

**Minutes of the Third Meeting of  
Assessment Steering Group II (ASG-II) of the Arctic Monitoring and  
Assessment Programme**

**Reykjavik, Iceland  
November 1-3, 2000**

AMAP Working Paper 2000:1

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## **Minutes of the 3<sup>rd</sup> AMAP ASG-II Meeting, Reykjavik, Iceland, November 1-3, 2000**

### **1. Opening of the Meeting**

- 1.1 The Chair of the ASG, Helgi Jensson (Iceland), opened the meeting and welcomed the delegates to Iceland. He then provided information on practical arrangements.
- 1.2 It was noted that the ASG meeting had been enlarged to include national data managers, representatives of thematic data centres and some additional national experts for this meeting, to provide the possibility to discuss, for example, arrangements for providing data to the assessment groups, etc. A list of participants is presented in Annex 1.

### **2. Adoption of the Agenda**

- 2.1 The draft agenda, Annex 2, distributed prior to the meeting was adopted without changes. A List of Actions agreed at the meeting is attached as Annex 3.
- 2.2 Lars-Otto Reiersen (AMAP Secretariat) indicated that agenda items 1-7 would be covered in plenary, followed by more detailed discussions of items 4-7 in break-out groups based on themes (POPs, Heavy Metals, Human Health, Radioactivity, Oil, Thematic Data Centres and Data Managers, and extended Board). Break-out groups stated a need for cross-fertilization consultations between the groups, and procedures for this were established.
- 2.3 Jozef Pacyna (Norway) raised the issues of sources and pathways, and the possible need for a separate assessment of these issues, or a separate specialist group on sources and pathways to support the other topic assessments (POPs, heavy metals, etc.) in their consideration of these issues. The ASG reconfirmed the intention that relevant sources and pathways aspects would be included in each of the individual assessments (POPs, heavy metals, radioactivity, oil/PAHs, and acidification). However, the possible need for establishing a cross-disciplinary group on sources and pathways to provide input on these issues to each of the other assessment groups should be considered by the break-out groups for a decision later during the meeting. An additional break-out group on Sources was established to meet during the ASG meeting.

### **3. Progress Report from the ASG Chair and the AMAP Secretariat**

- 3.1 The AMAP Working Group Chair, Hanne Petersen (Denmark), informed participants about the Ministerial Meeting in Barrow, Alaska, held October 12-13, 2000. At this meeting, the AMAP Report to the Second Ministerial Meeting of the Arctic Council, and its supporting documentation (the AMAP Update Report on Issues of Concern: POPs, Mercury, Radioactivity and Human Health) had been presented and accepted. The main message from the Ministers was that AMAP work is of high quality and received with appreciation by SAOs and Ministers. Ministers were also encouraged to hear that AMAP Phase 2 work is continuing to progress well, and the Ministers look forward to receiving the next Assessments in 2002.

- 3.2 Lars-Otto Reiersen added that AMAP is currently on schedule for completion of the next AMAP Assessment Report by August 2002, but that the schedule may have to be adjusted depending upon the dates for the Rio+10 meeting tentatively planned in South Africa (see Minutes Item 12.5) if AMAP is to provide a contribution to this meeting based on its 2002 assessments.
- 3.3 Helgi Jensson, noting the comment of Hanne Petersen that participants in Barrow seemed pleasantly surprised that everything with respect to production of the next AMAP Assessment was going as planned, expressed his confidence that the ASG would be able to continue to meet these expectations.

#### **4. Overall Strategy for the Scientific Assessment Work**

- 4.1 Helgi Jensson explained that the preparation of the second AMAP Assessment Report (AMAP II) will proceed in a similar manner to the preparation of the first Assessment report (AMAP I), using Lead Country Experts and Key National Experts as the main contributors, supported by a large number of designated experts. The intention, however, is that AMAP II will not repeat the findings reported in AMAP I, but instead will further develop the information presented in the update reports produced by the assessment groups for the Barrow Ministerial meeting, to prepare comprehensive 'Issue Specific AMAP Assessment Reports (ISAARs)' presenting mainly new findings since 1996.
- 4.2 Preliminary comments were solicited from Lead Country Experts.
- 4.3 Cynthia de Wit (Sweden) commented that the Rovaniemi Workshop on Human Health and POPs held January 17-21, 2000, had provided a good opportunity to pull together a great deal of information. The POPs group has identified major ongoing research projects that will produce results in time for the Assessment report. If anyone is aware of additional studies that will be producing results by autumn 2001, they should bring this to the attention of Cynthia de Wit or Aaron Fisk (Canada) so that the results may be covered in the report. Aaron Fisk has been engaged as Scientific Secretary for the POPs assessment to assist the Lead Co-Authors (Cynthia de Wit and Derek Muir) in compiling data and drafting the assessment.
- 4.4 Jens Hansen (Denmark) reported that at the most recent meeting of the Human Health expert group on the Faeroe Islands (2-4 October 2000), the group had agreed on a content outline, a process and the responsible author(s) for each section (document distributed to the meeting). A draft timeline is as follows: early February 2001 - first draft to be circulated within the human health group; Spring 2001 – human health meeting to discuss sections and agree on conclusions followed by circulation of first draft to AMAP ASG/WG; August 2001 – second draft for circulation; October 2001 – meeting to discuss second draft; November 2001 – addition of final data and completion of assessment report for circulation to ASG and WG members. There were no problems regarding finances in the human health expert group. A Secretariat to support the health group has been established, supported by the Lead Countries Denmark and Canada. In response to questions concerning the geographical coverage of the human health assessment, Jens Hansen informed that efforts were being made to ensure full circumpolar coverage, partly linked to the planned RAIPON-AMAP-GEF project in

Russia and other bilateral projects. If these bilateral initiatives and the national programmes proceeded according to plan no major geographical gaps were envisaged.

- 4.5 Lars-Otto Reiersen noted that he had tried to find further information concerning dietary studies being carried out by an independent group in Denmark, but had not been successful. Jens Hansen informed that he was aware of this work, and offered to find out more about the status of this study.
- 4.6 Suzanne Marcy (USA) reported that the Heavy Metals group is planning to hold a series of workshops and meetings, each of which will include a writing session to draft main parts of the AMAP heavy metals assessment, as follows: February 2001 – sources and transport of heavy metals; June 2001 – transformation and fate; September 2001 – effects. The Heavy Metals group is lobbying within the USA to ensure funding for these meetings, but is also looking to other countries for support in hosting meetings and covering logistics, specifically Norway (sources and transport), USA (transformation and fate), and Denmark (effects) were being investigated as meeting locations. The first draft of the heavy metals assessment will be prepared by November 2001 so that the Heavy Metals group can review the entire document at a meeting in January 2002, and approve the draft. The final draft is planned for March 2002, for circulation to ASG and WG members in April 2002. To date, the USA has funded a preparatory workshop held in Alaska (7-10 September 1999) and has also provided funding to facilitate data transfer to AMAP thematic data centres; discussions have been held with the University of Alaska Fairbanks concerning this work. Victoria Woshner has been engaged as Scientific Secretary for the Heavy metals group to assist the Lead Author (Suzanne Marcy) in compiling data and drafting the assessment. .
- 4.7 Hein Rune Skjoldal (Norway) reported that the Oil and PAH group held an initial meeting in St. Petersburg this year (1 June 2000) and that the draft minutes with suggestions would be distributed to the meeting. One problem noted was the lack of experts from countries other than Norway and Russia, particularly, Canadian and US experts are required in the group. The group would like to leave the ASG meeting having a clearer idea of direction and a draft schedule. Helgi Jensson pointed out that the Oil group is less advanced than the other assessment groups since it has 2 extra years (until 2004) to complete its assessment. David Stone (Canada) indicated that Canada would be able to redirect effort and resources towards the oil assessment after 2002; currently its focus is on meeting the requirements for the assessments due in 2002. Cynthia de Wit added that since the PAHs are being split between two reports (pyrogenic PAHs under the POPs assessment and petrogenic PAHs under the Oil assessment), the POPs group would welcome some expertise and input from the Oil group, in particular with respect sources of information and data concerning PAHs to be covered in the POPs report since much of this information is normally collected in relation to oil related studies.
- 4.8 Juha Kämäri (Finland) reported that the Acidification assessment is due in 2006. At this stage, therefore, the Acidification group is still only considering necessary steps to prepare the assessment. However, there are concrete plans to conduct an assessment of data and information available from Russia for the Norilsk/Taimyr region as early as 2001. Finland has secured funding for this work for 2001. This will constitute a major part of the preparation (and input) for the 2006 assessment. A Russian scientist has been approached to assist and act as consultant in this project. Field expeditions in the

Norilsk/Taimyr peninsula area are being planned for 2001, 2002, and possibly 2003. An intermediate report on this region, which will be for internal AMAP use and not for delivery to the Ministers, is planned for the end of 2001, at which time more information can be provided.

- 4.9 Helene Stensrud (Norway) reported that there is a plan of work for producing the Radioactivity assessment, including an outline for the report and allocation of responsibilities. Several projects, including bilateral projects, that will provide major contributions to the radioactivity assessment are underway. The next meeting of the Radioactivity expert group is planned to be held in Halifax (Canada) in November 2000, and another in February 2001.
- 4.10 Helgi Jensson called upon Harald Loeng (Norway) to provide his views on the request from Jozef Pacyna (Norway) that a new chapter covering sources, fluxes and transfer of contaminants be included in AMAP II. The concern stems from the fact that phase 2 assessments as currently outlined do not include looking at future scenarios, and that the most efficient way of introducing this element into the assessment is to examine future emission scenarios, based on historic levels and trends.
- 4.11 Harald Loeng reminded participants that a decision had been made previously to incorporate sources and pathways into the various chapters. He did, however, express a concern that pathways issues might be neglected if assessments concentrate too much on only describing current (spatial and temporal) trends and effects. As an example, he referred to the conclusions of the first AMAP assessment which highlighted the evidence of large fluxes of contaminants to the Arctic via some Russian rivers, but did not relate these fluxes to the potentially much larger transport via ocean currents (as a consequence of low contaminant levels but much greater water volume fluxes). This subject clearly needs to be better addressed in the next AMAP assessment. Lead authors were therefore encouraged to ensure an appropriate consideration of atmospheric and water transport from outside the Arctic when preparing their assessments.
- 4.12 Keith Puckett (Canada) stated that a separate chapter worked well in AMAP I since it was one large document, but since AMAP II will consist of several stand-alone assessment reports, it may be more beneficial to include issues such as sources, emissions and transport in each assessment.
- 4.13 Lars-Otto Reiersen added that future scenarios are a new challenge for AMAP, and are of particular interest for the climate group, constituting an important part of the proposed ACIA assessment. Helgi Jensson requested all groups (radioactivity, POPs, heavy metals and human health, and also acidification and oil) look into the possibility of assessing future scenarios. It was recognized that determining future scenarios for human health is complex due to the significant confounding lifestyle factors. Break-out groups were asked to discuss whether or not future scenarios should be put into each assessment, or into an additional stand-alone assessment.
- 4.14 Suzanne Marcy strongly supported the recommendation that future scenarios be incorporated into the AMAP Assessment, but that included in each chapter.
- 4.15 Hein Rune Skjoldal referred participants to the annual reports of the International Council for the Exploration of the Sea (ICES)'s Advisory Committee on the Marine

Environment (ACME). He presented information from the draft of the most recent ACME report, which includes comprehensive information on monitoring guidelines and statistical techniques for use in environmental assessments, etc. This information is largely compiled at the request of OSPARCOM and HELCOM but equally applicable for AMAP. ICES, which hosts the AMAP marine TDC, has indicated a desire for better collaboration with AMAP, and the ASG agreed that this cooperation should be further developed.

