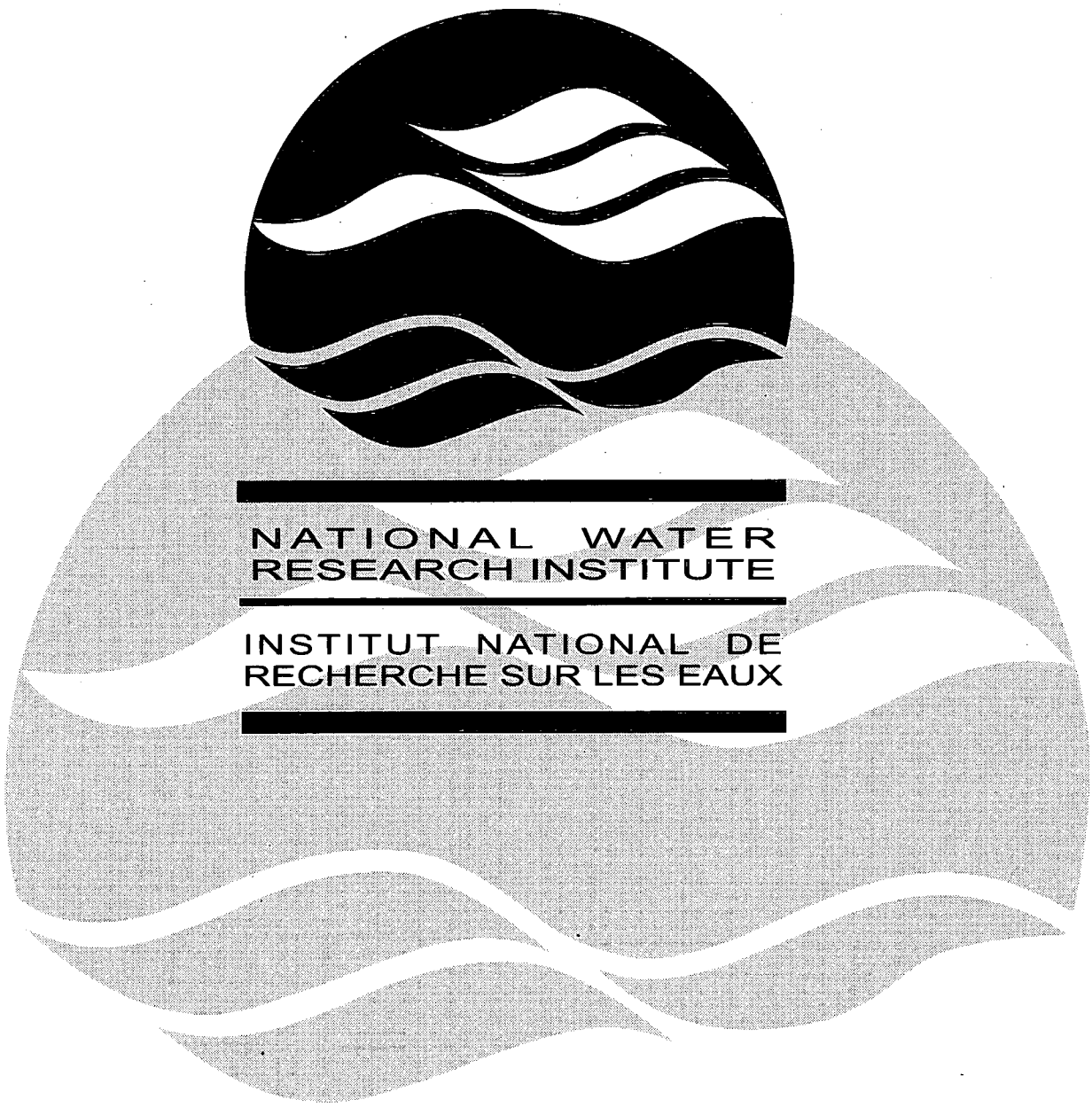

SUMMARY REPORT OF THE ANALYTICAL PROGRAMS AND CAPABILITIES OF LABORATORIES AND ORGANIZATIONS THAT CONTRIBUTE MEASUREMENT DATA TO THE NORTHERN CONTAMINANTS PROGRAM

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NWRI Contribution No. 99-302

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MANAGEMENT PERSPECTIVE

This summary report provides a comprehensive overview of the laboratories that provide measurement data to the Northern Contaminants Program (NCP). It identifies the responsibilities and analytical capabilities of these organizations, the types of measurement data being generated by the individual facilities, and their current quality control efforts supporting the NCP analyses. In addition, this report identifies several areas where additional QA may be redundant, and prioritizes the specific analytes and matrices requiring further attention in an ongoing NCP quality assurance (QA) program. By offering a solid measure of assurance of the quality, reliability and intercomparability of NCP data, the information from this QA program will support the long-term objective of international scientific study and cooperation in Arctic research.

The NCP Interlaboratory Quality Assurance (QA) Program, coordinated by Environment Canada, provides information on the quality, reliability and comparability of measurement results produced by laboratories generating data for NCP-funded research projects. This information assists NCP science managers and northerners to make informed decisions regarding the sources of contaminants and their effects on the Arctic environment and on human health. In addition, it ensures that the NCP's contributions to international agreements and controls to protect the health of the Arctic ecosystem and northerners are based on scientifically sound data.

PERSPECTIVE DE LA DIRECTION

Ce rapport sommaire présente un tour d'horizon complet des laboratoires qui fournissent des données de mesure au Programme de lutte contre les contaminants dans le Nord (PLCN). Il indique les responsabilités et les capacités d'analyse de ces organisations, les types de données générées par les divers laboratoires et leurs travaux actuels de contrôle de la qualité pour les analyses réalisées pour le PLCN. De plus, ce rapport cerne un certain nombre de domaines dans lesquels une AQ additionnelle serait superflue, et établit un ordre de priorité des analytes et des matrices qui devraient faire l'objet d'une plus grande attention dans le cadre d'un programme continu d'assurance de la qualité (AQ) du PLCN. En assurant la qualité, la fiabilité et la comparabilité des données du PLNC, les informations fournies par ce programme d'AQ contribueront à l'atteinte de l'objectif à long terme de l'étude scientifique internationale et de la collaboration à la recherche sur l'Arctique.

Le Programme interlaboratoires d'assurance de la qualité pour le PLCN, qui est coordonné par Environnement Canada, fournit de l'information sur la qualité, la fiabilité et la comparabilité des résultats de mesures produits par les laboratoires qui fournissent des données pour les projets de recherche financés par le PLCN. Cette information aidera les gestionnaires scientifiques et les populations du Nord à prendre des décisions éclairées concernant les sources de contaminants et leurs effets sur l'environnement arctique et sur la santé humaine. En outre, elle permettra de faire en sorte que les contributions du PLCN aux ententes et à la surveillance internationales visant à protéger la santé de l'écosystème arctique et des populations nordiques soient fondées sur des données scientifiques valables.

ABSTRACT

This report summarizes the results of a survey conducted during 1998/99, that identifies the organizations that contribute scientific data to the research projects funded by the Northern Contaminants Program (NCP). Details are provided on the analytical capabilities and types of measurement data produced by these laboratories, along with the current quality control measures being applied to the NCP samples. Information is also presented on the analytes, contaminant levels and matrices of the NCP samples, in order to prioritize the current and future quality assurance (QA) needs of Phase II of the NCP.

Several recommendations are made in this report for the future direction of the NCP Interlaboratory QA Program. Of key importance is the need to address the quality of data being generated for organochlorinated pesticides, PCBs, toxaphene, heavy metals and methylmercury. On the other hand, the reliability of NCP radionuclide measurements and those of nutrients in water appear to be adequately addressed elsewhere and there is no need for the NCP QA program to duplicate these efforts. Lastly, it is recommended that QA issues for emerging contaminants of concern and for less commonly-studied contaminants, such as organotins, dioxins and PAHs, be assessed on an ongoing basis.

RÉSUMÉ

Le présent rapport résume les résultats d'une enquête menée en 1998-1999 qui identifie les organisations qui contribuent des données scientifiques aux projets de recherche financés par le Programme de lutte contre les contaminants dans le Nord (PLCN). Il fournit des données sur les capacités d'analyse et les types de données de mesure produites par ces laboratoires ainsi que les mesures de contrôle de la qualité utilisées pour les échantillons du PLCN. De plus, le rapport nous renseigne sur les analytes, les concentrations de contaminants et les matrices pour les échantillons du PLCN afin de déterminer les besoins prioritaires actuels et futurs en matière d'assurance de la qualité de la Phase II du PLCN.

Les auteurs font plusieurs recommandations concernant l'orientation future du Programme interlaboratoires d'assurance de la qualité (AQ) du PLCN. L'un des points principaux est la nécessité de se pencher sur la qualité des données produites sur les pesticides organochlorés, les PCB, le toxaphène, les métaux lourds et le méthylmercure. En revanche, la fiabilité des mesures des radionucléides réalisées pour le PLCN ainsi que des données sur les éléments nutritifs dans l'eau semble assurée ailleurs, c'est pourquoi il n'est pas nécessaire que la programme d'AQ du PLCN déploie également des efforts dans ce sens. Enfin, on recommande que les questions se rapportant à l'AQ dans le cas des contaminants émergents qui suscitent des préoccupations et des contaminants moins étudiés, comme les composés organostanniques, les dioxines et les composés d'hydrocarbures aromatiques polycycliques fassent l'objet d'une évaluation continue.

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List of Tables

This report has been updated from the original version submitted to the Northern Contaminants Program (NCP) in January 1999. The changes reflect additional information received after the original published date of December 30, 1998. In particular, the changes reflect amendments from the Indian and Northern Health Laboratory and new information from the National Water Research Institute up to June 1999.

Introduction

The Northern Contaminants Program (NCP), like all research and monitoring programs, requires an ongoing quality assurance (QA) program that provides assurance to its managers of the quality, reliability and comparability of measurement results being generated for their research projects. At the same time, it should also meet the diverse QA/QC needs of the researchers and analysts by providing them with appropriate diagnostic tools for their analyses and offering guidance and support toward corrective measures, if needed.

PHASE I of the NCP devoted considerable attention to identifying contaminants and pathways, monitoring trends, and establishing controls on substances of concern in the Arctic environment. PHASE II is more focused on immediate human health and safety issues associated with these contaminants in traditionally harvested foods for Northern people. For this reason, the NCP QA program must not only address environmental samples, but should include these emerging matrices and contaminants of concern.

The first step in designing such a QA program is to determine who the organizations are that contribute scientific data to the NCP. Second, with such a broad scope of research interests, a summary of the relevant matrices and the target analytes and concentration levels of the NCP samples should be compiled in order to prioritize the QA needs. Finally, specific elements of the QA program, such as a series of interlaboratory comparison studies, should be designed so as to meet these needs in the most efficient and cost-effective means possible.

This report summarizes the analytical capabilities of the laboratories that contribute measurement data to the NCP, and the relevant analytes, concentration levels and matrices in the various NCP-funded research projects. In conjunction with information on the availability and suitability of external quality assurance programs pertinent to the

NCP, an effective interlaboratory QA program for PHASE II of the NCP can be designed and implemented.

The Survey

In October 1998, the authors conducted a survey of the laboratories and organizations that contribute measurement data to the Northern Contaminants Program (NCP). By comparing the analytical capabilities and the types of measurement data produced by these laboratories to the relevant analytes, concentration levels and matrices of the NCP samples, the current and future Quality Assurance (QA) needs of Phase II of the NCP can be determined.

