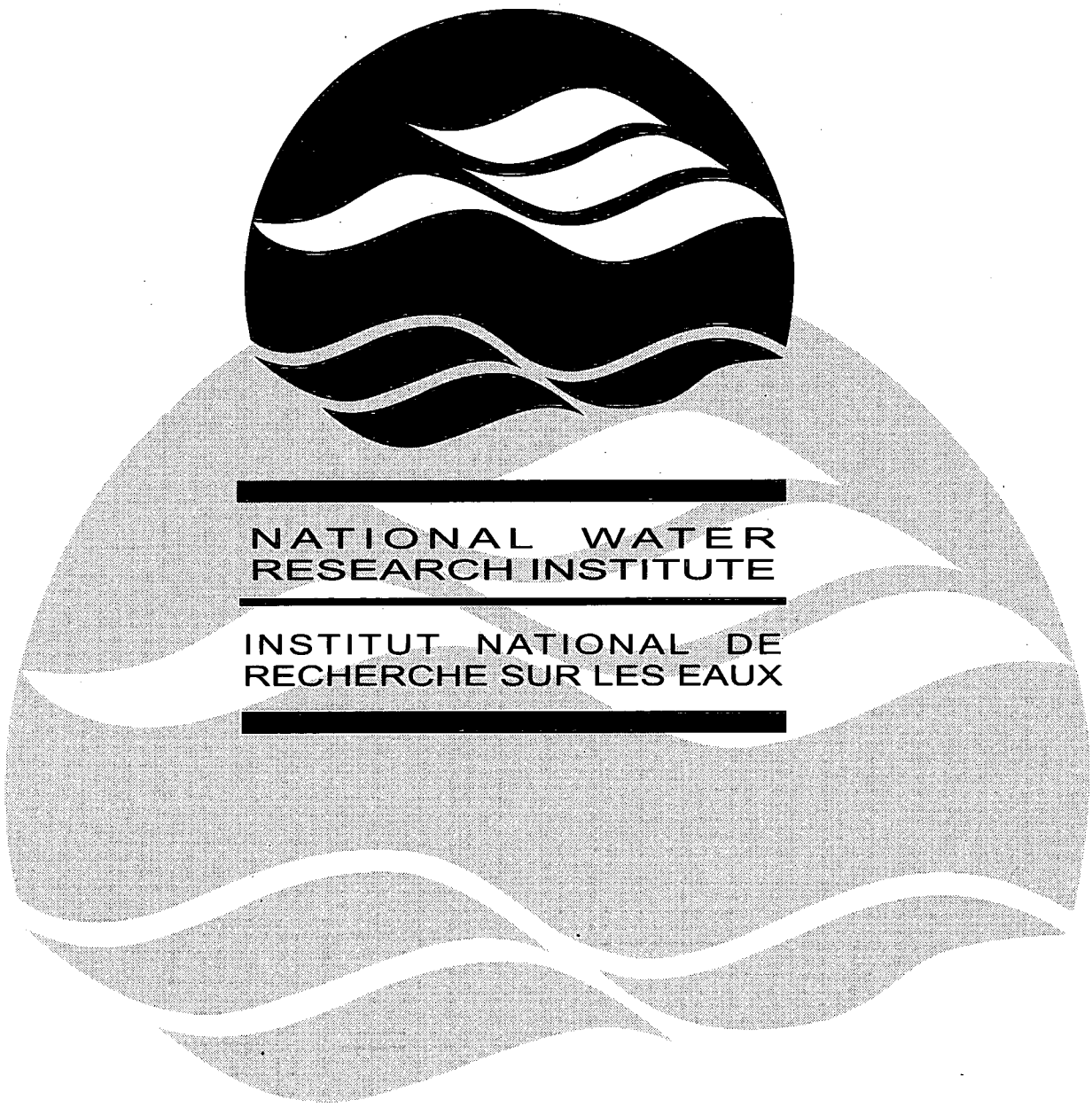


# SUMMARY REPORT OF THE ANALYTICAL PROGRAMS AND CAPABILITIES OF LABORATORIES AND ORGANIZATIONS THAT CONTRIBUTE MEASUREMENT DATA TO THE NORTHERN CONTAMINANTS PROGRAM

