP mandate with respect to specified pollution issues. These reports will be analogous to the main chapters of the 1998 *AMAP Assessment Report: Arctic Pollution Issues*.

2) A State of the Arctic Environment Report (SOAER) summarising the results of the ISAARs.

   This will be a report similar in style and format to AMAP's 1997 *Arctic Pollution Issues: A State of the Arctic Environment Report*. It will be intended for an educated general public and will be prefaced by an executive summary with recommendations specifically addressed to Ministers.

3.2 Mode of Preparation

The ISAARs will be prepared according to contents lists initially developed at the Second Assessment Steering Group II (ASG-II) Meeting in Toronto, November 1999.

Procedures for the assessment and the preparation of the ISAARs should be based on those employed in the production of the 1997/1998 AMAP Assessment Report. Under this arrangement,

each ISAAR will be drafted by small groups of experts (Lead Country Experts - LCEs, and Key National Experts - KNEs) who will be able to consult with and call upon other "Designated Experts" in AMAP member countries and organizations as necessary. Their preparation will be coordinated by the AMAP Assessment Steering Group (ASG); cf. section 4.

The countries have undertaken 'Lead Country' responsibilities for the ISAARs as follows:

Issue Specific AAR	Lead Country(s)	Assessment Leader(s) (LCE)	Agency
Persistent Organics	Canada & Sweden	Derek Muir (Canada)	National Water Research Institute
		Cynthia de Wit (Sweden)	University of Stockholm
Heavy Metals	USA	Suzanne Marcy	US-EPA
Radioactivity	Norway & Russia	Per Strand (Norway)	Norwegian Radiation Protection Agency
		Yuri Tsaturov (Russia)	Roshydromet
Human health	Denmark & Canada	Jens C. Hansen (Denmark)	University of Aarhus
		Andrew Gilman (Canada)	Health Canada
Oil	Norway & Russia	Hein Rune Skjoldal (Norway)	Institute of Marine Research
		Sergey Melnikov (Russia)	Regional Centre 'Monitoring of the Arctic'
Acidification	Finland	Juha Kämäri	Finnish Environment Institute
TBT**	Iceland	Jörundur Svavarsson	University of Iceland
Climate*	USA	John Calder	NOAA
UV*	USA	Elizabeth Weatherhead	NOAA
* These components of the assessment will constitute AMAP contributions to the Arctic Climate Impact Assessment (ACIA). ** TBT will be included in the POPs assessment			

The ISAARs will provide the accessible scientific basis and validation to the statements made in the SOAER. The Secretariat will have the responsibility for preparation of the SOAER under direction of the Assessment Steering Committee (ASG); but with each complete draft being reviewed by the AMAP WG. ISAARs that are part of the Arctic Climate Impact Assessment (ACIA) fall under the responsibility of the Assessment Steering Committee (ASC) and may be differently organized. The SOAER will be drafted on the basis of the content of the ISAARs by a scientific journalist. The executive summary will be prepared by the Secretariat under the direction of the WG.

The drafts of all Reports will be distributed to the Delegations of the Participating Countries and to the Observers for comments. Final drafts of both the executive summary and the SOAER will be approved by the WG.

The Secretariat has contracted [to be identified], for the production and printing of the ISAARs and the SOAER.

3.3 Quality Assurance Recommendations

All data intended to be used in the assessment should be critically reviewed by the drafting groups prior to use in the assessment. This review should cover the following steps of the monitoring and assessment process:

- sampling design (site selection, spatial resolution, frequency determination etc.);
- field operations (sampling, field pre-treatment, field measurements);
- sample shipments to laboratory (sample conservation and identification, time and method of delivery);
- laboratory operations (laboratory pre-treatment, analysis, laboratory data verification, analytical quality control including intercalibration exercises);
- data handling (data entry, storage, retrieval, presentation);
- data analysis and evaluation.

3.4 Categories of Data Quality

The following categories of data are proposed, based on quality assurance considerations:

A. Evidence of certification or documented quality assurance on all stages of the data gathering process.

B. Some parts of QA/QC process can be documented (but may not be fully described in e.g. published reports).

C. No data available on QA/QC procedures, but results are consistent with other reports concerning the same sample types.

D. No evidence of data QA or of data compatibility with the certified data flux.

For preparation of the ISAARs all published and unpublished data should be "rated" by the drafting groups. Only data in categories "A" and "B" should be accepted for spatial and temporal trends and other types of basic data interpretations. Category "C" data can be used to show relative trends i.e. assuming they are internally consistent. Category "D" data should not be used in the assessment process.

3.5 Geographical Area Covered by the AMAP Assessment

AMAP recognizes that different definitions of the Arctic are employed within different disciplines, and that a particular definition applicable in one sub-region may not be appropriate in some other sub-region. Consequently a “flexible” definition of the Arctic area of concern has been adopted. Furthermore, a number of 'Key Areas' have been identified for special attention with respect to integrated monitoring activities.

The following framework for a definition of the Arctic area to be covered by the assessment has been agreed:

i) In the North Atlantic, the southern boundary will follow the definition of OSPARCOM, with the western boundary being extended from Cape Farewell to the southern limit of Labrador.

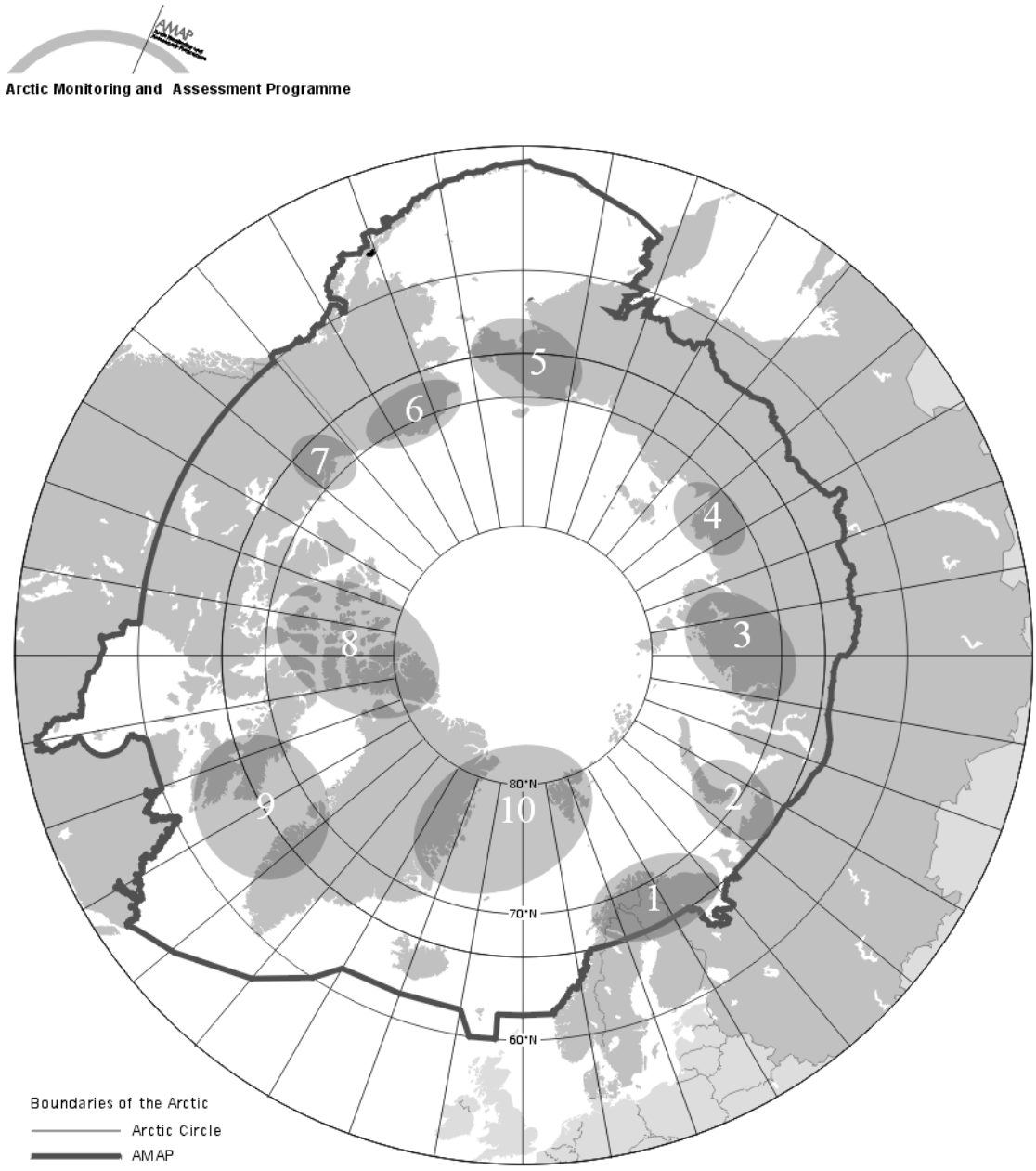
ii) In the terrestrial environment, the southern boundary in each country will be as determined by that country, within the constraints of the Arctic circle and 60 degree north.

iii) In the Bering Sea area, the southern boundary will be the Aleutian chain.

iv) The Hudson Bay and the White Sea will be considered to be part of the (Arctic) area to be included in the assessment.

For some items of concern the AMAP Assessment will cover areas further south than the boundary presented.

A map presenting the boundary of the Arctic area to be used in the assessment, as it presently defined is presented below.



Key areas:

1 - Northern Fennoscandian and Kola peninsula area
2 - Mouth of Pechora river, Novaya Zemlya, Kara and Pechora Sea area
3 - Norilsk, Taimyr peninsula area
4 - Mouth of Lena river
5 - Chukotsky peninsula
6 - Northern Alaska, North Slope area
7 - Lower Mackenzie river and delta area
8 - Canadian Arctic Islands and Arctic Archipelego
9 - West Greenland, Baffin Island area
10 - Svalbard, East Greenland area

4. Terms of Reference for the Assessment Steering Group (ASG), Assessment Steering Committee (ASC), the Lead Country Experts (LCEs), Key National Experts (KNEs), National Data Managers (NDMs), the AMAP Data Manager and the AMAP Secretariat

4.1 Assessment Steering Group

Membership and Scope

The AMAP Board and the Lead Country Experts (LCEs) shall be responsible for drafting the assessments on human health, heavy metals, POPs, radioactivity, acidification, oil/PAHs, TBT, and combined effects. AMAP Working Group delegates may participate in the ASG. The AMAP Secretariat shall provide support for the work of the ASG.

ASG has the responsibility:

1. To oversee the assessment process for human health, heavy metals, POPs, radioactivity, acidification, oil/PAHs, TBT, and combined effects and, together with the AMAP Secretariat, to coordinate all work related to the preparation of the assessment reports,
2. To ensure that the assessment reports are prepared according to the decisions made by the AMAP WG,
3. To foster cooperation and cross-fertilization between the LCEs/expert groups,
4. To plan and implement, together with the AMAP Secretariat, the submission of special inputs from the observing organizations and countries,
5. To ensure, together with the AMAP Secretariat, distribution of the drafts to experts of all the participating countries and the observers, and receipt of comments from them,
6. To forward draft assessments, including conclusions and recommendations, to the AMAP WG,
7. To advise the AMAP WG regarding coordination of monitoring programs,
8. To work with the Assessment Steering Committee (ASC) to coordinate with its activities on climate and UV and on combined effects with regard to these areas, and
9. To cooperate with appropriate international organizations in producing the assessments.

4.2 Assessment Steering Committee (ASC) of the Arctic Climate Impact Assessment (ACIA)

Membership and Scope

The ASC is composed of two representatives each from AMAP, CAFF and IASC, and two persons representing the Arctic indigenous peoples (Permanent Participants). Lead authors, responsible for drafting the Scientific Document, will be members of the ASC (in case of joint lead authorship for a chapter, only one author will be a member of the ASC). The ASC may invite representatives from international organizations that contribute in a major way to the assessment. Through these appointments all Arctic countries shall have a participant in the ASC. If, after recruitment of all lead authors, any Arctic country still does not have participation in the ASC, then that Arctic country will be asked to name a representative to the ASC. The AMAP Heads of Delegation and CAFF National Representatives will be welcome to attend ASC meetings. Liaison participation in the ASC will be extended on a case by case basis.

The ASC operates on the basis of consensus.

ASC has the responsibility to:

1. Oversee the scientific part of the Arctic Climate Impact Assessment (ACIA) process and coordinate all work related to the preparation of the assessment reports;

2. Foster cooperation and cross-fertilization between the sub-topics of the assessment (chapters) and the groups comprising the ASC;
3. Call for and integrate inputs from AMAP, CAFF and IASC, as well as observer countries and/or organizations;
4. Ensure circulation of draft reports to Arctic countries and Permanent Participants for thorough scientific comments;
5. Ensure independent peer review of final drafts;
6. Coordinate and forward assessment results, including conclusions and recommendations, to the AMAP and CAFF Working Groups for drafting of the Policy Document and its recommendations;
7. Cooperate with appropriate international organizations;
8. Identify resource needs for further consideration by AMAP, CAFF and IASC;
9. Report to AMAP, CAFF and IASC.

The ASC will be responsible for drafting the ACIA Synthesis Document. AMAP and CAFF will be responsible for drafting the ACIA Policy Document.

The ASC elects an ASC Chair and a Vice-chair for a four-year period, which may be extended. The Chair and Vice-chair will be the principal individuals to guide the implementation of the assessment and will coordinate the work between the ASC, Secretariat and the lead authors.