The first step in the process was to contact the project leaders of the NCP projects funded for 1998/99, to identify how they conduct or acquire their measurement data. A list of these projects is provided in Appendix A along with the type of analyses and proposed means of acquiring the measurement data. In some projects, the required analyses were to be conducted "in-house" while in others, the researchers planned to send their samples to external laboratories or institutions for analysis. Table A1 in Appendix A lists the proposed measurement laboratories with their associated NCP research projects.

A written questionnaire was then sent to these measurement organizations. This survey addressed the analytical capabilities of their laboratories, and sought to identify what other analytical services would be available to the NCP. This information was gathered to facilitate a broader understanding of these measurement facilities and to clarify which laboratories are conducting what types of analyses for the NCP.

Appendix B contains a copy of the blank questionnaire, "Survey of the Laboratories that Contribute Scientific Data to the Northern Contaminants Program". Table 1 lists the 26 laboratories and institutions who received a copy of this questionnaire. All the completed responses can be found in Appendix C of this report.

Twenty-one of the 23 organizations that were mailed a questionnaire responded directly and two additional copies were completed by laboratory managers on behalf of the researchers for whom they conduct their NCP analyses. Frontier Geosciences provided their survey information by telephone. In their survey responses, both the University of Waterloo laboratory and Saskatoon District Health advised that they do not conduct routine chemical analyses, and another (International Broodstock Technologies) telephoned to say that they are not involved in the measurement of contaminants such as metals, radionuclides or organic substances. In all, twenty-four laboratories are currently producing measurement data for the NCP-funded research projects and should be invited to participate in any future interlaboratory studies in the NCP QA program.

The Laboratories Contributing Data to the NCP

The following laboratories provide or were anticipated to provide most of the measurement data to the current NCP-funded research projects. For brevity, they are identified in this report by the following codes and acronyms:

AECL	Atomic Energy of Canada Limited, Whiteshell Laboratories
AES	Atmospheric Environment Service, Environment Canada, Downsview
AXYS	Axys Analytical Services Ltd., Sidney, BC
CAIRS	Canadian Institute for Radiation Safety, Saskatoon
CINE	Centre for Indigenous Peoples' Nutrition and Environment, McGill University
CTQ	Centre de Toxicologie du Québec, CHUQ/CHUL, Sainte-Foy
DFO-NF	Department of Fisheries and Oceans, St. John's, Nfld.
Elemental	Elemental Research Inc., North Vancouver
Enviro-Test	Enviro-Test Laboratories, Edmonton
FRD-HC	Food Research Division, Residue Laboratory, Health Canada
Frontier	Frontier Geosciences Laboratories, Washington
FWI	Freshwater Institute, Dept. of Fisheries and Oceans, Winnipeg

GLIER	Great Lakes Institute for Environmental Research, Univ. of Windsor
IML	Institut Maurice-Lamontagne, Dept. of Fisheries and Oceans, PQ
INHL	Indian & Northern Health Laboratory, Medical Services Branch, Health Canada
IOS	Institute of Ocean Sciences, Dept. of Fisheries and Oceans, BC
NHRI	National Hydrology Research Institute, Environment Canada
NLET	National Laboratory for Environmental Testing, Environment Canada
Norwest	Norwest Labs, Surrey, BC
Nunavik	Nunavik Research Centre, Makivik Corporation, Kuujjuaq, PQ
NWRC	National Wildlife Research Centre, Environment Canada
NWRI	National Water Research Institute, Environment Canada
SDH	Saskatoon District Health, Dept. of Lab. Medicine, Univ. of Saskatchewan
SRC	Saskatchewan Research Council Analytical Services
Taiga	Taiga Environmental Laboratory, DIAND, Yellowknife
U of W	University of Waterloo, Department of Earth Sciences
WQL-PNR	Water Quality Lab., Prairie & Northern Region, Environment Canada

Some laboratories conducted their own in-house analyses, but many of the measurement analyses were contracted out to other government, university or commercial laboratories. The seven private sector laboratories are AXYS, CAIRS (private, not-for-profit), CINE, Enviro-Test, Elemental Research, Norwest and Nunavik.

Information Gathered from the Survey

Tables 2 to 9 summarize the information provided by the laboratories in this survey. In order to design an effective QA program that will meet the needs of the NCP researchers as well as those of the measurement laboratories, one must be aware of the accreditation status of the laboratories (Table 2), the main focus of their NCP activities (Tables 3 and 4), their analytical capabilities in general terms (Table 5) and the parameters and matrices specifically addressed by each laboratory for the NCP (Tables 6 through 8), as well as elements of their existing QA efforts in terms of RMs/CRMs used for the NCP work

(Table 8) and participation in external QA programs (Table 9). Each of these factors are described in further detail below.

General Information and Accreditation Status

Table 2 indicates whether the laboratories are in the public or private sector, and identifies their accreditation status. Out of 23 laboratories, 16 are in the public sector and 7 are in the private sector. Ten laboratories possess accreditation from the Canadian Association for Environmental Analytical Laboratories (CAEAL) and one indicated that CAEAL accreditation was in progress. Seven possess accreditation status or certifications from other accrediting bodies. Ten facilities indicated that they possess neither CAEAL accreditation nor accreditation/certification from any other authority. Clearly, the quality of data for many NCP parameters and some matrices of interest is already being competently addressed by other external QA programs for some of the measurement facilities. Nevertheless, more than half of the NCP laboratories do not participate in any of these QA programs.

Size of Laboratory

Table 3 provides a general comparison of the laboratory facilities by size, and lists the main focus of their activities along with major instrumentation available for NCP analyses. In terms of number of staff, the organizations providing the NCP analyses range from one (a lone NCP researcher at the University of Waterloo) to more than 300 personnel. The majority of the NCP laboratories (14 out of 22) have less than 20 staff while five have between 20 and 100 personnel. Four organizations have between 220 to 320 staff.

The four largest facilities (AECL, Enviro-Test, Norwest and Saskatoon District Health) each hold multiple accreditations and/or certifications. With their CAEAL accreditation and participation in other external interlaboratory comparison programs, it is apparent that the data quality of these laboratories is already being extensively monitored. For

these laboratories then, the focus, in terms of QA for the NCP analyses, should be to identify and address the specific areas where additional QA is needed.

Thus, one of the key directives for the NCP QA program should be to address the measurement capabilities and the QA needs of the smaller laboratories who are providing measurement data to the NCP but who are not participating in pertinent external QA monitoring programs. At the same time, because more than half the NCP laboratories have less than 20 staff, it also is necessary to carefully consider the number of samples and frequency of the interlaboratory studies so as not to place a QA burden on these organizations that is out of proportion to their sample load.

Main Focus of Activities

As summarized in Table 4, 'analytical services' was listed as the main activity for 13 of the laboratories in this survey. 'Research and development' was also identified as a significant part of their work by 8 organizations while 3 identified themselves as being in the medical field. Other categories of activity indicated in this survey were oceanography, monitoring, and consulting. None of these measurement facilities identified forestry or agriculture as their main interest.

Major Instrumentation Available

Table 3 lists the major instrumentation used and/or available for the NCP analyses. The large diversity of laboratory equipment clearly indicates that the NCP laboratories are capable of providing a large array of measurement data ranging from quick screening analyses to complex high resolution GC/MS, ICP/MS and MS/MS analyses. Various types of chromatography (e.g. GC, HPLC, IC) and spectrometry (e.g. MS, alpha, gamma, ICP-AES) are widely used. Other equipment used includes Flow Injection-Mercury Hydride Systems, an Empix Image Analyzer, and many centrifugal, elemental, ultra-trace mercury, and combustion analyzers.

Other Services Available

Many of the laboratories indicated in their survey responses that they have considerable available expertise in areas other than those directly supporting current NCP research measurements. As seen in Table 5, the analytical expertise available to the NCP researchers is extremely broad in scope. For several of the organizations surveyed, this additional pool of expertise also includes capabilities for designing and conducting field surveys, sample collection, environmental monitoring, method development and consulting. In addition, highly specialized services such as radiation surveys, enantiomeric analysis, analysis of DNA adducts, alpha/beta spectroscopy, taxonomic identification, identification of unknown chemicals, fish dissection, sediment coring, and fishing were also listed by individual facilities.

Matrices and Parameters being Analyzed for the NCP

Table 6 summarizes the matrices being tested by each laboratory while the parameters being measured are tabulated in Table 7. Table 8 further details the specific analyte/matrix combinations being addressed along with their typical range of concentrations in the NCP samples. (Please note that the survey responses from some of the laboratories reflect only their NCP measurements, while other facilities appear to have provided the full scope of their analytical capabilities, including non-NCP work. This should not, however, misdirect the design of the NCP QA program since it would be beneficial to invite each organization with the capability to provide a particular measurement, to participate in each appropriate QA study, regardless of whether they are currently providing such analyses for the NCP. The additional results will not only provide for a broader peer assessment of the interlaboratory data, it will also establish a quality assessment of each laboratory's potential to provide such measurements for the NCP in future years.)

The list of matrices that the various laboratories are capable of analyzing is extensive, ranging from common environmental samples, such as sediment, air and water, to various types of biota and human tissue samples. The biota investigated, includes mussels, fish,

caribou, wolves, birds, plants and various tissues from marine mammals such as ringed seal, polar bear and beluga. Table 6 indicates which laboratory is involved in testing each of the various matrices. Where the survey responses provided sufficient details, specific types of samples have been identified under the various categories. 20 laboratories test various types and tissues of biota, of which at least 14 can test fish. 19 facilities test water samples and 13 of these also analyze sediment and/or soil. Other matrices tested include human food (4), animal feed (2), snow (5), urine (6) , blood (6), mining products and effluents (4), and XAD columns, polyurethane foam plugs and particulate filters.

The parameters that are routinely measured by the laboratories are listed in Table 7. These include a wide variety of trace metals, especially mercury (and methyl mercury), cadmium, selenium, lead and zinc. In all, twelve laboratories conduct trace metal analyses, while thirteen specifically analyze for mercury. INHL is the only laboratory measuring mercury levels in hair. Radionuclide measurements and stable isotope analyses are provided by 6 facilities, while nutrients in water are measured by four laboratories.

Among the organic parameters of interest, the most common targeted were organochlorines (OCs) and PCBs (17), dioxins and furans (8), PAHs (5), and toxaphene (9). Two laboratories (AXYS, DFO-NF) indicated capabilities for organotin analyses and three (FWI, INHL, NWRC) indicated that they provide methylmercury measurements. NWRI is the only facility studying brominated diphenyl ethers.

Existing QA Efforts Supporting the NCP Analyses

Table 8 provides a list of the various reference materials (RMs) and certified reference materials (CRMs) used by each laboratory to support their quality control for NCP measurements. Nine laboratories did not provide any information on reference standards or CRMs. However, among the thirteen responses, RMs and CRMs are acquired from at least 12 different organizations. Not surprisingly, NIST (National Institute for Standards and Technologies) and the NRC (National Research Council) were the sources of CRMs for most analyses (8 and 6 laboratories used their materials, respectively). However,

other organizations providing RMs and CRMs for the NCP work include the Institute of Reference Materials and Measurements (IRMM), Quality Assurance of Information for Marine Environmental Monitoring in Europe (QUASIMEME), CIL/Radian, National Water Research Institute (NWRI), National Wildlife Research Centre (NWRC), Fisheries and Oceans Canada (DFO), AccuStandard's Contract Laboratory Program, CANMET (Canada Centre for Mineral and Energy Technology), Analytical Products Group, and Inorganic Ventures.