- 4.16 Following this plenary briefing the ASG split into eight discussion groups based on the following themes: POPs; heavy metals; human health; radioactivity; oil; sources, transport and scenarios; data management; and extended Board. Discussion groups were requested to report their provisional time schedules in preparation for a plenary discussion on this issue (see Agenda item 15), and to provide a marked up copy of the Assessment Guidelines (see Agenda item 6) and the AMAP Trends and Effects Monitoring Programme documents (see Agenda item 7). Meetings between the various groups were also held, as required.
- 4.17 POPs: As a result of their group discussions, the POPs group reported that their work plan had been further developed. Joint discussions with the oil group had helped clarify issues relating to the division of effort concerning assessment of PAHs. Necessary work on the Assessment Guidelines and AMAP Trends and Effects Monitoring Programme documents had been completed. The issue of 'Scenarios' was discussed, and the proposed content of the POPs assessment adjusted to add new sections on scenarios.
- 4.18 Human Health: The Human health group provided an updated table of contents for their assessment with the responsible author for each section identified, Annex 4, as well as a working plan. Future scenarios will be covered under the section titled 'Adaptations'. It was decided that the data available on dietary assessments should be used to produce an overview of diets in the Arctic. Since the AMAP Human health TDC had been put on hold, it was agreed that all dietary survey data should be sent to the AMAP Secretariat (Simon Wilson). The human health group identified a need for more collaboration with the POPs and heavy metals groups; collaboration with the radioactivity group would be established through a planned joint human health/radioactivity experts group meeting. With respect to effects on children and youth, the relevant aspects will be included in the AMAP human health report, but also provided as input to the wider scope Children and Youth report that will be prepared under the Arctic Council's Sustainable Development initiative.
- 4.19 Heavy Metals: The heavy metals group drafted a framework for the document and an annotated outline of its content. These, together with tentative plans for workshops in the spring are outlined in Annex 5. Assessment group membership was clarified and comments on the Assessment Guidelines were provided.
- 4.20 Oil: The oil group produced a draft outline for the oil and PAHs document (Annex 6), as well as a workplan and timeline. A need was identified for the oil group to collaborate with the POPs group on PAH aspects and with the human health group on health aspects. In addition, it was considered that collaboration between AMAP and EPPR groups working on oil related issues would be mutually beneficial. The AMAP Board would follow-up on this suggestion by taking contact with the EPPR Chair. The ASG supported the proposal from the St. Petersburg oil group meeting to arrange a

workshop on oil/PAH in the Arctic, to present new information on biological effects due to oil, the fate of oil under Arctic conditions, and to document existing and potential sources. The ASG further supported the recommendations from the St. Petersburg oil group meeting regarding methodology and areas proposed for 'essential subregional' monitoring.

- 4.21 Radioactivity: Since there was only one member of the radioactivity group participating in the ASG meeting, there was no opportunity to review the draft outline for the document and timelines. However, comments on the Assessment Guidelines were provided, and possible collaboration with the human health expert group was explored.
- 4.22 Acidification: Since only the Lead Author of the acidification assessment was participating in the ASG meeting, and the assessment is only in very early stages of preparation (due in 2006) no additional information was reported at this time.
- 4.23 Sources, emissions and pathways: This *ad hoc* group discussed how to handle sources and emissions and pathways related information within the AMAP II assessments. The group confirmed that it was preferable to cover relevant information on these issues in each assessment, as opposed to producing a separate report. However, the need for a special workshop on sources and emissions was identified to compile relevant information as input to the various assessments. In this context, a need to coordinate between AMAP and ACAP was also identified.
- 4.24 Data management: see section 5 below.
- 4.25 Extended Board: The extended Board discussed the role of the indigenous people's organizations in the production of each report, noting that their role was not very visible. It was decided that the permanent participants would compile relevant material and be responsible for preparing a generic introductory section for the various assessments entitled "Setting the Scene". Relevant material extracted from the previous assessment report would also be incorporated in the introductory section. This section will appear in each of the scientific assessment reports, suitably adapted for the subject of the assessment, as well as the Ministerial/popular report. There will be a common framework and common elements in each report, including observations of environmental change, indigenous knowledge, and conclusions based on the results of scientific studies, but the emphasis may vary. For example, the Ministerial/popular report should place a greater emphasis on the connection between reported observations/indigenous knowledge and scientific results/knowledge. It was felt that this would provide a way of ensuring that the rationale and human element of the Assessment is not lost, given the different format of the AMAP II assessments (i.e. a series of separate documents as opposed to a single AAR).
- 4.26 The ASG agreed that a) relevant information on sources, transport and future scenarios should be covered in each separate scientific assessment report; and b) that a stand-alone chapter on these issues would be produced in the popular (2002 SOAER) report. In this connection, Jozef Pacyna agreed to arrange a workshop in late-summer/early-autumn 2001 on sources and emissions to discuss and compile relevant information on these subjects; this workshop would represent a follow-up to the 1999 Bergen workshop on sources and modelling.

## **5. Data Gathering for the Assessment**

- 5.1 Simon Wilson (AMAP Secretariat) provided an update on the status of the thematic data centres (TDCs). There are currently six TDCs with representatives of five of them were participating in the ASG meeting: AMAP atmospheric TDC, at the Norwegian Institute for Air Research (NILU); AMAP marine TDC, at the International Council for the Exploration of the Sea (ICES); AMAP terrestrial and freshwater TDCs, at the University of Alaska – Fairbanks; and AMAP radioactivity TDC, at the Norwegian Radiation Protection Authority. The AMAP human health TDC has been put on hold due, in part, to legal/confidentiality issues that are restricting supply of data to the TDC. Simon Wilson reminded the ASG of the types of data that the respective TDCs were handling.
- 5.2 National Data Managers (NDMs) from Canada, Denmark, Finland, Iceland, Netherlands, Sweden and US (metals) participated in the ASG meeting.
- 5.3 Assessment groups were encouraged to discuss with TDCs and NDMs the best ways of arranging the flow of data into the various assessment, including how to handle information and data not covered by the TDCs. AMAP's assessments are based on inclusion of all relevant data and information and it is important that the assessment groups are aware of the information available, and how to access it. As part of this process, the AMAP Secretariat will provide lists of reports that are available at the Secretariat. The AMAP NIPs documents and the AMAP PD are additional tools developed to support this process.
- 5.4 Information on sources of pollution (both location and quantification) is an essential component of the assessment and one that can hopefully be improved under AMAP II. AMAP has requested that countries provide copies of data (officially) reported to other fora (UN ECE, OSPAR, EC, OECD, etc.) also to AMAP for use in its assessments. Norway has proposed a form for registering availability of officially reported data available in the various countries, and the assessment groups were asked to consider its utility for their purposes. Jozef Pacyna also mentioned Russian source data collection activities ongoing as part of the LOIRA/LOICZ/IGBP project for which he could act as liaison with AMAP. One point raised in discussion was the fact that AMAP's assessment groups have access to both 'officially reported' and 'expert estimated' data on emissions. The importance of obtaining both of these types of information to check consistency, etc. was stressed. The ASG were informed that, within the context of the AMAP assessments, they are free to use both 'officially reported' and 'scientifically derived' emissions data, and comparison of these two types of information was encouraged.
- 5.5 Data ownership was a significant issue during the production of AMAP I, since data were being used in the Assessment Report prior to their publication in peer-reviewed journals. Consequently a form was developed, and signed by all experts involved in the AMAP assessment process, that guaranteed the rights of the data originators and explained how their data would and would not be used. Although, as several ASG members noted, a good rapport with a high degree of trust has been established between AMAP and contributing scientists as a result of their Phase I experiences, it was noted that new individuals have entered the process (both AMAP experts and potential data suppliers). It was, therefore, agreed that a similar exercise would be conducted for the

production of AMAP II, to re-confirm the ground rules and to reassure new scientists that their data is protected. The relevant form, "AMAP Experts Data Agreement" is Attachment 1 to Section F (Data Reporting Issues) of the AMAP Trends and Effects Programme documentation. This form will be circulated by the Secretariat for signing by all experts engaged in production of the AMAP II assessments. The AMAP Data Policy also defines the mechanisms by which data originators can restrict access to their data reported to AMAP TDCs (see Section F of the AMAP Trends and Effects Programme documentation - Attachment 2). The associated form identifies the owners of data provided to AMAP and any restrictions they may care to introduce concerning access their data, and one such form should be completed for all datasets delivered to AMAP.

- 5.6 Concerning provision of Russian data, it was noted that the Russian NIP document states that data collected under national projects financed by other bodies can only be made available to AMAP as aggregated data. This was a matter of concern to ASG, since aggregated data are limited in their use. This constraint does not apply to data from bilateral/multilateral projects, such as the RAIPON-AMAP-GEF project. In order to make use of these data in AMAP II, they must be obtained by autumn 2001. Lars-Otto Reiersen noted that bilateral projects seem to be the best way to obtain data from Russia, noting that sampling under the RAIPON-GEF project had been initiated in order to ensure that some data are available in 2001. The ASG were informed that Derek Muir (Canada) has funding approved by the Northern Contaminants Program in Canada to prepare a special issue on contaminants in the Russian Arctic for the journal *Science of the Total Environment*, co-edited with scientists at Akvaplan-niva (Norway). This volume will use data that are already available, although there is a concern that there are not enough Russians currently involved in the project. Jozef Pacyna informed that funding from INTAS might be available to support this type of project (i.e., release of Russian data). AMAP has made efforts to obtain additional data from projects sponsored during AMAP phase I by the US Office of Naval Research, but so far, has obtained only radioactivity data. Simon Wilson informed the ASG of discussions between AMAP and GEMS-WATER where the possibility had been raised of cooperating on work to estimate fluxes through Russian Rivers by combining AMAP contaminants data with GEMS-WATER (water and sediment) discharge data.
- 5.7 One of the break-out groups convened during the ASG addressed data management issues. Reporting to plenary, this group informed the ASG that during the discussions within this group, the representatives from the AMAP thematic data centres (TDCs) discussed common issues. The major challenge for TDCs is the flow of data into each centre. This issue was considered on a country-by-country basis. Preliminary lists of project datasets that should be reported to the various TDCs were identified from the AMAP project directory and discussions between the TDCs and national data managers present in the group had facilitated some initial agreements on how to approach problems related to data reporting to the TDCs. The group also met with the POPs, Heavy metals and Radioactivity groups to discuss both which data might be compiled at the TDCs but also, how the TDCs might serve the assessment groups in terms of delivery of products, etc. for use in the assessments. The POPs, Heavy Metals, and Radioactivity groups were asked to consider their needs with respect to dietary information that will be compiled at the AMAP Secretariat since it will not now be handled at the AMAP human health TDC.