- The ASC Chair will preside over ASC meetings and carry out any duties entrusted upon the Chair by the ASC;
- The Chair and the Vice-chair will decide on division of labor as appropriate.

An ASC Executive will consist of the ASC Chair, Vice-chair, the Executive Director of the ACIA Secretariat, a person representing the Arctic indigenous peoples, and a member ensuring representation of the three main partners:

- The Executive Body will oversee ACIA activities between meetings.

The United States has established an ACIA Secretariat to assist the ACIA through 2004. The ACIA Secretariat is located at the University of Alaska, Fairbanks:

- The ACIA Secretariat will serve the ASC and ACIA as needed.
- An Executive Director for ACIA Secretariat is approved by the ASC.
- The Executive Director of the ACIA Secretariat has full responsibility for the implementation of the ACIA Secretariat (organizational arrangements, budget, personal matters, etc.). The Executive Director is encouraged to broaden, where possible, the professional staff with qualified individuals from other countries.

4.3 Lead Country Experts and National Key Experts

Lead Countries will appoint Lead Country Experts (LCEs) who will have primary responsibility for completion of a ISAAR, working with the assistance of Key National Experts (KNEs); these (LCEs and KNEs) may further consult with, and request input from, other designated experts (DEs) from the participating countries and organizations. Key National Experts will include data managers.

LCEs/KNEs have the responsibility:

- to draft the assessments;
- to ensure comprehensive utilisation of the existing data in the assessments under their responsibility;

- to ensure that the assessment are prepared according to decisions made by the AMAP WG and recommendations of the ASG;
- to review the SOAER to ensure authenticity;
- to obtain peer review comments as appropriate;
- to utilise data management and quality assurance expertise as needed;
- to draft recommendations for actions for the assessment under their responsibility.

To ensure cross fertilisation between disciplines, the scheduled meetings of LCEs/KNEs will be collocated with ASG meetings as necessary. The timing of LCE/KNE meetings will be decided by the ASG Chairperson and the AMAP Secretariat in consultation with LCE/KNE Chairpersons.

4.4 National Data Managers (NDMs) and the AMAP Data Manager

NDMs and the AMAP data manager have the responsibility:

- to collate, check and submit information concerning NIP projects in the AMAP Project Directory;
- to update the national information entered in the AMAP Project Directory at regular intervals;
- to facilitate contact between persons responsible for data archival and persons producing AMAP Assessment presentations;
- to facilitate and coordinate other flow of information upon request from the national Working Group Member;
- to coordinate and arrange for reporting of data to designated AMAP data centres.

4.5 AMAP Secretariat

AMAP Secretariat has the responsibility:

- to assist the ASG to oversee and coordinate the work related to the assessment;
- to assist the LCEs in the drafting of assessments;
- to assist in the submission of special inputs to the assessment;
- to draft the Executive Summary including conclusions and recommendations under the guidance of the Working Group;
- to circulate draft assessments to the WG members and observers for comments;
- to receive and compile the comments and make them available to the assessment experts;
- to draft specific parts of the ISAARs if so instructed by the ASG and/or WG.

5. List of Members of the Assessment Steering Group (ASG), Assessment Steering Committee (ASC), and Expert Groups responsible for preparation of the ISAARs (Lead Country Experts, Key National Experts and Designated Experts)

5.1 Members of the Assessment Steering Group (ASG)

The ASG consists of the following persons. All participating countries and all major areas of concern are represented.

Name	Country	Background	ISAAR responsibility
Helgi Jensson	Iceland	Biochemist	ASG Chair
Hanne Petersen	AMAP Board/Denmark	Marine	
Lars-Otto Reiersen	AMAP Board	Marine biologist	
Andrew Gilman	Canada	Environmental Health	Human Health
Derek Muir	Canada	Chemist	POPs (ecosystems)
Jens C. Hansen	Denmark	Environmental Medicine	Human Health
Juha Kämäri	Finland	Limnologist	Acidification
Per Strand	Norway	Radiation	Radioactivity
Harald Loeng	Norway	Oceanology	Pathways (ocean)
Hein Rune Skjoldal	Norway	Biologist	Oil
Yuri Tsaturov	Russia	Radiation	Radioactivity
Sergey Melnikov	Russia	Oil	Oil
Cynthia de Wit	Sweden	Biologist	POPs (effects)
John Calder	USA	Chemist	Climate
Suzanne Marcy	USA	-	Heavy Metals
Elizabeth Weatherhead	USA	Atmospheric physics	UV radiation
Jan-Idar Solbakken	Nordic Saami Council	Biologist	Traditional knowledge

5.2 Members of the Assessment Steering Committee (ASC) - Provisional (as of 20/1/01)

The ASC consists of the following persons.

Name	Affiliation / Country	Responsibility
Executive		
Robert Corell	IASC/USA	ASC Chair
Pål Prestrud	CAFF/Norway	ASC Vice-Chair
Lars-Otto Reiersen	AMAP/Norway	
Jan-Idar Solbakken	IPO-Saami	
Terry Fenge	IPO-ICC	
Committee		
Hanne Petersen	AMAP/Denmark	
Røgnvaldur Hannesson	IASC/Iceland	
Gordon McBean	CAFF/Canada	Lead Author
Harald Loeng	ICES/Norway	Lead Author
Elizabeth Weatherhead	USA	Lead Author
Terry Callaghan	Sweden	Lead Author
Petteri Taalas	Finland	Lead Author
Valdimar Kattsov	Russia	Lead Author
Erland Kallen	Sweden	Lead Author
John Walsh	USA	Lead Author
Jim Reist	Canada	Lead Author
Henry Huntington	USA	Lead Author
Igor Krupnik	USA	Lead Author
Dave Klein	USA	Lead Author
Mark Nuttall	United Kingdom	Lead Author
Hjalmar Vilhjalmsson	Iceland	Lead Author
Alf Haakon Hoel	Norway	Lead Author
Glenn Juday	USA	Lead Author
Jim Berner	USA	Lead Author
Arne Instanes	Norway	Lead Author
Liaison		
John Calder	NOAA/USA	Liaison with NOAA
Karl Erb	NSF/USA	Liaison with NSF
Odd Rogne	IASC/Norway	Liaison with IASC
Secretariat		
Gunter Weller	ACIA Secretariat/USA	Executive Director
Patricia Anderson	ACIA Secretariat/USA	
Thomas Murray	ACIA Secretariat/USA	

5.3 List of Experts Proposed for the Issue Specific AMAP Assessment Reports

Persistent Organic Pollutants (POPs)

Name	Country	Specialty	Responsibility
D. Muir	Canada	Marine, freshw.	Co-lead Author (LCE)
C. de Wit	Sweden	Ecotoxicology	Co-lead Author (LCE)
A. Fisk	Canada	Food chains	Scientific secretary
B. Braune	Canada	Birds, polar bear	Key National Expert
G. Stern	Canada	Marine mammals	Key National Expert
R. Dietz	Denmark	Marine mammals	Key National Expert
J. Svavarsson	Iceland	TBT	Key National Expert
G.W. Gabrielsen	Norway	Marine birds, levels, effects	Key National Expert
J. Klungsøyr	Norway	Marine chemistry, incl. biota	Key National Expert
J. Utne Skaare	Norway	Marine mammals, levels/effects	Key National Expert
B. Munro Jensen	Norway	Ecological effects, marine mammals	Key National Expert
I. Burkow	Norway	Environmental chemistry	Key National Expert
S. Melnikov	Russia	Abiotic	Key National Expert
M. Olsson	Sweden	Marine ecology	Key National Expert
J. Ford	USA	Terrestrial, freshwater environments	Key National Expert
M. Krahn	USA	Marine chemistry	Key National Expert
T. O'Hara	USA	Terrestrial and marine biota	Key National Expert
T. Bidleman	Canada	Atmosphere	Designated Expert
P. Blanchard	Canada	Atmosphere	Designated Expert
M. Evans	Canada	Freshwater	Designated Expert
Y.-F. Li	Canada	Sources	Designated Expert
L. Lockhart	Canada	Freshwater	Designated Expert
R. Macdonald	Canada	Marine	Designated Expert
R. Norstrom	Canada	Polar Bears	Designated Expert
F. Wania	Canada	Models	Designated Expert
J. Platz	Denmark	Pyrogenic PAHs	Designated Expert
P. Johansen	Denmark	Biota, food	Designated Expert
F. Riget	Denmark	Environmental monitoring, statistics	Designated Expert
M. Dam	Faroe Islands	Environmental monitoring	Designated Expert
T. Hirvi	Finland	Biota	Designated Expert
S. Juntto	Finland	Atmosphere	Designated Expert
J. Mannio	Finland	Lakes, sediments	Designated Expert
J. Paasivinta	Finland	Biological/chemical degradation	Designated Expert
S. Einarsson	Iceland	Marine environment	Designated Expert
T. Nygård	Norway	Terrestrial environment, birds	Designated Expert
K. Nœs	Norway	Marine chemistry, sediments	Designated Expert
K. Hylland	Norway	Biological effects	Designated Expert
T. Savinova	Russia	Seabirds	Designated Expert
J. Axelman	Sweden	Marine, modelling	Designated Expert
B. van Bavel	Sweden	Marine environment	Designated Expert
L Birnbaum	USA	Toxicology	Designated Expert
P. Becker	USA	Marine mammals	Designated Expert
D. Jaffe	USA	Pathways	Designated Expert
T. Shana	USA	Marine mammals	Designated Expert
T. Wade	USA	Marine chemistry	Designated Expert

Name	Country	Specialty	Responsibility
K. Ballschmitter	Germany	Marine environment	Designated Expert
J. Duinker	Germany	Marine mammals	Designated Expert
A. van Pul	The Netherlands	Atmosphere	Designated Expert
K. Jones	United Kingdom		Designated Expert
S. Tanabe	Japan	Marine environment, air	Designated Expert

Heavy Metals

Name	Country	Specialty	Responsibility
S. Marcy	USA	Ecology, ecosystem assessment	Lead Author (LCE)
V. Woshner	USA	Marine mammals	Scientific secretary
Not specified	Canada	Freshwater	Key National Expert
S. Juntto	Finland	Atmosphere	Key National Expert
E. Yngvadottir	Iceland		Key National Expert
K. Hylland	Norway	Biological effects	Key National Expert
J. Pacyna	Norway	Atmosphere, sources, pathways	Key National Expert
V. Tsibulski	Russia	Transboundary air pollution	Key National Expert
H. Borg	Sweden	Effects, aquatic environment	Key National Expert
B. Braune	Canada	Birds, polarbear	Designated Expert
B. Elkin	Canada	Terrestrial (caribou)	Designated Expert
M. Evans	Canada	Freshwater fish and sediments	Designated Expert
M. Kwan	Canada	Marine mammals	Designated Expert
R. Macdonald	Canada	Marine environment	Designated Expert
R. Dietz	Denmark	Marine mammals, biota	Designated Expert
P. Johansen	Denmark	Mining, food	Designated Expert
F. Riget	Denmark	Environmental monitoring, statistics	Designated Expert
M. Dam	Faroe Islands	Environmental monitoring	Designated Expert
J. Mannio	Finland	Freshwater	Designated Expert
J. Derome	Finland	Terrestrial environment, vegetation	Designated Expert
R. Salmmen	Finland	Terrestrial geochemistry	Designated Expert
Y. Viisanen	Finland	Atmosphere	Designated Expert
J. Skei	Norway	Marine chemistry, sediments	Designated Expert
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K. Næs	Norway	Marine chemistry, sediments	Designated Expert
R.T. Ottesen	Norway	Geochemistry	Designated Expert
E. Steinnes	Norway	Terrestrial environment	Designated Expert
J. Bartnicki	Norway	Atmospheric transport	Designated Expert
S. Melnikov	Russia	Marine environment	Designated Expert
V.M. Igamberdiev	Russia	Terrestrial environment	Designated Expert
A. Zhulidov	Russia	Freshwater environment	Designated Expert
A. Baklanov	Russia	Atmosphere, terrestrial	Designated Expert
S. Dutchak	Russia	Atmosphere, sources	Designated Expert
T.N. Savinova	Russia	Marine, seabirds	Designated Expert
A. Andersson	Sweden	Terrestrial environment	Designated Expert
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K. Johansson	Sweden	Terrestrial, sediments	Designated Expert
M. Olsson	Sweden	Marine ecology	Designated Expert
N. Fisher	USA	Marine pollution	Key National Expert

Name	Country	Specialty	Responsibility
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G. Shaw	USA	Atmospheric deposition	Designated Expert
B. J. Presley	USA	Marine	Designated Expert
S. Pfirman	USA	Seaice	Designated Expert
M.A. Champ	USA	Marine	Designated Expert
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P. Becker	USA	Marine mammals	Designated Expert
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J. Nriagu	USA	Atmosphere, sources	Designated Expert
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A. van Pul	The Netherlands	Atmosphere	Designated Expert

Radioactivity

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H. Dahlgaard	Denmark	Radioecology	Key National Expert
K. Rissanen	Finland	Radioecology	Key National Expert
H. Nies	Germany	Marine radioecology	Key National Expert
A. Nikitin	Russia	Physics	Key National Expert
A. Heinrich	USA	Radiation protection	Key National Expert
V. McClelland	USA	Radiation protection	Key National Expert
B. Howard	United Kingdom	Terrestrial ecology	Key National Expert
B. Elkin	Canada	Terrestrial (caribou)	Designated Expert
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B. Tracy	Canada	Radiation protection	Designated Expert
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B. Salbu	Norway	Radiochemistry	Designated Expert
K. Hove	Norway	Animal sciences	Designated Expert
L. Føyn	Norway	Marine radioecology	Designated Expert
H. Stensrud	Norway	Radiotoxicology	Designated Expert
J-L. Carrol	Norway	Marine radioecology	Designated Expert
J. Bartnicki	Norway	Atmospheric transport	Designated Expert
R. Bergmann	Sweden		Designated Expert
D. Layton	USA	Radioecology	Designated Expert
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B. Moran	USA	Marine radionuclides	Designated Expert