As seen in Table 9, the laboratories providing analytical data to the NCP, participate in 19 different external interlaboratory comparison programs. While 6 laboratories did not indicate participation in any external QA program, most that did respond, indicated that they have participated in more than one external ILS program. 12 laboratories indicated that they participate in CAEAL's program for various parameters, 6 participate in NWRI's ILS program, and 4 have participated in various US-EPA programs. However, not one survey respondent indicated that they participate in the NOAA-NIST program for PAHs, OCs and PCB congeners in marine sediment and biota samples. The National Research Council (NOAA) program for trace metals and QUASIMEME's studies on marine samples each have 2 NCP laboratory participants.

Upon further scrutiny of the parameters and matrices in these other external interlaboratory comparison programs, it becomes apparent that many of the NCP measurement laboratories participate in several highly specialized QA studies that would not be applicable to any of the other facilities in this survey. Clearly, an NCP QA program must review and consider accepting participation in these additional programs as supporting the NCP's data quality needs, where such programs apply to only one or two NCP measurement laboratories at most. Further details on these programs can be found in the *Summary Report on the Availability and Suitability of External National and International Quality Assurance Programs Pertinent to the Northern Contaminants Program.*

Recommendations for Future NCP Intercomparison Studies

The most common contaminants being measured by the NCP measurement laboratories are OCs and PCBs. While a number of the NCP laboratories participate in the CAEAL OC/PCB program and are, in some cases, accredited for such analyses, the test parameters are few and their concentration levels in the check samples are considerably higher than those found in most of the NCP samples. It is therefore recommended that the NCP QA program incorporate an interlaboratory component for OC/PCBs that specifically addresses the parameters of interest to the NCP researchers (e.g. HCHs, chlordane and PCB congeners) at more appropriate levels in both biotic and abiotic samples. Because of the number of target parameters, and the variety of matrices being evaluated by the different NCP researchers, it will likely be necessary to conduct a series of independent interlaboratory studies to more fully assess the intercomparability of the different types of measurements being conducted.

By the late 1980's, toxaphene was often found to be the most abundant pesticide residue in fish and several marine mammals across the Canadian Northwest Territories. As the results of the recent NCP survey on other available external QA programs reveals, there are some toxaphene intercomparison studies available, but their schedules are infrequent and non-routine. Therefore, since 9 facilities are conducting toxaphene analyses, it is recommended that the NCP establish a series of intercomparison studies to monitor the quality of toxaphene data being generated by its laboratories, where such external interlaboratory QA studies are not available or are not suitable to the work of the NCP laboratories. If any suitable toxaphene intercomparison studies become available from external sources, the NCP laboratories should be encouraged to participate, and the NCP interlaboratory studies should then be designed to be complimentary in terms of target concentrations and matrices.

The survey responses indicate that 12 facilities measure the concentration levels of various trace metals in NCP samples, but only 3 laboratories specifically test for methylmercury. This compound is a highly toxic environmental neurotoxin that can

cause irreparable damage to the central nervous system and is of considerable interest to the NCP. In addition, more recent evidence suggests that methylmercury toxicity can be inhibited by various antioxidants including selenium. Therefore, because of this increased interest, it is recommended that the NCP QA program continue to address the data quality of its trace metal analyses, including mercury and selenium, as well as those of methylmercury, where feasible.

Analyses for nutrients in water are conducted by four facilities in this survey. However, because the quality of such analyses is routinely addressed in other external QA programs (such as the ones conducted by CAEAL and by NWRI), it is recommended that the NCP QA program make participation in an external Nutrients in Water QA program mandatory for these measurement laboratories.

Six laboratories identified the measurement of radionuclides in various matrices and/or stable isotope analyses of water among their analytical capabilities. However, the recent NCP survey on other external QA programs reveals that there have been a number of excellent international intercomparison programs conducted by the IAEA. Therefore, because these are such specialized areas of measurement, it is recommended that the NCP investigate further, the specific QA needs of each of the radionuclide measurement facilities, to more closely evaluate the merit of conducting its own interlaboratory studies. In addition, the NCP should, where suitable, promote the participation of these laboratories in existing international comparison studies, such as those offered by the IAEA.

Dioxin and furan analyses were identified in this survey as being provided by eight laboratories. It is therefore recommended that the NCP QA program incorporate an interlaboratory check sample study on the analysis of dioxins and furans in matrix samples. However, because only a few researchers identified these contaminants in their proposals, further correspondence needs to be conducted with the NCP researchers and

the potential study participants to identify the most suitable matrix/matrices for these check samples.

Finally, only two facilities are currently conducting organotin analyses. In view of the rising concern about these contaminants, every effort should be made to find a suitable external QA program on organotin analyses in which participation by these two facilities should be encouraged. In the meantime, it is recommended that the NCP QA program design a small intercomparison study to address the comparability of the organotin data being generated by these two laboratories.

Next Steps

At its most fundamental level, the NCP QA program should ensure that acceptable levels of precision and accuracy are generated for all measurement results. It should ensure comparability among the various research and analytical laboratories and among the different research projects. Finally, it should provide NCP managers a scientifically sound base for evaluating the overall quality of data in the program.

An ongoing series of appropriate interlaboratory comparison exercises, such as those recommended above, would be the key component of a program that could achieve these goals. However, with the small number of laboratory facilities conducting many of the novel measurements for the NCP, it would be neither cost-effective nor informative to conduct NCP-directed QA studies for each and every type of analytical measurement and analyte/matrix combination.

Therefore, the next step in designing and implementing an effective QA strategy for Phase II of the NCP will be to assess, for each analyte/matrix type of measurement, the feasibility of conducting NCP interlaboratory assessments where there may already exist appropriate external QA programs. By coordinating with non-NCP programs conducting suitable interlaboratory studies, there could be a potential cost savings and the

participating laboratories would not be burdened by "too much duplicate QA". The NCP survey *Summary Report on the Availability and Suitability of External National and International Quality Assurance Programs Pertinent to the Northern Contaminants Program* further addresses these issues.

Summary

This survey provides a comprehensive overview of the laboratories that currently provide measurement data to the NCP. It identifies the analytical capabilities of these organizations, the types of measurement data being generated by the individual facilities, and their current QA efforts supporting the NCP analyses. In addition, this report identifies several areas where additional QA may be redundant, and prioritizes the specific analytes and matrices requiring further attention in an ongoing NCP QA program.

The series of intercomparison studies recommended in this report, should identify sources of measurement uncertainty and variation of analytical results within or between the NCP laboratories and/or research projects. In conjunction with reviews of these laboratories' performance evaluations from other pertinent external QA programs, a clearer picture of the overall data quality being generated for the NCP can be provided to its managers.

Finally, by offering a solid measure of assurance of the quality, reliability and intercomparability of NCP data, this QA program can also support the long-term objective of international scientific study and cooperation in Arctic research.

Table 1: Laboratory Contacts for the Survey Questionnaire

Laboratory	Contact Person	Analytes for the NCP
AECL	Karen Ross/Rich Hamon	Radionuclides
AES	Terry Bidleman	Organics
AXYS	Debbie Fyles, Coreen Hamilton	Organics
CAIRS	Brian Bjorndal	Radionuclides
CINE	Laurie Chan	Metals, organics
CTQ	Jean-Philippe Weber	Metals, organics
DFO-NF	Joseph Banoub	Organotins
Elemental Research	Charles LeBlanc	Metals
Enviro-Test	Deib Birkholz	Metals, organics
Frontier Geosciences	Nicolas Bloom (by telephone)	Metals, organics
FWI	Gary Stern Joanne DeLaronde (metals) Paul Wilkinson (radionuclides) Brian Billeck (organics)	Metals, organics, radionuclides
GLIER	Doug Haffner	Metals, organics
IML	Michael Lebeuf	(no response, see NLET)
INHL	Harold Schwartz	Metals, organics
IOS	Fiona McLaughlin	Organics
NHRI	Marlene Evans	(redirected to WQL-PNR)
NLET	Mike Comba	Organics
Norwest	Randy Neumann	Metals, organics
Nunavik	Michael Kwan	Metals
NWRC	Bryan Wakeford Ross Norstrom	Metals, organics
NWRI	Dr. Derek Muir (redirected to NLET) Dr. Bill Strachan	Organics
SDH	Pat Thomas, Kim Barks	(pre-analytical, medical only)
SRC	Dave Chorney	Radionuclides
Taiga	William Coedy	Metals
U of W	John Hoff	(sorption of organics on snow)
WQL-PNR	Guat Peng Lee	Nutrients in water

Note: A complete listing of all contacts, and their telephone and Fax numbers, can be found in Table B1 of Appendix B.

Table 2: Accreditation Status of Laboratories

Laboratory	Sector	CAEAL Accreditation?	Other Accreditation?
AECL	Public	Major Ions in Water (Ion Chromatography); Metals in Water (FAA, ICP); Uranium in Water (HPLC); PAH in Water (GC/MS); Volatiles in Water (P&T/GC/MS); Total PCB in Oil (GC/ECD); Radiostrontium/Tritium/Carbon-14 in Water (LSC); Radionuclides in Water (Gamma Spec.); Radionuclides in Water (Alpha Spec.)	Yes, full QA program is in compliance with the Atomic Energy Control Board requirements and/or ISO Guide 25
AES	Public	No	No
AXYS	Private	Dioxins/Furans, DBD/DBF, Chlorinated Pesticides, PCB Congeners, Toxaphene, PAHs, Organotins, Nonylphenol	Yes- Standards Council of Canada, State of New York Dept. of Health, BC EDQA
CAIRS	Private	No	Yes-Certified Personal Dosimetry Service (AECB 5-106)
CINE	Private	No	No
CTQ	Public	No	No
DFO-NF	Public	No	No
Elemental	Private	No	ISO 9002/94; HPB Establishment License
Enviro-Test	Private	Yes, but test categories not provided	American Industrial Hygiene Assoc.; EPA-FIFRA GLP compliant
FWI	Public	No, but it is in progress	No
GLIER	Public	Yes-PCBs, PAHs, metals	No
INHL	Public	No	No
IOS	Public	No	No
NLET	Public	OC/PCBs in water; PAHs in water and sediment	No
Norwest	Private	Inorganics (metals, nutrients, physical, ions); Organics (hydrocarbons , PCBs, PAHs, BTEX, pesticides)	Yes, SCC/CAEAL-pesticides in food; SCC/CFIA-feed and fertilizer, microbiology of food
Nunavik	Private	No	No
NWRC	Public	OC/PCBs in Eggs/livers; OC/PCBs in blood plasma; Dioxins in eggs/liver/fat	No
NWRI	Public	No	No
SDH	Public	No	Yes, CMA; Royal College of Physicians and Surgeons
SRC	Public	Yes, (Extensive list of parameters)	No
Taiga	Public	Yes, Water (inorganics); Air Filters; Soil/Sediment	No
U of W	Public	No	No
WQL-PNR	Public	Major ions, TSS, conductivity	No