5.8 Discussion also focussed on whether or not to use old as well as new data for the Assessment, as this has implications for the products that might be delivered by TDCs. The ASG agreed that the use of old data is essential for parts of the assessment dealing with temporal trends, and that new data filling gaps in spatial coverage identified in AMAP I could be combined with old data to describe circumpolar spatial trends, however, the focus of the assessments should be on new data. The general intention was that appendices to the 2002 assessment reports would include only data not represented in the appendices to the 1998 AAR. However, it was noted that alternative approaches exist that would allow all AMAP produced tables (of aggregated data) to be kept together. This could be achieved by, e.g., including the full data set (updated versions of the AAR appendices incorporating new data) in an electronic file that could be included on a CD-ROM or placed on the AMAP website, but not included in the hard copy publications. The advantages of this were recognized by the ASG, and options to take this approach would be further considered, also taking into account the issue of data ownership and restrictions on release of data.

## **6. Finalizing the Assessment Guidelines for AMAP Phase 2**

- 6.1 Lars-Otto Reiersen introduced the draft assessment guidelines document, which was sent out in advance of this meeting. The guidelines, which are revised for the second AMAP Assessment, were developed in order to support production of the Assessment. The importance of adhering to the guidelines was stressed because of the very tight timelines under which AMAP is working, particularly since both the scientific and the Ministerial report are being prepared simultaneously for the same deadline.
- 6.2 The AMAP WG decided at their WG14 meeting in September 2000 to request the ASG to finalise the assessment guidelines. The individual assessment groups were requested to review the guidelines document, to check the lists of experts for their assessment and update or insert their preliminary assessment outline/content, and also to review other parts of the document. All comments, edits or additions to the guidelines should be supplied to Simon Wilson, either during or immediately after the ASG meeting.
- 6.3 The ASG approved the guidelines, subject to the corrections noted, and requested that the Secretariat finalise and publish the assessment guidelines as soon as possible following the ASG meeting. They will constitute "living" documents, maintained on the AMAP website, and updated as necessary.

## **7. Finalizing the AMAP Trends and Effects Monitoring Programme**

- 7.1 The AMAP WG decided at their WG14 meeting in September 2000 to request the ASG to finalise the AMAP Trends and Effects Programme documents. Simon Wilson presented the current status of the draft document as follows:
- Section A – Introduction – finished;
  - Section B – AMAP Trend Monitoring Programme – finalised with the exception of Table B.6, assessment groups were requested to review and complete this table and provide any necessary changes to Simon Wilson by the end of the meeting;

- Section C – AMAP Effects Monitoring Programme – sections have been updated, specific comments from Norway have been integrated, but general comments from Norway are yet to be addressed, ASG were requested to provide any necessary changes to Simon Wilson by the end of the meeting;
- Section D – Supporting Studies – ASG were requested to provide any necessary changes to Simon Wilson by the end of the meeting;
- Section E – Quality Assurance – draft currently consists of a very rough first version and any comments would be welcome, ASG were requested to provide any necessary changes to Simon Wilson by the end of the meeting;
- Section F – Policy – finished;
- Section G – Appendices (references, methodologies, etc.) – revised on the basis of input received, ASG were requested to provide any necessary changes to Simon Wilson by the end of the meeting.

7.2 General ASG comments concluded the following: A short reference to laboratory studies addressing effects (of both single compounds and mixtures) should be added to Section D. For section C, the document should be finalized on the basis of any specific changes noted to the AMAP Secretariat. Although the relevance of some of the general comments from Norway was acknowledged, Bjørn Munro Jenssen agreed that it would be impractical at this stage to introduce these, but concluded that Section C as it now stands was appropriate as 'guidance' for the development of the 'Effects' components of the AMAP Monitoring Programme and could be updated in the future on the basis of experiences gained during initial application of several of the biological effects techniques. The individual assessment groups would deliver input concerning other sections of the documentation, once incorporated the documents could be published.

7.3 The ASG approved the Trends and Effects Programme documents, subject to the corrections noted, and requested the Secretariat to finalise and publish these documents as soon as possible following the ASG meeting. They will constitute "living" documents, maintained on the AMAP website, and updated as necessary.

## **8. Overview of the National Implementation Plans (NIPs) as of November 2000, and the AMAP Project Directory (PD)**

8.1 Simon Wilson briefly presented the AMAP Project Directory (AMAP PD) and explained that AMAP produces the PD to support the assessment process and document progress in implementing the NIPs. There are currently over 150 projects included in the PD. Countries (and where identified, National Data Managers) were encouraged to finalize and check the completeness of their NIP entries. Simon Wilson also introduced a paper overviewing the present coverage (geographical and parameters/media) of the NIPs with respect to the AMAP "Trend Monitoring Programme" guidelines. This matrix (Annex 7) was based on information contained in the NIP documents provided by the different countries and, if required, it could be further developed to include PD information and represent activities with respect to ES parameters; a similar matrix could also be completed for the coverage of the "Effects Monitoring Programme". The assessment groups were requested to use this document to identify any significant gaps in the monitoring relevant to their assessments.

## **9. Production of the (Scientific Assessment) Reports**

- 9.1 An updated timetable for the production of the reports is presented in Annex 8.
- 9.2 The AMAP Secretariat is looking into options for the production of the Assessment Reports and their accompanying maps and graphics. The individual scientific assessment reports will be prepared as a series of separate documents with a similar style. The AMAP Secretariat will initiate actions to select a publisher for the reports.
- 9.3 Lead authors were requested to provide input to Simon Wilson with respect to standardizing graphics, software used for compiling bibliographic information, consistency of, and need for colours or shading throughout the documents. In general, full colour options were strongly encouraged for the reports to be produced.
- 9.4 ASG members discussed the advantages and disadvantages of electronic versions and hard copies of the reports. It was noted that for AMAP II, the focus should be more on the electronic version (either CD-ROM or on-line Internet documents), however, the need for hard copy versions of both the popular and scientific reports was recognized. Both the SOAER and AAR products of AMAP I proved very effective in moving the contaminants agenda forward, and are a popular publications among Ministers, scientists and the public alike.
- 9.5 The AMAP Secretariat was requested to contact countries to determine the number of copies of the various reports that would be needed, and in which format.

## **10. Executive Summary (2002 SOAER)**

- 10.1 The ASG will recommend to the WG that approval be given for production of a popular version of the Assessment Report, similar to the SOAER report produced in 1997. This report will incorporate the key elements of all the individual scientific assessment reports delivered in 2002 and be drafted by a scientific journalist.
- 10.2 The ASG recommend that the AMAP WG hire a consultant to produce the popular version, preferably a professional journalist with knowledge of the Arctic. The AMAP Secretariat will request nominations for this consultant and circulate these to WG members. Once a decision has been reached, members of the ASG would be notified. The need to conduct this activity as a matter of urgency was recognized as financial and administrative (commitments, contracts, etc.) aspects need to be in place well advance of the actual work itself. Similar actions need to be initiated with respect to the publisher of the report.
- 10.3 The ASG agreed to recommend to the AMAP WG that the translation of documents will be left to the discretion and responsibility of each country, however, if countries are already able to identify translation needs, this could make their production more efficient (both with respect to cost and timetables).

10.4 The AMAP Secretariat will write to the AMAP WG (cc: ASG) seeking their input on these matters, including issues relating to financing report production work.

## **11. ACIA Work**

- 11.1 Hanne Petersen briefly described the background to the Arctic Climate Impact Assessment (ACIA) work that is being implemented by several organizations, with AMAP and CAFF responsible for this work under the Arctic Council. The development of an ACIA Assessment report for 2004 is following a similar process to that employed for the other AMAP assessments, with an Assessment Steering Committee (ASC) established to take a role similar to the ASG. There is a need to clarify the links between the ASG and the ASC, particularly since combined effects of climate, UV and contaminants is being addressed primarily from the AMAP/CAFF parts of the work.
- 11.2 ASG members were asked to look at the chapter outline for the ACIA report (to be included in the finalised assessment guidelines) and determine if they could contribute to the ACIA report. The lead of the AMAP parts of the ACIA assessment are John Calder and Betsy Weatherhead of the USA; there is still an opportunity to recommend lead authors and experts to be involved in the ACIA.

## **12. Coordination of AMAP Assessment Work Requested From Others**

- 12.1 Lars Kullerud (UNEP/GRID-A) and Lars-Otto Reiersen presented information on the GEO-III and GIWA assessments, and on AMAP involvement in assessments being conducted by UNEP Chemicals and on plans for Rio+10, respectively, indicating the requests and expectations for AMAP with respect to each of these initiatives.
- 12.2 Global Environmental Outlook - III (GEO-III). GEO-III is a global assessment delivered by UNEP approximately every three years; the next is due in time for Rio+10 in 2002. The assessment is produced using collaborating centres. Whereas the previous assessment was regionally focussed, GEO-III is thematically focussed, therefore, polar issues risk being buried in the assessment. The Arctic Council is expected to deliver input for Chapter 2 (State of the Environment and Policy Retrospective: 1972-2002) and participate in its completion, and to propose issues and experts for two scenarios for Polar Regions to be addressed in Chapter 3 (Outlook: 2002-2032). Not all of the nine themes in Chapter 2 (atmosphere, land, forest, freshwater, coastal & marine areas, biodiversity, urban areas, human health and the environment, and environmental disasters) are considered to be of relevance to the Arctic, and even fewer are dealt with through the Arctic Council. UNEP is asking AMAP to produce two pages on each of these issues. The first drafts are due in January 2001 (Chapter 2) and late spring 2001 (Chapter 3).

Helgi Jensson recommended that UNEP hire a scientific journalist to work together with the AMAP Secretariat to derive information from both existing AMAP publications and those in progress, and then confirm the drafts with AMAP. AMAP could assist UNEP in identifying a journalist. The ASG recommend that the AMAP Board and Secretariat, in consultation with the lead country experts, be responsible for confirming the input from AMAP. Furthermore, if any AMAP Lead Authors were

interested in contributing directly, they would be free to do so, but should take into account their agreements with respect to access to data delivered to AMAP, etc.