Name	Country	Specialty	Responsibility
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R. Dyer	USA		Designated Expert
D. Dasher	USA	Radiation protection	Designated Expert
N. Fisher	USA	Radioactive wastes	Designated Expert
J. van der Plicht	The Netherlands	Radioecology	Designated Expert
F. Steenhuisen	The Netherlands	GIS	Designated Expert
A. W. von Weers	The Netherlands	Radioecology	Designated Expert
D. Woodhead	United Kingdom		Designated Expert

Human Health

Name	Country	Specialty	Responsibility
J.C. Hansen	Denmark	Environmental health	Co-lead Author (LCE)
A. Gilman	Canada	Environmental health	Co-lead Author (LCE)
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K. Olafsdottir	Iceland		Key National Expert
J.Ø. Odland	Norway	Environmental health, obstetrics	Key National Expert
I. Burkow	Norway	Environmental chemistry	Key National Expert
V.P. Klopov	Russia		Key National Expert
J. Berner	USA	Environmental health, pediatrics	Key National Expert
L Birnbaum	USA	Toxicology	Key National Expert
E. Dewailly	Canada	Environmental health	Designated Expert
J. Van Oostdam	Canada	Environmental health	Designated Expert
E. Nieboerg	Canada/Norway	Public health	Designated Expert
P. Bjerregaard	Denmark	Environmental health	Designated Expert
E. Bonefeld Jørgensen	Denmark	Environmental health, toxicology	Designated Expert
P. Weihe	Faroe Islands	Environmental health	Designated Expert
E. Berge	Norway	Atmospheric transport in cities	Designated Expert
V. P. Chashchin	Russia		Designated Expert
B. Lagerkvist	Sweden		Designated Expert
P.S. Chen	USA		Designated Expert
C. Schoenwalder	USA	Environmental health	Designated Expert
Adrian Ryan	Permanent participants (IPOs)	Traditional knowledge	Designated Expert
G. Conway	IUCH	Occupational injuries	Designated Expert

Acidification and Arctic Haze

Name	Country	Specialty	Responsibility
J. Kämäri	Finland	Modelling, soils, waters	Lead Author (LCE)
To be decided			Scientific secretary
G. Fenech	Canada	Acid rain	Key National Expert
K. Tørset	Norway	Atmosphere	Key National Expert
E. Berge	Norway	Atmospheric transport and chemistry	Key National Expert
T. Moiseenko	Russia	Surface waters	Key National Expert
E. Degerman	Sweden	Biology	Key National Expert

Name	Country	Specialty	Responsibility
D. Lowenthal	USA	Arctic Haze	Key National Expert
R. Schnell	USA	Arctic Haze	Key National Expert
D. Jeffries	Canada	Surface waters	Designated Expert
R. Vet	Canada	Air, precipitation	Designated Expert
J. Derome	Finland	Forests, soil	Designated Expert
A. M. Kähkönen	Finland	Geochemistry	Designated Expert
Y. Viisanen	Finland	Arctic Haze	Designated Expert
D. Åmlid	Norway	Forests	Designated Expert
S. Wiik	Sweden	Fish	Designated Expert
G. Shaw	USA	Arctic Haze, atmospheric deposition	Designated Expert

Oil

Name	Country	Specialty	Responsibility
H.R. Skjoldal	Norway	Marine, oil	Co-lead Author (LCE)
S. Melnikov	Russia	Marine, oil	Co-lead Author (LCE)
R. Shearer	Canada	Marine, oil	Key National Expert
J. Klungsøyr	Norway	Marine, oil	Key National Expert
J. Hameedi	USA	Marine, oil	Key National Expert
L. Lockhart	Canada	Freshwater	Designated Expert
R. Macdonald	Canada	Marine, oil	Designated Expert
B. Serigstad	Norway	Marine, oil	Designated Expert
T. Bakke	Norway	Marine, oil	Designated Expert
S. Dahle	Norway	Marine, oil	Designated Expert
J. Braddock	USA	Hydrocarbon contamination	Designated Expert
C. H. Peterson	USA	Marine ecosystem	Designated Expert

Modelling/Pathways - Provisional

Name	Country	Specialty	Responsibility
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E. Berge	Norway	Atmospheric transport, chemical transport models	Key National Expert
K. Cochran	USA	Flux modelling	Key National Expert
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T. Iversen	Norway	Atmospheric pathways	Designated Expert

Influence on Global Environmental Processes on the State of the Arctic Environment (UV and Climate Change):

ACIA Contributing and Consulting Authors - *Provisional (as of 20/1/01)*

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P. Taalas	Finland	Past, present and future	Lead Author
V. Kattsov	Russia	changes in climate, ozone	Lead Author
E. Kallen	Sweden	and UV.	Lead Author
J. Walsh	USA	Cryosphere and hydrologic variability	Lead Author
T. Callaghan	Sweden	Terrestrial systems	Lead Author
J. Reist	Canada	Freshwater systems	Lead Author
H. Loeng	Norway	Oceanic and marine systems	Lead Author
H. Huntington	USA	Indigenous perspectives on	Lead Author
I. Krupnik	USA	climate change	Lead Author
D. Klein	USA	Wildlife and associated conservation issues	Lead Author
M. Nuttall	United Kingdom	Subsistence	Lead Author
H. Vilhjalmsson	Iceland	Fisheries and aquaculture	Lead Author
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G. Juday	USA	Forests, land management, and agriculture	Lead Author
J. Berner	USA	Human health	Lead Author
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R. King	Canada	paleo and recent climate	Contrib/consult. Author
I. Hanssen-Bauer	Norway	conventional data	Contrib/consult. Author
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K. Holmen	Sweden	carbon cycle	Contrib/consult. Author
M. Serreze	USA	climate data variability	Contrib/consult. Author
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B. Dickson	United Kingdom	oceanography	Contrib/consult. Author
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D. Schindell	USA	models - climate and ozone	Contrib/consult. Author
S. Kirkwood	Sweden	stratosphere - observations and process models	Contrib/consult. Author
A. Stoffelen or	Netherlands	data assimilation	Contrib/consult. Author
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J. Raisanen	Sweden	scenarios	Contrib/consult. Author
H. Cattle	United Kingdom	climate and sea ice models	Contrib/consult. Author
P. Lemke or	Germany	sea ice	Contrib/consult. Author
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J. Hesselbjerg-Christensen	Denmark	regional atmospheric models	Contrib/consult. Author
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A. Lynch	USA	regional atmospheric models	Contrib/consult. Author

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I. Isaksen	Norway	ozone modelling	Contrib/consult. Author
T. Prowse	Canada	terrestrial hydrology	Contrib/consult. Author
K. Vinnikov	USA	sea ice - snow cover	Contrib/consult. Author
S. Solomon	Canada	offshore permafrost	Contrib/consult. Author
V. Romanovsky	Russia	terrestrial permafrost	Contrib/consult. Author
J. Ove Hagen	Norway	glaciers, ice sheets	Contrib/consult. Author
J. Oerlemans	Netherlands	glaciers and ice sheets	Contrib/consult. Author
M. Lapparanta	Finland	sea ice	Contrib/consult. Author
R. Brown	Canada	snow cover	Contrib/consult. Author
P. Graham	Sweden	river discharge (modeling)	Contrib/consult. Author
L. Olaf Björn	Sweden	UV-B impacts	Contrib/consult. Author
T.R. Cristensen	Sweden	trace gas emission	Contrib/consult. Author
G. Shaver	USA	primary production, element cycling, ecosystem and vegetation models	Contrib/consult. Author
F.S. Chapin III	USA	biodiversity and ecosystem function	Contrib/consult. Author
B. Huntley	United Kingdom	paleoenvironments and biota	Contrib/consult. Author
R. Ims	Norway	animal responses to climate change	Contrib/consult. Author
D. Klein	USA	trophic interactions and grazing	Contrib/consult. Author
N. Matveyeva	Russia	biodiversity of plants	Contrib/consult. Author
Y. Chernov	Russia	biodiversity of animals	Contrib/consult. Author
N. Panikov	Russia	microbial populations and function	Contrib/consult. Author
W.C. Oechel	USA	trace gas emission, feedbacks to climate system	Contrib/consult. Author
T. Ingold	United Kingdom	traditional knowledge	Contrib/consult. Author
J. Hobbie	USA		Contrib/consult. Author
F. Wrona	Canada		Contrib/consult. Author
D. Hessen	Norway	UV, freshwater	Contrib/consult. Author
Holopainen	Finland?		Contrib/consult. Author
D. Lean	Canada	contaminants/Hg	Consulting Author
M. Power	Canada	fish	Consulting Author
J. Hammer	Sweden	fish	Consulting Author
W. Graneli	Sweden		Consulting Author
K. Brander	ICES	climate-zooplankton-fish relations	Contrib/consult. Author
E. Carmack (or colleague)	Canada	physical oceanographic processes related to climate in the Arctic	Contrib/consult. Author
K. Drinkwater	Canada	climate variability and effect on fish stocks	Contrib/consult. Author
B. Hansen	Denmark/Faeroes	climate variability and processes in the North Atlantic	Contrib/consult. Author
K. Kovacs	Norway	marine mammals and sea birds	Contrib/consult. Author
E. Sakshaug	Norway	plankton	Contrib/consult. Author
S. Fox	USA		Contrib/consult. Author

Name	Country	Specialty	Responsibility
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S. Norris	WWF	protected areas	Contrib/consult. Author
P. Prokosch	WWF	protected areas in Arctic	Contrib/consult. Author
L. Baskin	Russia	wildlife conservation (Russia and Arctic)	Contrib/consult. Author
K. Danell	Sweden	climate change influences on wildlife	Contrib/consult. Author
A. Gunn	Canada		Contrib/consult. Author
D. Russell	Canada		Contrib/consult. Author
G. Kofinas	USA	herding in Canada/Alaska	Contrib/consult. Author
B. Forbes	Finland	herding in Fennoscandia	Contrib/consult. Author
H. Beach	Sweden	hunting, fishing and herding in Fennoscandia	Contrib/consult. Author
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S. Langdon	USA	hunting, herding and fishing in Alaska	Contrib/consult. Author
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G. Osherenko	USA	hunting and herding in Russian Far North	Contrib/consult. Author
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G. Wenzel	Canada	hunting and fishing in Canada [Nunavut]	Contrib/consult. Author
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J. Odland	Norway		Contrib/consult. Author
S. Kvernmo	Norway		Contrib/consult. Author
L. Soinen	Finland		Contrib/consult. Author
V. Klopov	Russia		Contrib/consult. Author
B. Laageruist	Sweden		Contrib/consult. Author
K. Olafsdottir	Iceland		Contrib/consult. Author
J. Hansen	Denmark		Contrib/consult. Author
P. Bjerregard	Denmark/ Greenland		Contrib/consult. Author
E. Dewailly	Canada		Contrib/consult. Author
J. Van Ostdam	Canada		Contrib/consult. Author
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C. Furgal	Canada		Contrib/consult. Author
T. O'Hara	USA		Consulting Author
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Name	Country	Specialty	Responsibility
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O. Smith	USA	marine structures	Contrib/consult. Author
V. Romanovsky	USA	permafrost	Contrib/consult. Author
L. N. Khrustalev	Russia	infrastructure Russian Arctic	Contrib/consult. Author
L. Brigham	USA	marine environment/Arctic marine transport	Contrib/consult. Author
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H. Heide-Jørgensen	Denmark	Climate, UV effects	Designated Expert
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5.4 National Data Managers

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USA (other)	To be identified

5.5 AMAP Data Manager

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5.6 SOAER Journalist

To be decided

5.7 AMAP Report Publisher/Printer

To be decided

6. AMAP Information Flow, Data Handling and AMAP Thematic Data Centres

6.1 Background

Part of the AMAP assessments are based on information and results published in the scientific literature and available through scientific reports; including results from programmes of relevant international bodies. The AMAP assessment process also utilises data arising from (recent) monitoring activities conducted as part of the AMAP National Implementation Plans (NIPs), only a part of which will be reported in the literature. To assist assessment groups in accessing, in particular, those data which have not yet been published, AMAP has established Thematic Data Centres' (TDCs). See also Section F of *AMAP Trends and Effects Programme: 1998-2003* (AMAP Report 99:7).

The main procedures and mechanisms involved in directing the flow of data into the AMAP assessment process are described below.

The essential features of this data flow procedure are described in the diagram (Figure 1) on the following page.

6.2 Identification of Data Sources

An AMAP Project Directory (PD) has been developed to register information on monitoring and research projects and programmes of relevance in the Arctic area; including projects/programmes that constitute AMAP NIPs. The AMAP PD can be accessed on-line from the AMAP website (http://www.amap.no/pd2000.htm). Documents describing the country NIPs are also available on the Internet, via the AMAP website (http://www.amap.no/) under the links to 'Online documentation'.

Other sources of data will be identified by assessment groups through appropriate activities including, e.g. literature searches, and AMAP coordinated cooperation with relevant international bodies, etc.