Table 3: General Description of Laboratory Facilities

Laboratory	Size of Laboratory	Main focus of Activities	Major Instrumentation
AECL	Staff: 300 Steady sample load that peaks from July through November each year	Analytical Services	Extensive (e.g. ICP, AA, Ultra-Trace Mercury Analyzer, HPLC, IC, Combustion Analyzers)
AES	Staff: 3	Research and Development	GC-ECD; GC-MS
AXYS	Staff: 60 Sample load: 30-50,000 samples per year	Analytical Services	3 HRGC/MS; 3 Quad GC/MS; 2 GC-ECD; 1 HPLC
CAIRS	Staff: 6 6000 to 7200 samples/year	Analytical Services Medical Mining Other: Dosimetry	Empix Image Analysis System; CAIRS Radon/thoron calibration facility; Oxford HP series 6 Alpha/beta counting system; Alpha/beta alphaspectroscopy system
CINE	Staff: 1 scientist, 2 chemists, 2-10 students 200 (OC) and 1000 (metals) samples/year	Research and Development	1 GC-ECD/FID; 1 GC/MS/MS (Ion Trap); 1 GFAAS, 1 flame AAS; 1 CVAAS for Hg
CTQ	Staff: 34	Medical	1 ICP-MS ; 2 LC-UV-PDA; 3 GFAAS; 1 HPLC Fluorescence; 3 GC/MS ; 3 GC-ECD; 1 LC/MS
DFO-NF	Staff: 24 person years + 8 research assistants	Research and Development	3 GCs; 1 GC/MS; 1MS/MS triple qudrapoles equipped with electro-spray; atmospheric Pressure Chemical Metastable atom bombardment; EI, CI, DCI and FAB ionizations, H13, C and Multinucleus, NMR -+T Sulphur Conductivity with hemoprobes
Elemental	Staff: 21; (5 Ph.D., 9 B.Sc.); 10 000 square feet, long term storage facilities on-site, 12 years in operation	Analytical Services (ICP/MS specialists)	3 ICP/MS; One Laser ablation ICP/MS; One HPLC/MS; One IC; one TOC (total organic carbon)
Enviro-Test	Staff: 220 permanent and ~100 part-time 6 laboratories across Canada (Edmonton, Calgary, Grande Prairie, Saskatoon, Winnipeg and Thunder Bay) Some divisions process up to 1000 samples/day	Analytical Services Other Services: consulting to industry, government, re: data collection needs, toxicology, agriculture, forestry (pulp & paper), mining, and R&D	GC/MS quadrupole (24); LC/MS (2); LC/MS/MS/MS (2); GC/HRMS (1); ICP/MS (2); ICP/ES (7); GFAAS (3); HGAAS (3); AAS(7); GCS (17); LCS(17)
FWI	2 staff dedicated to metals and radionuclides (~75 samples per week 2 staff dedicated to organics (~30 samples per week)	Research and Development	Metals: 2 GFAAs, 2 flame AAs, 1 CVAA, 1 HGFAA Radiochemistry: 14 alpha spectrometers, 8 gamma spectrometers, 4 scintillation counters Organics: Two GC-ECDs, 1 GC-MSD, 2 high res. Mass Spec.

Laboratory	Size of Laboratory	Main focus of Activities	Major Instrumentation
GLIER	Staff: 4 (3 in organic lab, 1 in metals lab)	Research and Development	1 ICP/MS; 1 ICP optical; 1 AA; 2 GC/MS; 3 GC-ECD/FID; 1 HPLC
INHL	Staff: 4 400 (PCBs) and 500 (mercury) samples/year	Analytical Services	3 GC/MS; 1 GC-ECD; 1 MS-Engine; 1 Mercury Analyzer robotic system
IOS	Staff: 3 (1 research scientist; 1 geochemical oceanographer; 1 analyst)	Other: Oceanography	GC-ECD
NLET	Staff: 10 3000 samples/year	Analytical Services	HRMS (EI-CI); GC-MSD (EI, negative ion CI); 13 GCs; 1 AED
Norwest	Staff: 250, (at 8 sites) 250,000 samples/year	Analytical services	8 ICPs; 50 GCs (incl. 5 GC-MC); 2 HPLC 1 GFAAS; 2 IC; 25 Autoanalyzers; 4 centrifugal analyzers; combustion analyzers; etc.
Nunavik	Staff: 7 (3 branch scientists and 4 technicians) 600 to 1200 samples per year	Other: Research and Monitoring	1 THGA Graphite furnace AAS; 1 Flow Injection- Mercury/Hydride System
NWRC	Staff: 15	Analytical Services	1 HRGC-MS; 3 GC-MSDs; 1GFAAS
NWRI	Staff: 4 500 samples/year	Research and Development	2 GCs; 1 GC-MS; 1 GC-MS Ion Trap; 1 NICP-MS
SDH	Staff: 260, (at 3 locations) 14,000,000 lab tests/year	Medical	Extensive (specific equipment not provided)
SRC	Staff: 45 23,000 to 25,000 samples/year	Analytical Services	ICP-AES; EDXRF; NAA; IC; GC; GC/MS
Taiga	Staff: 6 ~2000 samples/year (~20 parameters/sample)	Analytical Services	1 ICP/MS; 2 GCs; 1 GFAAS; 2 AAs; 6 Technicon Auto-analyzers; 2 Hg-CVAAs
U of W	Staff: 1	Other: sorption of chemicals on snow	GC and Micromeritics nitrogen adsorption (BET) surface area analyzer
WQL-PNR	Staff: 6	Analytical Services	TRAACS & other Technicon Auto Analyzers; Elemental Analyzer (CHN); TOC Analyzer; UV-VIS spectrophotometer

Table 4: Main Focus of Laboratory Work

Category of Main Focus	Number of Laboratories
Analytical Services	13
Research & Development	8
Medical	3
Mining	1
Oceanography	1
Consulting	1
Forestry	0
Agriculture	0
TOTAL	**27**

Table 5: Summary of Additional Laboratory Capabilities and Services

Laboratory	Analytical Capabilities by Parameter and Matrix	Other Services
AECL	• Radionuclides in biota (food: fish, plants, mammals, birds) and water; • Metals, COD, BOD, suspended solids, mercury; dioxins/furans, extractables (acid/base/neutrals, neutral-chlorinated), PCBs, volatiles, hardness	• Sample collection
AES	• OCs, toxaphene, coplanar PCBs and PCNs in air; • Toxaphene, HCH in water; • Total gaseous mercury in air; • [Other matrices: soil, sediment]	• High volume sampling methods for air and water; • Enantiomeric analysis
AXYS	• Total PCBs; PCB Congeners; coplanar PCBs; Toxaphene; Aroclors 1242, 1254, 1260; Chlorinated Pesticides; Dioxins/Furans; Dioxin Precursors; PAHs; Parent PAHs; Alkanes; Chlorophenols; Organotins; Resin Acids; Fatty Acids; Nonylphenol in sediment, soils, tissue (fish, animals), water, effluent	• Design of field and sampling programs; • Field sampling; • Method development; • Sample homogenization
CAIRS	• Radon and Thoron Progeny; • Radioactive Dust; • Radon in air and water; • Tritium in water	• Environmental monitoring, (air, water); • Radiation surveys; • Alpha/beta spectroscopy
CINE	• Trace metals in water, vegetation, fish, and wildlife; • OCs (including dioxins/furans) in fish and wildlife (liver, blood and adipose tissues); • Hg and OC/PCBs in blood; • Nutrients, PCBs, pesticides, toxaphene, trace metals, vitamins and minerals in food	• None indicated
CTQ	• Cd, Hg, Pb and OCs in blood; • Cu, Se, Zn, PCBs, OCs and dioxins/furans in serum; • OC/PCBs and toxaphene in plasma and tissues; • OC/PCBs in milk and placental tissue; • Selenium in hair, plasma, whole blood and urine	• None indicated
DFO-NF	• Triazines; Azamethiphos compounds; Germethin; Ingraol; • Butyltins in fish, mussels and seal tissues	• DNA Adducts (intact)
Elemental	• Various metals and elements in all solids and liquids • metals/caribou	• None indicated
Enviro-Test	• Trace metals, dioxins/furans, congener PCBs, toxaphene, chlorinated diphenyl ethers, chlorophenols and resin acids in fish and sediment; • Pb, Hg and Cd in blood; • Metallothionein in fish gill, kidney and liver; • EROD and AHH in fish liver; • Cortisol, estradiol and testosterone in fish blood serum	• Taxonomic identification; • Dissection of organs from fish; • MS interpretation and identification of unknown organic chemicals; • Extractable organic chlorine in sediment, water, and biological tissues using neutron activation analysis.
FRD-HC	• Toxaphene in blood and adipose tissue	• None indicated
Frontier	• Arsenic in soil	•
FWI	• Trace metals and methyl mercury in sediment, fish, human and marine mammal tissues; • Mercury in snow; • PAHs, petroleum hydrocarbons, toxaphene, chlordane, DDT, HCH, chlorobenzenes, chlorinated paraffins and anisoles, PCB congeners in water, air sediment, biota; • Radionuclides in air, water, sediment and biota; • PCP and dioxin/furan in sediment	• Field work and sample collection; • Sediment coring; • Fishing

Laboratory	Analytical Capabilities by Parameter and Matrix	Other Services
GLIER	• OCs in caribou and moose fat, liver and muscle tissues; • Metals in caribou liver and kidneys	• None indicated
IML	• Coplanar PCBs in fish, mussels and seal tissues	• None indicated
INHL	• PCBs and pesticides in serum and blood; • Mercury and methylmercury in hair, fish, urine, and blood	• None indicated
IOS	• HCHs in seawater; • Coplanar PCBs, dioxins/furans, chlorinated anisoles in beluga extracts	• Field sample collection in the Arctic Ocean and Canadian Arctic Archipelago
NHRI	• Stable isotope analyses of water	• None indicated
NLET	• PCB congeners; OCs; PAHs; chlorobenzenes; toxaphene in water, air, fish, biota and sediment; • BDPEs in biota; • Total mercury in snow	• Field work, cost recovery/custom analysis, methods development, CAEAL auditors, expert advice, consulting
Norwest	• Extensive; details not provided	• None indicated
Nunavik	• Pb, Cd, As, Se, and Hg in biological tissues (fish, mussels and seal tissues)	• Coordinating biota sampling for contaminant studies of Nunavik region; • experienced field technician available
NWRC	• OC/PCBs in biota (polar bears); • OCs and trace metals in bird tissues (blood and eggs); • Dioxin/furans; • Hg, organic Hg, and Se in liver; Cd in kidney; and Hg, Se and Cd in blood or arctic sea ducks	• Field collection done by other staff in NWRC; • Specimens dissected in NWRC and stored in CWS Specimen Bank
NWRI	• Toxaphene in air, water, rain, snow • PAHs in air, water, rain, snow, sediment • PCBs in air, water, rain, snow, sediment, fish • OCs in water	• Rain networking • Field sampling for water, sediment and air
SDH	• No contaminant measurements	• Pre-analytical human tissue analyses
SRC	• Radiochemical analysis and radioactivity measurements; • Elemental analysis, organics analysis; • Water quality and potability packages (trace metals/water; major ions, nutrients, physical parameters in water); • Soil, sediment, sludge analyses for moisture, pH, elements; • Metals and radionuclides in vegetation; • Hg and As in fish; • Pb-210 and Po-210/ animal tissue, urine and feces	• % ash; • Hazardous waste classification (PCBs, metals); • Industrial hygiene; • Paint analysis; • Alloy analysis;
Taiga	• Trace metals, Hg in fish, biota, water, air filters, sediment; • Major ions, physical parameters, nutrients in water; • Bacteriology of water	• Field sampling
U of W	• Specific surface area of snow; • Chlorinated organic contaminants/snow and surfaces; • Stable isotope analysis of water	• None indicated
WQL-PNR	• TP, DP, ortho-P; DOC; Chlorophyll-a; Colour; Conductivity; Ammonium-N; Nitrate + Nitrite; Total Dissolved N; pH; NFR & NFFR, Organic C and N	• Field work (but no capacity)