**Y.D. Stokker and G. Gomes**

**NWRI Contribution No. 99-302**

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

**Yvonne D. Stokker and Glynn Gomes[1]**

**National Laboratory for Environmental Testing**
**National Water Research Institute**
**Burlington, Ontario L7R 4A6**

**[1]Gomes Consulting Enterprises**
**116 River Oaks Blvd. East**
**Oakville, Ontario L6H 4C5**

**NWRI Contribution No. 99-302**

## 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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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<br>Joanne DeLaronde (metals)<br>Paul Wilkinson (radionuclides)<br>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<br>Ross Norstrom | Metals, organics |
| NWRI | Dr. Derek Muir (redirected to NLET)<br>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<br>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<br>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<br>6000 to 7200 samples/year | Analytical Services<br>Medical<br>Mining<br>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<br>200 (OC) and 1000 (metals) samples/year | Research and Development | 1 GC-ECD/FID; 1 GC/MS/MS (Ion Trap);<br>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<br>6 laboratories across Canada (Edmonton, Calgary, Grande Prairie, Saskatoon, Winnipeg and Thunder Bay)<br>Some divisions process up to 1000 samples/day | Analytical Services<br>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<br>2 staff dedicated to organics (~30 samples per week) | Research and Development | Metals: 2 GFAAs, 2 flame AAs, 1 CVAA, 1 HGFAA<br>Radiochemistry: 14 alpha spectrometers, 8 gamma spectrometers, 4 scintillation counters<br>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<br>400 (PCBs) and 500 (mercury) samples/year | Analytical Services | 3 GC/MS; 1 GC-ECD; 1 MS-Engine;<br>1 Mercury Analyzer robotic system |
| IOS | Staff: 3 (1 research scientist; 1 geochemical oceanographer; 1 analyst) | Other: Oceanography | GC-ECD |
| NLET | Staff: 10<br>3000 samples/year | Analytical Services | HRMS (EI-CI); GC-MSD (EI, negative ion CI); 13 GCs; 1 AED |
| Norwest | Staff: 250, (at 8 sites)<br>250,000 samples/year | Analytical services | 8 ICPs; 50 GCs (incl. 5 GC-MC); 2 HPLC<br>1 GFAAS; 2 IC; 25 Autoanalyzers; 4 centrifugal analyzers; combustion analyzers; etc. |
| Nunavik | Staff: 7 (3 branch scientists and 4 technicians)<br>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<br>500 samples/year | Research and Development | 2 GCs; 1 GC-MS; 1 GC-MS Ion Trap;<br>1 NICP-MS |
| SDH | Staff: 260, (at 3 locations)<br>14,000,000 lab tests/year | Medical | Extensive (specific equipment not provided) |
| SRC | Staff: 45<br>23,000 to 25,000 samples/year | Analytical Services | ICP-AES; EDXRF; NAA; IC; GC; GC/MS |
| Taiga | Staff: 6<br>~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;<br>• 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;<br>• Toxaphene, HCH in water;<br>• Total gaseous mercury in air;<br>• [Other matrices: soil, sediment] | • High volume sampling methods for air and water;<br>• 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;<br>• Field sampling;<br>• Method development;<br>• Sample homogenization |
| CAIRS | • Radon and Thoron Progeny;<br>• Radioactive Dust;<br>• Radon in air and water;<br>• Tritium in water | • Environmental monitoring, (air, water);<br>• Radiation surveys;<br>• Alpha/beta spectroscopy |
| CINE | • Trace metals in water, vegetation, fish, and wildlife;<br>• OCs (including dioxins/furans) in fish and wildlife (liver, blood and adipose tissues);<br>• Hg and OC/PCBs in blood;<br>• Nutrients, PCBs, pesticides, toxaphene, trace metals, vitamins and minerals in food | • None indicated |
| CTQ | • Cd, Hg, Pb and OCs in blood;<br>• Cu, Se, Zn, PCBs, OCs and dioxins/furans in serum;<br>• OC/PCBs and toxaphene in plasma and tissues;<br>• OC/PCBs in milk and placental tissue;<br>• Selenium in hair, plasma, whole blood and urine | • None indicated |
| DFO-NF | • Triazines; Azamethiphos compounds; Germethin; Ingraol;<br>• Butyltins in fish, mussels and seal tissues | • DNA Adducts (intact) |
| Elemental | • Various metals and elements in all solids and liquids<br>• metals/caribou | • None indicated |
| Enviro-Test | • Trace metals, dioxins/furans, congener PCBs, toxaphene, chlorinated diphenyl ethers, chlorophenols and resin acids in fish and sediment;<br>• Pb, Hg and Cd in blood;<br>• Metallothionein in fish gill, kidney and liver;<br>• EROD and AHH in fish liver;<br>• Cortisol, estradiol and testosterone in fish blood serum | • Taxonomic identification;<br>• Dissection of organs from fish;<br>• MS interpretation and identification of unknown organic chemicals;<br>• 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;<br>• Mercury in snow;<br>• PAHs, petroleum hydrocarbons, toxaphene, chlordane, DDT, HCH, chlorobenzenes, chlorinated paraffins and anisoles, PCB congeners in water, air sediment, biota;<br>• Radionuclides in air, water, sediment and biota;<br>• PCP and dioxin/furan in sediment | • Field work and sample collection;<br>• Sediment coring;<br>• Fishing |