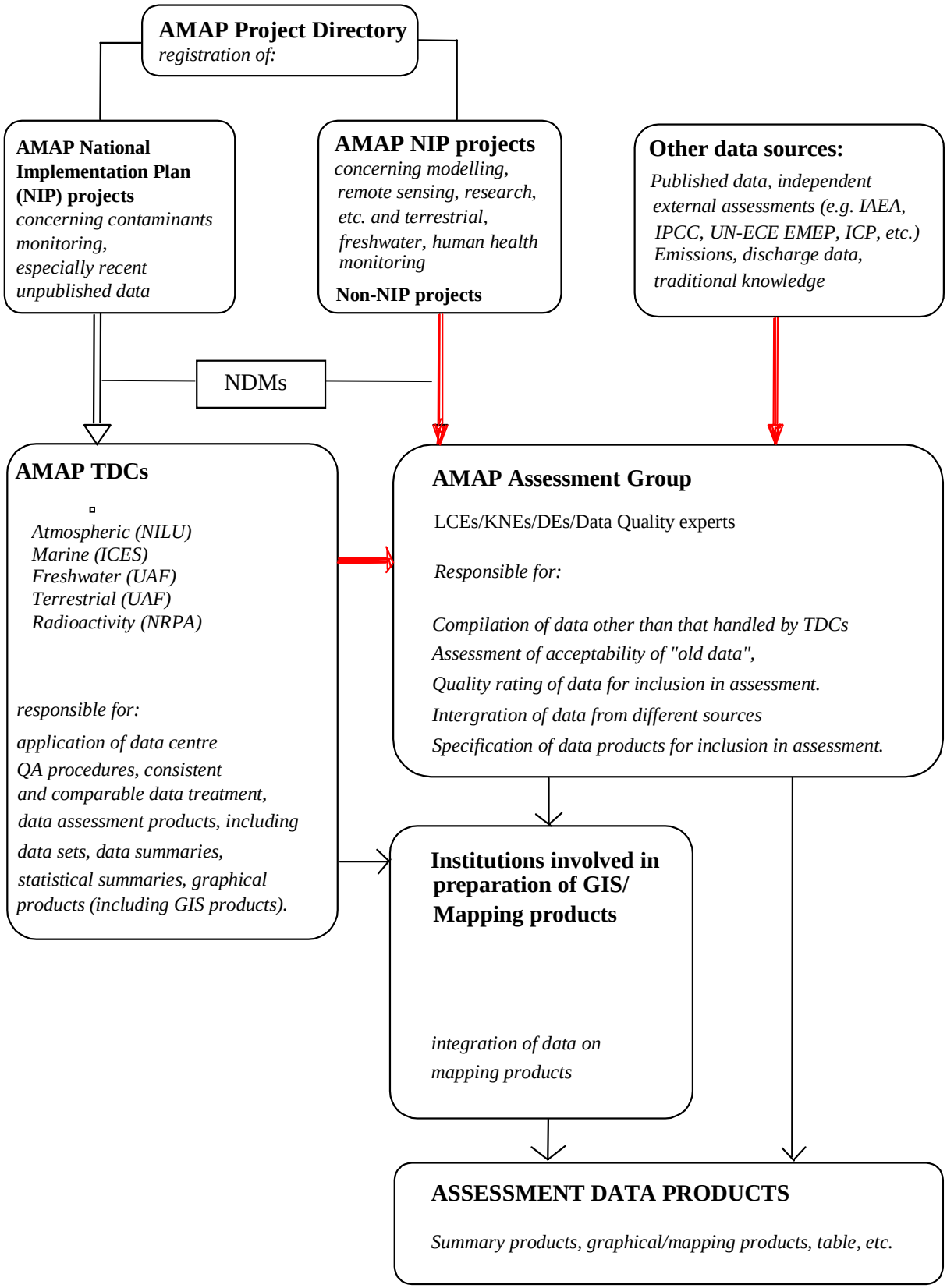
6.3 Access to Data - Data Compilation

A part of the NIP data will be available directly to assessment experts (e.g. data from projects for which they themselves are responsible); or through 'key publications' reporting results from the various projects. These data, together with results from internationally coordinated programmes with which AMAP has specific co-operative agreements, will be compiled directly by assessment groups. A significant part of the NIP data will, however, not be available by these means; two mechanisms have, therefore, been established to introduce these data into the assessment process:

1) For certain data, initially those data arising from 'targetted NIP projects' (see below), attempts are being made to compile data at AMAP (thematic) data centres, from which they will be made available to assessment groups in the form of required products.

2) For other NIP projects/programmes, e.g., concerning data for which no appropriate AMAP TDC has yet been established, assessment groups are required to independently compile these data. Assessment groups should contact the relevant National Data Manager (NDMs) to request assistance in obtaining these data.

Figure1. Flow of data and information for the Assessment



Red arrows	Summarised data, data products, "peer reviewed" published data, etc.
Thick white arrow	Observational data (measured values in environmental samples, quality assured prior to submission).

6.4 Data Ownership

The assessments that will be performed by AMAP will include some data that have not been published in the open scientific literature. To ensure that the rights of scientists contributing new data to the AMAP assessment are protected, AMAP has developed a 'Data Policy' (see Section F of *AMAP Trends and Effects Programme: 1998-2003* - AMAP Report 99:7). As a part of this 'Data Policy', all experts involved in the assessment, e.g. drafting group leaders, Key National Experts, etc. will sign a form concerning data ownership.

All data handling associated with the preparation of the AMAP assessment will take due note of the AMAP Data Policy and related agreements. Data supplied to AMAP assessment groups, AMAP TDCs, etc. is subject to this agreement, and no data will be distributed or used outside of the context of the preparation of the AMAP assessment unless so agreed by data owners.

6.5 Role of AMAP Thematic Data Centres (TDCs)

AMAP TDCs have been established to meet the following objectives:

- to provide access to data from recent monitoring and research activities conducted as part of the AMAP NIPs, in particular those data which will not be available in published form in time for the assessment.
- to provide a means to ensure treatment of data in a consistent manner, uniform statistical analysis, etc., including application of objective quality assurance procedures;
- to begin the process of establishing a long-term archive of Arctic relevant monitoring data, for use in future assessment of temporal trends, etc.; and
- to meet the terms of reference of the Ministerial declarations, charging AMAP with establishing databases of sources, type and levels of radionuclide contamination of the atmospheric, the aquatic and the terrestrial environments of the Arctic and the Northern areas.

To date, AMAP has established TDCs to handle atmospheric, freshwater, terrestrial, marine and radioactivity data, and data on contaminants in humans. These data centres and their contact information are listed in Section F of the *AMAP Trends and Effects Programme: 1998-2003* (AMAP Report 99:7).

6.6 Targetted Projects for data handling at AMAP Thematic Data Centres

As mentioned above, AMAP TDCs are specifically implemented to compile data sets arising form recent monitoring activities associated with AMAP NIPs, and data sets of special relevance for e.g. temporal trend assessment, source data for modelling work, compilation of Arctic-wide contaminant data sets, etc.

In this context, lists of priority projects for reporting of data to the AMAP atmospheric, freshwater, terrestrial, marine and radioactivity data centres are prepared by the AMAP Data Manager and provided to TDCs and assessment groups. Coordination and arranging for the reporting of these data is the responsibility of AMAP National Data Mangers (NDMs).

6.7 GIS/mapping support for the AMAP assessment process

Guidelines pending

6.8 Modelling support for the AMAP assessment process

Guidelines pending

7. Structure of the Assessments

7.1 Structure and Content of the AMAP Assessment Reports

The ISAARs and SOAER will have different structures reflecting the educational and professional background of the intended readers of the two documents.

The basic principles applied in deciding the content of the AMAP phase 2 assessments are:

- To build upon the information presented in the 1997/98 AMAP assessment reports; to avoid repetition of basic information contained in (e.g. the introductory chapters/sections of) these earlier reports, but to allow new information to be presented in a manner that can be linked to the information presented in the previous AMAP reports.
- To enhance the content of the assessments in relation to identified priorities such as that concerning temporal trends, effects, and filling geographical gaps identified during the AMAP first phase assessments.

7.2 Extended Structures of the AMAP Issue Specific Assessment Reports

During the AMAP ASG meetings in Toronto (November 1999) and Reykjavik (November 2000), the assessment leads and expert groups prepared outline structures and contents for the following assessments:

- Persistent Organic Pollutants;
- Heavy Metals;
- Radionuclides;
- Human Health.

The ASC has also developed the provisional outline structure for the content of the Arctic Climate Impact Assessment (ACIA).

The main objectives of this preparatory work was:

1. To show briefly the content of the intended ISAARs.
2. To identify and to fill gaps within the ISAARs.
3. To allow the drafting groups to identify where and how issues with a cross issue component would be covered in the ISAARs (e.g. TBT, PAHs)
4. To prepare a background for initiation of the assessment work.

Persistent Organic Pollutants and Other Organic Contaminants

An update on organochlorines previously treated in the 1998 AAR (to incorporate new data), current use pesticides, PAHs, TBT and new substances as found in the Arctic.

Potential substances: AMAP monitoring programme analytes, POPs protocol substances (aldrin, dieldrin, chlordane, toxaphene etc.), PCDD/PCDF, PAHs, lindane, PCP, short chain paraffins, BCPS, bromocyclen, organophosphates, triazines, haloacetic acids, brominated flame retardants, PCDEs, alkyl phenols/ethoxylates, etc.

1. Introduction (something here about the UN ECE, LRTAP protocols, UNEP, OSPAR)
    - 1.1. Physical and chemical characteristics of persistent organic pollutants (POPs)
        - 1.1.1. Industrial products and byproducts (e g PAHs)
        - 1.1.2. Chlorinated pesticides
            - 1.1.2.1. Persistent pesticides
            - 1.1.2.2. Less persistent chlorinated pesticides
        - 1.1.3. Other pesticides
            - 1.1.3.1. Tributyltin (TBT)

2. Sources of persistent organic pollutants
    - 2.1. Pathways
    - 2.2. Global sources
    - 2.3. Sources in circumpolar countries
    - 2.4. Local/regional sources within the Arctic

3. Toxicology
    - 3.1. Toxicokinetics
    - 3.2. Types of effects
    - 3.3. Effects of specific POPs
        - 3.3.1. Halogenated industrial chemicals and by-products
        - 3.3.2. Persistent organic pesticides
        - 3.3.3. Less persistent organochlorine pesticides
        - 3.3.4 PAHs
        - 3.3.5. Other pesticides
            - 3.3.5.1. Tributyltin (TBT)

4. Regional and circumpolar levels and trends in abiotic and biotic media
    - 4.1. Air and precipitation
        - 4.1.1. Air
        - 4.1.2. Precipitation
        - 4.1.3. Summary and conclusions - air and precipitation
    - 4.2. Terrestrial environment
        - 4.2.1. Soils and plants
        - 4.2.2. Terrestrial herbivores
        - 4.2.3. Birds of prey
        - 4.2.4. Other carnivores
        - 4.2.5. Summary and conclusions - terrestrial environment
    - 4.3. Freshwater environment
        - 4.3.1. Levels in water
        - 4.3.2. Freshwater surface sediments
        - 4.3.3. Freshwater fish and invertebrates
        - 4.3.4. Summary and conclusions - freshwater environment
            - 4.3.4.1. Abiotic environment
            - 4.3.4.2. Biota
    - 4.4. Marine environment
        - 4.4.1. Seawater

4.4.1.1. Sea ice, suspended particulates, surface microlayers and fog waters
4.4.2. Marine sediments
4.4.3. Marine invertebrates
4.4.3.1. Tributyltin
4.4.4. Marine and anadromous fish
4.4.5. Seabirds
4.4.6. Pinnipeds and cetaceans
4.4.7. Polar bear
4.4.8. Arctic fox
4.4.9. Summary and conclusions - marine environment
4.4.9.1. Abiotic environment
4.4.9.2. Biota

5. Temporal variation in POP levels
5.1. Air and precipitation
5.1.1. Temporal trends in air
5.1 2. Temporal trends in precipitation
5.2. Terrestrial environment
5.3. Freshwater environment
5.3.1. Lake sediments
5.3.2 Temporal trends in fish in northern Scandinavia
5.3.3. Temporal trends in freshwater fish in the North American Arctic
5.4. Marine environment
5.4.1. Sediments
5.4.2. Temporal trends in seabirds
5.4.3. Temporal trends in pinnipeds and cetaceans
5.4.3.1. Pinnipeds
5.4.3.2. Cetaceans
5.4.4. Temporal trends in polar bear
5.5. Summary and conclusions - temporal trends

6. Biological effects
6.1. Terrestrial environment
6.2. Freshwater environment
6.3. Marine environment
6.4. Summary and conclusions - biological effects
6.4.1. Observed effects
6.4.2. Assessment of current levels in biota

7. Future trends
7.1. Projected levels and trends
7.2. Projected exposure and effects

8. Conclusions and recommendations
8.1. Levels and effects
8.1.1. Air and precipitation
8.1.2. Seawater and freshwater
8.1.3. Sediments and suspended solids
8.1.4. Biota
8.2. Sources
8.3. Spatial trends
8.4. Temporal trends
8.5. General monitoring

Appendices
1. AMAP monitoring programme for POPs and biological effects (POPs).
2. Data tables