Table 6: Matrices Analyzed by the NCP Laboratories

Laboratory	Water	Sediment	Soil	Air	Human Food	Animal Feed	Biota	Human Tissues	Other
AECL	X	X	X	X	X		X – fish, mammals, birds, plants		X – urine, milk, mine tailings, effluents, sludges
AES	X	X	X	X					
AXYS	X	X					X – vegetation, animal and fish tissues	X – tissues (including blood)	X – effluents, XAD-2 columns, PUF plugs, particulate filters
CAIRS	X			X					X - dust
CINE	X				X		X – fish, animals	X - blood	X – chemical cocktail
CTQ	X			X			X	X	X – urine, milk, placenta, blood, tissues
DFO-NF	X	X					X – fish, mussels, seal	X	
Elemental	X	X	X		X	X	X	X	X – all solid and liquid matrices
Enviro-Test	X	X		X			X - tissue, blood, urine, bile from terrestrial or aquatic species	X - blood, adipose tissue, hair, urine	
FDR-HC							X – blood, adipose tissue		
Frontier			X						
FWI	X	X		X			X – fish, plants, marine mammals, invertebrates, fish	X	X - snow
GLIER	X	X	X				X – fish, plants, birds, caribou, etc.		
IML							X – fish, mussels, seals		
INHL							X – fish	X – serum/blood, hair, urine	
IOS	X						X - beluga		X – particulates and dissolved OCs on XAD columns
NHRI	X								
NLET	X	X	X				X – marine mammals, invertebrates, plants, fish		X – snow, urine, blood
Norwest	X		X	X	X	X	X – plant, animals	X – hair	X - fertilizer
Nunavik							X – fish, mussels, seals		
NWRC							X - wildlife tissues (egg, muscle, fat, blood), birds, polar bears		
NWRI	X	X		X			X - fish		X - rain, snow
SDH								X	
SRC	X	X	X	X			X – plants, animal tissue, fish	X – urine, feces	X – organics, mine products, sludge
Taiga	X	X		X			X – fish, mammals, whole blood		
U of W									X - snow
WQL-PNR	X								
TOTAL	**19**	**12**	**8**	**10**	**4**	**2**	**20**	**11**	**13**

Table 7: Parameters Measured by the NCP Laboratories

Laboratory	Trace Metals	Hg	Methyl -Hg	Nutrients	OCs and PCBs	Dioxins and Furans	PAHs	Toxa-phene	Radio-nuclides
AECL	X	X			X	X			X
AES		X			X			X	
AXYS	organotins				X	X	X	X	
CAIRS									X
CINE	X	X		X	X	X		X	
CTQ	X	X			X	X		X	
DFO-NF	organotins				X				
Elemental	X								
Enviro-Test	X	X			X	X	X	X	
FRD-HC								X	
Frontier	X	X							
FWI	X	X	X		X	X	X	X	X
GLIER	X				X				
IML					X				
INHL		X	X		X				
IOS					X	X			
NHRI									X
NLET		X			X		X	X	
Nunavik	X	X							
NWRC	X	X	X		X	X			
NWRI					X		X	X	
SRC	X	X		X	X				X
Taiga	X	X		X					
U of W					X				X
WQL-PNR				X					
TOTAL	12	13	3	4	17	8	5	9	6

Table 8: RMs and CRMs used with the NCP analyses

Laboratory	NCP Samples by Matrix and Analyte	Typical Concentrations	RMs and CRMs Used
AECL	not provided	not provided	not provided
AES	Air - toxaphene – chlordanes – HCHs – coplanar PCBs – PCNs Water - toxaphene – HCHs – chlordanes	• 2-10 pg/cu. meter • 2-10 pg/cu. meter • 2-100 pg/cu. meter • 0.5-50 fg/cu. meter • 1-40 pg/cu. Meter • 10-100 pg/L • 100-3000 pg/L • 0.3-5 pg/L	not provided
AXYS	PCB Congeners Toxaphene Dioxin/furans PAH Chlorophenols	not provided	Standard reference materials are routinely analyzed when available. If no certified reference materials are available, spiked samples are used to demonstrate the accuracy of the data. Spiked sediments and tissues are analyzed at regular intervals.
CAIRS	not provided	not provided	not provided
CINE	not provided	not provided	DORM-1, DORM-2, and CLB-1 (PCB solutions) from NRC SRM 1588 organics in cod liver oil from NIST
CTQ	not provided	not provided	Certified controls from our Comparison Program (Metals) SRM-1589 (PCBs in serum) SRM-1945 (Organics in whale blubber) SRM-1588 (Organics in cod liver oil) CRM 188 (Pesticides in milk powder) CRM 450 (PCBs in natural milk powder)
DFO-NF	• Biota (blue mussels, ringed seal, arctic char) • Organics (TBT, DBT, MBT)	• ng/g	PACS-2 and 1 Reference Sediment Material QUASIMEME Standards for Organotin Compounds
Elemental	not provided	not provided	not provided

Laboratory	NCP Samples by Matrix and Analyte	Typical Concentrations	RMs and CRMs Used
Enviro-Test	– Suspended Sediment - PAHs – Extractable organic chlorine (EOCl) – Chlorinated phenols – PCBs – Organochlorine pesticides – Dioxins/furans – Fish muscle - EOCl – Chlorinated phenols – Dioxins/furans – Fish Bile - EOCl – Chlorinated diphenyl ethers – Resin acids – Chlorinated phenols – PAH-metabolites, FACS	• <0.003 – 0.58 µg/g • <0.3 – 3.2 µg/g • <0.05 – 60 ng/g • <0.002-0.3 µg/g • <0.001-0.01 µg/g • <0.2 – 65 pg/g TEQ • <0.2 – 42 µg/g • <0.5- 25 ng/g • 0.2- 100 TEQ • <0.2 – 192 µg/g • <0.25- 101 pg/g • 3- 190 µg/g • <25 – 26,000 ng/g • 0.04 – 17 µg/g BaP and <3 – 1500 µg/g Phen	NRC sediment and biota NIST biota, sediment and solutions CIL Radian Biota
FWI	• Biota (fish muscles and marine mammal tissue) • Sediment • Metals and radionuclides	• Extensive: see the four DFO, Winnipeg questionnaires and attachments on organics, metals and radionuclides in Appendix C	**Metals** – MESS-2, BCSS-1, PACS-2, LUTS-1, TORT-2, DORM-2, DOLT-2, SLRS-1, SLRS-2) from NRC – Mussel tissue (SRM2976), Oyster tissue (SRM1566), Citrus leaves (SRM1572), Bovine liver (SRM 1577a) from NIST **Radiochemistry** – SRM-4327, Po-208, and gamma emissions spiked clay, river sediment and lake sediment from NIST **Organics** – SRM 1941a (marine sediment) from NIST – EC7-Lake St. Clair sediment from NWRI – CS-1, HS-1, HS-2 (sediments for PCBs) from NRC – SRM1588 (PCBS and chlorinated pesticides in cod liver oil) from NIST
GLIER	• Worked with NCP projects 4 years ago • PCBs/OCs/pesticides/metals in biota • PCBs/OCs in caribou • Total PCBs in wolves • Lichen	• 0.02 µg/kg • 500 µg/kg	Herring Gull Homogenate from Canada Wildlife Service, NWRC
INHL	• Total Hg in hair	• 0.5 - 39.6 µg/g	Control sample from INHL ILS for inorganic Hg in hair (0.5 - 6.0 µg/g) IAEA-085: Total Hg (23.2 µg/g) and MeHg (22.9 µg/g) in Hair IAEA-086: Total Hg (0.573 µg/g) and MeHg (0.258 µg/g) in Hair

Laboratory	NCP Samples by Matrix and Analyte	Typical Concentrations	RMs and CRMs Used
IOS	• Seawater - organics • a-HCH • b-HCH • g-HCH • HCB	• 0-6000 ng/m3 • 0-400 ng/m3 • 0-800 ng/m3 • 0-50 ng/m3	Contract Laboratory Program (CLP) from Accustandard
NLET	Congener PCBs and OCs in biota	Ultra-trace	NIST COD liver oil DFO Ontario lake trout reference material
Norwest	not provided	not provided	not provided
Nunavik	not provided	not provided	Oyster Tissues 1556a and Bovine Liver 1577b from NIST DORM-2 and DOLT-2 from NRC
NWRC	Biota -- bird tissues • Organics (OC, PCBs) • Trace metals	not provided	DORM-1 and DOLT-2 from NRC for metals
NWRI	Air, water, rain, snow • Toxaphene • Congener PCBs • PAHs • OCs	not provided	NWRI - organic standards in ampules IADN - past QC standards
SDH	Work is primarily pre-analytical	• not provided	not provided
SRC	Radionuclides - Animal Tissues – Plants – Dustfall	• <0.0050 – 1 Bq/g • <0.0050 – 20 Bq/g	NIST CANMET
Taiga	not provided	not provided	not provided
U of W	not provided	not provided	not provided
WQL-PNR	• Water • TP • DP • Ortho-P • TDN • Nitrate + Nitrite • Ammonium-N • Particulate N • Particulate Org. C • NFR/NFFR • DOC	• 0.01-0.15 mg/L • 0.01-0.04 • 0.004-0.015 • < 1 • <0.05-0.5 • Around 0.005 • 0.06-0.68 • 0.3-5.0 • 3-200 • unknown	NIST APG Setpoint Lab Standards Inorganic Ventures QC Plus Inorganic QC Standards

Table 9: Participation in other External Interlaboratory QA Programs

Laboratory	AECL-CRL	AWAC	CAEAL	CAPCO	CDCP	CFIA-MB	CFIA-ON	CTQ	IADN	IAEA	INHL	NOAA-NIST	NOAA-NRC	NWRI	NY SDH	QUASIMEME	US-DOE	US-EPA	WHO-ECEH	WHO-IRCR
AECL	X		X															X		X
AES																				
AXYS			X	X										X				X		
CAIRS																				
CINE																				
CTQ					X			X							X					
DFO-NF			X																	
Evirotest			X					X						X					X	
FWI			X						X	X			X				X	X		
GLIER			X																	
INHL						X					X									
NLET			X				X									X				
Norwest			X																	
Nunavik													X			X				
NWRC			X			X														
NWRI				X					X					X						
IOS																				
SDH																				
SRC		X	X											X				X		
Taiga			X											X						
U of W																				
WQL-PNR			X											X						
Totals	**1**	**1**	**12**	**2**	**1**	**2**	**1**	**2**	**2**	**1**	**1**	**0**	**2**	**6**	**1**	**2**	**1**	**4**	**1**	**1**

AECL-CRL	Atomic Energy of Canada Limited – Chalk River Laboratories
AWAC	Alberta Water Analysts Committee
CAEAL	Canadian Association for Environmental Analytical Laboratories
CAPCO	Canadian Association for Pesticide Control Officials, (by Environment Canada)
CDCP	Centre for Disease Control and Prevention
CFIA-MB	Canadian Food Inspection Agency, Winnipeg, Manitoba
CFIA-ON	Canadian Food Inspection Agency, Ontario Operations Laboratory
CTQ	Centre de Toxicologie du Québec
IADN	Integrated Atmospheric Deposition Network
IAEA	International Atomic Energy Agency
INHL	Indian and Northern Health Laboratory, Health Canada
NOAA	National Oceanic and Atmospheric Administration
NOAA-NIST	National Institute of Standards and Technology for NOAA
NOAA-NRC	National Research Council for NOAA
NWRI	National Water Research Institute, Environment Canada
NY-SDH	New York State Department of Health
QUASIMEME	Quality Assurance of Information for Marine Environmental Monitoring in Europe
US-DOE	United States Department of Energy
US-EPA	United States Environmental protection Agency
WHO-ECEH	World Health Organization, European Centre for Environmental Health
WHO-IRCR	World Health Organization, International Reference Center for Radioactivity

Appendix A:
Analytical Laboratories and Associated NCP Research Projects

Northern Contaminants Program Projects for 1998/99

Proposed Laboratory Analyses

Human Health

Health Canada

1. A Study with Cynomolgus Monkeys (Macaca fasicularis) to Determine the Toxicological Effects of Technical Grade Toxaphene (F. Iverson). *The residue laboratory of the Food Research Division will conduct toxaphene analyses of blood and adipose tissue. The lab has conducted an international round-robin study of toxaphene methodology employing individual congeners.*

2. Assessment of Radiation Doses to Northern Residents from Consumption of Caribou Meat (B. Tracy and A. Baweja). *Saskatchewan Research Council will analyze meat, urine and faecal samples for Pb-210 and Po-210; QA functions by Envir. Measurements Lab/US Dept. of Energy in New York.*

CINE

5. Assessment of Dietary Benefit:Risk in Inuit Communities (Year 2) (CINE)
CINE will analyze food for nutrients and contaminants, including PCBs, selected pesticides, toxaphene, Hg, Cd, As, Pb and vitamins and minerals.