- 12.3 Global International Waters Assessment (GIWA). The objective of GIWA is to conduct assessments that are capable of identifying priority projects for Global Environment Facility (GEF) funding using an established scoping exercise and a causal chain analysis. GIWA operates through coordinating centres and has asked AMAP to take the lead for the Arctic mega region, with the AMAP Secretariat acting as a coordinating body.

The timing of GIWA is of concern because it overlaps with the production of the AMAP Assessment Report. Further, the scope of GIWA is of concern because several issues to be addressed under GIWA (e.g. fisheries, socio-economics) are beyond the scope of AMAP.

Lars-Otto Reiersen pointed out that the initial request for AMAP participation in GIWA went to the AMAP WG, not the ASG, and that the response was positive but more information was needed. The ASG recommended that GIWA provide AMAP with a more detailed proposal of their expectations of AMAP, the human resources required, what resources GIWA can make available to AMAP, and what GIWA thinks other working groups in the Arctic Council could provide in the process.

It was recommended that Lars Kullerud and Lars-Otto Reiersen further investigate GIWA funding possibilities and that a decision on AMAP's involvement in GIWA is a matter to be determined by the AMAP WG, with input from the SAOs. The ASG asked Hanne Petersen to raise this issue with the SAOs.

- 12.4 UNEP-Chemicals. AMAP received a request from UNEP-Chemicals one year ago to use the AMAP Assessment Report as a basis for drafting parts of the UNEP-Chemicals assessment (Regional Assessment of Persistent Toxic Substances) and Canada provided funding to support this initiative. UNEP-Chemicals is now prepared to move forward with this and intends to do so in cooperation with AMAP. Experts from the POPs group may be contacted to review materials.
- 12.5 Rio+10. The Arctic Council decided to provide material for the upcoming Rio+10 meeting (tentatively scheduled to be held in South Africa sometime in 2002) with the Sustainable Development group responsible for coordinating the production of this input. The concern expressed by ASG was that if the Rio+10 meeting is held earlier than September 2002, AMAP will encounter difficulties in determining how much information can be incorporated from its AMAP II assessment prior to its official release for consideration by the SAOs and Ministers at the planned Third Arctic Council Ministerial Meeting in Finland in autumn 2002.

### **13. AMAP International Symposium in 2002; Follow-up of the Tromsø Symposium**

- 13.1 Lars-Otto Reiersen informed the ASG that AMAP plans to hold a two- to three-day symposium focussing on POPs, heavy metals and human health in 2002, to be arranged in connection with the Ministerial Meeting, either in Finland at the same site as the Arctic Council Ministerial Meeting, or in Tromsø, as a follow-up to the 1997 AMAP

Symposium that was held there. Selected papers on radioactivity issues would also be included but radioactivity would largely be covered at the Fifth International Conference on Radioactivity in the Arctic planned for St. Petersburg in September 2002. The AMAP Secretariat will send a letter to lead authors seeking nominations for key people to be on the technical organizing committee for this symposium. ASG members were asked to provide any further comments on this symposium to Lars-Otto Reiersen. The AMAP Secretariat would also contact the AMAP WG concerning financing of this Symposium.

- 13.2 The AMAP Secretariat agreed to make a list of known upcoming meetings, workshops and conferences, and to distribute this list to lead authors and Key National Experts.

#### **14. Next ASG Meeting**

- 14.1 The next ASG meeting is tentatively set for April 23-24, 2001 somewhere in Scandinavia back-to-back with the planned Human Health expert group meeting. A decision will be made by the end of January as to whether or not this meeting will be necessary.
- 14.2 An extended ASG/expert (cross-fertilization) meeting is provisionally scheduled for September 2001, with two smaller ASG meetings, involving primarily the lead authors, planned to occur after this to finalise the assessments and conclude the AMAP II process.
- 14.3 A working group meeting in May 2002 will be used to finalize the deliverables to the Ministers.

#### **15. Draft Time Schedule and Actions to be Followed up After This Meeting**

- 15.1 Lars-Otto Reiersen presented a time schedule covering activities of the POPs, Heavy Metals, Radioactivity, and Human Health expert/drafting groups, as well as the ASG and the production of the SOAER.
- 15.2 The time schedule for the Oil and Acidification expert/drafting groups were added to the schedule.
- 15.3 It was decided that the best time for a cross-fertilization meeting would be in early September 2001. By that time, key experts would have more material to work with and could focus on filling-in details on drafts.
- 15.4 A revised time schedule is in Annex 8. The list of Actions agreed during the meeting appears in Annex 3.

#### **16. Other Business**

- 16.1 Specimen banking. Scientists were invited to fill out the questionnaire from the Nordic Environmental Specimen Banking Project (<http://esb.naturforvaltning.no>) available

from [kari.viken-olsen@dirnat.no](mailto:kari.viken-olsen@dirnat.no) (or the AMAP Secretariat). The AMAP Secretariat has already completed this questionnaire for AMAP as a whole, however, specimen banking is a high priority for AMAP and since most of the relevant activities involve individual institutes, it is recommended that each country or relevant institute also respond to this request.

- 16.2 All countries were asked to review nominations for key experts for the oil assessment group. They should also approve the list of experts given in the Assessment Guidelines since the Guidelines will be moved to the public site on the AMAP web site.
- 16.3 Expert/drafting groups may make use of the password-protected area on the AMAP web site for exchanging documents, etc. and should contact Simon Wilson if they wish to have such an area established for their use.
- 16.4 It has been agreed by the AMAP WG that information circulated by the AMAP Secretariat would be sent by email only in future, each circulation would however be accompanied by a fax notification of the distribution.

## **17. End of the Meeting**

- 17.1 Helgi Jensson closed the meeting, offering everyone words of encouragement for the ongoing preparation of the Assessment report.

## Annex 1. List of participants at the Third Meeting of the Assessment Steering Group II (ASG II-3).

Country	First name	Last name	Institute name	Mailing address	Direct phone	Direct fax	e-mail	Institute phone	Institute fax
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## Annex 2 - Draft agenda of the Third Meeting of the Assessment Steering Group II (ASG II-3).

- 1. Opening of the meeting**
- 2. Approval of the agenda**
- 3. Progress report from the ASG Chair and the AMAP Secretariat**
  - report from the AMAP WG, the Ministerial meeting and special projects
- 4. The overall strategy for the scientific assessment work**
  - the drafting of the chapters, drafting groups etc. (lead authors to report)
  - funding of the work
  - circulation of drafts within the groups and within ASG and AMAP
  - workshops and crossfertilization meetings needed
- 5. Data Gathering for the Assessment,**
  - the Thematic Data Centres
  - the National Data Managers
  - source information
  - other methods
  - data ownership
  - etc.
- 6. Finalizing the Assessment Guidelines for the AMAP phase 2**
  - the chapter contents
  - how to handle pathways and circulation
  - the Lead Authors
  - the National Key Experts
  - the Designated Experts
  - the Quality Assurance requirements and the control of that
  - standard guidelines for the assessment and production
  - etc.
- 7. Finalizing the AMAP Trends and Effects Monitoring Programme**
  - list of recommended methods
  - definition of ES areas
  - etc.
- 8. Overview of The National Implementation Plans (NIPs), as of November 2000, and the AMAP PD**
  - what exist today
  - how to use it
  - etc.
- 9. Production of the Reports**
  - cooperation with graphical production
  - cooperation with publisher

#### **10. An Executive Summary**

- is the ASG in favour of recommending to the AMAP WG that a readable report (Executive Summary) should be prepared, possibly by a professional journalist?

#### **11. The ACIA work**

- strategy and cooperation between ASG and ASC

#### **12. Coordination of AMAP assessment work requested from others**

- e.g. Rio+10, UNEP Chemical, GIWA, etc.

#### **13. AMAP International Symposium in 2002, follow up of the Tromsø symposium**

- If supported, the planning has to start very soon
- the 5<sup>th</sup> radioactivity conference is already under preparation for June 2002 in ST. Petersburg

#### **14. Next ASG meeting**

#### **15. Draft time schedule and actions to be followed up after this meeting**

- Drafting group meetings
- time for reporting and circulation of drafts

#### **16. Any other business**

#### **17. End of the meeting**

The Chair may wish to brake up the plenary into smaller working groups during the three days, e.g. for items 6 and 7.

#### **Draft Time Schedule:**

Tuesday 31.10.	Arrival. Lead authors may convene in small groups to prepare for the meeting.
Wednesday 1.11.	0900 Opening of the ASG meeting 0900 - 1200 Agenda items 1, 2, 3 & 4. 1200 - 1300 Lunch 1300 - 1800 Items 4 cont.,5, 6 & 7 (working groups ?)  1900 An ASG dinner?
Thursday 2.11.	0900 - 1100 working groups cont. 1100 - 1200 Working groups summary in plenary 1200 - 1300 Lunch 1300 - 1800 Items 8, 9, 10 & 11
Friday 3.11.	0900 - 1200 Items 12, 13, 14, 15 & 16 1200 End of meeting 1400 Flight to Copenhagen

### Annex 3 - List of Actions agreed at the ASG II-3 meeting.

Agenda point	Action	By	Deadline
4.5	To find out more about the status of dietary study being organized by Danish group.	Jens Hansen	Jan. 2001
4.26	Arrange a workshop in late-summer/early-autumn 2001 on sources, emissions and scenarios. To discuss and compile relevant information on these subjects for inclusion in individual scientific assessments, and for a separate section in the 2002 SOAER.	Jozef Pacyna	Sept. 2001
5.4	To consider for their purposes the utility of the form proposed by Norway for registering availability of officially reported source data available in the various countries.	All assessment groups	Jan. 2001
5.4	Act as liaison between AMAP and LORA/LOICZ/IGBP with respect to activities ongoing concerning Russian source data collection.	Jozef Pacyna	Dec. 2000
5.5	Distribute 'AMAP Experts Data Agreement' to all persons engaged in AMAP II assessment work, requesting its signing and return.	AMAP Secretariat and all persons engaged in AMAP II assessment work	April 2001
5.7	To consider and inform the Secretariat about their needs with respect to dietary information that will be compiled at the AMAP Secretariat.	POPs, Heavy Metals, and Radioactivity groups	April 2001
6.3	Finalise and publish the assessment guidelines.	AMAP Secretariat	Dec. 2000
7.3	Finalise and publish all Sections of the Trends and Effects Programme documents.	AMAP Secretariat	Dec. 2000
9.2 & 10.2	Initiate actions to select a publisher for the individual scientific assessment reports and SOAER.	AMAP Secretariat	Jan. 2001
9.3	Provide input to Simon Wilson with respect to standardizing graphics, software used for compiling bibliographic information, consistency of, and need for colours or shading throughout the documents, etc.	Lead authors	April 2001
9.5	Contact countries to determine the number of copies of the various reports (individual scientific assessments and SOAER) that would be needed, and in which format (printed, CD-ROM, etc.).	AMAP Secretariat	April 2001
10.2	Request nominations for a journalist/consultant to prepare the SOAER, and circulate these to WG members.	AMAP Secretariat	Jan. 2001