Heavy Metals - with an emphasis on mercury

Introduction to Heavy Metals Report

Part A:
1. Introduction: Current State of the Arctic
2. Sources and Pathways
    - Natural and anthropogenic sources and fluxes (Source Inventories of Atmospheric Emissions; Mass Balance; Point Source Considerations; Monitoring)
    - Environmental Processes Leading to Exposure (Transport; Deposition; Transformation, e.g. Arctic Sunrise)
    - 2.1 Air Monitoring
    - 2.2 River waters
    - 2.3 Ocean Waters
3. Spatial Trends
    - 3.1 Atmospheric deposition
    - 3.2 Sediments
    - 3.3 Terrestrial biota
    - 3.4 Freshwater biota
    - 3.5 Marine Biota
        - 3.5.1 Invertebrates
        - 3.5.2 Fish
        - 3.5.3 Seabirds
        - 3.5.4 Marine Mammals
4. Temporal Trends
    - 4.1 Air
    - 4.2 Marine fish
    - 4.3 Marine birds
    - 4.4 Marine mammals
    - 4.5 Terrestrial environment
5. Biological Effects
    - Species Sensitivities
    - 5.1 Fish
    - 5.2 Birds of Prey
    - 5.3 Seabirds
    - 5.4 Marine mammals
    - 5.5 Other Studies
6. Data Gaps

Part B: Synthesis (results of symposium-workshop discussions)
1. - Linkage – sources transport transformation processes leading to exposure and effects
2. - Scenarios for future effects
3. - Research recommendations based on data deficiencies and gaps in information

Part C: Interpretation and Recommendations
1. - Characterization of risks based on available information
2. - Summarization of results of scenarios
3. - Recommendations

References
Appendix

Radioactivity

1. Introduction

2. New data: Sources (by sources: source terms and contamination of vicinities)

3. New data: Contamination levels
    - 3.1 Oceans and seas
    - 3.2 Freshwater ecosystems
    - 3.3 Terrestrial ecosystems

4. Assessment of human exposure
    - 4.1 Methodology
    - 4.2 Exposure levels - by countries, regions, population groups and/or sources

5. Assessment of exposure to biota
    - 5.1 Methodology
    - 5.2 Exposure levels - by regions and/or sources, different species

6. Arctic vulnerability to radioactivity
    - 6.1 GIS for arctic regions
    - 6.2 Radiological models
    - 6.3 Maps of vulnerability

7. Potential accidents (by sources)
    - 7.1 Scenarios and source terms
    - 7.2 Environmental transfer
    - 7.3 Potential exposure of humans and biota

8. Risk management
    - 8.1 Nuclear safety and surety
    - 8.2 Radiation protection (intervention, etc.)
    - 8.3 Monitoring

9. Conclusions and recommendations

Human Health

Summary (Editorial board)

1. Introduction
   Reference to the ministerial declaration and description of the concept of combined effects (Editorial board)

2. Ethonocultural adaptation of the peoples of the Arctic Region
   Social and cultural changes globally and in the Arctic and their effects on contaminant exposure, health and well-being (Adrian Ryan/Peter Bjerregaard)

3. Priority contaminants and new Xenobiotics of concern
   Chemical properties of known and new contaminants of concern (Ivan C. Burkow)

4. Environmental and biological monitoring

   4.1. Environmental monitoring
   Collection of existing data from each nation on contaminants in food (traditional and imported), drinking water and any other relevant sources of exposure (Jay van Oostdam + national experts)

   4.2. Biological monitoring
   The circumpolar study plus other studies carried out in the Arctic related to exposure levels. Include data on spatial and temporal trends (Jay Van Oostdam + national experts)

5. Biological effects.

   5.1. Cellular effects Models and Genetic susceptibility
   Summary of the state of art in molecular studies on the health/environment interaction relevant to the Arctic (Linda Birnbaum, Eva Bonefeld Jorgensen.)

   5.2. Biomarkers of effect
   Description on biomarkers of effect applicable in Arctic Studies and relevant to the Arctic exposure situation. Primarily based on the outcome of the Biomarker Conference May 2000. (Chris Schonwalder)

6. Lifestyle and health

   6.1 Introduction
   Food, beneficial role of traditional food, negative effects of smoking, alcohol, working conditions etc. (Jon Øyvind Odland)

   6.2 Diet
   Positive effects of traditional food, results of dietary surveys, nutrient intakes and dietary deficiencies, contaminant exposure estimates, benefits and risks of current food consumption patterns (Bente Deutch)

   6.3 Other risk factors
   Tobacco, alcohol, occupational exposure, role of integrated factors on pregnancy and child development (Jon Øyvind Odland)

   6.4. Health Conditions

Health conditions of Arctic people in general, changes in mortality and morbidity patterns (trends). Linkages to contaminant exposure, climate change, etc. where possible. Use of data collected for children and youth project (Jim Berner)

6.5. Social and Cultural Changes and their effects on Health and exposure (Peter Bjerregaard)

7. Epidemiological Studies in the Arctic.
Summary of post population studies (in the Faeroes, Seychelles, Great Lakes, and St. Lawrence), published Arctic studies, and preliminary results of new studies. Focus on pregnancy, immune system and neuro-behavioural outcomes (Eric Dewailly)

8. Risk assessment of exposure at levels presently found in the Arctic.
Focus on groups and regions that exceed published world guidelines (Pál Weihe)

9. Risk reduction strategies for Arctic peoples.
Public health recommendations for reduction of exposure locally, nationally, and internationally, taking cultural and traditional aspects into consideration (emphasis on methylmercury and P0Ps) (Writing Team: Eric Dewailly, Adrian Ryan, Pál Weihe, Jim Berner, Peter Bjerregaard, Andy Gilman)

10. Conclusions and Recommendations (Editorial Group)

References

Appendices

Petroleum hydrocarbons and Polycyclic Aromatic Hydrocarbons (PAHs) in the Arctic

Executive Summary

Introduction

1. Oil and PAH in the Arctic
    - Production areas
    - Transportation routes
    - Industrial sites and harbours
    - Future development scenarios
    - Discharges and emissions from petroleum exploration and production
    - (incl. current practice and legislation)
    - Source characteristics and diagnostic ratios, natural sources (crude oil, coal and peat, sediments and aqueous sources).

2. Oil and PAH in the Arctic environment
    - Concentrations in sediments, water and biota
    - Fate of oil, incl. oil-ice interaction and weathering processes
    - Temporal changes, results from long term monitoring and sediment cores
    - Potential sources and pathways

3. Biological effects
    - Biological uptake and metabolism
    - Short and long term effects of spilled oil and operational discharges
        1. lethal effects
        2. sub-lethal and behavioural effects
        3. genotoxicity
        4. synergistic effects (ex: UV-oil)
        5. models (energetic, population dynamics)
    - Experiences from accidental oil spills

4. Environmental impacts of petroleum activities
    - Environmental quality (sediments, water, air)
    - Habitats
        1. sediment resuspension (pipeline trenching, well drilling)
        2. turbidity (relation with SPM, ecological effects)
        3. noise and vibration (airborne and underwater measurements)
        4. altered migration routes and timing (e.g. fall migration of bowhead whales)
        5. impaired habitats (e.g. anadromous fish)
    - Sensitivity and vulnerability of arctic ecosystems

5. Human health

6. Experiences from Environmental Impact Analyses and Risk Analyses

7. Conclusion and recommendations

***Influence of Global environmental processes on the state of the Arctic environment* - Provisional (as of 20/1/01)**

THE ARCTIC REGION

Preface: Purpose of ACIA—structure (sectoral vs. regional, etc.), philosophy, connections

Chapter 1: The Arctic System

1. Arctic overview—definition, characteristics, etc.
2. Humans in the Arctic: who, indigenous, demographics, activities, etc.

THE ARCTIC AS PART OF THE GLOBAL CLIMATE SYSTEM

Chapeau

Chapter 2: Climate System and the Roles of Ozone and UV Processes on the Planet and the Arctic (Lead authors: Gordon McBean, Petteri Taalas, Betsy Weatherhead)

1. Description of the global climate and ozone systems
2. How does the arctic system interact with the global system?
3. Importance of oceans, sea ice, clouds, dynamics, aerosols, etc.
4. What are the extra-arctic influences, e.g., El Niño, North Atlantic Oscillation, etc.
5. How do the climate and ozone systems interact?
6. Global balances of GHG and ODS and the role of the Arctic as a source or sink

    a. Reference IPCC conclusions, TAR Working Group 1, Chapter 1, global
    b. Reference IPCC conclusions, TAR Working Group 2, Chapter 16, Polar (Arctic subset)
    c. Reference AMAP (Table of Contents, Chapter 11, items 1-6)
    d. Reference UV: AMAP Chapter 11, IASC UV report, WMO Ozone Assessment, Solomon's Nature paper
    e. Feedbacks

Chapter 3. Past and Present Changes of Climate and UV: Climate Variability and Change, Ozone Processes and UV Increases in the Arctic Region (Lead authors: Gordon McBean, Petteri Taalas, Betsy Weatherhead)

1. Arctic paleoclimate and historic record
2. Arctic observational (climate, ozone, UV)
3. Emphasis on the long-term (back to last glaciation, with earlier information with respect to variability and possibility of rapid changes) - deal with last few decades in chapters 5,6,7,8
4. Understanding and quantifying natural variability
5. Information on extremes and rapid changes
6. Include precipitation minus evaporation (input to chapter 5)
7. Information on the quality and quantity of observing systems (climate and ozone/UV) in arctic region
8. Indigenous/local knowledge (as a distinct source of data)
9. Sub-regional variability (present vs. paleo)

Chapter 4. Future Changes of Climate and UV: Modeling and Scenarios for the Arctic Region (Lead authors: Vladimir Kattsov, Erland Källén, Betsy Weatherhead)

1. To what extent do (can) the global models describe physical climate and ozone/UV processes in the arctic region?

2. Arctic regional modeling - ocean, ice, atmosphere - resolution?
3. Build upon IPCC, use scenarios A2, B2, CMIP information - focus on 2020, 2050, 2080(2100) for time slices
4. A set of scenarios and their interpretation, uncertainty and limits of predictability (with or without stabilization)
5. What variables are needed for impact studies?
6. Changes in frequency and extent of extreme events
7. What can be said about future changes for the sub-regions and sub-annual times scales (seasons)?

PHYSICAL AND BIOLOGICAL SYSTEMS AND RESPONSE TO CLIMATE CHANGE

Chapeau: Current knowledge of components, including humans and how climate change is propagated through the system.

Chapter 5. The Cryosphere and Hydrologic Variability (Lead author: John Walsh)

1. Precipitation minus evaporation (primarily in Chapters 2-3; ties to snow cover, glaciers, ice sheets emphasized here)
   - uncertainties in observational estimates of P-E
   - recent variations of P-E
   - recent variations of river discharge
   - projected changes

2. Sea ice
   - growth and melt – climatological distribution
   - horizontal transport (esp. to North Atlantic)
   - influences on global circulation (of atmosphere and ocean)
   - recent variations of ice extent and concentration
   - recent variations of ice thickness
   - role of the NAO and AO in recent sea ice variations
   - projected changes

3. Snow cover
   - role of snow in the arctic hydrologic cycle
   - albedo variations and parameterizations
   - albedo-temperature feedback: evidence in recent data
   - influence of snow on the large-scale circulation
   - current status of snow modeling
   - recent variations in snow coverage
   - projected changes

4. Glaciers, ice sheets
   - factors affecting mass balance of glaciers, ice sheets
   - freshwater fluxes to oceans from glaciers and ice sheets
   - current status of glacier, ice sheet modeling
   - recent variations of glaciers, ice sheets
   - projected changes

5. Permafrost
   - factors affecting permafrost extent, thickness
   - current status of permafrost modeling
   - recent variations of permafrost

- projected changes

Chapter 6: Terrestrial Ecosystems (Lead author: Terry Callaghan)

Pre-Section Chapeau: Rationale for approaches within the section

1. Distribution, extent, characteristics and human dimensions of arctic terrestrial ecosystems and organisms. Will adaptation to cold and historically low UV-B environments constrain responses to warming and increased UV-B?

2. Past and current dynamics of arctic terrestrial and freshwater ecosystems. How are dynamics related to climate? (includes indigenous knowledge)

3. Effects of changes in climate and UV on arctic organisms. What changes have been seen? Are these caused by climatic changes? What changes do we expect to see? When do we expect to see changes? (includes indigenous knowledge)
   a. Plants
   b. Animals
   c. Micro-organisms

4. Effects of changes in climate and UV on arctic ecosystems. What changes have been seen? Are these caused by climatic changes? What changes do we expect to see? When do we expect to see changes? Will climate and UV-induced changes at the ecosystem level be identified before or after those at organism level? (includes indigenous knowledge)
   a. Ecosystem structure, in terms of
      - trophic interactions and
      - biodiversity
   b. Ecosystem function in terms of
      - Carbon and nutrient cycling and other soil processes
      - Primary and secondary productivity

5. Effects of changes in climate and UV on arctic ecosystems at the landscape level. How will the various positive and negative feedbacks to climate and UV balance? How strong or weak is their signal compared to noise? How will the patchiness of landscapes change? How will distributions of biota change?
   a. Carbon emissions
   b. Albedo
   c. Disturbance
   d. Vegetation and animal redistribution, e.g., treeline movement
   e. Interactions between terrestrial and freshwater ecosystems
   f. Interactions between terrestrial and marine ecosystems

6. Uncertainties: comments on constraints of methodologies and requirements for new data bases
   a. Methodologies
      - Scaling up and down
      - Observation versus experimentation and inter-comparison of different methodologies
   b. Need to fill in gaps in geographical coverage

7. Synthesis: sub-regional scenarios – vulnerability, sensitivity, “adaptation”

Post section pre-synthesis: scenarios of linkages between sections

Chapter 7: Arctic Freshwater Ecosystems (Lead author: Jim Reist)

1. Types, structure and function of arctic freshwater ecosystems:

a. Types: large, deep lakes; small, shallow lakes; tundra standing water and ponds; small-medium, local rivers; large northward flowing rivers; simple systems (high arctic) vs. complex systems
b. Organisms/trophic components: nutrients; microbes/microplankton; autotrophs; heterotrophs; fish – freshwater and anadromous (temperature guilds); plankton and benthic issues
c. What they are (components); how they function (processes and linkages); seasonality and structure of ecosystems (e.g., thermoclines and lake types)

2. How environmental variables are mediated into aquatic ecosystem processes and components:
   a. Temperature, precipitation, wind – degree days, amounts and form of precipitation and how these translate to productivity
   b. Seasonal variability and limits, timing of events (e.g., fall rain)
   c. Gaps in understanding
   d. Lag times between abiotic input and biotic response

3. Past changes in arctic aquatic ecosystems:
   a. Long-term (development since deglaciation); unglaciated areas; paleorecords (e.g., diatom profiles)??
   b. Short-term historical record; knowledge base (quantitative, qualitative, scenario?)
   c. Potential adaptability to change and relationship to system complexity

4. Effects of change in climate and UV on aquatic organisms:
   a. Internal physiological processes and individuals.
   b. UV damage to fish eggs/larvae, algae, plankton.
   c. Interaction of climate change and UV change (enhancement of effects?).
   d. Short-term changes at population level (e.g., dynamic parameters shift); potential for increased productivity in some situations.
   e. Emphasis on key nodal taxa/processes/trophic groups –indicator species/groups.
   f. Vulnerabilities: population/species – adaptive capacity of organisms.