| Laboratory | Analytical Capabilities by Parameter and Matrix | Other Services |
|---|---|---|
| GLIER | • OCs in caribou and moose fat, liver and muscle tissues;<br>• 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;<br>• Mercury and methylmercury in hair, fish, urine, and blood | • None indicated |
| IOS | • HCHs in seawater;<br>• 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;<br>• BDPEs in biota;<br>• 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;<br>• experienced field technician available |
| NWRC | • OC/PCBs in biota (polar bears);<br>• OCs and trace metals in bird tissues (blood and eggs);<br>• Dioxin/furans;<br>• 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;<br>• Specimens dissected in NWRC and stored in CWS Specimen Bank |
| NWRI | • Toxaphene in air, water, rain, snow<br>• PAHs in air, water, rain, snow, sediment<br>• PCBs in air, water, rain, snow, sediment, fish<br>• OCs in water | • Rain networking<br>• Field sampling for water, sediment and air |
| SDH | • No contaminant measurements | • Pre-analytical human tissue analyses |
| SRC | • Radiochemical analysis and radioactivity measurements;<br>• Elemental analysis, organics analysis;<br>• Water quality and potability packages (trace metals/water; major ions, nutrients, physical parameters in water);<br>• Soil, sediment, sludge analyses for moisture, pH, elements;<br>• Metals and radionuclides in vegetation;<br>• Hg and As in fish;<br>• Pb-210 and Po-210/ animal tissue, urine and feces | • % ash;<br>• Hazardous waste classification (PCBs, metals);<br>• Industrial hygiene;<br>• Paint analysis;<br>• Alloy analysis; |
| Taiga | • Trace metals, Hg in fish, biota, water, air filters, sediment;<br>• Major ions, physical parameters, nutrients in water;<br>• Bacteriology of water | • Field sampling |
| U of W | • Specific surface area of snow;<br>• Chlorinated organic contaminants/snow and surfaces;<br>• 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<br>– chlordanes<br>– HCHs<br>– coplanar PCBs<br>– PCNs<br>Water - toxaphene<br>– HCHs<br>– chlordanes | • 2-10 pg/cu. meter<br>• 2-10 pg/cu. meter<br>• 2-100 pg/cu. meter<br>• 0.5-50 fg/cu. meter<br>• 1-40 pg/cu. Meter<br>• 10-100 pg/L<br>• 100-3000 pg/L<br>• 0.3-5 pg/L | not provided |
| AXYS | PCB Congeners<br>Toxaphene<br>Dioxin/furans<br>PAH<br>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<br>SRM 1588 organics in cod liver oil from NIST |
| CTQ | not provided | not provided | Certified controls from our Comparison Program (Metals)<br>SRM-1589 (PCBs in serum)<br>SRM-1945 (Organics in whale blubber)<br>SRM-1588 (Organics in cod liver oil)<br>CRM 188 (Pesticides in milk powder)<br>CRM 450 (PCBs in natural milk powder) |
| DFO-NF | • Biota (blue mussels, ringed seal, arctic char)<br>• Organics (TBT, DBT, MBT) | • ng/g | PACS-2 and 1 Reference Sediment Material<br>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<br>– Extractable organic chlorine (EOCl)<br>– Chlorinated phenols<br>– PCBs<br>– Organochlorine pesticides<br>– Dioxins/furans<br>– Fish muscle - EOCl<br>– Chlorinated phenols<br>– Dioxins/furans<br>– Fish Bile - EOCl<br>– Chlorinated diphenyl ethers<br>– Resin acids<br>– Chlorinated phenols<br>– PAH-metabolites, FACS | • <0.003 – 0.58 µg/g<br>• <0.3 – 3.2 µg/g<br>• <0.05 – 60 ng/g<br>• <0.002-0.3 µg/g<br>• <0.001-0.01 µg/g<br>• <0.2 – 65 pg/g TEQ<br>• <0.2 – 42 µg/g<br>• <0.5- 25 ng/g<br>• 0.2- 100 TEQ<br>• <0.2 – 192 µg/g<br>• <0.25- 101 pg/g<br>• 3- 190 µg/g<br>• <25 – 26,000 ng/g<br>• 0.04 – 17 µg/g BaP and <3 – 1500 µg/g Phen | NRC sediment and biota<br>NIST biota, sediment and solutions<br>CIL Radian Biota |