10.3	Request countries to indicate possible needs with respect to translation of the various reports.	AMAP Secretariat	April 2001
10.4	Write to AMAP WG requesting their views on hiring a journalist to prepare the SOAER, financing of all work related publication of the various reports, etc.	AMAP Secretariat	Jan. 2001
11.2	To look at the chapter outline for the ACIA report and determine if they could contribute to the ACIA report.	ASG members	Jan. 2001
12.3	Further investigate GIWA funding possibilities in relation to AMAP's involvement in the GIWA assessment preparation.	Lars Kullerud and Lars-Otto Reiersen	Jan. 2001
12.3	Raise this issue of AMAP's involvement in the GIWA assessment preparation with the SAOs.	Hanne Petersen	Jan. 2001
13.1	Contact the AMAP WG concerning financing of the proposed second AMAP Symposium.	AMAP Secretariat	April 2001
13.2	Make a list of known upcoming meetings, workshops and conferences, and distribute this list to lead authors and Key National Experts.	AMAP Secretariat	April 2001
16.1	Complete the questionnaire from the Nordic Environmental Specimen Banking Project.	Relevant AMAP scientists/ institutes	April 2001
16.2	To review nominations for key experts for the oil assessment group and approve lists of experts given in the Assessment Guidelines.	All countries	April 2001
16.3	Contact Simon Wilson if they wish to have a password protected area on teh AMAP website established for the use of their groups.	Lead Authors	Jan. 2001

## Annex 4 - Human health group report.

### Contents of Human Health Main Report 2002

#### **Summary - 5 pp**

(Editorial Board)

#### **1. Introduction - 10 pp**

Reference to the ministerial declaration and description of the concept of combined effects.

(Editorial board)

#### **2. Ethnocultural adaptation of the peoples of the Arctic Region - 10 to 15 pp**

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- 10 pp**

Chemical properties of known and new contaminants of concern linked to POPs chapter and summarised in tables.

(Ivan C. Burkow)

#### **4. Environmental and biological monitoring**

##### **4.1. Environmental monitoring. - 15 pp**

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 - 15 pp**

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 - 10 pp**

Summary of the state of art in molecular studies on the health/environment interaction relevant to the Arctic. Include results of recent studies that have significance for the Arctic.

(Eva Bonefeld Jorgensen, Linda Birnbaum)

## **5.2. Biomarkers of effects - 10 pp**

Description of biomarkers of effects applicable in the Arctic and relevant to the Arctic exposure situation. Primarily based on the outcome of the Biomarker Conference, May 2000. Include results of recent studies of direct significance for Arctic populations.

(Chris Schonwalder)

5.1 and 5.2. will be combined - Lead authors for both: Eva Bonefeld Jorgensen and Linda Birnbaum in cooperation with Chis Schonwalder.

## **6. Lifestyle and health**

### **6.1. Introduction - 2 pp**

(Jon Øyvind Odland)

### **6.2. Diet - 30 pp**

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 - 15 pp**

Tobacco, alcohol, occupational exposure, role of integrated factors on pregnancy and child development.

(Jon Øyvind Odland)

### **6.4. Health Conditions - 15 pp**

Health conditions of Arctic people in general, changes in mortality and morbidity patterns (trends). Linkages to contaminant exposure where possible. Make use of data collected for children and youth project.

(Jim Berner)

## **7. Epidemiological Studies in the Arctic. - 15 pp**

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. - 5 to 10 pp**

Focus on groups and regions that exceed published world guidelines (Pal Weihe)

## **9. Risk reduction strategies for Arctic peoples. - 5 to 10 pp**

Public health recommendations for reduction of exposure locally, nationally, and internationally, taking cultural and traditional aspects into consideration (emphasis on methylmercury and POPs).

(Writing Team: Eric Dewailly, Adrian Ryan, Pal Weihe, Jim Berner, Peter Bjerregaard, Andy Gilman)

**10. Conclusions and Recommendations - 5 pp**

(Editorial Group)

**11. References - 5 pp**

(All chapter leads to provide references)

**12. Appendices - 10 pp**

(Submitted by chapter leads as required)

**TIMETABLE FOR HUMAN HEALTH REPORT**

2000	October	Start writing
2001	February	1st draft ready for circulation
2001	March	Editorial meeting
2001	April	Comments to lead authors
2001	Spring	HHEG meeting (Tentative dates: 20 - 25th April)
2001	August	2nd draft ready for circulation
2001	Autumn	Last entry of new data
2001	October	Editorial meeting
2001	November	Report ready for circulation

## Annex 5 - Heavy metals group update.

### **Draft Strategy for the AMAP II Heavy Metal (HM) Report**

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**The following provides: 1) an annotated outline of the current state of research and 2) a strategy for obtaining available data and report results for the AMAP Heavy Metals (HM) report for Phase II.**

The Heavy Metals assessment will be presented as an update of the state of the Arctic environment by:

- summarizing information on the status and trends of Arctic ecosystem conditions
- identifying possible causes for changing conditions
- detect emerging problems, their possible causes, and the potential risk to Arctic ecosystems
- recommend actions required to reduce risks to Arctic ecosystems

### **I. Heavy Metals Outline**

#### **A. Update (Objective 1)**

The first objective will be met in the outline presenting new results. This outline is harmonized with the POPs group, and includes key findings on heavy metals since 1995, the data cut off for AMAP Phase I, as well as data from areas not represented in the first assessment.

#### **B. Synthesis (Objective 2 and 3)**

To identify possible causes for changing conditions and emerging problems, the update will be followed with a synthesis chapter. The synthesis will establish linkages, based on our best scientific understanding, between sources and emissions, transport and deposition mechanisms and transformation processes to explain trends in environmental concentrations in each of the environmental compartments: air, water, land, sediments, biota. The synthesis will then link exposure patterns with observed effects in biota as far as is possible given current information. Where information is not sufficient to establish a linkage between exposure and effects (i.e. risk), a series of research recommendations will be made to improve the ability to achieve this objective in follow-on assessments.

## C. Interpretation and Recommendations (Objective 4)

The synthesis chapter will be followed by an interpretation chapter of the synthesis to describe the potential risks of current trends, including predictions with associated uncertainties, about how risk is likely to increase or decrease given actions to reduce, stabilize or increase inputs of heavy metals into the environment. Based on this interpretation, management actions will be recommended that are likely to reduce risk to Arctic ecosystems

## II. Topics to be Addressed and Data Types:

### Exposure:

- Sources
- Emissions
- Transport Mechanisms
- Deposition Mechanisms
- Transformation Mechanisms
- Contact, Concentrations
- Bioindicators of Exposure

### Effects:

- Community composition (e.g. of algae, benthic invertebrates, lichens)
- Population parameters (e.g., age structure, population growth)
- Individual endpoints (e.g., reproductive, endocrine and immune function, foraging, predator avoidance, mating or other behavioural change, biomarkers, bioassays, biomarkers, mortality, morbidity)

## III. Procedures for Completing the Assessment

### 1) Data gathering for the Assessment.

Efforts will begin shortly to assess the data available at the Thematic Data Centres (e.g., ICES). The strategy will be to gather all available HM data for the Arctic that was not included in AMAP phase 1, i.e., post-1996. As well, all National Data Managers will be contacted, provided with an update of the data gathered and a list of potential data contributors, and then queried about programs and data that we may have overlooked. We have already begun to contact potential data contributors and national key experts. From the experience of AMAP phase 1, we have a good understanding of the people that need to be contacted. Data contributors will be asked to prepare a short summary (4-5 pages) and interpretation of their data for incorporation into the report.

### 2) Finalizing the Assessment Guidelines

We have compiled a tentative table of contents for the HM report for AMAP phase 2 (see below). This is based on the recently published report: **HM in the Arctic: An Update** (Marcy et al, AMAP Report 2000:5). Provided within the table of contents are short summaries of the data currently available, selected published papers, and some of the projects currently under way for this report. We have also begun to identify data contributors, but this is by no means a complete list. The table of contents for Chapter 7 Heavy Metals from AMAP Phase 1 report is provided in the Appendix for reference.

## **IV. Annotated Contents Outline for AMAP Phase 2 report on HM:**

### **Introduction to Heavy Metals Report**

#### **Part A:**

#### **1. Introduction: Current State of the Arctic**

#### **2. Sources and Pathways**

##### **2.1 Air Monitoring**

- A major revision of much of the 1983 data on emissions of heavy metals that were presented in the 1997 AMAP assessments has been completed (Pacyna and Pacyna 2000a)
- Global inventory of lead from atmospheric emissions for 1989 has been updated for the reference year 1995 (Pacyna and Pacyna 2000a)
- The species gaseous elemental mercury, gaseous bivalent mercury ( $\text{Hg}^{2+}$ ), and particulate mercury contribute ca. 53%, 37%, and 10% of the total atmospheric Hg emissions, respectively (Pacyna and Pacyna 2000b).
- Long-range transport of gas-phase (elemental mercury) to determine the potential atmospheric pathways of mercury being measured in the Canadian High Arctic. (Cheng and Schroeder 2000)
- In autumn/winter, anthropogenic contributions from sources in populated areas of Europe and North America were identified. Elevated concentrations in summer appear to be of geological origin (Schroeder 1999).
- The model predicts a Hg deposition rate that is much higher than that measured in the eastern US. The data also suggest that some of the oxidized Hg in the snow pack may be reduced and evaded as  $\text{Hg}^0$  following snow melt (Lindberg et. al 2000).
- INTAS Project on sources & emissions of HM in Russia (Pacyna).
- Cloud water chemistry in Arctic (Bullock)

##### **2.2 River waters**

- Monitoring in Russian and Norwegian rivers ?? (any new Canadian or US work??)
- Yukon Rivers?? (Thurman??)
- LOIRA Work in Russia (Pacyna & Gordeev)

##### **2.3 Ocean Waters**

- Measurement of HM has continued in Barents and Kara Seas, Canada Basin, Canadian archipelago??? (Strachan, Bidleman, et al.)
- New mass balance of ??? in Arctic Ocean (Bidleman 2000)
- LOIRA Work in Russia (Pacyna & Gordeev)

#### **3. Spatial Trends**

##### **3.1 Atmospheric deposition**

- Data from Hg network in the Arctic (Alaska/CA/Norway/Russia?)