5. Effects of change in climate and UV on aquatic ecosystems:
   a. Ecosystem structure:
      - Composition – biodiversity; invasions/extirpations; range expansion/contraction
      - Trophic shifts – increase/decrease productivity; changes in complexity
      - Habitat changes – flow regimes, slumping; loss/shift in critical thermal habitat
   b. Ecosystem function:
      - Nutrient inputs/fluxes and cycling, carbon flow, sequestration/release
      - Productivity flows
      - Sediment transport (from land to aquatic system; from large rivers to sea)
      - Source/sink issues for greenhouse gases
   c. Vulnerabilities - Key nodes, forcing functions, adaptive capacities of systems
   d. Permafrost issues/hydrology cross-linkages

6. Effects of change in climate at the ‘landscape’/regional level:
   a. Ice formation/loss: ice-free seasons and change in duration
   b. Species distribution shifts
   c. Photochemical effects associated with contaminants (e.g., UV and mercury, enhanced potential input to biota)
   d. Linkages: terrestrial to/from freshwater; freshwater to/from marine (anadromous fish); large rivers as conduits to accelerate/amplify local change

7. Humans and arctic freshwaters:
   a. Human use of freshwater ecosystems (transportation – soft and hard water); human footprint on ecosystems; cross-reference to AMAP contaminants and increased re-volatilization of

current sinks; waste deposition (e.g., Kola Peninsula sulphur dioxide) and nutrient input; recreation; fishing (cross reference to Fisheries chapter)
   b. Levels of impacts – catastrophes (pulses); inputs and effects
   c. Cumulative effects with climate change

8. Gaps in knowledge and understanding which prevent/impede forecasting of climate change effects:
   a. Type of freshwater system; geographical/regional coverage
   b. Understanding components or processes in ecosystems
   c. Understanding/quantifying linkages of environmental parameters to ecosystem components or processes
   d. Methods/approaches
   e. Data bases
   f. Monitoring programs, indicator species, developing new hypotheses, accumulating data and testing hypotheses

9. Summary/Conclusions:
   a. Potential for surprises (e.g., 2nd or 3rd order linkages)
   b. Precision vs. accuracy of 'forecasts' or scenarios – can we bound things (best vs. worst case scenario)
   c. Scenario development – word models of plausible futures for particular sub-regions.
   d. Time frame for change vs. response in the systems
   e. Potential disconnect between climate change time horizons and ecosystem/component adaptability
   f. Temporal (seasonal) disconnect between climate change effects in south and organisms in north (e.g., critical cues for migration/spawning of anadromous fish come at inappropriate times)
   g. Risk analysis – can we assign probabilistic risks to particular changes/impacts
   h. Parallels/contrasts with Antarctic aquatic systems – can we learn by proxy?

Chapter 8: Oceanic and Marine Systems (Lead author: Harald Loeng)

1. Introduction
   a. General physical characteristics
   b. Brief description of the marine ecosystem

2. Paleorecords (brief description of historical ocean climate/knowledge) (ref. Ch.3)

3. Climate variability in the ocean
   a. Temperature observations
   b. Sea ice
      - distribution
      - thickness
   c. Changes in water mass distribution
      - Arctic Ocean
      - Greenland Sea
      - Others

4. Processes influencing climate variability
   a. Thermohaline circulation (THC) [Box: Ramstorf]
      - deep water formation
      - overflow processes
   b. Atmospheric forcing (NAO/AO)
   c. Carbon cycle

5. UV in the ocean

6. Climate/UV effects on the marine ecosystem
   a. Plankton production
      - phytoplankton/ice algae
      - zooplankton
   b. Fish stock population parameters
      - recruitment
      - growth
      - migration/distribution
   c. Biodiversity
   d. Marine mammals (move to wildlife?)
   e. Sea birds (move to wildlife?)

7. Future changes in marine climate and UV
   a. Consequences for the physical environment
   b. Consequences for the marine ecosystem

8. Lack of knowledge / Need for research

9. Conclusions and recommendations

IMPACTS ON HUMANS AND THEIR ACTIVITIES

Chapeau

Chapter 9: Indigenous Perspectives on Climate Change (Lead author: Henry Huntington)

1. Introduction (the usual who's where, etc.)

2. Discussion of indigenous knowledge--what it is and isn't, how much has been documented

3. Summary of documented indigenous knowledge/perspectives and relevance to climate change

4. Case studies on specific examples of indigenous knowledge/perspectives related to climate change

5. Discussion of the significance of this knowledge and these perspectives

6. Discussion of further research needs

7. Conclusions

Chapter 10: Wildlife and Associated Conservation Issues (Lead author: David Klein)

1. Introduction: General overview of climate change in the Arctic and how it can influence wildlife
   a. Emphasize interface with Terrestrial and Marine ecosystem chapters and with chapter on Hunting, Fishing, Herding, and Gathering
   b. Regional variations in climate trends and model predictions
   c. Direct vs indirect effects: sea ice changes and effects on marine mammals and birds, UV-B radiation, vegetation changes and effects on herbivores, terrestrial animal movements, disease and parasites, changed species distribution, altered access for subsistence use of wildlife by arctic residents, increased access for industrial exploitation and development as threat to wildlife and their habitats

d. Stress importance of involvement of arctic residents in wildlife management and conservation through their contributions of local knowledge and shared management responsibility (co-management)

2. Climate change effects on focal animal groups and species
   a. Endangered, threatened and rare species
      - Marine systems (e.g., black-legged kittiwake, polar bear, whales, etc.)
      - Terrestrial systems (e.g., Peary caribou, polar fox in Fennoscandia, etc.)
      - Risk analysis
   b. Wildlife species of societal interest
      - Subsistence resource species (e.g., marine mammals, marine birds, caribou, waterfowl, ptarmigan, etc.), cultural relationships, indigenous knowledge (eg. whales, caribou, etc.)
      - Commercially harvested species [e.g., marine mammals, muskox, caribou, (reindeer)]
      - Migratory birds (e.g., waterfowl, shore birds, marine birds, etc.)
        - Estuary/delta nesters – sea level rise effects, increased storm tide frequency
        - Multiple ecosystem relationships – threats in Arctic and in wintering grounds
        - Altered migration routes and harvest availability
        - Pollution effects – open sea lanes/oil spills, contaminants
      - Other focus of interest species
        - Wildlife watching/tourism (e.g., whales, muskoxen, sea birds, and other charismatic species including polar bears, arctic foxes, wolves, caribou, raptorial birds)
        - Attraction of carnivores to food wastes from population increase of northern residents, increased marine access for shipping and tourism, and expanded northern development (e.g., bears, wolves, foxes, ravens, etc.)
      - Keystone species for ecosystem function & integrity – (e.g., marine mammals, caribou, cyclic species- lemmings, ptarmigan, hares, etc.)

3. Threats from new species
   a. Alien species
      - Accidental – (e.g., rats on Pribilof Islands as threats to sea bird colonies, feral dogs, etc.)
      - Deliberate – (e.g., muskoxen to Greenland and Quebec, proposed wood bison to Alaska and Sakha Rep.,)
      - Reindeer – competition with caribou/muskoxen
   b. Natural invasions
      - Northward moving species and competition with indigenous species (e.g., marine mammals and sea birds with increased open water; on land, moose, deer, red fox, lynx etc.)
      - Associated parasites, disease, and predators
      - Changed predator-prey relationships

4. Importance of protected areas
   a. Assessment of existing protected areas
   b. Need for additional protected areas
      - Inventory and assessment of representative arctic ecosystems
      - Identify critical habitats
   c. Threats to protected areas
      - Present and projected resource development
      - Present and projected regional tourism
      - Area and regional protection from contaminants
      - Maps and overlays of critical habitats and present and projected areas needing protection

5. Management needs and strategies
   a. Wildlife management is essentially control of human activities and associated restoration efforts

b. Management for change; adaptive management and adapting to change
c. Importance of involvement of local residents in development of management strategies, drawing on local knowledge, and shared management responsibility (co-management)
d. Completion of inventory of critical habitats and threatened populations
e. Importance of melding of traditional patterns of subsistence use of the land with establishment of protected areas
f. Matrix of threats to wildlife in the Arctic and associated climate change influences
g. Increase societal awareness of issues via government agencies, non-governmental organizations (NGOs), related industries (tourism, oil, mining, etc.), public education and outreach (news media, schools, NGOs, nature publications, etc.)
h. Coordinate with national/regional management agencies and NGOs re above threats in development of management strategies
i. Bi-national/international agreements for protection of endangered/threatened and rare species, and set harvest quotas
j. New technologies: remote sensing and monitoring, genetic/DNA population studies, modeling population and systems ecology, contaminant chemistry, sampling techniques
k. Research needs

6. Summary

Chapter 11: Hunting, Fishing, Herding, Gathering (formerly "Subsistence") (Lead author: Mark Nuttall)

1. Background and Current status

   a. Archaeological record and historical developments

   b. Current patterns and uses: species and resources used, harvesting methods, seasonal patterns and distributions, interannual variability,

   c. Social organisation of resource use and harvesting and social cultural significance of hunting ,fishing, herding and gathering. Sharing and distribution patterns. Importance of resource use for community wellbeing. --tie in with Human Health chapter

   d. Management and governance: land status, land claims/sovereignty, rights to use and access, regulatory systems, co-management and co-governance, indigenous and local rights, participatory approaches to resource use and management. --tie in with Wildlife and Conservation Issues chapter

2. Climate Impacts

   a. Evidence for past climate change and impacts on species distribution and resource use. Discussion of how people responded to and coped with climate impacts on population dynamics, distribution and availability of resources, e.g., caribou, seals, whales. --tie in with Terrestrial, Freshwater and Marine chapters

   b. Impacts of climate change on ecological relations of local communities and resources. Changes in settlement patterns and local perceptions of the environment.

   c. Consequences of physical changes, e.g., on mobility and movement across sea ice and land, stability of winter and spring ice, loss of hunting, fishing and herding grounds, changing migration routes of terrestrial and marine resources, positive effects (such as access to different habitats and the enhanced opportunities to hunt, fish etc different species).

d. Changes to local economies and infrastructure, as well as consequences for community dynamics, social life and household structure. Changes in social organisation of hunting, fishing, herding and gathering.

e. Contributions to overall combined effects, e.g., implications of climate change for health and social services, economic impacts of loss of local food production, distribution and exchange, and impact on local and regional markets

f. Adaptability and responses to climate change – how people negotiate and manage impacts of change at individual, household, community and regional levels. Gender and generational differences. Negative impacts, but also opportunities and possibilities for future resource use.

g. Climate impacts in relation to wider social, economic and political changes.

Chapter 12: Fisheries and Aquaculture (To Be Provided)

Divide By Areas: e.g. Barents Sea, Iceland, Greenland (perhaps Iceland/Greenland), Newfoundland/Labrador, Bering Sea

1. Fishery

   a. Historical yield records of selected commercial fish stocks (3-4 per area).
   b. Historical development of fishing effort (i.a. participation, vessel type and size, fishing gear and technology).
   c. Management history.
   d. Outline of historical marine climate variations.
   e. Analysis of historical stock developments.
      - Observed changes in stock abundance and structure.
      - Impact of climate variations and trends.
      - Changes caused by fishery and management.
   f. Present stock status and structure.
   g. Projection of possible future climate and anthropogenic impacts on stock developments.
   h. Economic and social impacts.
      - Historical.
      - Future.

2. Aquaculture

   a. Historical development and yields.
   b. Effects of climate variations and trends.
   c. Future developments.
   d. Economic and social impacts.