| FWI | • Biota (fish muscles and marine mammal tissue)<br>• Sediment<br>• Metals and radionuclides | • Extensive: see the four DFO, Winnipeg questionnaires and attachments on organics, metals and radionuclides in Appendix C | **Metals**<br>– MESS-2, BCSS-1, PACS-2, LUTS-1, TORT-2, DORM-2, DOLT-2, SLRS-1, SLRS-2) from NRC<br>– Mussel tissue (SRM2976), Oyster tissue (SRM1566), Citrus leaves (SRM1572), Bovine liver (SRM 1577a) from NIST<br>**Radiochemistry**<br>– SRM-4327, Po-208, and gamma emissions spiked clay, river sediment and lake sediment from NIST<br>**Organics**<br>– SRM 1941a (marine sediment) from NIST<br>– EC7-Lake St. Clair sediment from NWRI<br>– CS-1, HS-1, HS-2 (sediments for PCBs) from NRC<br>– SRM1588 (PCBS and chlorinated pesticides in cod liver oil) from NIST |
| GLIER | • Worked with NCP projects 4 years ago<br>• PCBs/OCs/pesticides/metals in biota<br>• PCBs/OCs in caribou<br>• Total PCBs in wolves<br>• Lichen | • 0.02 µg/kg<br>• 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)<br>IAEA-085: Total Hg (23.2 µg/g) and MeHg (22.9 µg/g) in Hair<br>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<br>• a-HCH<br>• b-HCH<br>• g-HCH<br>• HCB | • 0-6000 ng/m3<br>• 0-400 ng/m3<br>• 0-800 ng/m3<br>• 0-50 ng/m3 | Contract Laboratory Program (CLP) from Accustandard |
| NLET | Congener PCBs and OCs in biota | Ultra-trace | NIST COD liver oil<br>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<br>DORM-2 and DOLT-2 from NRC |
| NWRC | Biota -- bird tissues<br>• Organics (OC, PCBs)<br>• Trace metals | not provided | DORM-1 and DOLT-2 from NRC for metals |
| NWRI | Air, water, rain, snow<br>• Toxaphene<br>• Congener PCBs<br>• PAHs<br>• OCs | not provided | NWRI - organic standards in ampules<br>IADN - past QC standards |
| SDH | Work is primarily pre-analytical | • not provided | not provided |
| SRC | Radionuclides - Animal Tissues<br>– Plants<br>– Dustfall | • <0.0050 – 1 Bq/g<br>• <0.0050 – 20 Bq/g | NIST<br>CANMET |
| Taiga | not provided | not provided | not provided |
| U of W | not provided | not provided | not provided |
| WQL-PNR | • Water<br>• TP<br>• DP<br>• Ortho-P<br>• TDN<br>• Nitrate + Nitrite<br>• Ammonium-N<br>• Particulate N<br>• Particulate Org. C<br>• NFR/NFFR<br>• DOC | • 0.01-0.15 mg/L<br>• 0.01-0.04<br>• 0.004-0.015<br>• < 1<br>• <0.05-0.5<br>• Around 0.005<br>• 0.06-0.68<br>• 0.3-5.0<br>• 3-200<br>• unknown | NIST<br>APG Setpoint Lab Standards<br>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<br>117. Radiation Exposure in Lutsel K'e<br>119. Radiation and Other Contaminants in the Deline Environment |