### 3.2 Sediments

- New marine sediments from Canadian Arctic?? (Stern, Fisk)
- Lake sediment cores from north-south in Canada?? (Lockhart)
- Sediments cores Greenland (Asmund et al 2000, Sci.Tot. Environ. 245)

### 3.3 Terrestrial biota

- Caribou & moose data from Alaska to be combined with data from Phase 1 (O'Hara)
- West Greenland Caribou (Aastrup et al. 2000, Sci.Tot. Environ. 245)
- Greenland human diet study (Johansen)

### 3.4 Freshwater biota

- Greenland Arctic char (Riget et al., Sci.Tot. Environ. 245)
- Zooplankton, chironomidae, charr on Bear Island ??(Skotvold)

### 3.5 Marine Biota

#### 3.5.1 Invertebrates

- NOW (north Baffin Bay) zooplankton species?? (Fisk and Norstrom)
- Barents Sea food web?? (Borga and Skaare)
- Levels in zooplankton from Fram Strait to Barents Sea?? (Borga and Skaare)

#### 3.5.2 Fish

- Global Sculpin Program (M. Olsson)

#### 3.5.3 Seabirds

- NOW seabirds (Fisk and Norstrom)
- Barents Sea (Savinova et al.)
- Greenland human diet study (Johansen)
- Continued monitoring of seabird eggs in the Canadian Arctic (Braune)
- Lead, cadmium, mercury and selenium in Greenland marine biota and sediments during AMAP phase 1. (Riget, F.; Dietz, R.; Johansen, P.; Asmund, G. 2000. The Science of the Total Environment 245: 3 – 14)

#### 3.5.4 Marine Mammals

- HM in beluga of Alaska (Krahn)
- New data from Alaska (O'Hara)
- Heavy metals in narwhals from 2 locations in Greenland (Dietz et al. in prep)
- Geographical differences of zinc, cadmium, mercury and selenium in polar bears (*Ursus maritimus*) from Greenland. (Dietz, R. F. Riget and E.W. Born 2000. The Science of the Total Environment 245: 25-48)
- Geographical differences in elements from North Atlantic minke whales (Outridge et al. 2000)
- Heavy metals in Pilot whales from the Faroe Islands (Dam et al. in prep)
- Harp and ringed seals of White Sea (Savinova)

## **4. Temporal Trends**

### 4.1 Air

- Continued monitoring of air concentrations at Alert, Station Nord and Ny Ålesund
- Marine sediments
- A down-core increase in MeHg was believed to be related to increased methylation of Hg, and to higher scavenging of MeHg by acid volatile sulfides in progressively more anoxic subsurface layers (Naidu, pers. comm.).
- The dynamics of mercury trends in Greenland marine sediments have been investigated by Asmund and Nielsen (2000).

### 4.2 Marine fish

- Salmon from Alaska (Duffy)
- Sculpins from Greenland waters (Riget and Dietz)

### 4.3 Marine birds

- Gull eggs (US-TASSC)
- Eggs and livers of Canadian arctic seabirds (Braune)
- Norway and Svalbard seabirds are available (Gabrielsen)
- Black Guillemot from Greenland (Riget and Dietz)

### 4.4 Marine mammals

- Canadian beluga (1982-1996) have been re-analyzed for HM (Wagemann?)
- Monitoring of HM in ringed seals in Alaska (O'Hara?)
- Monitoring of HM in ringed seals in Canada (Wageman and Lockhart?)
- Monitoring of HM in ringed seals in Greenland (Dietz and Riget)
- Temporal trends of cadmium and mercury in Greenland marine biota. (Riget, F. and Dietz, R 2000. *The Science of the Total Environment* 245: 29 – 60)
- Evaluation of the AMAP programme 1994-95, by use of power analysis. Illustrated by selected heavy metals and POPs. (Riget, F., R. Dietz, and M. Cleemann 2000. *The Science of the Total Environment* 245: 25-48)
- Monitoring of HM in ringed seals in Svalbard (Skaare?)
- Applied for funding for Hg and Cd time trend analysis in polar bear tissue and skin (Dietz et al.)

### 4.5 Terrestrial environment

- Peat bogs from Greenland (Asmund)
- Svalbard arctic fox? (Fuglei)
- HM in fish and reindeer continue in Sweden?? (Bignert and Olsson)

## **5. Biological Effects**

### 5.1 Fish

- Freshwater fish studies are being conducted to address surface runoff of heavy metals from the Red Dog Mine. Necropsies, histology, and some biochemical endpoint measures are being undertaken for marine fish from other areas. (US)
- Enzyme induction in Arctic char of Bear Lake char (Evenset)
- Incorporating traditional knowledge in their study of gross abnormalities in freshwater fish. (Canada)
- Investigation of CYP1A, antioxidants, and GST as markers. (Sweden and Iceland)
- Metallothionein (MT) in freshwater trout in waters containing mining discharges. (Norway)
- Arctic char are assessed for CYP1A and other CYPs. In flounder and Atlantic cod, MT and d-aminolevulinic acid dehydratase (ALA-D), CYP1A, and gross pathology are being assessed. (Norway)
- Assessment of fish in Arctic rivers and lakes, measuring gross and histologic characteristics in association with HM (POPs and PAHs). (Russia)
- Traditional knowledge on contaminants (US)

## 5.2 Birds of Prey

- Non-Arctic ptarmigan for MT and histopathology. (Norway)

## 5.3 Seabirds

- Eider research (US)
- Spectacled eiders includes blood work (i.e., element levels and biomarkers), radiography, pathology, and telemetry. The major concern is Pb from lead shot.
- King eiders are being evaluated using necropsy, pathology, histology, and telemetry for Pb and Cd effects. (US)
- Steller's eiders are being monitored for population status (blood, biochemistry, necropsy). (US)
- King and common eiders are investigated for effects from Cd exposure using immunotoxicology, histopathology, endocrine, and nutritional studies. (Canada)
- Marine birds (Murmansk Biological Institute et al.).
- Marine seabirds are being assessing for CYP1A (Norway)

## 5.4 Marine mammals

- Harbor seal tissues are being archived with data on body condition. Steller sea lions are being monitored for general health and nutritional status. (US)
- Ringed seals, walrus, beluga and bowhead whales and polar bear are being necropsied with histology work-ups for many metals. (US)
- Work with Beluga whales focuses on the distribution of metals in tissues. Proposed work will include immune system effects. Beluga whales are also being studied for Ag-Se-Hg interactions. (US)
- Bowhead whales have been monitored since the 1980's for metals. Cadmium is a particular concern and is being investigated using histology, cell culture and MT (including in vitro HM challenges). (US)

- Harbor porpoise will be addressed as part of the IWC Pollution 2000+ cooperative project. (US)
- Extensive effects program for beluga whales from Canada that includes immune status, gross assessment and histopathology, retinal electron microscopy, detoxification mechanisms for Hg-Se in liver and brain, blood, and speciation of Hg in blood, brain, spinal cord and liver. (Lockhart)
- Gross anatomy and examination of bowhead whale, walrus, bearded seal, and narwhal, while not an effects assessment, may be valuable. (O'Hara et al)
- Ringed seal work on renal histopathology and bone mineral density linked to high Cd levels. (Sonne-Hansen et al. 2000)
- Energy and telemetry studies are being conducted on walrus.
- Pilot whale renal histopathology and possibly mercury work is underway. (Faroe Island)
- Harbor porpoise are being studied through IWC Pollution 2000+. Data include blood chemistries, telemetry, and general health information on captive animals.
- Polar bear pathology related to body burdens of metals is being coupled with craniometrical asymmetries, BMD, and historic samples are being investigated as well (Sonne-Hansen et al. in prep)
- Metallothionein induction in West Greenland ringed seals (Hyeland et al. in prep.)
- Focus for marine mammal in Russia.( The Veterinary Institute in Moscow)
- Polar bears, tissue pathology in East Greenland polar bears (Sonne-Hansen et al. in prep)

### 5.5 Other Studies

- Pathology and histo-pathology studies are planned for Alaskan ringed seals, whales and beluga and Canadian and Alaskan Arctic fox and wolverines
- An assessment of selenium to mercury in Greenland marine animals. (Dietz, R.; Riget, F.; Born, E.W. 2000. *The Science of the Total Environment* 245: 15 – 24)
- Lead toxicity on kelp and invertebrates near the Black Angel Mine (Johansen et al. in prep).
- Mussel monitoring program using MT related to mine discharges. (Norway)
- Acidification research that includes metal mobilization studies and possible effects on vegetation, soil microorganisms, and stream fish. (Finland)
- Effects of heavy metals on arctic zooplankton.(Zauke et al.)

### 6. Data Gaps

- Importance of Russian rivers
- Circumpolar coverage of HM in key species other than polar bears
- Biological effects
- Spatial extent of Hgo depletion? (Bullock)

**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 & Recommendations**

1. - Characterization of risks based on available information
2. - Summarization of results of scenarios
3. - Recommendations

**Appendix**

**AMAP I 1998 - Chapter 7 Heavy metals**

Contents

Include table of contents

## Annex 6 - Draft list of content for the 2004 AMAP assessment on oil and PAH.

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

#### **Executive summary**

#### **Introduction**

#### **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).

#### **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

#### **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

#### **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

#### **Human health**

#### **Experiences from Environmental Impact Analyses and Risk Analyses Assessment, conclusion and recommendations**

## Annex 7 - Coverage of NIPs with respect to the AMAP (contaminant) Trend Monitoring Programme in the different Key areas.

The following tables for POPs, heavy metals, acidification parameters, PAHs and PHs, and radioactivity, respectively, show which components of the AMAP trend monitoring programme are covered by activities under the AMAP National Implementation Plans (NIPs) that are currently defined the Arctic countries. The tables are arranged under these five 'media groupings' for the convenience of assessment groups. Each table is divided into sections according to the various subprogrammes (atmospheric, marine, freshwater, terrestrial, and human health), with rows corresponding to main groups of media/compartments to be monitored. Column entries show which countries are conducting relevant activities within the different 'key areas' as specified under the AMAP monitoring programme (see AMAP Trends and Effects Programme documentation Section A). Note: some regions not otherwise covered by the 10 'key areas' (e.g. the Faroe Islands and Iceland) have been included with their nearest key area.

Country NIPs are identified as follows: C = Canada, D = Denmark/Greenland, DF = Denmark/Faroes Islands, F = Finland, I = Iceland, N = Norway, R = Russia, S = Sweden, U = USA.

These tables are intended to provide an overview only. For further information or detail, it is necessary to refer to the National Implementation Plan documents that are available as online documents on the AMAP website.