6. Use of PBTK Model for Risk Assessment of Exposure to Mixtures of Organochlorines in Traditional Food (Year 2) (CINE). *CINE will analyze for OCs: {HCB, α-, β-, and γ-HCH, oxy-, cis- and trans-chlordane, cis and trans nonachlor, dieldrin, DDE, DDT, mirex, toxaphene} and PCB congeners (28, 32, 101, 99, 118, 105, 153, 128, 138, 156, 187, 183, 180, 199} in chemical cocktail, blood, liver and adipose tissues of rats.*

8. Toxicology of Mercury and Selenium in Ringed Seal Tissues (CINE)
CINE will analyze Hg, methyl-Hg, and Se in seal muscles, livers, brain and kidneys.

CHUL (or "CTQ")

10. Mercury in Salluit: Temporal Trend and Interaction with Selenium (CHUL)
Hg in hair will be analyzed by Indian and Northern Health Laboratory (INHL) of the Medical Services Branch of Health Canada. Hg in blood and Se in hair, plasma, whole blood and urine will be analyzed by Quebec Toxicology Laboratory (CTQ).

12. Adverse Developmental Effects in Pigs Following *in utero* and Lactational Exposure to Organochlorines: Effects on Male Reproductive Function and the Immune System (CHUL - P. Ayotte) *CTQ will analyze blood plasma for PCBs {28, 52, 99, 101, 105, 118, 128, 138, 153, 156, 170, 180, 183, 187} and OCs {p,p'-DDE, p,p'-DDT, o,p'-DDT, o,p'-DDE, α- and γ-chlordane, β-HCH, dieldrin, heptachlor epoxide, HCB, mirex, oxychlordane and trans-nonachlor}.*

13. Transplacental Exposure to PCBs and Infant Development/Human Exposure Assessment (CHUL)
CTQ will analyze blood serum for PCBs. chlorinated pesticides {and dioxins/furans} and heavy metals {Hg, Pb, Se}.

14. Effects of Prenatal Exposure to OCs and Mercury on the Immune System of Inuit Infants (CHUL) *CTQ will analyze for OCs and Hg in blood.*

17. Methylmercury and Mercury Speciation in Arctic People and Marine Mammals (CHUL - J. Grondin) *FWI will analyze liver and brain tissue for Se, Hg and MeHg.*

University and other

20. Inuvik Regional Human Contaminants Monitoring Programme (C. MacNeil - Inuvik Reg. Health & Social Services Board) *CTQ will analyze blood for OCs and metals. INHL/MSB-HC will analyze Hg in hair.*

International Activities

Indian Affairs and Northern Development

23. Facilitation of International Action Related to the Long-Range Transport of Contaminants into the Arctic (D. Stone) *No laboratory analyses.*

Environment Canada

24. Analysis of Existing Eastern Arctic Air Samples (Cape Dorset) (L.A. Barrie)
FWI to analyze air samples for 120 OCs, PCBs and PAHs.

25. Analysis, Interpretation and Synthesis of Arctic Air Data (L. Barrie)
PCNs and coplanar PCBs in archived air samples by AES.

26. Northern Contaminants Air Monitoring (L. Barrie)
FWI will analyze air samples for OCs {PCB congeners, toxaphene, chlordane, DDT, chlorobenzenes and selected herbicides} and 20 priority PAHs. QC and preliminary data analysis will be done by Conor Pacific & AES.

28. New Persistent Chemicals in the Arctic Environment (T. Bidleman)
AES will analyze for coplanar PCBs, PCNs. NWRI will analyze for BDPEs, OP and toxaphene. FWI will analyze for chlorinated paraffins and anisoles. Matrices include air, seawater, beluga, seal, sediment.

29. Atmospheric Mercury Measurements at Alert (W. Schroeder)
Total gaseous Hg in air at AES and in snow at NWRI.

32. Input of Contaminants to the Arctic Ocean via Russian Rivers (W. Strachan) *POPs and TMs in rivers by Russian laboratories.*

33. Organochlorine Contaminants in Archipelago Air and Water (W. Strachan) *POPs {OCs, PCB congeners, CBs, toxaphene, PAHs} in water, air and sediment by NWRI.*

Fisheries and Oceans Canada

37. The Seasonal Cycle of Organochlorine Concentrations in the Canadian Basin (R. Macdonald, F. McLaughlin, E. Carmack) *OCs {toxaphene, HCH, pesticides} in air, water, sediment and biota (zooplankton, fish) at FWI. HCH in water at IOS and AES.*

39. Long-range Transport of Contaminants to the Canada Basin and Selective Withdrawal through the Canadian Archipelago (R. Macdonald, F. McLaughlin, E. Carmack) *OCs {toxaphene, HCH, pesticides}, PAHs, metals and radionuclides in air, water, sediment and biota (zooplankton, fish) at FWI. HCH in water at IOS and AES.*

40. Mercury Accumulation in Snow on Sea Ice (H. Welch) *Hg in snow will be analyzed at FWI.*

University and other

47. Adsorption Coefficients, Specific Surface Area of Snow and Preliminary Field Validation for Models of Deposition and Fate of Organic Contaminants and Hg in Arctic and Alpine Ecosystems (J. Hoff, University of Waterloo) *Laboratory component does not involve monitoring analyses.*

49. Global Modelling of Persistent Pollutants (F. Wania,WECC) *No laboratory analyses.*

50. Canadian Northern Aboriginal Coordinating Committee on POPs - Support for UNEP Process: Towards a Global Legally Binding Instrument on POPs (T. Fenge, ICC) *No laboratory analyses.*

Education, Communications and Community-based Strategies

Metis Nation

51. Contaminant Education Program for Northerners (J. Farrow) *No laboratory analyses.*

Inuit Tapirisat of Canada/Inuit Circumpolar Conference

52. A Five-Year Inuit Strategy of Communication and Action on Transboundary Contaminants in the Arctic Environment (C. Boljkovac). *No laboratory analyses.*

Council of Yukon First Nations

53. Traditional Knowledge Research Guidelines (N. Kassi). *No laboratory analyses.*

Dene Nation

55. Phase I - Development of Communication package for the NWT Cancer Registry (S. Papik) *No laboratory analyses.*
Phase I - Development of Communication Package for the NWT Cancer Registry (ITC)

56. Annual Traditional Knowledge Workshop (Dene Nation) *No laboratory analyses.*

Yukon Contaminants Committee

58. Contaminants in Northern Canada: a Yukon Perspective (M. Palmer) *No laboratory analysis.*

Community Resource Development (M. Plamer) *No laboratory analysis.*

59. Yukon Contaminants Committee Communications Program (M. Palmer) *No laboratory analysis.*

NWT Contaminants Committee

60. NWT Environmental Contaminants Committee (C. Mills) *No laboratory analysis.*

62. Eastern NWT Regional Workshop on Contaminants (NWT Environmental Contaminants Committee) *No laboratory analysis.*

Centre Hospitalier de l'Universite Laval

63. The Social Representations of Contamination in the Nunavik Population (CHUL - S. Bruneau) *No laboratory analysis.*

Environment Canada

64. Community-Based Ecological Monitoring: Provide a Link Between Traditional Knowledge and Scientific Knowledge on Contaminants Issues (J. Eamer) *Laboratory analyses, if required, are covered elsewhere.*

University and Other

65. Frontline Training Course and Terminology Workshop for Community Professionals (Kitikmeot Health Board/Contaminants Working Group) *No laboratory analysis.*

68. Development of community programs and information packages on issues of contaminants in the Inuvialuit Settlement Region (B. Archie, Inuvialuit Regional Corporation) *No laboratory analysis*

69. Addressing Community Concerns on Environmental Issues and Contaminants IV (Akaitcho Territory Tribal Council) *No laboratory analysis.*

70. Sahtu Contaminants Program (Sahtu Dene Council) *No laboratory analysis.*

71. Public management of environmental health information in Nunavik (M. Grey, Nunavik, Health and Nutrition Committee) *No laboratory analysis.*

72. Country Food, Nutrition and Health: Developing Effective Communication Strategies in Labrador (Labrador Inuit Association Research Department) *No laboratory analysis.*

73. Labrador Inuit Perspectives on Environmental Health: Analysis of the Environmental Health Study (Labrador Inuit Association Research Department) *No laboratory analysis.*

Fisheries and Oceans

81. Mercury Toxicology in Arctic Fish and Marine Mammals (W.L. Lockhart)
Hg and MeHg in fish (and possibly sediment) and in beluga liver, kidney and muscle by FWI.

82. Temporal Trends of Organochlorines in SE Baffin Beluga and Holman Ringed Seal (G. Stern)
90 PCB congeners and OCs in beluga blubber by FWI. Coplanar PCBs, dioxins and furans, chlorinated anisoles in beluga extracts by IOS. PCNs by AES. BDPEs by NWRI.

83. Mercury in Fish from Surveys in Lakes in the Western Northwest Territories (W.L. Lockhart)
Hg, MeHg, Se and As in fish by FWI.

Environment Canada

85. Spatial Trends and Pathways of POPs and Metals in Fish, Shellfish and Marine Mammals of Northern Labrador and Nunavik and Nunavut (D. Muir)
Organochlorines, including toxaphene, (by NLET), coplanar PCBs by DFO-IML, butyl tins (by DFO-Nfld.) and heavy metals {Hg, Cd, As, Pb, Se} (by NvRC) in fish, mussels and seal tissues.

86. Limnological and Fisheries Investigations in Lakes Important to the Sahtu Traditional Fisheries: a Special Focus on Mercury Issues in Loche Lake/Lac a Jaques (M.S. Evans)
OCs and metals analysis by FWI. Stable isotope analyses at NHRI.

87. Trends and Effects of Contaminants in Polar Bears (R. Norstrom)
OCs {PCBs and DDT} in polar bears at NWRC or Norwegian Veterinary Institute

89. Contaminants in Arctic Seabird Eggs (B. Braune)
OCs and heavy metals {Se, Hg} in bird eggs by NWRC.

92. Levels and Effects of Selected Trace Elements in Arctic Seaducks (M. Wayland)
NWRC will analyze for Hg, organic Hg, and Se in liver, Cd in kidney, and Hg, Se and Cd in blood.

GNWT

96. Community-based Monitoring of Abnormalities in Wildlife (B. Elkin)
No specific laboratory analyses.

97. Metals and Radionuclide Accumulation and Effects in Caribou (B. Elkin)
Metals {Cd, Cu, Al, Zn, Fe, Ni, Hg, Mn} by Elemental Research. Radionuclides {Pb-210, Po-210, Cs-137, Cs-134, K-40, Sr, U, Th, Ra, Ti, } by AECL Whiteshell Labs. Matrices are caribou liver, kidney, bone and muscle.