| AES, Environment Canada, Downsview | 25. Analysis, Interpretation and Synthesis of Arctic Air Data<br>26. Northern Contaminants Air Monitoring<br>28. New Persistent Chemicals in the Arctic Environment<br>37. The Seasonal Cycle of Organochlorine Concentrations in the Canadian Basin<br>39. Long-range Transport of Contaminants to the Canada Basin and Selective Withdrawal through the Canadian Archipelago<br>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<br>117. Radiation Exposure in Lutsel K'e<br>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)<br>6. Use of PBTK Model for Risk Assessment of Exposure to Mixtures of Organochlorines in Traditional Food (Year 2)<br>8. Toxicology of Mercury and Selenium in Ringed Seal Tissues<br>109. Baseline Study of Contaminants in Baker Lake<br>110. Uptake of Contaminants in Beaver and Muskrat of the Slave River Delta<br>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<br>12. Adverse Developmental Effects in Pigs Following *in utero* and Lactational Exposure to Organochlorines....<br>13. Transplacental Exposure to PCBs and Infant Development/Human Exposure Assessment<br>14. Effects of Prenatal Exposure to OCs and Mercury on the Immune System of Inuit Infants<br>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<br>109. Baseline Study of Contaminants in Baker Lake<br>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<br>24. Analysis of Existing Eastern Arctic Air Samples (Cape Dorset)<br>26. Northern Contaminants Air Monitoring<br>28. New Persistent Chemicals in the Arctic Environment<br>37. The Seasonal Cycle of Organochlorine Concentrations in the Canadian Basin<br>39. Long-range Transport of Contaminants to the Canada Basin and Selective Withdrawal through the Canadian Archipelago<br>40. Mercury Accumulation in Snow on Sea Ice<br>81. Mercury Toxicology in Arctic Fish and Marine Mammals<br>82. Temporal Trends of Organochlorines in SE Baffin Beluga and Holman Ringed Seal<br>83. Mercury in Fish from Surveys in Lakes in the Western Northwest Territories<br>86. Limnological and Fisheries Investigations in Lakes Important to the Sahtu Traditional Fisheries: ...Mercury Issues ...<br>103. Algae Project<br>107. Carcross PCP Study<br>111. Methylmercury and Mercury Speciation in Arctic People and Marine Mammals<br>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<br>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<br>39. Long-range Transport of Contaminants to the Canada Basin and Selective Withdrawal through the Canadian Archipelago<br>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<br>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<br>89. Contaminants in Arctic Seabird Eggs<br>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<br>29. Atmospheric Mercury Measurements at Alert<br>33. Organochlorine Contaminants in Archipelago Air and Water<br>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<br>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<br>100. Bog Iron and Natural Foams<br>101. Mercury Project<br>102. Whitehorse Watershed<br>103. Algae Project<br>104. Kluane River Groundwater Study<br>105. Whitehorse Waste Oil Pit<br>106. White Pass Right-of-Way Reconnaissance<br>118. Sahtu Caribou/Moose Sampling Program<br>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**<br>Please list test categories: |
| **( ) Private Sector** | **5. ( ) Other accreditation/certifications**<br>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)** |
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| 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 |
|---|---|---|---|
| | | | |
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Please add any other information or comments that you feel would add value to the above survey.