Rows that are shaded grey in the tables indicate media/compartments where monitoring of one or more parameters is considered 'Essential' (E) under the AMAP monitoring programme. Parts of the tables that should be covered according to the 'Essential Subregional' (ES) monitoring definitions (see AMAP Trends and Effects Programme documentation Section A for an explanation of E/ES, etc.) are not yet indicated in a similar manner. This is because information on which subregions should be covered by ES monitoring for the various parameter groups is not yet complete (see AMAP Trends and Effects Programme documentation Section B - Table B.6). It is envisaged that the specification of ES 'regions' will be completed by the various assessment groups during the ASG meeting in Reykjavik, after which shading of cells within these tables will be updated to also reflect desired ES monitoring.

An Appendix provides some additional information (tables and figures) on locations of stations where monitoring of parameters is being conducted for the AMAP atmospheric subprogramme. Similar maps will be prepared for other subprogrammes when the NIP registrations in the AMAP PD are more complete.

## Phase 2 coverage: Trend monitoring of POPs

	Key Area: 1 - Northern Fenno- scandia and Kola Peninsula	Key Area: 2 - Mouth of Pechora river, Novaya Zemlya, Kara and Pechora Sea area	Key Area: 3 - Norilsk, Taimyr Peninsula area (and Laptev Sea)	Key Area: 4 - Mouth of Lena river (and East Siberian Sea)	Key Area: 5 - Chukotka Peninsula (and Chukchi Sea)	Key Area: 6 - Northern Alaska, North Slope area	Key Area: 7 - Lower Mackenzie river and delta area	Key Area: 8 - Canadian Arctic Islands and Arctic Archipelego (and Canada Basin and Central Arctic Basin)	Key Area: 9 - West Greenland, Baffin Island area (and Nunavik/ Hudson Bay areas)	Key Area: 10 - Svalbard, East Greenland area (and Iceland/- Faroes)
<b>ATMOSPHERIC SUBPROGRAMME</b>										
Air/Aerosol	F	C		C	U/R			C R	C	N I
Bulk precipitation	F S									I
Throughfall										
Snowpack								R		
Frozen fog (rime), intensive										
Glacial cores										
<b>MARINE SUBPROGRAMME</b>										
Surficial sediment	N	R	R	R	R			C	C	
Sediment cores	N									
Seawater		R	R	R	R			C R	C	
Sea ice								R		
Macro-algae										
Shellfish	N	R	R	R	R				D C	DF I
Marine fish	N	R							D C	D DF I
Seal/walrus					R	U		C D	D C	N D DF

	Key Area: 1 - Northern Fenno- scandia and Kola Peninsula	Key Area: 2 - Mouth of Pechora river, Novaya Zemlya, Kara and Pechora Sea area	Key Area: 3 - Norilsk, Taimyr Peninsula area (and Laptev Sea)	Key Area: 4 - Mouth of Lena river (and East Siberian Sea)	Key Area: 5 - Chukotka Peninsula (and Chukchi Sea)	Key Area: 6 - Northern Alaska, North Slope area	Key Area: 7 - Lower Mackenzie river and delta area	Key Area: 8 - Canadian Arctic Islands and Arctic Archipelego (and Canada Basin and Central Arctic Basin)	Key Area: 9 - West Greenland, Baffin Island area (and Nunavik/ Hudson Bay areas)	Key Area: 10 - Svalbard, East Greenland area (and Iceland/- Faroes)
Porpoise/toothed whales						U	C		D C	N DF
Baleen whales						U			D	
Polar bear/Arctic fox	n/a					C U		C	C	N D C
Seabirds								C	D	N DF
<b>FRESHWATER SUBPROGRAMME</b>										
Sediment	F R	R	R		R			C		
Lake and River water / SPM	F R	R	R		R					
Groundwater										
Ice										
Freshwater plankton/invertebrates	R		R		R					
Freshwater fish	F S R		R		R		C	C	D C	D DF
Water fowl										
<b>TERRESTRIAL SUBPROGRAMME</b>										
Soil	R	R	R							
Humus										
Peat cores										
Snowpack										
Ice cap cores										

	Key Area: 1 - Northern Fenno- scandia and Kola Peninsula	Key Area: 2 - Mouth of Pechora river, Novaya Zemlya, Kara and Pechora Sea area	Key Area: 3 - Norilsk, Taimyr Peninsula area (and Laptev Sea)	Key Area: 4 - Mouth of Lena river (and East Siberian Sea)	Key Area: 5 - Chukotka Peninsula (and Chukchi Sea)	Key Area: 6 - Northern Alaska, North Slope area	Key Area: 7 - Lower Mackenzie river and delta area	Key Area: 8 - Canadian Arctic Islands and Arctic Archipelego (and Canada Basin and Central Arctic Basin)	Key Area: 9 - West Greenland, Baffin Island area (and Nunavik/ Hudson Bay areas)	Key Area: 10 - Svalbard, East Greenland area (and Iceland/- Faroes)
Lichens / mosses	R	R	R		R					
Mushrooms / Higher plants	R	R	R		R					
Reindeer/ caribou	F R	R	R		R				D	N
Other terrestrial mammals	F R	R	R		R				D	DF
Terrestrial birds	R	R	R		R				D	N
<b>HUMAN HEALTH SUBPROGRAMME</b>										
Maternal Blood	F N	R	R		R	U		C	D C	D DF I
Cord Blood	N					U			C	
Breast milk	F N								C	
Urine										
Hair										
Wholebody										
Milk/food items	F						C	C	D C	DF

## Phase 2 coverage: Trend monitoring of Heavy Metals

	Key Area: 1 - Northern Fenno- scandia and Kola Peninsula	Key Area: 2 - Mouth of Pechora river, Novaya Zemlya, Kara and Pechora Sea area	Key Area: 3 - Norilsk, Taimyr Peninsula area (and Laptev Sea)	Key Area: 4 - Mouth of Lena river (and East Siberian Sea)	Key Area: 5 - Chukotka Peninsula (and Chukchi Sea)	Key Area: 6 - Northern Alaska, North Slope area	Key Area: 7 - Lower Mackenzie river and delta area	Key Area: 8 - Canadian Arctic Islands and Arctic Archipelego (and Canada Basin and Central Arctic Basin)	Key Area: 9 - West Greenland, Baffin Island area (and Nunavik/ Hudson Bay areas)	Key Area: 10 - Svalbard, East Greenland area (and Iceland/- Faroes)
<b>ATMOSPHERIC SUBPROGRAMME</b>										
Air/Aerosol	F R	C	R		U/R	U		C R	C	N D I
Bulk precipitation	F S N								C	I
Throughfall										
Snowpack								R	C	
Frozen fog (rime), intensive										
Glacial cores										
<b>MARINE SUBPROGRAMME</b>										
Surficial sediment	N	R		R	R					
Sediment cores	N									DF
Seawater		R		R	R			C R		
Sea ice								C R		
Macro-algae								C		
Shellfish	N	R							D C	DF I
Marine fish	N	R							D C	D DF I

	Key Area: 1 - Northern Fenno- scandia and Kola Peninsula	Key Area: 2 - Mouth of Pechora river, Novaya Zemlya, Kara and Pechora Sea area	Key Area: 3 - Norilsk, Taimyr Peninsula area (and Laptev Sea)	Key Area: 4 - Mouth of Lena river (and East Siberian Sea)	Key Area: 5 - Chukotka Peninsula (and Chukchi Sea)	Key Area: 6 - Northern Alaska, North Slope area	Key Area: 7 - Lower Mackenzie river and delta area	Key Area: 8 - Canadian Arctic Islands and Arctic Archipelego (and Canada Basin and Central Arctic Basin)	Key Area: 9 - West Greenland, Baffin Island area (and Nunavik/ Hudson Bay areas)	Key Area: 10 - Svalbard, East Greenland area (and Iceland/- Faroes)
Seal/walrus					R	U		C D	D C	N D DF
Porpoise/toothed whales						U		C	D C	N DF
Baleen whales						U			D	
Polar bear/Arctic fox						U		C		N D
Seabirds								C	D C	N D DF
<b>FRESHWATER SUBPROGRAMME</b>										
Sediment	F R	R	R		R			C	C	C
Lake and River water / SPM	F S R	R	R		R			C		I
Groundwater	F									
Ice										
Freshwater plankton/invertebrates	R	R	R		R			C		
Freshwater fish	F S R	R	R		R			C	C	D C D DF
Water fowl										
<b>TERRESTRIAL SUBPROGRAMME</b>										
Soil	F R	R	R		R				C	

	Key Area: 1 - Northern Fenno- scandia and Kola Peninsula	Key Area: 2 - Mouth of Pechora river, Novaya Zemlya, Kara and Pechora Sea area	Key Area: 3 - Norilsk, Taimyr Peninsula area (and Laptev Sea)	Key Area: 4 - Mouth of Lena river (and East Siberian Sea)	Key Area: 5 - Chukotka Peninsula (and Chukchi Sea)	Key Area: 6 - Northern Alaska, North Slope area	Key Area: 7 - Lower Mackenzie river and delta area	Key Area: 8 - Canadian Arctic Islands and Arctic Archipelego (and Canada Basin and Central Arctic Basin)	Key Area: 9 - West Greenland, Baffin Island area (and Nunavik/ Hudson Bay areas)	Key Area: 10 - Svalbard, East Greenland area (and Iceland/- Faroes)
Humus	F									
Peat cores									D	
Snowpack										
Ice cap cores										
Lichens / mosses	R	R	R		R				D	
Mushrooms / Higher plants		R							D	
Reindeer/ caribou	F S N R	R	R		R		C		D C	N
Other terrestrial mammals	F R	R	R		R				D	DF
Terrestrial birds	N R	R	R		R				D	N
<b>HUMAN HEALTH SUBPROGRAMME</b>										
Maternal Blood	F N	R	R		R	U		C	D C	D DF I
Cord Blood	N					U			C	
Breast milk									C	
Urine	N								C	
Hair									C	
Wholebody										
Milk/food items	F						C	C	D C	DF

## Phase 2 coverage: Trend monitoring of Acidification

	Key Area: 1 - Northern Fenno- scandia and Kola Peninsula	Key Area: 2 - Mouth of Pechora river, Novaya Zemlya, Kara and Pechora Sea area	Key Area: 3 - Norilsk, Taimyr Peninsula area (and Laptev Sea)	Key Area: 4 - Mouth of Lena river (and East Siberian Sea)	Key Area: 5 - Chukotka Peninsula (and Chukchi Sea)	Key Area: 6 - Northern Alaska, North Slope area	Key Area: 7 - Lower Mackenzi e river and delta area	Key Area: 8 - Canadian Arctic Islands and Arctic Archipelego (and Canada Basin and Central Arctic Basin)	Key Area: 9 - West Greenland, Baffin Island area (and Nunavik/ Hudson Bay areas)	Key Area: 10 - Svalbard, East Greenland area (and Iceland/- Faroes)
<b>ATMOSPHERIC SUBPROGRAMME</b>										
Air/Aerosol	F S N R		R					C		N D I
Bulk precipitation	F S N R	R	R	R						N I
Throughfall	F									
Snowpack										
Frozen fog (rime), intensive										
Glacial cores										
<b>MARINE SUBPROGRAMME - NOT APPLICABLE</b>										
<b>FRESHWATER SUBPROGRAMME</b>										
Sediment										
Lake and River water / SPM	F S N									I
Groundwater	F S									
Ice										
Freshwater plankton/invertebrates										