Chapter 13: Forests, Land Management, and Agriculture (Lead author: Glenn Juday)

1. Extent and characteristics of forests and agriculture in the (AMAP) area. (What kind of forests and agriculture occur in the area and what are the main approaches to management systems?)
   a. (Extensions of) boreal forests in the far north (closed canopy, woodland, treeline)
   b. Values and products of the northern boreal forest
   c. Three models of far northern agriculture - tradition, local need, market opportunity (harvest of native plant foods?)
   d. Land ownership/tenure and management systems; management goals
   e. Reindeer production systems

2. Sensitivity of forests and agriculture to UVb impacts in the far north. (What are the key impacts/controls of UVb, and how adaptable are northern boreal forests and food production systems?)
   a. Direct impacts of UVb to crops
   b. Direct impacts of UVb to forest vegetation
   c. Potential indirect effects of UVb

3. Sensitivity of forest and agricultural plants and animals to climate impacts in the far north. (What are the key climate controls, and how adaptable are organisms in northern boreal forests and food production systems?)
   a. Climate warming and direct effects in agriculture (growing seasons, warmth limits, soil moisture, snow cover)
   b. Direct effects of climate variability on forest growth (direct controls of temperature and precipitation on tree growth, tree stress/health, tree reproduction)

4. Sensitivity of forest ecosystems and agricultural/food production systems to climate impacts in the far north. (What are the key climate controls, and how adaptable are ecosystems and production systems in the north?)
   a. Climate warming and agricultural inputs (adaptability of production systems, relative cost advantage/disadvantage in the north, transportation issues, local demand, new crop opportunities)
   b. Indirect effects of climate variability on forest growth (indirect controls of climate change on northern forest ecosystems)
      - Insect outbreaks and tree mortality
      - Wildland (forest and tundra) fire
      - Mechanical damage (snow and ice breakage, wind)

5. The forest-tundra environment.
   a. Values and management of treeline forests
   b. Treeline movement history

6. "Plausible futures" of climate change and forest/forest management response. What are the plausible expressions of climate change in the northern boreal region, and what range of ecosystem responses are
   a. To be developed from climate scenarios

Chapter 14: Human Health (Lead author: Jim Berner)

1. Background
   a. Description of current causes of morbidity and mortality in arctic populations, and historical trends.
   b. Description of technologic and medical advances which have modified traditional sources of morbidity and mortality.
   c. Description of known social/economic/cultural factors that impact communities as stressors, as well as those that may enhance adaptability and resilience.

2. Climate-induced ecosystem change and potential influence on human health
   a. Discuss two currently documented climate change trends, warming, and cooling.
   b. Past responses to climate change by arctic populations
   c. Current structure of remote communities
      - Less ability to adapt to climate change, can no longer migrate intact
      - Families fragment, and move to other communities, without their support systems.
      - Receiving communities rarely have resources to accommodate in-migration.
   d. Decreases in key species, central to traditional life, can cause a variety of adverse impacts.
      - Community grief response with associated depression

- Changes from traditional diet, with loss of nutrient benefits, and an increase in certain diseases, such as diabetes, certain cancers, and heart disease.
- Development of potentially adversarial relationship with wildlife agencies and advocacy groups

e. Increase in UV exposure, with potential effects on ocular and dermatologic conditions, and immune suppression.
f. Changes in organisms at the bottom of the food web, with potential changes in the range of human and zoonotic disease vectors
g. Heating or cooling will affect the volatilization of organic contaminants, and thus their distribution

3. Detection of climate change impact on human health
   a. Duration of climate change is slow compared to human life span
   b. Effects of climate change on health are non-specific
   c. Impact assessment will require systematic monitoring over many years
   d. Description of possible monitoring system

Chapter 15. Infrastructure, including business/industry (Lead author: Arne Instanes)

1. Physical environment
   a. Seasonal frost
   b. Permafrost
   c. Coastal zone
   d. Offshore

2. Hazards
   a. Freezing/thawing
   b. Sea ice changes,
   c. Floods, erosion, avalanches (geohazards)
   d. Wind/snow/ice storms
   e. UV

3. Infrastructure
   a. Natural resources (oil, gas, mining, …)
   b. Military activity, communities (waste disposal, water supply, settlement relocation)
   c. Transportation systems, -land/air/sea - roads, ports, airports, railroads
   d. Military activity

4. Engineering design - government responses - building codes

SYNTHESIS

Chapter 16. A Synthesis: Implications of Climate Variability and Change and UV Increases for the People and Institutions of the Arctic Region

1. Major patterns and variabilities of the change and impacts for the arctic region
2. Implications of such changes for ecosystems and their services across the arctic region
3. Main consequences of socio-cultural change, impacts and vulnerabilities across the Arctic
4. Economic and infrastructural consequences of these changes for the people and institutions of the arctic region
5. Adaptive capacity
6. Mitigative response options (what are the ways we could address the impacts? Not recommendations, but presenting the options that are available)

Each of these impact areas in the assessment (ACIA) will be analyzed in a hierarchical manner. Impacts will be considered on a sub-regional basis. Within each sub-region, the assessment will focus on three areas (the physical environment, ecosystems, and people).

8. Instructions to the Authors and Drafting Groups

The AMAP phase 2 assessment process includes the preparation of a series of scientific assessments (ISAARs). The drafting groups established during AMAP WG14 (comprising Lead Country Experts, Key National Experts, etc., see section 5 above) are responsible for drafting the ISAARs.

The Assessment Steering Group (ASG) is responsible for co-ordinating the work of these groups; the Assessment Steering Committee is responsible for coordinating the assessment work that falls under the Arctic Climate Impact Assessment (ACIA).

The final work of publication of the ISAARs will be conducted by ASG with technical assistance of the AMAP Secretariat.

8.1 Language

The language to be used in production of the assessment is American English.

8.2 Document registration and identification

The drafting process will involve the generation and exchange of a large amount of text and documentation. It is vital that all drafts are identified with the draft number, a revision or version numbers etc. and also the name of the author(s) and the date to ensure that the correct versions can be referred to and distributed, etc.

The following registration system is suggested:

Assessment Title - Section / Draft No / Initials / Date

Example: POPs - 2.2/2/DM/15.05.01 means:

Persistent Organic Pollutants ISAAR; section 2.2 (Global sources); 2nd draft; author - Derek Muir; dated 15 May 2001.

8.3 Exchange and distribution of Assessment texts

All printed copies of drafts of the assessments should be marked with a page header or footer including the text '**AMAP Draft - do not circulate or cite without permission**'. In addition, where possible the words '**AMAP Draft**' should be applied as a faint watermark to all pages of draft text - most common word-processors support the addition of 'watermarks'.

Prior to production of each draft of an ISAAR (i.e. first draft, second draft, final draft, etc.), materials should be exchanged internally within the drafting groups in the manner most convenient to the group members. This process should be coordinated by the drafting group Chairs/Leads. It is anticipated that use of the Internet and e-mail services, etc. will provide the most efficient means of accomplishing this work. If drafting groups would like assistance in setting up, for example, private working areas on the Internet, automatic e-mail distribution lists, etc., to facilitate this work, they should contact the AMAP Secretariat. Drafting groups are also encouraged to make extensive use of revision marking and annotation facilities available in many word-processors to track and comment changes in documents during the drafting process. Full use of the latter may imply agreement between primary authors on a single word-processing system to be used for the ISAAR production, if this is practical.

For each main draft, all relevant texts, supporting documentation (reference lists, abbreviations used, etc.) and graphical materials must be compiled and checked by the chapter lead authors (LCEs), and submitted to the Secretariat by the agreed deadlines in the form of:

- a clearly legible double-spaced manuscript version suitable for copying (hand-written drafts and faxed material should be avoided); graphical materials and large tables must be provided on separate pages.

All relevant text and supporting documentation should also be supplied (most conveniently as e-mail attachments) as:

- one or more electronic files. These should consist of text materials in word-processing formats (preferably MS-WORD version 6.0 or later, or Word Perfect version 6.0 or later). If other word-processing systems are in use it is necessary to contact the Secretariat to confirm that these formats can be converted. Also acceptable are Rich Text Format (.rtf) and ASCII text files (most word-processors can produce output files in these formats - it is recommended to include ASCII versions of all word-processor format files in case of problems with the latter).

Graphics should preferably **not be embedded** in the draft documents but rather supplied in separate files (one for each graphic) on paper or in some common bitmap format (e.g., .jpeg, .gif, .bmp, etc.). The same applies for tables where provision of appropriately numbered tables on separate pages is preferable to tables 'embedded' in the text of drafts.

It should be noted that texts will be reformatted by the Secretariat: drafts should therefore **avoid all but the most basic formatting** attributes (bold, underline, italics, etc.):

- **effort in using advanced layout features** (columns, integrating graphics in text, text boxes, heading styles, etc.) during the drafting stage **is unhelpful and will only be a source of problems** for the Secretariat.
- page numbering on the supplied versions may differ from the versions distributed by the Secretariat (e.g. due to changes in paper size / page layout specifications). All **comments should refer to page numbering on Secretariat distributed versions**.
- to avoid problems associated with use of different paper sizes (A4 vs. Letter) and different printer settings for page layout (margins, etc.) **the Secretariat will distribute drafts as both Portable Document Format (.pdf) files**, which will present the defined layout**, and Rich Text Format (.rtf) files** suitable for revision marking etc.
- due to potential problems associated with translation of 'special characters' (e.g. Greek characters, superscripts) and tables during conversion of word-processor files, **drafters should avoid special characters during early stages of drafting** by inserting some explicit text alternative (see 8.4 below). As a rule, select characters from the *Times* / *Times New Roman* / *CG Times* and *Arial* character set families, and the *Symbol* set for special characters if these are required.
- if specific presentation features are desired, these should be indicated by annotations on the hardcopy versions or clearly identifiable notes in electronic documents (note: do not rely on electronic annotations - these may be lost if files are converted to different word-processor readable formats).

8.4 Units/Symbols/Abbreviations

Metric units belonging to the International System of Units (SI units) should be used. The units must be designated by their international symbols (see Appendix to these Guidelines).

It is recommended to use mL (millilitre) instead of cm^3 and L (litre) instead of dm^3 - the upper case 'L' should be used for litre rather than lower case 'l' as the latter can be confused with the numeric character 1. Use of "/" for "per" rather then negative superscripts is recommended. Subscripts should be used for indices in chemical formulas (e.g. H_2O). 10 in corresponding power should be used if the number of "0's" exceeds 3 (e.g. 10^4 m^2 rather then 10,000 m^2). Radionuclides should be given as ^{137}Cs rather then Cs-137 or 137Cs.

Due to potential problems associated with translation of 'special characters' during conversion of word processing files, drafters should be 'explicit' when producing draft texts. Thus, **the use of a prefix-word construction (micro g/L) is strongly preferred to the use of the Greek symbol** (as in μg/L) - the commonly applied use of the letter 'u' as a substitute for 'micro' (as in ug/L) should also be avoided. Final corrections and the appropriate conversions to special symbol sets will be applied to the final drafts by the Secretariat.

Concentrations of chemicals should be expressed in a form appropriate to the media concerned, and on the basis (e.g. per unit wet weight, per unit dry weight, per unit lipid weight, per unit volume) normally applied for that type of media. The method selected must, however, be used consistently throughout the chapter; i.e. concentrations in a given media should not include both presentation of values on a wet weight basis in some cases and on a lipid weight basis in others; or, use of mg/L in some cases and M(oles)/L in others, etc. It is the responsibility of the drafting group co-ordinators to define the units/basis to be used for a given chemical in a given media within their chapter, to ensure that it is used consistently, and where necessary) to ensure that this is consistent with the way in which values are expressed in other chapters.

In general, it is recommended to express chemical concentrations as mass units per:

- litre in water
- milli-litre in biological fluids
- unit of dry weight in soils and sediments
- unit of wet weight in biological tissue (supported by information on water and fat content), or
- unit of lipid weight in (fatty) biological tissue (supported by information on fat content)
- unit of dry weight for atmospheric particulate media
- unit of volume for atmospheric gaseous media

Chemicals shall be presented by their conventional trivial names according to the International Union for Pure and Applied Chemistry (IUPAC) recommendations. The corresponding chemical names and chemical formulas must be presented in a separate table for inclusion in Annexes to the ISAARs. Conventional trivial names of biological species must be followed by Latin names printed in italics when mentioned for the first time. Final editorial work must include checking consistency in use of chemical and biological names, etc.

Authors/co-ordinators must compile a list of all abbreviations and acronyms used in their chapters. All acronyms must be defined at the first instance of their use. The Secretarial will compile a complete list of included acronyms and abbreviations for possible inclusion into Annexes to the ISAARs as a glossary.

In general - **if you cannot decide on a standard/convention, aim at least to be consistent** - if changes are necessary they can generally be located/made as a batch operation using available tools such as Search and Replace. Inconsistency means that this operation has to be repeated for all variations found.

8.5 Statistics*

Standard practices shall be adopted for reporting of ass statistical information. As complete information as possible will be reported regarding exact location and times of any sampling which is reported. Such standard practices will include values such as mean, median, standard deviation, standard error on simple linear estimates, and geometric means. Definitions for each of the above may be found in any basic statistics book, such as Neter, Wasserman and Kunter's 'Applied Linear Statistical Models'. When any term or other than the above five terms are used, a definition of the term should be included in the text with the first occurrence of the term. If enough occurrences of another statistical term are encountered, they will be acknowledged and adopted as a standard statistical term without need for further explanation.

Trimmed means and trimmed medians should be accomplished with the level of trimming which has taken place. All smoothing of data should indicate the statistical tool (loess, running mean, etc.) used for smoothing with a published reference to the smoothing techniques and any parameters which may be relevant.

* These parts of the "Instructions" should be considered as a draft and the Secretariat requests comments.