Yukon Contaminants Committee

98. Yukon Traditional Foods Monitoring Program (M. Palmer)
OC {toxaphene} analyses of fish and/or sediment and/or animals by AXYS and/or DFO.

99. Contaminant Profiles (M. Palmer) *Unspecified water analyses.*

100. Bog Iron and Natural Foams (M. Palmer) *Unspecified analyses.*

101. Mercury Project (M. Palmer) *Ambient Hg in soils by unspecified private laboratory.*

102. Whitehorse Watershed (M. Palmer) *Unspecified analyses by private laboratory.*

103. Algae Project (M. Palmer) *Algal identification and analysis by private laboratory, FWI and McMaster University.*

104. Kluane River Groundwater Study (M. Palmer) *Stable isotope analysis of water by private laboratory, NHRI and University of Waterloo.*

105. Whitehorse Waste Oil Pit (M. Palmer) *PCBs, DDT, dioxin, hydrocarbons and metals in water and sediment by a private laboratory.*

106. White Pass Right-of-Way Reconnaissance (M. Palmer) *Metals in soils by unspecified private laboratory.*

107. Carcross PCP Study (M. Palmer) *PCP and dioxin/furan in sediment cores by FWI.*

NWT Contaminants Committee

108. Investigating the Importance of Water Chemistry on Mercury Concentration in Fish from Mackenzie River Basin Lakes (C. Mills) *Taiga Environmental Laboratory will analyze water samples for physical parameters, major ions, nutrients and 23 metals, including Hg.*

109. Baseline Study of Contaminants in Baker Lake (C. Mills)
OC and PCB analysis of food samples will be done by CINE. Analysis of fish, caribou and water for metals including Hg, Cd, Cu, Zn and U will be done by CINE or by Elemental Research. Radon will be measured on site by detectors provided by Canadian Institute for Radiation Safety (CAIRS).

110. Uptake of Contaminants in Beaver and Muskrat of the Slave River Delta (C. Mills)
Taiga Northern Laboratory will analyze for metals and CINE will analyze for dioxins/furans, PCBs, OC pesticides, toxaphene and lipids in beaver and muskrat liver and muscle tissues.

Fisheries and Oceans Canada

111. Methylmercury and Mercury Speciation in Arctic People and Marine Mammals (L. Lockhart)
FWI will analyze human liver tissue and seal liver and brain tissues for Hg, MeHg and other Hg species and for Se.

University and Other

114. Uptake and Effect of Arsenic (AS) from Gold Mines on Three Traditionally Important Plant Species in the Akaitcho Territory (Dene Nation)
Frontier Geosciences will analyze soil samples, and CINE will analyze berries for total As.

115. Butyltin Contamination in Beluga Whales (*Delphinapterus leucas*) from the St. Lawrence Estuary and Northern Québec (S. de Mora, Université du Québec à Rimouski)
Université du Québec à Rimouski will analyze beluga liver, skin and meat for TBT.

117. Radiation Exposure in Lutsel K'e (Lutsel K'e Env. Com.)
Whiteshell Laboratories will analyze for radionuclides. Radon measurements will be conducted through the CAIRS. Metals analysis, including U, Th and As will be done by Elemental Research. Matrices are food (fish, rabbits, moose and caribou) and water.

118. Sahtu Caribou/Moose Sampling Program (G. Bayha, Sahtu Dene Council)
Great Lakes Institute will analyze caribou and moose fat, liver and muscle tissues for OCs and liver and kidneys for metals. Radionuclides will be analyzed by an unspecified laboratory.

119. Radiation and Other Contaminants in the Deline Environment (Deline Uranium Com.)
Whiteshell Laboratories will analyze for radionuclides in food (fish, plants, mammals, birds) and water. Radon measurements will be made with monitors provided by CAIRS. FWI will date the sediment cores. Metals and OCs will be measured by an unspecified laboratory.

122. Modelling and Evaluation of Food Web Contaminants Accumulation (D. Mackay)
No contaminant analyses are to be done as part of this project.

Appendix A

Table A1: Analytical Laboratories and their Associated NCP Projects

Laboratories	Associated Study (by Proposal Number)
AECL Whiteshell Laboratories	97. Metals and Radionuclide Accumulation and Effects in Caribou 117. Radiation Exposure in Lutsel K'e 119. Radiation and Other Contaminants in the Deline Environment
AES, Environment Canada, Downsview	25. Analysis, Interpretation and Synthesis of Arctic Air Data 26. Northern Contaminants Air Monitoring 28. New Persistent Chemicals in the Arctic Environment 37. The Seasonal Cycle of Organochlorine Concentrations in the Canadian Basin 39. Long-range Transport of Contaminants to the Canada Basin and Selective Withdrawal through the Canadian Archipelago 82. Temporal Trends of Organochlorines in SE Baffin Beluga and Holman Ringed Seal
Axys Analytical Services	98. Yukon Traditional Foods Monitoring Program
CAIRS (Canadian Institute for Radiation Safety), Saskatoon	109. Baseline Study of Contaminants in Baker Lake 117. Radiation Exposure in Lutsel K'e 119. Radiation and Other Contaminants in the Deline Environment
CINE (Centre for Indigenous Peoples' Nutrition and Environment), McGill Univ.	5. Assessment of Dietary Benefit:Risk in Inuit Communities (Year 2) 6. Use of PBTK Model for Risk Assessment of Exposure to Mixtures of Organochlorines in Traditional Food (Year 2) 8. Toxicology of Mercury and Selenium in Ringed Seal Tissues 109. Baseline Study of Contaminants in Baker Lake 110. Uptake of Contaminants in Beaver and Muskrat of the Slave River Delta 114. Uptake and Effect of Arsenic (As) from Gold Mines on 3 Traditionally Important Plant Species in the Akaitcho Territory
CTQ (Centre de Toxicologie du Quebec) CHUQ/CHUL, Sainte-Foy, PQ	10. Mercury in Salluit: Temporal Trend and Interaction with Selenium 12. Adverse Developmental Effects in Pigs Following *in utero* and Lactational Exposure to Organochlorines.... 13. Transplacental Exposure to PCBs and Infant Development/Human Exposure Assessment 14. Effects of Prenatal Exposure to OCs and Mercury on the Immune System of Inuit Infants 20. Inuvik Regional Human Contaminants Monitoring Programme
DFO-NF (Dept.of Fisheries & Oceans), Nfld	85. Spatial Trends and Pathways of POPs and Metals in Fish, Shellfish and Marine Mammals of Northern Labrador....
Elemental Research Inc., Vancouver, BC	97. Metals and Radionuclide Accumulation and Effects in Caribou 109. Baseline Study of Contaminants in Baker Lake 117. Radiation Exposure in Lutsel K'e
Enviro-Test Laboratories, Edmonton	(NCP Phase I studies)
Food Research Division, Health Canada	1. A Study with Cynomolgus Monkeys to Determine the Toxicological Effects of Technical Grade Toxaphene
Frontier Geosciences Laboratories	114. Uptake and Effect of Arsenic (As) from Gold Mines on 3 Traditionally Important Plant Species in the Akaitcho Territory

Appendix A

Laboratories	Associated Study (by Proposal Number)
FWI (Freshwater Institute), DFO, Winnipeg	17. Methylmercury and Mercury Speciation in Arctic People and Marine Mammals 24. Analysis of Existing Eastern Arctic Air Samples (Cape Dorset) 26. Northern Contaminants Air Monitoring 28. New Persistent Chemicals in the Arctic Environment 37. The Seasonal Cycle of Organochlorine Concentrations in the Canadian Basin 39. Long-range Transport of Contaminants to the Canada Basin and Selective Withdrawal through the Canadian Archipelago 40. Mercury Accumulation in Snow on Sea Ice 81. Mercury Toxicology in Arctic Fish and Marine Mammals 82. Temporal Trends of Organochlorines in SE Baffin Beluga and Holman Ringed Seal 83. Mercury in Fish from Surveys in Lakes in the Western Northwest Territories 86. Limnological and Fisheries Investigations in Lakes Important to the Sahtu Traditional Fisheries: ...Mercury Issues ... 103. Algae Project 107. Carcross PCP Study 111. Methylmercury and Mercury Speciation in Arctic People and Marine Mammals 119. Radiation and Other Contaminants in the Deline Environment
GLIER, (Great Lakes Institute for Environmental Research), Univ. of Windsor	118. Sahtu Caribou/Moose Sampling Program
IML (Institut Maurice-Lamontagne), DFO	85. Spatial Trends and Pathways of POPs and Metals in Fish, Shellfish and Marine Mammals of Northern Labrador and....
INHL (Indian and Northern Health Laboratory), MSB, Health Canada	10. Mercury in Salluit: Temporal Trend and Interaction with Selenium 20. Inuvik Regional Human Contaminants Monitoring Programme
IOS (Institute of Ocean Sciences), DFO-BC	37. The Seasonal Cycle of Organochlorine Concentrations in the Canadian Basin 39. Long-range Transport of Contaminants to the Canada Basin and Selective Withdrawal through the Canadian Archipelago 82. Temporal Trends of Organochlorines in SE Baffin Beluga and Holman Ringed Seal
McMaster University	103. Algae Project
NHRI (National Hydrology Research Inst.), Environment Canada, Saskatoon	104. Kluane River Groundwater Study 86. Limnological and Fisheries Investigations in Lakes Important to the Sahtu Traditional Fisheries: ....Mercury Issues...
NLET, National Lab. for Environmental Testing, Environment Canada	85. Spatial Trends and Pathways of POPs and Metals in Fish, Shellfish and Marine Mammals of Northern Labrador and ....
Norwegian Veterinary Institute	87. Trends and Effects of Contaminants in Polar Bears
Norwest Laboratories	
NvRC (Nunavik Research Centre)	85. Spatial Trends and Pathways of POPs and Metals in Fish, Shellfish and Marine Mammals of Northern Labrador and....

Appendix A

Laboratories	Associated Study (by Proposal Number)
NWRC (National Wildlife Research Centre), Environment Canada	87. Trends and Effects of Contaminants in Polar Bears 89. Contaminants in Arctic Seabird Eggs 92. Levels and Effects of Selected Trace Elements in Arctic Seaducks
NWRI, National Water Research Institute, Environment Canada, Burlington	28. New Persistent Chemicals in the Arctic Environment 29. Atmospheric Mercury Measurements at Alert 33. Organochlorine Contaminants in Archipelago Air and Water 82. Temporal Trends of Organochlorines in SE Baffin Beluga and Holman Ringed Seal
Saskatchewan Research Council	2. Assessment of Radiation Doses to Northern Residents from Consumption of Caribou Meat
Saskatoon District Health, Dept. of Laboratory Medicine	(pre-analytical work, only)
Taiga Environmental Laboratory, DIAND, Yellowknife	108. Investigating the Importance of Water Chemistry on Mercury Concentration in Fish from Mackenzie River Basin Lakes 110. Uptake of Contaminants in Beaver and Muskrat of the Slave River Delta
Université du Québec à Rimouski	115. Butyltin Contamination in Beluga Whales from the St. Lawrence Estuary and Northern Quebec
University of Waterloo	104. Kluane River Groundwater Study
unspecified laboratory analyses	99. Contaminant Profiles 100. Bog Iron and Natural Foams 101. Mercury Project 102. Whitehorse Watershed 103. Algae Project 104. Kluane River Groundwater Study 105. Whitehorse Waste Oil Pit 106. White Pass Right-of-Way Reconnaissance 118. Sahtu Caribou/Moose Sampling Program 119. Radiation and other Contaminants in the Deline Environment
various Russian laboratories	32. Input of Contaminants to the Arctic Ocean via Russian Rivers
WQL-PNR, (Water Quality Lab, Prairie & Northern Region), Environment Canada	86. Limnological and Fisheries Investigations in Lakes Important to the Sahtu Traditional Fisheries: ...Mercury Issues ...