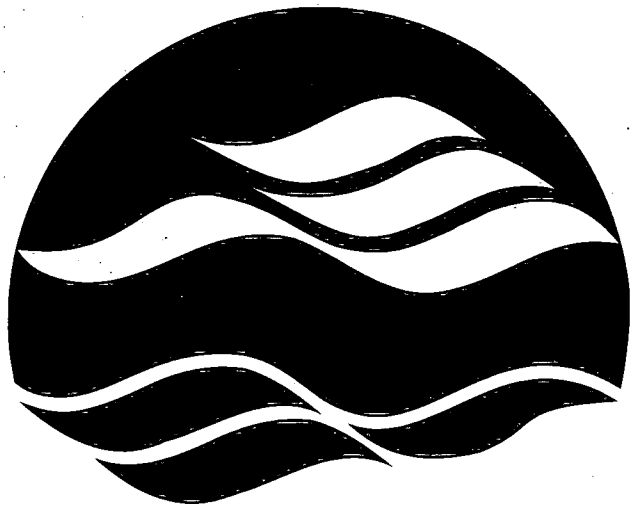
Please return to: Glynn Gomes Tel. (905) 338-2927 Fax: (905) 338-9579
Email: gomesg@globalserve.net

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

| Laboratory/Organization | CONTACT | RESPONSE/COMMENTS |
|---|---|---|
| AECL (Atomic Energy of Canada Limited)<br>Whiteshell Labs<br>Pinawa, Manitoba | Karen Ross<br>phone 204-753-2311<br>Fax. 204-753-2455 | Y |
| AES, Environment Canada<br>Downsview | Terry Bidleman<br>phone 416-739-5730<br>Fax. 416-739-5708 | Y |
| Axys Analytical Ltd.<br>Sidney, BC | C. Hamilton; Debbie Fyles<br>phone 250-656-0881<br>Fax. 250-656-4511 | Y |
| CAIRS (Canadian Institute for Radiation Safety), Saskatoon | Brian Bjorndal<br>phone 306-975-0566<br>Fax. 306-975-0494 | Y |
| CINE (Centre for Indigenous Peoples' Nutrition and Environment), McGill Univ. | Dr. Laurie Chan<br>phone 514-398-7765<br>Fax. 514-398-1020 | Y |
| CTQ (Centre de Toxicologie du Québec)<br>CHUQ/CHUL, Sainte-Foy, PQ | Dr. Jean Philippe Weber<br>phone 418-654-2254<br>Fax. 418-654-2148 | Y |
| CTQ - Centre de Research en Biologie de la Reproduction | Pierre Ayotte<br>418-666-7000 | Yes, but do not provide analytical measurement data |
| CTQ - The histocompatibility/immunology laboratory at CHUQ | Dr Raynald Roy<br>phone 418-656-4141 x 7527 | Yes, but do not provide analytical measurement data |
| DFO-NF, Dept. of Fisheries and Oceans<br>North Atlantic Fisheries Centre<br>St. John's, Newfoundland | Dr. Joseph H. Banoub<br>Tel. (709) 772-4928<br>Fax (709) 772-5315 | Y |
| Elemental Research Inc.<br>North Vancouver, BC | Dr. Charles Leblanc<br>phone 604-986-0445<br>Fax. 604-986-0071 | Y |
| Enviro-Test Laboratories<br>Edmonton, Alberta | Dr. Detlef (Deib) Birkholz<br>phone 403-437-5205<br>Fax. 403-437-2311 | Y |
| Food Research Division<br>Residue Laboratory, Health Canada | Dr. Harvey Newsome<br>phone 613-957-0947 | No response to telephone inquiries; no survey sent |
| Frontier Geosciences Laboratories<br>Washington | Nicolas Bloom | No survey sent – information gathered via telephone |
| FWI (Freshwater Institute)<br>Dept. of Fisheries and Oceans<br>Winnipeg | Dr. Gary Stern<br>phone 204-984-6761<br>Fax. 204-984-2403 | 4 replies (one each for PAH, OC/PCB, Trace Metal and Radiochemistry labs) |
| GLIER, (Great Lakes Institute for Environmental Research)<br>University of Windsor | Dr. G.D. (Doug) Haffner<br>phone 519-253-4232<br>Fax. 519-971-3616 | Y |
| IML (Institut Maurice-Lamontagne)<br>Dept. of Fisheries and Oceans<br>Mont-Joli, PQ | Dr. Michel Lebeuf<br>phone 418-775-0690<br>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)<br>Medical Services Branch<br>Health Canada | Dr. Harold Schwartz<br>phone (613) 957-8549<br>Fax (613) 946-2340 | Y |