Care should be taken to distinguish between the standard deviation of dataset and the standard error of an estimate. The standard deviation of a dataset simply describes the variation observed in the data. The standard error of a statistical estimate indicates the level of certainty one can have in an estimate (for instance, the mean). As an example, a one year temperature record may have a mean of 20 degrees, a standard deviation of + /- 15 degrees, and a standard error on the mean of 2 degrees. That means that while the temperature may routinely fluctuate between 5 and 35 degrees, we can feel certain that we understand the mean annual temperature to within to degrees. Both the standard deviation and the standard error on an estimate are useful and should be reported whenever possible. Common practice dictates that data are reported in the following manner. The five hundred samples of CO taken revealed a mean concentration of 220 (+ – 35) ppb with a standard deviation of 70 ppb. "or" The five hundred samples of CO taken revealed a mean concentration of 220 (+/– 35, +/–70) ppb, where the 35 ppb is the standard error on the estimate of the mean and the 70 ppb is the standard deviation of the data. Note that these estimates of uncertainty are presented at the one sigma level.

Particular care should be taken not to mis-interpret the standard deviation or the standard error when the data are auto-corrected. The standard formula for each of these parameters can only be used to indicate 95% confidence intervals when each datapoint is independent from every other datapoint. Most environmental does not satisfy these criteria. For instance, temperature data generally does not fall into this category because one day's temperature is highly correlated with the next day's temperature. Strictly speaking, one can only infer 95% confidence interval from the standard error when the residuals from a study are iid and gaussian (identically distributed, independent and gaussian). Therefore, references to 95% confidence intervals should be avoided unless the writer is certain that such statements are statistically correct.

Uncertainty in measurement apparati should be reported separately form uncertainty in the distribution of the data. Whether to include the accuracy and precision of an instrument used to collect data is left to the author. The decision to include such uncertainty in accuracy should be based on the magnitude of the uncertainty and the potential quantitative use of the data with other datasets. The decision to include such uncertainty in precision should be based on the magnitude of the uncertainty and the potential use of the data to derive trends.

Aggregated data should be presented through mean value (x) and corresponding standard deviation (s) when data are statistically normally distributed and a number of values in the data set is statistically sufficient. If a number of values in the data set is low (e.g.<10), t-distribution should be used and data should be presented through mean value (x) and confidential interval with 95 percentile ($\delta_{0.95}$). Medians (M) and other non-parametric statistics should be used only to summarise non-normally distributed data sets. Data on appropriate normalisation parameters must be supplied e.g. grain size distribution, organic matter content or sediment data, etc. and any normalisation methods applied must be fully described.

8.6 Biological data*

Biological data presented in the assessment, should be followed, to the extent available, by tables with information which define species, location (of sampling), year, tissue, sex, age/size etc. If the analysed contaminant shows age/size, sex, temporal related differences, the data need to be presented for comparable groups, or if appropriate the data must be recalculated for a "standard" animal (e.g. 5 year male from 1994), any such standardisation applied must be fully described.

8.7 Bibliographical references

Bibliographical references shall be indicated in the text by the name of author or abbreviated title (in the case of collective publication or report), followed by the year of publication (e.g., Bewers, 1992 or World Resources, 1992). Where an author is cited twice for publications in a given year, these must be distinguished by a character sequence following the year (e.g. Reiersen 1992a, Reiersen 1992b, etc.)

References

The bibliographical details should be given in the following sequences:

Reference to a paper in a periodical:

1. Author(s)'s last name and initial(s).
2. Year of publication.
3. Full title of paper.
4. Name of periodical abbreviated in accordance with the principle of the *World List of Scientific Periodicals*.
5. Volume No.
6. First and last page of paper.

Reference to a book:

1. Authors(s)'s or editor(s)'s last name and initial(s), and (ed.(s)) for editor(s).
2. Year of publication.
3. Full title.
4. Publisher.
5. Place of publication.
6. Total number of pages.

Reference to a chapter or paper in a compound work:

1. Author(s)'s last name and initial(s).
2. Year of publication.
3. Full title of chapter/paper.
4. Editor(s)'s initial(s) and last name(s).
5. Full title of book/publication.
6. First and last page of chapter/paper.
7. Publisher.
8. Place of publication.

All co-ordinators for the various chapters must compile a list of all references used in their chapters - this list must comprise the full citation for each reference. To assist in this process, that AMAP Secretariat will compile a list (maintained as a simple database) of all references cited in the ISAAR drafts. This database will be constructed during the drafting process in an effort to avoid last-minute work to complete citations prior to publication of the reports.

A final list of references will appear at the end of each ISAAR.

8.8 Graphical material

The AMAP assessment reports include four basic types of graphics:

1. Maps
2. Schematic diagrams, sketches, etc.
3. Plots, charts and graphs
4. Photographs

General Issues concerning preparation of graphical materials

- If you would like a specific map, diagram, or chart to be produced for you, please provide a detailed specification of your requirements, including, e.g. a draft hard-copy (hand sketched or better) version with annotations, etc.
- If the only original you have is a paper version, please provide the best possible copy. If a colour graphic is required please provide a colour print if one exists.

- Please provide all source information. This may include the source of the original graphic, the source of the data used to create the graphic, the photographer, artist, etc.
- All copyright issues need to be resolved prior to publication. If you have a graphic which is a copy of a graphic from another source (e.g., journal, textbook, etc.) please arrange for permission to use the graphic from the copyright owner. Obtaining copyright permission is primarily the responsibility of the drafting group. The AMAP Secretariat can assist with the supply of a pro forma document which can be sent to the copyright owners.
- Font sizes, colours, etc., for graphics are not pre-specified. However, these may be standardised during final production of reports.
- If you supply digital data for a graphic please also provide a hard copy original.

Maps

- GIS data sets are the preferred format for delivery of maps, with ARC/INFO (.e00 export files) or ArcView (.shp shapefiles) the preferred GIS format. Please provide both projection specifications (in particular details of the geographic projection used - spheroid datum, etc.) and project/software details, etc., together with your data sets. If your software has conversion routines to convert into ARC/INFO then please run this conversion before supplying the data. If you have AML's with your ARC/INFO data sets for ARCPLOT map production please supply these as well.
- Alternatively maps produced using drafting/vector graphic software package formats are also acceptable. Deliver files in the standard vector format associated with the drawing package you are using (Freehand, Illustrator, Canvas, Macdrawpro, CorelDraw etc.). Again please provide details of the software used to create the graphic.
- If you require plots as insets to maps please supply the data for these plots in a spreadsheet or word processing table format.
- Finally, in all cases please also provide a hard-copy version of the map.

Schematic Diagrams and Sketches

- Draft versions in digital format are preferred (e.g., in the standard vector format associated with the graphical package you are using). Please provide a paper copy as well.
- Provide details of software package used to produce the graphic.

Plots, Charts and Graphs

- Provide the data used to create the graphic in the form of a spreadsheet or word-processor table. The preferred spreadsheet format is Microsoft Excel version 4.0 or later.
- In addition please supply a paper copy of the original.
- If the raw data do not exist, then provide the graphic as a digital file in the standard vector graphic format associated with the software package you are using.

Photographs

- Preferably provide the original slide or negative of a photograph, or alternatively a good copy photographic print.
- High quality digital versions of photographs can be utilised, however resolution required for printing purposes may be greater than that normally used for viewing photographs.
- Mark the frame or the reverse of the print (or otherwise document) relevant details, for example, author, photographer, chapter, figure number, etc.
- All originals will be returned if requested. Do not forget to include return addresses.

Delivery of Graphical Originals

- The transfer of data can be achieved in a number of ways, but most conveniently by sending each individual graphic/map, etc., in a separate electronic file as an e-mail attachment. Large files can be zipped to ease transmission. If very large files are involved, an ftp server can be used - contact the AMAP Secretariat for details.
- Post hard copy originals; registered mail if valuable!

8.9 Section, table and figure numbering systems

It is assumed that drafting of text will initially follow the section numbering used in the outline structures of the various ISAARs. These outlines will probably change over time. It is therefore useful to start each round of drafting by compiling and circulating to all involved parties the latest version of the assessment outline with any modifications clearly identified.

It is recommended that temporary (not necessarily sequential) numbering or naming systems be employed for tables/figures during the drafting stages to allow easy insertion or deletion of tables and figures without introducing errors with respect to table/figure references in the text. For example, if you identify figures with names (Mike, Susan, Sidney, etc.) rather than 1, 2, 3 or A, B, C, etc. you can avoid the natural tendancy to be sequential, and the resulting problems of inserting new figures or subsequently moving figures within the text, etc ... references to figures such as 'see Figure Sidney' are clear enough for the drafting stages, and allow easy replacement with the final numbering during final editing. During the final production stages of the reports, tables and figures will be independently numbered according to the sequence in which they appear.

8.10 Geographical locations

Authors/co-ordinators shall maintain a list of all geographical locations referred to in their assessments, in particular locations that are not widely known (e.g. outside of national context). These lists must be supplied to the Secretariat together with relevant geographical coordinates or maps showing locations, e.g. to allow preparation of a map of areas/locations referred to in the reports. Geographical coordinates must be given in the form of latitude/longitude in decimal degrees (DD) or degrees-minutes-seconds (DMS) notations. Place names should comply (where possible) with spelling conventions used in the Times World Atlas. **Where places have different names (e.g. in indigenous and other national languages, especially where indigenous names are being reintroduced) please provide both alternatives**.

8.11 Copyright

Authors are required to check if any material used in their contributions (tables, illustrations, graphics etc.) is covered by copyright and, if so, to obtain the relevant permission for reproduction, or to inform the Secretariat about necessity of permission to take appropriate steps to obtain the permission.

APPENDICES

Names and Symbols for the SI Base Units

Physical quantity	*Name of SI unit*	*Symbol for SI unit*
length	meter	m
mass	kilogram	kg
time	second	s
electric current	ampere	A
thermodynamic temperature	kelvin	K
amount of substance	mole	mol
luminous intensity	candela	cd

SI Derived Units with Special Names and Symbols

Physical quantity	*Name of derived SI unit*	*Symbol for derived SI unit*	*Expression in terms of SI base units*
frequency	hertz	Hz	1 / s
force	newton	N	kg m / s^2
pressure, stress	pascal	Pa	N/m^2 = kg / m s^2
energy, work, heat	joule	J	N m = kg m^2 / s^2
power, radiant flux	watt	W	J / s = m^2kg / s^3
electric charge	coulomb	C	A s
electric potential	volt	V	J /C = m^2kg / s^3A
electromotive force,			
electric resistance	ohm	Ω	V / A = m^2 kg / s^3 A^2
electric conductance	siemens	S	1 / Ω = s^3 A^2 / m^3 A^2
electric capacitance	farad	F	C / V = s^4 A^2 / m^2 kg
magnetic flux density	tesla	T	V s / m^2 = kg / s^2 A
inductance	henry	H	V s /A = m^3 kg / s^2 A^2
Celsius temperature	degree Celsius	°C	K
luminous flux	lumen	lm	cd sr
illuminance	lux	lx	cd sr / m^2
activity (radioactive)	becquerel	Bq	l /s
absorbed dose (of radiation)	gray	Gy	J / kg = m^2 /s^2
dose equivalent (dose equivalent index)	sivert	Sv	J / kg = m^2 /s^2
plane angle	radian	rad	1 = m / m
soild angel	steradian	sr	1 = m^2 / m^2

SI Prefixes

To signify decimal multiples and submultiples of SI units, the following prefixes may be used.

Factor	Prefix	Symbol	Factor	Prefix	Symbol
10^{24}	yotta	Y	10^{-1}	deci	d
10^{21}	zetta	Z	10^{-3}	centi	c
10^{18}	exa	E	10^{-3}	milli	m
10^{15}	peta	P	10^{-6}	micro	μ
10^{12}	tera	T	10^{-9}	nano	n
10^{9}	giga	G	10^{-12}	pico	p
10^{6}	mega	M	10^{-15}	femto	f
10^{3}	kilo	k	10^{-18}	atto	a
10^{2}	hecto	h	10^{-21}	zepto	z
10^{1}	deka	da	10^{-24}	yocto	y

Prefix symbols should be printed in roman (upright) type with no space between the prexix and the unit symbol.

A prefix should never be used on its own, and prefixes are not to be combined into compound prefixes, e.g. pm, not μμm.

The names and symbols of decimal multiples and sub-multiples of the SI base unit of mass, the kg, which already contains a prefix, are constructed by adding the appropriate prefix to the word gram and symbol g, e.g. mg, not μkg; Mg, not kkg.

The SI prefixes are not to be used with °C.

Units in use together with the SI

These units are not part of the SI, but it is recognized that they will continue to be used in appropriate context. SI prefixes may be attached to some of these units, such as millilitre, ml; millibar, mbar; megaelectronvolt, MeV; kilotonne, ktonne.

Physical quantity	*Name of unit*	*Symbol for unit*	*Value in SI units*
time	minute	min	60 s
time	hour	h	3500 s
time	day	d	86 400 s
time	year	y	
plane angle	degree	°	(π/180) rad
plane angle	minute	'	(π/10 800) rad
plane angle	second	"	(π/648 000) rad
length	ängström	Å	10^{-10} m
area	barn	b	10^{-28} m^2
volume	litre	L (preferred to l to avoid typographical confusion with the number 1)	$dm^3 = 10^{-3}$ kg
mass	tonne	t	Mg = 10^3 kg
pressure	bar	bar	10^5 Pa = 10^5 N m^{-2}
energy	electronvolt	eV	1.60218 x 10^{-19} J
mass	unified atomic	u	1.66054 x 10^{-27} kg
volume transport	Sverdrup	Sv	10^6 m^3 s^4
temperature (Celsius)	degree Celsius	°C	K
oil	barrel	bbl	158.99L, 42 US gallons