	Key Area: 1 - Northern Fenno- scandia and Kola Peninsula	Key Area: 2 - Mouth of Pechora river, Novaya Zemlya, Kara and Pechora Sea area	Key Area: 3 - Norilsk, Taimyr Peninsula area (and Laptev Sea)	Key Area: 4 - Mouth of Lena river (and East Siberian Sea)	Key Area: 5 - Chukotka Peninsula (and Chukchi Sea)	Key Area: 6 - Northern Alaska, North Slope area	Key Area: 7 - Lower Mackenzi e river and delta area	Key Area: 8 - Canadian Arctic Islands and Arctic Archipelego (and Canada Basin and Central Arctic Basin)	Key Area: 9 - West Greenland, Baffin Island area (and Nunavik/ Hudson Bay areas)	Key Area: 10 - Svalbard, East Greenland area (and Iceland/- Faroes)
Freshwater fish										
Water fowl										
<b>TERRESTRIAL SUBPROGRAMME</b>										
Soil										
Humus										
Peat cores										
Snowpack										
Ice cap cores										
Lichens / mosses										
Mushrooms / Higher plants										
Reindeer/ caribou										
Other terrestrial mammals										
Terrestrial birds										
<b>HUMAN HEALTH SUBPROGRAMME - NOT APPLICABLE</b>										

## Phase 2 coverage: Trend monitoring of PAH-PH

	Key Area: 1 - Northern Fenno- scandia and Kola Peninsula	Key Area: 2 - Mouth of Pechora river, Novaya Zemlya, Kara and Pechora Sea area	Key Area: 3 - Norilsk, Taimyr Peninsula area (and Laptev Sea)	Key Area: 4 - Mouth of Lena river (and East Siberian Sea)	Key Area: 5 - Chukotka Peninsula (and Chukchi Sea)	Key Area: 6 - Northern Alaska, North Slope area	Key Area: 7 - Lower Mackenzie river and delta area	Key Area: 8 - Canadian Arctic Islands and Arctic Archipelego (and Canada Basin and Central Arctic Basin)	Key Area: 9 - West Greenland, Baffin Island area (and Nunavik/ Hudson Bay areas)	Key Area: 10 - Svalbard, East Greenland area (and Iceland/- Faroes)
<b>ATMOSPHERIC SUBPROGRAMME</b>										
Air/Aerosol	F R		R					R		N
Bulk precipitation	F S								D	
Throughfall										
Snowpack								R		
Frozen fog (rime), intensive										
Glacial cores										
<b>MARINE SUBPROGRAMME</b>										
Surficial sediment	N	R		R						
Sediment cores	N					U				
Seawater		R		R				R		
Sea ice								R		
Macro-algae										
Shellfish	N	R				U			D	DF
Marine fish	N	R				U			D	D DF
Seal/walrus										
Porpoise/toothed whales										DF
Baleen whales										
Polar bear/Arctic fox										
Seabirds										DF
<b>FRESHWATER SUBPROGRAMME</b>										
Sediment		R						C	D	D

	Key Area: 1 - Northern Fenno- scandia and Kola Peninsula	Key Area: 2 - Mouth of Pechora river, Novaya Zemlya, Kara and Pechora Sea area	Key Area: 3 - Norilsk, Taimyr Peninsula area (and Laptev Sea)	Key Area: 4 - Mouth of Lena river (and East Siberian Sea)	Key Area: 5 - Chukotka Peninsula (and Chukchi Sea)	Key Area: 6 - Northern Alaska, North Slope area	Key Area: 7 - Lower Mackenzie river and delta area	Key Area: 8 - Canadian Arctic Islands and Arctic Archipelego (and Canada Basin and Central Arctic Basin)	Key Area: 9 - West Greenland, Baffin Island area (and Nunavik/ Hudson Bay areas)	Key Area: 10 - Svalbard, East Greenland area (and Iceland/- Faroes)
Lake and River water / SPM		R								
Groundwater										
Ice										
Freshwater plankton/invertebrates										
Freshwater fish									D	D DF
Water fowl										
<b>TERRESTRIAL SUBPROGRAMME</b>										
Soil		R								
Humus										
Peat cores									D	
Snowpack										
Ice cap cores										
Lichens / mosses		R							D	
Mushrooms / Higher plants		R								
Reindeer/ caribou										
Other terrestrial mammals										
Terrestrial birds										
<b>HUMAN HEALTH SUBPROGRAMME</b>										
Maternal Blood										
Cord Blood										
Breast milk										
Urine										
Hair										
Wholebody										
Milk/food items										

## Phase 2 coverage: Trend monitoring of Radioactivity

	Key Area: 1 - Northern Fenno- scandia and Kola Peninsula	Key Area: 2 - Mouth of Pechora river, Novaya Zemlya, Kara and Pechora Sea area	Key Area: 3 - Norilsk, Taimyr Peninsula area (and Laptev Sea)	Key Area: 4 - Mouth of Lena river (and East Siberian Sea)	Key Area: 5 - Chukotka Peninsula (and Chukchi Sea)	Key Area: 6 - Northern Alaska, North Slope area	Key Area: 7 - Lower Mackenzie river and delta area	Key Area: 8 - Canadian Arctic Islands and Arctic Archipelego (and Canada Basin and Central Arctic Basin)	Key Area: 9 - West Greenland, Baffin Island area (and Nunavik/ Hudson Bay areas)	Key Area: 10 - Svalbard, East Greenland area (and Iceland/- Faroes)
<b>ATMOSPHERIC SUBPROGRAMME</b>										
Air/Aerosol	F S R N	R	R	R	R					
Bulk precipitation	F S R	R	R	R	R			D	D	D DF
Throughfall										
Snowpack										
Frozen fog (rime), intensive										
Glacial cores										
<b>MARINE SUBPROGRAMME</b>										
Surficial sediment	N							D	D	
Sediment cores										
Seawater	R N	R	R	R	R			D	D	D DF
Sea ice										
Macro-algae	N							D	D	D DF I
Shellfish	N							D	D	DF
Marine fish	F N								D	D DF
Seal/walrus								D	D	D

	Key Area: 1 - Northern Fenno- scandia and Kola Peninsula	Key Area: 2 - Mouth of Pechora river, Novaya Zemlya, Kara and Pechora Sea area	Key Area: 3 - Norilsk, Taimyr Peninsula area (and Laptev Sea)	Key Area: 4 - Mouth of Lena river (and East Siberian Sea)	Key Area: 5 - Chukotka Peninsula (and Chukchi Sea)	Key Area: 6 - Northern Alaska, North Slope area	Key Area: 7 - Lower Mackenzie river and delta area	Key Area: 8 - Canadian Arctic Islands and Arctic Archipelego (and Canada Basin and Central Arctic Basin)	Key Area: 9 - West Greenland, Baffin Island area (and Nunavik/ Hudson Bay areas)	Key Area: 10 - Svalbard, East Greenland area (and Iceland/- Faroes)
Porpoise/toothed whales								D	D	DF
Baleen whales										
Polar bear/Arctic fox										
Seabirds									D	D DF
<b>FRESHWATER SUBPROGRAMME</b>										
Sediment										
Lake and River water / SPM	F							D	D	D DF
Groundwater										
Ice										
Freshwater plankton/invertebrates										
Freshwater fish	F							D	D	D DF
Water fowl										
<b>TERRESTRIAL SUBPROGRAMME</b>										
Soil	F							D	D	D DF
Humus										D
Peat cores										
Snowpack										
Ice cap cores										
Lichens / mosses	F							D	D	DF
Mushrooms / Higher plants	F N								D	DF
Reindeer/ caribou	F N						C		D C	

	Key Area: 1 - Northern Fenno- scandia and Kola Peninsula	Key Area: 2 - Mouth of Pechora river, Novaya Zemlya, Kara and Pechora Sea area	Key Area: 3 - Norilsk, Taimyr Peninsula area (and Laptev Sea)	Key Area: 4 - Mouth of Lena river (and East Siberian Sea)	Key Area: 5 - Chukotka Peninsula (and Chukchi Sea)	Key Area: 6 - Northern Alaska, North Slope area	Key Area: 7 - Lower Mackenzie river and delta area	Key Area: 8 - Canadian Arctic Islands and Arctic Archipelego (and Canada Basin and Central Arctic Basin)	Key Area: 9 - West Greenland, Baffin Island area (and Nunavik/ Hudson Bay areas)	Key Area: 10 - Svalbard, East Greenland area (and Iceland/- Faroes)
Other terrestrial mammals									D	DF
Terrestrial birds	F									
<b>HUMAN HEALTH SUBPROGRAMME</b>										
Maternal Blood										
Cord Blood										
Breast milk										
Urine										
Hair										
Wholebody	N					U (Amchitka)				
Milk/food items	F S								D	DF

## Annex 8 - Updated Timetable for Production of Assessments.

	POPs	HM	RAD.	HH	SOAER 2002	
<b>N D 2001</b>	N. Am. Exp. Meet		Can. Exp. Meet			ASG Meeting Tromsø Board Meeting EEA Copenhagen
<b>J F M A M J J A S O</b>	BFR W.shop, Sweden BFT W.shop, Canada/Drafting  1st Draft (Dioxin?), NCP, Canada	Exp. Meetings Sources Transport Effects  1st Draft  Oct. 1-5 HM?	Exp. Meeting 1st Draft	1st Draft Exp. Meeting Exp. Meeting  2nd Draft	ASG  ASG + Crossfertilization Meeting	Chair Meeting, Helsinki ASC Iceland, 1st or 3rd week. AMAP Board Meeting  SAO Meeting, Rovaniemi  "Source/Scenario" W.shop. Last week of August AMAP WG Last entry of new data
<b>N D 2002</b>					1st Draft, 1 Nov. Comments, 15 Dec.	"SAO Meeting"
<b>J F M A M J J A</b>	2nd Draft  3rd Draft Preview  Final Report	2nd Draft		3rd Draft	2nd Draft, 1 Febr. Comments, 1 March ASG Final Draft out, 15 April AMAP WG, 15 May Final Editing and Printing	W.shop. Biol. Effects. Board  "RAIPON W.shop?"  Approval of SOAER "SAO Meeting" C & R  AMAP Symposium
<b>S</b>						Ministerial Meeting?
<b>O N D 2003</b>						