| INRES-SANTÉ | Dr. Michel Fournier<br>phone 514-630-8824<br>Fax. 514-630-8940 | No response, but do not provide many measurement analyses |
| International Broodstock Technologies | Dr. Michael Easton<br>Tel. 604-988-3532<br>Fax: 604-988-3549 | Telephoned to advise that they do not provide analytical measurement data |
| IOS (Institute of Oceans Sciences)<br>Dept. of Fisheries and Oceans<br>Sidney, BC | Fiona McLaughlin<br>phone 250-363-6527<br>Fax. 250-363-6807 | Y |
| National Hydrology Research Institute<br>Environment Canada (ECS), Saskatoon | Marlene Evans | Survey response completed by WQL-PNR |
| NLET (National Lab. for Environmental Testing), Environment Canada, Burlington | Mike Comba<br>phone 905-336-4617<br>Fax. 905-336-6404 | Y |
| Norwest Labs<br>Surrey, BC | Randy Neumann<br>phone 604-514-3322<br>Fax. 604-514-3323 | Y |
| Nunavik Research Centre<br>Makivik Corporation<br>Kuujjuaq, PQ | Dr. Michael Kwan<br>phone 819-964-2951<br>Fax. 819-964-2230 | Y |
| NWRC (National Wildlife Research Centre)<br>Environment Canada | Bryan Wakeford<br>phone 819-997-1412<br>Fax. 819-953-6612 | Y |
| NWRC – Research Wildlife Toxicology Division, Environment Canada | Ross Norstrom<br>Phone: 819-997-1411 | No response |
| NWRI (National Water Research Institute)<br>Environment Canada, Burlington | Dr. Derek Muir<br>phone 905-319-6921<br>Fax. 905-336-4989 | Survey response completed by NLET. (NWRI closely tied to NLET and IML/DFO) |
| Saskatoon District Health, Toxicology Lab.<br>University of Saskatchewan | Kim Barks<br>phone 306-655-2909<br>Fax. 306-655-1726 | Y |
| Saskatchewan Research Council | Dave Chorney<br>phone 306-933-6933<br>Fax. 306-933-7922 | Y |
| Taiga Environmental Laboratory<br>DIAND, Yellowknife | Dr. William Coedy<br>phone 867-669-2788<br>Fax. 867-669-2718 | Y |
| University of Waterloo<br>Department of Earth Sciences<br>Waterloo, Ontario | John Hoff<br>phone 519-885-1211<br>x6370<br>Fax. 519-746-0183 | Y |
| Water Quality Lab, Prairie & Northern Reg<br>Environment Canada (EPS), Saskatoon | Guat Peng Lee<br>306-975-5389<br>FAX 306-975-5143 | Y |

# *Appendix C:*
# Laboratory Responses to Survey Questionnaire



NATIONAL WATER RESEARCH INSTITUTE

INSTITUT NATIONAL DE RECHERCHE SUR LES EAUX

**National Water Research Institute**
**Environment Canada**
**Canada Centre for Inland Waters**
P.O. Box 5050
867 Lakeshore Road
Burlington, Ontario
Canada L7R 4A6

**National Hydrology Research Centre**
11 Innovation Boulevard
Saskatoon, Saskatchewan
Canada S7N 3H5

**Institut national de recherche sur les eaux**
**Environnement Canada**
**Centre canadien des eaux intérieures**
Case postale 5050
867, chemin Lakeshore
Burlington; (Ontario)
Canada L7R 4A6

**Centre national de recherche en hydrologie**
11, boulevard Innovation
Saskatoon; (Saskatchewan)
Canada S7N 3H5

Environment Canada Environnement Canada

Canada