Appendix B:
Survey Questionnaire and Record of Contacts

October 7, 1998

Re: Survey of the labs that contribute scientific data to the Northern Contaminants Program

Dear Survey Participant,

Further to our discussion, I have attached the survey entitled "Questionnaire 1: Survey of the Labs that Contribute Scientific Data to the Northern Contaminants Program." In response to your questions about this survey, Environmental Standards and Reference Materials (ESRM; at the National Water Research Institute, Burlington) is having this market research conducted in order to obtain a clear overview of:

a. the laboratories that provide measurement data to research projects funded by the Northern Contaminants Program
b. what their full analytical capabilities are with respect the Northern Contaminants Program research; and,
c. in general, what other analytical services are available.

This information will be gathered for an internal report to the Northern Contaminants Program which will facilitate an understanding of "who is doing what" and "what else is available."

Part A (1 to 7) involves collecting identifying and contact information

Part B (8 to13) requests general laboratory information. This section is intended to provide a very general picture of the laboratory's capabilities and scope of activities.

Question 8 asks for the size of the laboratory/organization doing the analytical work in general terms (e.g. is the company a 3-person operation, or is it a large multinational firm with 300 staff?). Question 10 asks for the matrices that the laboratory can analyze (e.g. air, water, sediment, whale blubber, etc.). Question 11 asks for the major instrumentation used by the laboratory for analyses. In Question 12, "capacity" refers to how many samples the laboratory is capable of handling in a typical year and "load" refers to what the laboratory typically analyzes.

PART C (14 to 16) asks for details of participation in external ILS Programs and the use of RMs/CRMs.

Thank you for your interest and for taking the time to complete this questionnaire. If you have any additional questions please do not hesitate to call me at 905-338-2927 or at 905-336-6264.

Sincerely,

Glynn Gomes

Survey of the Labs that contribute scientific data to the Northern Contaminants Program

PART A: IDENTIFYING INFORMATION

1. Name of Organization:	
2. Name of individual completing this survey:	
3. ( ) Public Sector	**4. CAEAL accreditation ( ) Yes ( ) No** Please list test categories:
( ) Private Sector	**5. ( ) Other accreditation/certifications** Please List:

CONTACT FOR NORTHERN CONTAMINANTS PROGRAM ANALYSES		
6. Contact Name and Title:		
Address:		
Phone:	**Fax:**	**Email:**

LAB MANAGER (if different from above)		
7. Contact Name:		
Address:		
Phone:	**Fax:**	**Email:**

PART B: GENERAL LAB INFORMATION

8. Size of Company (e.g. # of staff, sample load). Please describe in general terms:

9. Main focus of activities (Please check one):

( ) Forestry	( ) Medical
( ) Agriculture	( ) Mining
( ) Research and Development	( ) Consulting
( ) Analytical Services	( ) Other, Explain:

LABORATORY ANALYTICAL CAPABILITIES			
10. Matrices (e.g. water, air, sediment, biota, human samples, etc.)			
11. Major Instrumentation (e.g. ICP-MS, four GCs, two GFAAS)			
12. Analyte/Matrix (e.g. trace metals/fish toxaphene/air mercury/blood)	**Detection Limits**	**Capacity/year**	**Sample Load/year (typically)**
13. Other Capabilities (e.g. field work, sample collection)			

PART C: (I) ILS PROGRAMS AND (II) SUPPORT TO THE NORTHERN CONTAMINANTS PROGRAM

14. Describe Participation in ILS Programs (e.g. whose programs, what programs, parameters, frequency; attach page if more space is required):		
(a) Organization:		
Contact Name:		
Address:		
Phone:	**Fax:**	**Email:**
Description (Analytes/Parameters, Frequency, etc.):		

(b) Organization:		
Contact Name:		
Address:		
Phone:	**Fax:**	**Email:**
Description (Parameters, Frequency, etc.):		
(c) Organization:		
Contact Name:		
Address:		
Phone:	**Fax:**	**Email:**
Description (Parameters, Frequency, etc.):		

15. Reference Materials and Certified Reference Materials Used in NCP-funded work:

16. Specific Analytical Data Generated for the NCP

Matrix	Analyte(s)	Typical Concentration Levels/ Range	Other Comments

Please add any other information or comments that you feel would add value to the above survey.

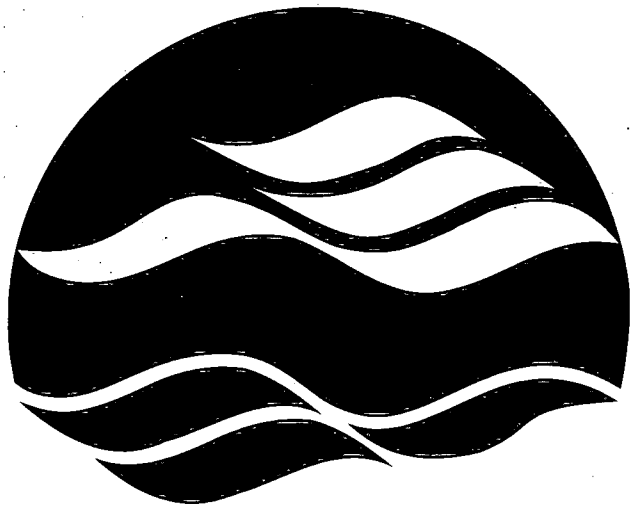
Please return to: Glynn Gomes Tel. (905) 338-2927 Fax: (905) 338-9579
Email: gomesg@globalserve.net

***Table B1*: Summary of Contacts for NCP Survey**

Laboratory/Organization	CONTACT	RESPONSE/COMMENTS
AECL (Atomic Energy of Canada Limited) Whiteshell Labs Pinawa, Manitoba	Karen Ross phone 204-753-2311 Fax. 204-753-2455	Y
AES, Environment Canada Downsview	Terry Bidleman phone 416-739-5730 Fax. 416-739-5708	Y
Axys Analytical Ltd. Sidney, BC	C. Hamilton; Debbie Fyles phone 250-656-0881 Fax. 250-656-4511	Y
CAIRS (Canadian Institute for Radiation Safety), Saskatoon	Brian Bjorndal phone 306-975-0566 Fax. 306-975-0494	Y
CINE (Centre for Indigenous Peoples' Nutrition and Environment), McGill Univ.	Dr. Laurie Chan phone 514-398-7765 Fax. 514-398-1020	Y
CTQ (Centre de Toxicologie du Québec) CHUQ/CHUL, Sainte-Foy, PQ	Dr. Jean Philippe Weber phone 418-654-2254 Fax. 418-654-2148	Y
CTQ - Centre de Research en Biologie de la Reproduction	Pierre Ayotte 418-666-7000	Yes, but do not provide analytical measurement data
CTQ - The histocompatibility/immunology laboratory at CHUQ	Dr Raynald Roy phone 418-656-4141 x 7527	Yes, but do not provide analytical measurement data
DFO-NF, Dept. of Fisheries and Oceans North Atlantic Fisheries Centre St. John's, Newfoundland	Dr. Joseph H. Banoub Tel. (709) 772-4928 Fax (709) 772-5315	Y
Elemental Research Inc. North Vancouver, BC	Dr. Charles Leblanc phone 604-986-0445 Fax. 604-986-0071	Y
Enviro-Test Laboratories Edmonton, Alberta	Dr. Detlef (Deib) Birkholz phone 403-437-5205 Fax. 403-437-2311	Y
Food Research Division Residue Laboratory, Health Canada	Dr. Harvey Newsome phone 613-957-0947	No response to telephone inquiries; no survey sent
Frontier Geosciences Laboratories Washington	Nicolas Bloom	No survey sent – information gathered via telephone
FWI (Freshwater Institute) Dept. of Fisheries and Oceans Winnipeg	Dr. Gary Stern phone 204-984-6761 Fax. 204-984-2403	4 replies (one each for PAH, OC/PCB, Trace Metal and Radiochemistry labs)
GLIER, (Great Lakes Institute for Environmental Research) University of Windsor	Dr. G.D. (Doug) Haffner phone 519-253-4232 Fax. 519-971-3616	Y
IML (Institut Maurice-Lamontagne) Dept. of Fisheries and Oceans Mont-Joli, PQ	Dr. Michel Lebeuf phone 418-775-0690 Fax. 418-775-0679	No response, but closely tied to NWRI and NLET analyses

Laboratory/Organization	CONTACT	RESPONSE/COMMENTS
INHL (Indian and Northern Health Lab) Medical Services Branch Health Canada	Dr. Harold Schwartz phone (613) 957-8549 Fax (613) 946-2340	Y
INRES-SANTÉ	Dr. Michel Fournier phone 514-630-8824 Fax. 514-630-8940	No response, but do not provide many measurement analyses
International Broodstock Technologies	Dr. Michael Easton Tel. 604-988-3532 Fax: 604-988-3549	Telephoned to advise that they do not provide analytical measurement data
IOS (Institute of Oceans Sciences) Dept. of Fisheries and Oceans Sidney, BC	Fiona McLaughlin phone 250-363-6527 Fax. 250-363-6807	Y
National Hydrology Research Institute Environment Canada (ECS), Saskatoon	Marlene Evans	Survey response completed by WQL-PNR
NLET (National Lab. for Environmental Testing), Environment Canada, Burlington	Mike Comba phone 905-336-4617 Fax. 905-336-6404	Y
Norwest Labs Surrey, BC	Randy Neumann phone 604-514-3322 Fax. 604-514-3323	Y
Nunavik Research Centre Makivik Corporation Kuujjuaq, PQ	Dr. Michael Kwan phone 819-964-2951 Fax. 819-964-2230	Y
NWRC (National Wildlife Research Centre) Environment Canada	Bryan Wakeford phone 819-997-1412 Fax. 819-953-6612	Y
NWRC – Research Wildlife Toxicology Division, Environment Canada	Ross Norstrom Phone: 819-997-1411	No response
NWRI (National Water Research Institute) Environment Canada, Burlington	Dr. Derek Muir phone 905-319-6921 Fax. 905-336-4989	Survey response completed by NLET. (NWRI closely tied to NLET and IML/DFO)
Saskatoon District Health, Toxicology Lab. University of Saskatchewan	Kim Barks phone 306-655-2909 Fax. 306-655-1726	Y
Saskatchewan Research Council	Dave Chorney phone 306-933-6933 Fax. 306-933-7922	Y
Taiga Environmental Laboratory DIAND, Yellowknife	Dr. William Coedy phone 867-669-2788 Fax. 867-669-2718	Y
University of Waterloo Department of Earth Sciences Waterloo, Ontario	John Hoff phone 519-885-1211 x6370 Fax. 519-746-0183	Y
Water Quality Lab, Prairie & Northern Reg Environment Canada (EPS), Saskatoon	Guat Peng Lee 306-975-5389 FAX 306-975-5143	Y

Appendix C:
Laboratory Responses to Survey Questionnaire



NATIONAL WATER RESEARCH INSTITUTE

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Environnement Canada
Centre canadien des eaux intérieures
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Canada L7R 4A6

Centre national de recherche en hydrologie
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Environment Canada Environnement Canada

Canada